NEW APPROACHES IN ROAD MAINTENANCE PLANNING: THE GLOBAL ROAD MANAGEMENT SYSTEM (GRMS)

Pasquale Colonna, Giandomenico Fioretti, Achille Fonzone, Sergio Sasso
Dept. of Highways and Transportation – Polytechnic University of Bari
E-mail: colonna@poliba.it, gfioretti@libero.it, a.fonzone@poliba.it, s.sasso@poliba.it

1 INTRODUCTION

Structural inadequacy of Italian roads, multidimensionality of transport policy aims, budget constrains faced by road administration press for urgent maintenance operations and for developing a new idea of maintenance, which can remedy past ineffectiveness and wastes and can cope with the whole body of relevant factors.

The paper describes a new approach for road maintenance and enhancement, called Global Road Management System (GRMS). The basic idea is that transportation infrastructures are elements of a territory, so management has to improve the quality of life of users of road and territory as well.

2 ITALIAN ROAD TRANSPORT: AN OVERVIEW

2.1 Facilities

A recent report by Italian road professors by Italian road professors (SIIV, 2001) depicts a worrying situation for Italian road infrastructure: the national network is made of about 170,000 km of main roads (private expressways, 6,500 km; national highways and freeways, 45,000 km; provincial roads, 115,000 km) and 670,000 km of municipal (urban, extra-urban, rural) roads. Most of these facilities was designed and built in the Fifties and the Sixties, so

✓ size of carriageways is not consistent with recent standard;
✓ aging seriously jeopardizes road surfaces, foundations and works of art functionality.

If one considers only national roads, 15% of network pavement is dangerous for circulation, while 63% needs interventions to prevent worsening of deterioration and the consequent increasing of maintenance costs.
2.2 Mobility

According to Italian Transportation Master Plan (Ministero delle Infrastrutture e dei Trasporti, 2001) from 1970 to 1996, national passenger mobility (measured as passengers per kilometre) increased by 131%, freight mobility (metric tons per kilometre) augmented by 117%; in the same period, the role of rail transport became less important both for passengers (in 1999, only 5.59% of whole traffic used train against 92.81% which moved by car) and freight (railway, 14.15%; road, 66.6%; navigation, 18.86%) traffic. Italian ministry of Transport built two scenarios for 2010 mobility:

<table>
<thead>
<tr>
<th>Passengers (*10^6)</th>
<th>Freight (tons *10^6)</th>
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<tbody>
<tr>
<td>road share</td>
<td>road share</td>
</tr>
<tr>
<td>LOW SCENARIO</td>
<td>1.959 84.8%</td>
</tr>
<tr>
<td>HIGH SCENARIO</td>
<td>2.292 84.8%</td>
</tr>
</tbody>
</table>

2.3 Social costs

Statistics highlights that, every year, more than 7.000 people die on Italian roads, while 250.000 people suffer injuries; e.g., in 1998, there were 5.857 dead men and 293.842 injured, which correspond to an evaluated social and economical cost greater than 22 thousand millions €. Some assessments ascribe 30% of accidents to the bad road conditions. Recent traffic surveying found that, in 1998, users lost 71 millions hours on the roads of Emilia Romagna – an Italian north-central region – because of stopped traffic, queues and slow circulation; if one extends this results to the whole nation, Italy paid 22 thousand millions € to congestion (SIIV, 2001).

3 TRADITIONAL APPROACHES

3.1 From human-based pavement maintenance to Pavement Management System

Traditionally, road maintenance coincided with pavement maintenance, also because of most of economic resources were consumed just by this kind of interventions. Decisions were assumed on the basis of the judgement of operators, so that choices were often inconsistent, ineffective and inefficient. From the Seventies on, some road administrations began using Pavement Management Systems (PMSs), trying to rationalize choices (Finn, 1998). Researchers learnt a lot by the implementation of PMSs:
pavement deterioration is slow in the first years of life, then becomes very fast; notwithstanding characteristics of pavements are extremely variable, it is possible to find a standard curve of damages;

- national and local governments investments in road maintenance are larger than in other important public sectors; this is surely due to the high costs of conservation, but also to unsuitable and not planned decisions;

- frequent slight interventions are cheaper than rare considerable ones; moreover, studies demonstrate that costs of maintenance delay increase with traffic volume;

- data from human direct observation are often not objective and inconsistent.

### 3.2 From Pavement Management System to Road Management System

The awareness that to conserve a road network needs not only pavement maintenance but also the care of whole road gave rise to the passage from Pavement Management System to Road Management System. At the same time, road administrations mission changed from “warranting good condition of the road stock” to “satisfying user demand, both in amount and in quality”; the adoption of this new paradigm by politicians, managers, technicians and users introduced a new crucial aim in road management: to allow users to cover a route in a “joyful” and safe way.

### 3.3 From Road Management System to Global Road Management System (GRMS)

This new perspective – even if revolutionary – is not enough to guarantee success in road maintenance: to this purpose, it is central to consider road as an element of the territory. The need of sustainable development makes unacceptable the concept of “tunnel” infrastructure, whose consideration can leave feedbacks with territory – the whole social, economical and environmental system – apart. Therefore, one has to consider a system of road network enhancement taking into account not only road user’s, but also territory user exigencies. A new system of maintenance planning and carrying out is required, aiming at to add value as quality of life for both road and territory users: this is the basis of Global Road Management System (GRMS).
4 GLOBAL ROAD MANAGEMENT SYSTEM (GRMS)

4.1 GRMS components

Global Road Management System is made of:

- a well structured organization, based on the use of the PArtitioned eNgineering DAta flow (PANDA) method for functional analysis (Phan and Howard, 1992), which allows an effective and efficient management;
- a Territorial Information System (SIT), a geographically related database, integrated by some modules for remote control and forecasting;
- a new evaluation model for road level-of-service, the Global Level of Service (GLS), intended to reassemble different involved factors and points of view (owner, user, territory) in just one easy-to-read indicator;
- pioneering technologies to automatically get data for maintenance planning, traffic management and safety;
- a stock of best practises, defined by PANDA, to warrant quick and rational operations;
- subjects and procedures to evaluate effectiveness and efficiency;
- a group of workers, mostly before unemployed.

The last element has great importance in the point of view of sustainability: in fact, by using jobless workers, GRMS is able not only to consent regular road operations, but also to sustain social insertion – and, so, human endorsement – of weak brackets; it is not useless to highlight that local economy takes advantage of well known “multiplier effect” of infrastructural investments in a certain region (Banister and Berechman, 2000).

4.2 GRMS capabilities

GRMS allows road network administrations:

- identification of critical damaged areas;
- emergency timely working out;
- planning, implementing and monitoring precautionary maintenance in the short term and restoration interventions in the middle-long one;
- checking and managing traffic, according to meteorology and flow conditions;
- enhancing safety;
- ensuring mobility services and promoting multidimensionality;
- taking advantage of databases and models useful to design network adjustment and to assume mobility management decisions;
- monitoring hydro geological risk and alarming competent authorities in case of danger;
- collaborating to civil protection by supporting disaster management;
- handling authorizations for road yards, accesses, forks and advertisements;
✓ having an historical archive of interventions at their disposal, helpful in case of contentious;
✓ counting on detailed and updated maps of sub-services, to coordinate interventions of the different interested agencies;
✓ two-way communication with users, called to active collaboration to GRMS;
✓ assessing quality of services offered to (road and territory) users and their own effectiveness and efficiency.

REFERENCES


