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Pavement Management System for Local Authorities – Personal remarks in the European Context

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Pavement Management System (PMS) assists decision makers in finding strategies for providing and maintaining pavements in a serviceable and safe condition at the most possible cost effective way. Even if it is commonly accepted that implementing a PMS is essential to improve the performance and to optimize the budget allocation, many local authorities are worrying slow in implementing a PMS especially for the costs to survey the actual pavement conditions and the lack of expertise to operate with high level and complex systems.

Survey of Pavement Conditions is the most influential factor because the equipment used and the data acquired have a great impact both on costs and performance of a PMS, since understanding the pavement conditions is the basis for the evaluation of pavement performance and for identification of treatments in making maintenance and rehabilitation decisions.

Road agencies managing local road networks need an approach that gives suitable results minimizing costs for Hardware, Software and staff.

Survey of Pavement Conditions

As many local authorities manage their network on a limited budget, it is fundamental to define, firstly, a data collection method which makes it possible to acquire a suitable knowledge of the pavement conditions in a limited time, with limited management costs, without traffic limitation and with safety at work.

In order to meet such an objective, many road authorities use visual surveys to identify surface distress, eventually reserving the 'more expensive' instrumental surveys (load-bearing capacity, evenness and skid resistance), for use only at certain locations on the network where specific conditions make them necessary for structural pavement design or safety reasons (segments with a high number of accidents, intersections, etc.).

Current methods for distress identification use equipped vehicles with high resolution cameras to record pavement surface video images at highway speed. These methods have replaced the older techniques of visual inspection, in which measurements were carried out using teams of individuals who drove at slow speeds (on the order of 15 km/hr).

Other than the more traditional 2D image analysis to detect pavement distress (cracks, patches, potholes, etc.), new systems and procedures are proposed to obtain 3D pavement evaluation. 3D surfaces can be generated using photogrammetry and stereo vision techniques. Alternatively, 3D detection of pavement distresses can be obtained with laser scanner technology. All these systems have great potentials but also limitation when equipment and management costs are the main constrains.

Evaluation of Pavement Performance

Visual inspection data are used to assign different levels of distress to the pavements in road network. To achieve standardization, several distress identification manuals have been proposed, each of which aims at providing an uniform nomenclature for the description of visible pavement defects. These information are, usually, combined in order to assign values to composite pavement condition indices from which the prioritization of maintenance works is computed. The allocation of resources then takes place either through empirical performance models or intervention levels.

Since most agencies manage similar pavement networks, theoretically their indices should be similar. In actual fact, they are established according to different parameters derived from the visual inspection and they are based on a scale whose limiting values change significantly.

In almost all European countries, PMS has been implemented throughout the last 20 years. This led to the establishing of very different systems. The European countries use different factors, rating systems, measuring procedures to derive performance indicators that are not or only to some extent comparable.

To achieve harmonization to assess European road networks on an uniform basis, in the European intergovernmental program for **CO**operation in the field of **S**cientific and **T**echnical research, the "COST Action 354 Performance Indicators for Road Pavements" was finalized to the definition of uniform European performance indicators for road pavements taking the needs of road operators and road users into account (safety, comfort, structural, environment).

Even if a Global Performance Index was defined based on Combined Performance Indices derived from several technical characteristics of the road pavement (measurements and distress) also Combined Performance Indexes for cracking and surface defects were defined, which include the different appearance forms of cracking (linear, alligator, reflective, etc.) and surface defects (potholes, bleeding, etc.). The combination procedures of both, cracking and surface defects, take into account the different distress types, the different units (area, length, number, etc.), and the amount of influence in form of different weights.

The study highlighted, also, that a low number of road agencies managing motorway and primary road networks use cracking rate and a limited range of surface defects for the calculation of their own indices. No information were available for secondary and local road networks.

Treatments Identification and Design

A description of typical causes of the distress and repair works is usually associated to each distress type, severity and extension identified during the survey. These information are useful enough to define functional repair treatments such as crack sealing, patching and other surface treatments. If restoration or strengthening of the pavement are identified as treatments, the correlation between surface distresses and structural evaluation for overlay design is a critical factor. It must be underlined that the use of distresses to predict pavement structural capacity is less accurate than approaches based on deflection measurements, however, researches in this field, carried out also at the University of Catania, have shown that, with an appropriate calibration to take into account local conditions (materials, traffic loads and environment), an estimation of structural parameters (i.e. AASHTO SN) can be obtained which is suitable for overlay design when pavement visual distress is the only source of information.