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Reconciling road safety and sustainable development in a context of climate change and economic constraints

WINTER MANAGEMENT ALONG THE ITALIAN MOTORWAY NETWORK

Mr. Massimo SCHINTU, Aiscat Executive Director

General Background

Even if it represents the 3% of the whole National primary road network, the tolled motorway network can be considered as the backbone of the Italian transport system, supporting the 25% of the country's overall mobility both on the long distances and on short-medium ones. In 2012 there has been a total traffic volume of more than 76,4 billion of vehicles-km along its 5,700 km of total length which are managed by the 23 different Concessionaires Companies gathered and represented by AISCAT (the Italian Association of Motorway and Tunnels Concessionaire Companies).

It is a network that presents some specific and peculiar features – structural and operational ones - characterizing it in the International context, namely:

- The presence of different operators
- The altimetric development, strictly connected to the particular Italian morphology, that can reach 1,000 – 1,100 meters over the sea level on certain mountain passes
- the quantity and the typology of traffic demand, with a high level of daily traffic flows (e.g. on some stretches there is a peak value of about 270,000 – 290,000 vehicles/day) and high percentage of heavy vehicles (e.g. an average of 20-25%, up to a maximum of 35% on some stretches)
- the limited capacity of the ordinary roads

The Need of a Specific Approach to Winter Management

In 2005 some heavy snowfalls during the winter season caused mobility breaks along the whole road system, with serious effects on the users and on the transport of goods, and with the comprehensible consequences at national economy level.

The registered events of that period showed that the operational approach followed so far and efforts already implemented were no longer sufficient to ensure the proper management of mobility and infrastructure.

Therefore, there was the need of finding a new way to maintain road practicability and guarantee traffic management under severe weather conditions as well.

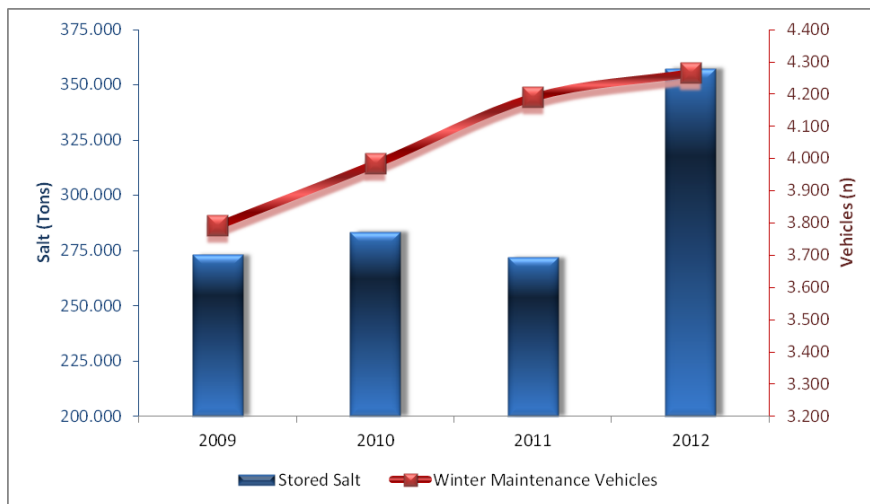
In this framework, national Institutions and road operators concentrated their energies to implement more effective management-operating tools aiming at strengthening the cooperation between the main actors involved and improving coordinated activities (with specific attention to heavy traffic flows) to preserve smooth road access.

Winter Emergency Operations: the Intervention Models

Over these last years, the tolled motorways sector has been paying more and more attention and care to winter management activities, with a considerable increase of the resources spent (which can be estimated – on average for all the concessionaire companies – about 7-10% of the total ordinary maintenance costs) and investments for new instruments and technology.

The chart here below shows the constant growth of the equipment at disposal of the Italian motorway operators which reached in 2012 the total amount of about 4,300 winter maintenance vehicles and 357,000 tons of salt stored for de-icing treatments.

Chart 1: evolution of some winter equipment used by Italian Motorway Concessionaire Companies



In addition to that, the main result achieved was the definition of proper emergency procedures and plans.

Actually, after a testing period, the motorway system is now ruled by:

- Guidelines for the coordinated management of emergencies in wintertime
- Operational Agreement regulating the circulation of heavy vehicles under snowfalls

1. Guidelines for the Coordinated Management of Emergencies in Wintertime

Through these Guidelines, shared by AISCAT and the Italian Road Police, the intention was to realize the **coordination of the operational and information procedures** that the Road Police and the Italian road concessionaires have to apply in case of snow phenomena, by achieving the following objectives:

1. Find on the National territory the areas most exposed to the crisis risk of snow, where to activate priority application of coordinated measures of intervention;
2. Create a homogeneous terminology and expressions recognized at National level for codifying the different phases of the “snow emergencies” (see table 1), associating these phases to the related activities to be carried out by all the operators involved (i.e. definition of interventions, timeline, duties, vehicles/equipment to be activated, etc.);
3. Definition of a shared communication procedure between the departments of the Road Police and the concessionaires, as well as between the concessionaires and the other entities or Institutions involved in the management of possible emergencies related to the snow phenomena.
4. Harmonizing and optimizing the information models for road users’ information (see table 2);
5. Coordinate and make homogeneous the needed provisions aimed at regulating traffic circulation (i.e. rerouting on alternative roads; filtering or banning freight vehicles, etc.).

