

IMPLEMENTATION OF ASSET MANAGEMENT IN ROAD ADMINISTRATION OF SLOVAK REPUBLIC

Lubomír Pepucha

University of Žilina, Research centre, Univerzitná 8215/1, 010 26 Žilina, Slovakia,
e-mail: lubomir.pepucha@fstav.uniza.sk

Luboš Remek

University of Žilina, Research centre, Univerzitná 8215/1, 010 26 Žilina, Slovakia,
e-mail: lubos.remek@fstav.uniza.sk

Juraj Šrámek

University of Žilina, Research centre, Univerzitná 8215/1, 010 26 Žilina, Slovakia,
e-mail: juraj.sramek@fstav.uniza.sk

Peter Danišovič

University of Žilina, Research centre, Univerzitná 8215/1, 010 26 Žilina, Slovakia,
e-mail: peter.danisovic@fstav.uniza.sk

Martin Slabej

University of Žilina Research centre, Univerzitná 8215/1, 010 26 Žilina, Slovakia,
e-mail: martin.slabej@fstav.uniza.sk

Michal Grinč

University of Žilina, Research centre, Univerzitná 8215/1, 010 26 Žilina, Slovakia,
e-mail: michal.grinc@fstav.uniza.sk

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Abstract: The article presents basic principles and solutions for the application of Asset Management as part of road administration in Slovakia. It deals with application of Assets management methods and best practices of global trends in road maintenance, repair and rehabilitation strategies. An effective public Asset Management combines principles and strategies of asset management used in private sector with sound practices and methods proven to be applicable by public road administrator and his digital information systems. The under-funding of road management leads to development of tools and methods, which enable us to define criteria for establishing priorities for investments into road assets.

1 Road Administration in Slovakia

Available resources allocation, in the field of maintenance, repair and rehabilitation, is made by Road Administration in Slovakia by the method of the proportional rationing in combination with pavement management system. New investment projects and reconstruction projects within the road network require a positive technical and economical assessment before approval. Financial crisis and economic problems of the country lead to decreasing of the road agency budgets, and foremost, a constant pressure to operate more effectively - spending of public resources lead to requirement for more effective operation standards, and more efficient management of the existing road assets. Best practices in Asset Management and innovative approaches and effective methods for engaging the private sector in the management of road systems may bring the solutions for the increasing needs in the field of road management.

National Road network composes a primary asset of any country in the world. Efficient and well-maintained infrastructure is essential for societal stability and for

promoting economic growth and environmental sustainability. Queiroz and Gautam (1) identified a very strong association between economic development, measured as per capita gross national product (GNP), and road infrastructure. Furthermore, the World Bank's (2) research showed that the economic development of nations correlates to a high extent with the countries' infrastructure systems. Sound public infrastructure plays a vital role in encouraging more productive and competitive national economies.

The road network of Slovakia consists of 391 km of limited access roads (motorways and express roads) and 174 367 km of 1st, 2nd and 3rd class roads. The main objective of motorway network is to provide transit according to Pan-European transport corridors, namely the IV., V. and VI. corridor. The purpose of express road network is to collect and transfer the transport generated by Slovak republic's regions, and contra wise, to distribute transport from foreign countries from motorways to the body of Slovak Republic. The 1st, 2nd and 3rd class roads fulfill the service task of transportation between-and-within regions of Slovak republic. On top of

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this network a network of urban communications and minor purpose communication is connected.

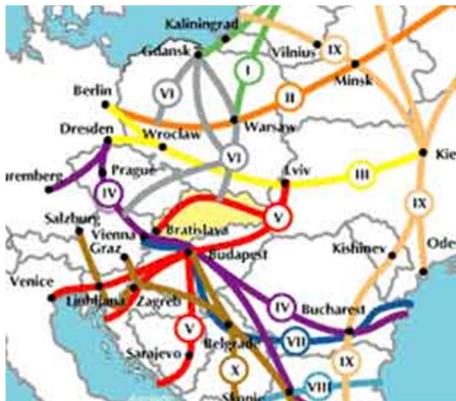


Figure 1 Pan-european corridors in SR

The full road network of Slovak republic is portrayed in Fig. 2. As seen in Tab. 1, different types of roads have different owners and administrators with their executive offices. This paper is aimed on the topic of asset management; therefore the viewpoint of administrators of road network will be crucial.

