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Management System for a Highway in Brazil

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Managing the physical structures of special works of art has been widely discussed recently among Brazilian specialists, mainly as result of the increasing number of concessions for federal and state highway administrations.

This fact, allied to new political-economic-social parameters, has been leading both government agencies and private companies to the development of efficient management methodologies and techniques for operational and engineering processes. On the other hand, their interest in such issues is nothing new among specialised engineers, and has long received special attention from those professionals dedicated to structure pathology, as well as from consultants and designers of special structures named in Brazil "special works of arts".

Based on the wide experience of its technical team, MCN Engenharia has developed a computerised system to monitor and manage the bridges, viaducts and pedestrian bridges located at BR-116 using information on constructions, identifying abnormalities through visual and equipment-assisted inspections, creating repair procedures for any type of abnormality detected, recording photographs and drafts on video, creating budgets and service timeframes, generating reports on pathologies and treatments, establishing rehabilitation priorities etc.

Process Definition in the Management of "Special works of art"

The main objective of any entity responsible for maintaining a road system is to "guarantee a satisfactory level of safety for both its users and the population under its influence, with adequate application of resources".

The standardisation of the processes related to road maintenance management aims at making sure that *"the infra-structural maintenance processes are being developed with methodologies that can provide standardised and almost instant responses."* Such responses can be obtained by implementing database systems that record and store all information instantly after their collection, guaranteeing the register and identification of all those in charge of maintenance. The system allows:

- prompt access to information;
- accomplishment within pre-established timeframes;
- continuous recycling of information;
- standardisation and continuous data exchange;
- selective access to information, according to user's needs;
- the verification of trends, regarding the evolution of each location surveyed.

Using decision-making and prioritisation techniques has become fundamental, and this requires the construction of a decision-making system. This system is expected to allocate properly all the resources available, observing the following criteria:

- What must be done?
- How must it be done?
- When must it be done?
- How much will it cost?
- Who will do it?

Or, more specifically:

- Which locations must be treated?
- How often?
- What is the best moment to perform repairs, carry out a treatment or improve it?
- How will such tasks be accomplished?

The importance of monitoring

When the wear presented by any existing structure does not receive timely treatment, it becomes an irreversible and natural process. One major characteristic to be observed closely in any structure is not the fact that it presents wear, since this is a natural process in all elements of a special work of art, but *how* this process starts and how long it takes to develop. There are two ways to treat wear. The first one is to develop studies that allow the examination of the types of deterioration processes installed. The second one is the fastest, most technically adequate and inexpensive way to eliminate wear when the structure already presents some deterioration.

Since wear processes are natural ones and can therefore be anticipated, the structures in the first situation will require interventions to relieve the installation of deterioration processes. On the other hand, other interventions are totally unexpected, since no previous studies or examinations have been performed on the structure. The two distinct situations lead to different strategies: preventive maintenance and corrective maintenance (repair).

Application of a management system - SIMGO

In order to increasingly reduce costs with unexpected repairs in special "works of art", it is essential that managers and users of the system can count on prompt information, which allows them to make decisions fast, based on a precise diagnosis. This is exactly the objective of the system.

It was developed aiming not only to provide information obtained during surveys and stored in databases, but also to plan the services and generate technical reports developed by specialised professionals, including the costs of operations and respective timetables.

The system is easy to use and allows greater flexibility when searching information. It runs on the Windows platform and requires no previous knowledge of other computer tools. It can also be used in a network environment, where several users can access information at the same time.

Maintenance – This term is used to define the actions performed in order to keep the structure under satisfactory operating conditions within the expected budget, usually by means of regular and planned interventions.

Structural Maintenance – Structure maintenance is a combination of all the technical and administrative actions taken to guarantee or reestablish the conditions required by any structure for satisfactory performance of its duties (British Standards 3811/84).

Preventive Maintenance – Preventive maintenance are all actions taken at regular intervals, based on two different criteria. The first one is contained in the project, which is concerned with keeping the best possible conditions of all materials and procedures for which the structure was designed. The basic assumption here is that maintenance is to be performed during the whole life of the structure. This way, a great deal of its behaviour can be previously known.

The second criterion is to base operations on the information obtained during inspections at random intervals. Usually, when such occasional surveys can identify problems, the structure has already been under use for a significant amount of time.

Important Concepts in Preventive Maintenance: **Pre-defined criteria for projects, materials and implementation;** and **Pre-established periods for surveys and treatments.**

Corrective Maintenance – Corrective maintenance results from an unexpected intervention which used no criteria to follow up on the structure. It is usually performed after the surveys motivated by the identification of a problem.

Repairs – This term refers to unexpected interventions.

1. In order to cope with the natural wear presented by structures, it is necessary to develop a way to track their deterioration by means of regular inspections, realised in pre-established periods. This monitoring allows managers to identify the deterioration mechanisms acting on the structure, as well as their specific types and particular pace of progression.
2. Monitoring requires a study of the costs needed to implement regular inspections and define the treatments to be conducted.

A correct planning of inspections and interventions, as well as the consequent budgeting for their execution can result in significantly lower operating costs and structure use.

Monitoring the performance of a "special work of art" permanently allows the creation of important preventive maintenance criteria. That is why it is important to implement a system using a tool like that it was used at BR-116/RJ.