Table 1: Classification codes - emergency levels

Zero code	a weather bulletin or warning has just been issued, the contents of which require a preventive communication plan
Green code	The Concessionaire organisation is ready to operate with the road surface treating: it is not snowing yet
Yellow code	It starts snowing. Its intensity is not critical and it is easily managed by the service vehicles. Traffic flow is smooth
Red code	The snowfall is intense and requires the intervention of all the available vehicles and equipments, even only along certain sections. Traffic moves very slowly on critical points of the road
Black code	Traffic flow has just been blocked on the carriageway due to cars sliding on the road surface that is partially/totally covered by the snow. The block may be also due to other reasons not directly related to the current snowfall, but it is snowing intensely

Table 2: Information Model

Code	State of the event	Information content (i.e. translation on VMS)
Zero	High impact weather warning issued	EXPECTED SNOW Junction – start Junction - end
Green	All the resources are ready to operate. Snowfall not started yet	
Yellow	Non-critical snowfall without effects on traffic	SNOW (or INTENSE SNOW or QUEUES due to SNOW/INTENSE SNOW) Junction – start Junction - end
Red	Intense snowfall managed at capacity limit	INTENSE SNOW (or QUEUES due to INTENSE SNOW) after junction– start (until Junction – end) BLOCKS ARE POSSIBLE
Black	First vehicles positioned crosswise the carriageway	BLOCKS DUE TO SNOW Junction – start Junction – end
	Different vehicles positioned crosswise the carriageway in several points or long-time foreseen to solve the first block	CLOSED DUE TO SNOW *) Junction – start Junction – end

Moreover, the Guidelines define the main contents and the objectives that the single operational plans, which are drafted every year by the concessionaire companies, have to ensure. Among these contents and objectives we can list the following ones as examples:

- Foresee the most probable scenario for the interested road sections;
- Share the information at local and territorial level;
- Foresee ways of communication and involvement also towards those operators that, although not being neighbors, are anyways interested by the application of the foreseen measures in case of emergencies (for instance if there is a persistent block of the traffic circulation and if it is difficult to re-open a road stretch to the traffic);
- Codify the different phases of the snow emergency, by indicating in details the needed provisions aimed at ensuring the most appropriate coordination and information actions related to the adopted measures, both internally (between the Road Police and the concessionaire companies), and externally towards the road users;
- Monitoring the resources, in terms of personnel, means and materials, that are foreseen to be used in the different phases;
- Foresee, by the concessionaire, a proper organization for the prompt removing of heavy vehicles on the network which, creating an obstacle for the circulation, make difficult the intervention of the snow ploughs. To that extent, it will be necessary to check the strategic points along the Motorways' network, where to allocate the vehicles for the mechanic rescue supposed to recuperate and move the heavy lorries. These specific rescue vehicles have to be present during all the phases of snow alert, for a prompt and rapid intervention in case of need;
- Designate the control and managing chain, as well as the responsible representatives of all the involved actors (i.e. other entities owners or operators, public administrations, rescue and users' assistance entities, etc.);
- Prepare a detailed information plan for the road users to be activated in case of snow emergency;
- Check and find the strategic points where preparing and, if needed, activating, the controlling and monitoring actions for the traffic circulation (included the possible rerouting operations);
- Prepare and set-up a system able to ensure the practicability and the availability of the services' areas.
- Include the main contents for emergency operational plans under snowfalls, fixing a Nation-wide recognized classification of codes (from a zero code to a black one) associated to the emergency level and related activities to be carried out by all the operators involved (i.e. definition of interventions, timeline, duties, kind and quantity of vehicles/equipment to be activated, etc.); moreover, it established also the communication and information procedures towards the road users related to the different codes (namely the messages to be displayed on Variable Message Signs).

2. Operational Agreement Regulating the Circulation of Heavy Vehicles Under Snowfalls

The *Operational Agreement* is an "Institutional" document signed in December 2005 by representatives of the Ministry of Infrastructure and Transport, Ministry of Internal Affairs, National Road Agency (Anas), Italian Association of Motorway Concessionaires Companies, hauliers associations. This Agreement allowed for a regulation of the mobility introducing for the first time proper provisions for the "temporary blocking" of HVs (exceeding 7,5 tons) along the carriageway in case of heavy snowfalls, letting gritters and snowploughs working to keep clean the road surface and waiting for weather and road condition improvements.