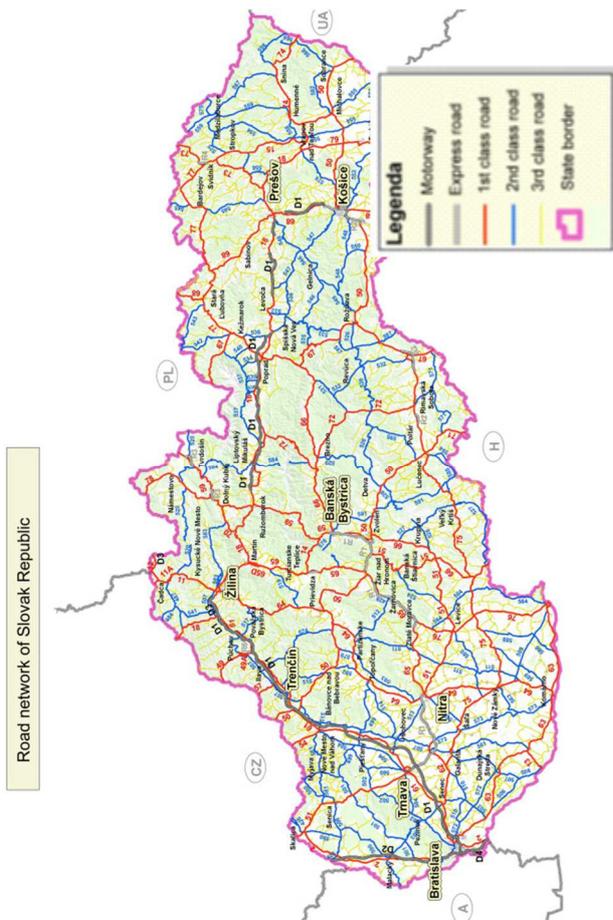


Figure 2 The full road network of Slovak republic

Road administrators differ significantly with available budget, length of roads they are responsible for, demands put on their assets, demands put on acquisition of new assets and many other issues, yet, and their task is the same. Their task is to develop and maintain a safe, eco-friendly and efficient transport system. This may be seen as securing a fluent and safe transport on them entrusted roads by providing maintenance, winter service, repair, reconstructions and acquisition of new assets according to concept of development of road network of Slovakia.

The main functions road administrator needs to fulfill are:

1. road management and creating conditions for safe traffic on responsible road network;
2. increasing traffic safety and reducing harmful environmental impact of vehicles;
3. organization of traffic and public transport;
4. state and owner's supervision over road construction and road maintenance, road usage, the service level of roads and organizing state supervision over compliance with the requirements established by legislation;
5. keeping road databank of roads, vehicles and public transport; observing special requirements established by legislation;
6. participating in the elaboration of policies, strategies, and development plans of road development.

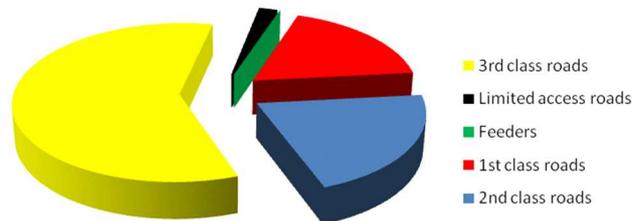


Figure 3 Road network of Slovak republic and its composition (3)

Various evaluations investment efficiency in road transport in recent years have highlighted the fact that the amount of fund expended on the development and maintenance of the road and highway network, as the top processes in the road management, does not reflect actual requirements. Organizations managing the road network therefore feel the need to improve procedures and methods for determining the efficiency of their operations, thus use the allocated resources more economically and efficiently.

2 Asset management in road administration

Asset management, broadly defined, refers to any system whereby things that are of value to an entity or group are monitored and maintained. It may apply to both tangible assets and to intangible concepts such as intellectual property and goodwill. Asset management is a

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systematic process of operating, maintaining, and upgrading assets cost-effectively. (5)

- Long-term in outlook.
- Accessible and user friendly.
- Flexible.

Table 1 Road network administrators of Slovak republic (3)

Type of communication	Owner	Administration and maintenance	Executive administration office
Motorways	State	National Highway Agency	Minister of Transport, Construction and Regional Development
Expressways	State	National Highway Agency	Minister of Transport, Construction and Regional Development
1st class roads	State	Slovak Road Administration- Bratislava	Regional transportation offices
2nd class roads	Regional administrations	Slovak Road Administration	District transportation offices
3rd class roads	Regional administrations	Slovak Road Administration	District transportation offices
Urban roads	Municipal authorities	Municipal authorities	Municipal offices
Minor purpose communications	Municipal authorities	Municipal authorities	Municipal offices

Asset Management as applied to the roads sector represents a systematic process of maintaining, upgrading and operating assets, combining engineering principles with sound business practice and economic rationale, and providing tools to facilitate a more organised and flexible approach to making the decisions necessary to achieve the public's expectations.

Road Administrations must maintain, operate, improve, replace and preserve this asset whilst, at the same time, carefully managing the scarce financial and human resources needed to achieve these objectives. All of this is accomplished under the close scrutiny of the public who pay for and are regular users of the road network, and who increasingly demand improved levels of service in terms of safety, reliability, environmental impact and comfort.

In practice, an Asset Management System will include all the processes, tools, data and policies necessary for the effective management of all the assets for which the Road Administration has responsibility, including physical highway infrastructure such as pavements and bridges as well as human resources, equipment and materials and other items of financial and economic value.

As a general principle, an Asset Management System should be:

- Customer focused.
- Mission driven.

2.1 Implementation of asset management system into road administration system

Each Road Administration is responsible for the management of its own unique set of assets but the typical assets of a Road Administration can be broadly summarized as:

- Physical infrastructure, such as pavements and bridges.
- Human resources (personnel and knowledge).
- Equipment and materials.
- Other items of value such as rights-of-way, data, computer systems, methods, technologies, and partners.

Asset Management Systems should generally:

- Include inventory information for the asset and condition measures.
- Include values of condition of the asset.
- Include a performance prediction capability.
- Ensure data integrity, enhance data accessibility and provide data compatibility.
- Include all relevant components in life cycle cost analyses.
- Enable the removal of outdated systems and unproductive assets.
- Consider both system and project optimization.
- Output useful information on a periodic basis, ideally in real time.

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- Facilitate iterative analysis processes that can be performed on a regular basis.

The type of assets and the requirements we put on a asset management system form a framework for an successful implementation. In terms of road administration the main systems we need to take into account are:

- Pavement management system.
- Bridge management system.
- Other already working management systems.

2.1.1 Pavement management system

Pavement Management System (PMS) offers road administrator the ability to select the most appropriate works program to maximise the long-term performance of the network under a range of user-defined funding and treatment strategies. The PMS consists of two basic components: A comprehensive database, which contains current and historical information on pavement condition, pavement structure, and traffic. The second component is a set of tools that allows us to determine existing and future pavement conditions, predict financial needs, and identify and prioritize pavement preservation projects.

2.1.2 Bridge management system

Bridges are considered to be vital links in any roadway network. Complete or partial failure to maintain these links paralyses the overall performance of the roadway network and causes excessive public and private losses. The ultimate goal of a Bridge Management System (BMS) is to provide a clear roadmap for the maintenance and rehabilitation of your bridge inventory. It must provide a strategy, or number of strategies, for a given set of budget constraints. It must also be capable of assessing the minimum budget requirements for a targeted level of service.

2.1.3 Other already working management systems

All others management systems which are proven themselves to help administrator to carry out his task are considered important. Therefore is a wise decision to try import any useful already working management systems into the overall asset management system. These system may be aimed at various areas of administrators activities be it his inner corporate management or directly at his area of focus.

2.2 Foreign experiences

In most OECD Member countries, the road network constitutes one of the largest community assets and is predominately government-owned. For their part, governments are placing greater pressures on road administrations to improve the efficiency of, and accountability for, the management of the road network. Indeed, in many countries, national road administrations and some smaller, local highway authorities face formal

accountability and reporting requirements on how they manage their assets.

Asset management is ultimately about managing a road administration's resources more like a business. In many countries, road administrations are now required to implement standardised asset inventory, valuation and depreciation approaches and enhance the information provided as part of their annual financial statements, in a manner more in line with those used by private sector companies.

The experiences of those OECD Member countries that are moving towards asset management in the roads sector have indicated that there are a number of points that should be considered by road administrations before implementing an asset management system:

- An asset management system should integrate existing management systems for individual assets, thus enabling a common approach to be adopted for the management of different assets.

- Improved collection, storage and management procedures for asset information, including inventory, location and condition data, will be required.

- Analysis capabilities should include the ability to prioritise maintenance options on the basis of the life-cycle cost of the assets.

- Asset management will encourage road administrations to adopt a more business-like approach to the management of the assets for which they have responsibility while the concept of asset valuation and depreciation will provide engineers with a common language with budget holders and decision makers. This will enable the implications of different investment strategies to be determined, including, potentially, assets in other sectors. Asset management will further encourage the concept of performance monitoring including, for example, performance indicators.