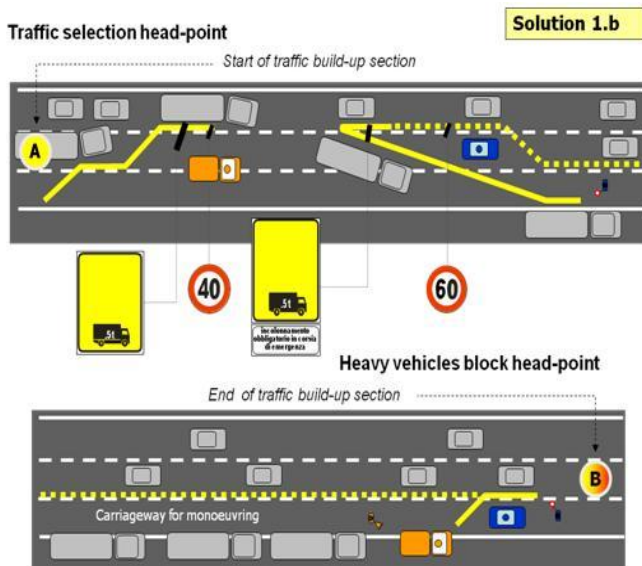
In fact, having seen that heavy lorries' circulation - especially if these HLs are not properly equipped - represents the most critical item for operation in case of particularly intense snow events, mainly because of the difficulties in removing the HLs blocked on a lane, with this Agreement it is possible to ensure a real collaboration between the road operators and the transportation ones.

General principles and application procedures for the provision of "temporary blocking", as well as related communication and road users' information activities to be deployed have been therefore defined. The HLs, in such a case, are stocked on lanes previously identified according to the configuration of the interested road stretch (by taking into account for instance the number of available lanes, the existence of an emergency lane, the width of the emergency lane, etc.), by guaranteeing as much as possible a safe circulation for users and for operators. In addition to the HLs blocking operations on the lanes, the use of

both internal and external areas from the interested lane is also foreseen, provided that these areas are fully accessible.

Moreover, as an addition to the Agreement, relevant signs frameworks have been applied for traffic storing on the roads, in order to guarantee the necessary protection to drivers, road users and operators' staff as well.

Table 3: Example of signing scheme for blocking HVs on the lane



The National Mobility Coordination Centre - “Viabilità Italia”

In January 2005 it was established at the Internal Affairs Ministry and under the coordination of the Director of the Road Police, the National Mobility Coordination Center (at present designed as “Italy Viability”), as a National structure supposed to plan and adopt the most appropriate intervention strategies to tackle crisis situations connected to the National Mobility. This structure, whose members are representatives of Road Police, Ministry of Internal Affairs, Fire Brigades, Civil Protection, Ministry of Infrastructure and Transport, Carabinieri Service, National Railways, ANAS and AISCAT, deals with the definition of the National Snow Plan (in which the Motorway critical nodes, stretches and areas, the motorway sections for temporary storage of HVs and the activities of all the resources involved in the emergency management are specified), as an operation synthesis of the above mentioned guidelines and Agreement, as well as of the wide range coordination of the activities during emergency situations and of the information to the road users and to the media.

Since its establishment, the Centre has met about a hundred times for the operational monitoring and management of critical situations related to particularly intense snowfalls causing effects on large areas of the country

Year after year the experiences on field allowed to highlight the strengths and weaknesses of the system built and, consequently, to imagine new operational solutions and to fine-tune progressively the implemented activities that have been translated into operational procedures (e.g for managing freezing rain or the maneuvers for storing in a proper way the HVs). Moreover hundreds of suitable areas were found to be used by HVs for long parking in case of adverse weather conditions.

Conclusions

The practical experience of these last years along the toll Motorways network in Italy, years in which several severe weather events occurred particularly in winter time, both for the intensity of the snowfalls and for the their territorial extension, made possible to test the validity of the adopted strategy and the efficiency of the defined tools.

New requirements were needed and this has led to the establishment of a regulatory framework (i.e. ministerial directives and other regulatory acts): actually, the measures adopted on several occasions with excellent results were properly codified (i.e. the regulatory acts for prohibiting or limiting the mobility along the road network, or the obligation of suitable winter equipment such as snow-chains or snow-tires) so as to maximize their impact and effectiveness.

As a tangible result, along the tolled motorway network the situations of complete blockage of LVs mobility have been generally reducing to zero.

At the same time, this experience has given the opportunity to improve more and more the intervention model system and to consolidate the needed coordination among the different involved Institutions (local and National) and the road operators, as well as to draw the future winter management's developments, which are focused on intervention time reduction (i.e. anticipating operational actions), weather forecasts improvement, implementation of new technologies, and, above all, on strengthening the involvement of road users (influencing their travel behavior with preventive information), "working" on the public opinion which thinks that *"circulation on Motorway network should always be guaranteed, even during extraordinary snowfalls"*.