2.3 The process of implementation of asset management in road administration

In the private sector, industry leaders develop tailored asset management systems that let them monitor and assess the status and condition of their assets (real estate, physical plants, inventories, and investments) individually and collectively. These systems give them the information and tools they need to retain their competitiveness. Similarly, public sector officials responsible for the nation's infrastructure have to maintain, replace, and preserve these assets. They have to make the best use of limited resources and have to ensure accountability to the public service. In addition, the need for more "business-like" practices has been accentuated due to the recent trend towards privatization of some of the government infrastructure development and maintenance activities.

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Table 2 State of road asset management in foreign countries (4)

Country	Pavement management system	Bridge management system	Other system	management	Integrated asset management system
Australia	yes	yes	no		Implemented in Western Australia
Belgium	yes	yes	no		no
Canada	yes	Being studied	Maintenance, road features		Being implemented
Finland	yes	yes	Gravel road maintenance management system Short-term strategy and project management system Contract management system		Being studied Financial accounting system for the state including accounting of road assets
Hungary	yes	yes	Maintenance management system		Being studied
Japan	yes	Being studied	Tunnel management system (being studied) Disaster prevention management system (being studied)		Being studied Database for all national highway information in use
Mexico	yes	yes	Road network maintenance strategy being studied		no
Netherlands	yes	yes	Environmental management system		Being studied
Poland	yes	yes	Winter management system		No
United Kingdoms	yes	yes	All asset routine maintenance system Environmental and winter maintenance management system		Resource accounting and budgeting (pilot) Being studied
United states	yes	yes	Various types of information systems		Being studied

There is a concept of a total highway management system for a state highway agency. Based on a comprehensive review of the state-of-the art in highway infrastructure management systems, there is a clear tendency towards integrated, flexible, and distributed systems. The concept of generic systems is practical for developing decision support systems for infrastructure management. Fig 4 shows a developed integrated infrastructure management system that can be used to manage a wide variety of infrastructure data.

There are many advantages to these integrated systems including better flow of information among subsystems, elimination of redundant data, reduction in system development and maintenance, and better and more consistent optimized maintenance and rehabilitation programs for the various infrastructure types. The use of generic models, which can be customized by the user to fit local conditions and experience, reduces the implementation efforts and allows for the exchange of experiences among infrastructure types. Integrated infrastructure management systems have been developed and implemented at the national, state, and municipal levels.

Typically, an asset management system in use by a road administration will utilize the following data:

- Definition of the network.
- Definition of the assets on the network (e.g. bridge, pavement).
- Location of the assets on the network.
- Condition of the assets.
- Levels of use (e.g. traffic flows).
- Policies and standards (e.g. maintenance standards and treatment designs as well as monitoring information such as performance measures).
- Budget information (e.g. broken down by asset type, program level).

Uprising from these deductions a set of needs we have to define for working asset management system is following:

- Data administration,
- Data collection,
- Data storage,
- Management systems,
- Data analysis.

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Figure 4 The proposed generic scheme for an asset management system

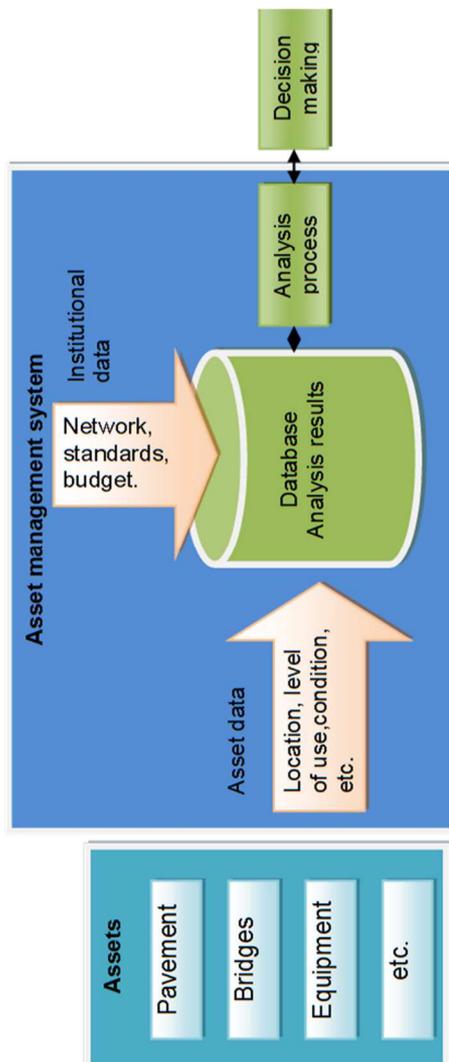


Figure 5 Typical flow of data into and out of a generic road asset management system

3 Implementation of asset management in road administration of Slovak republic

As presented in the first chapter of this paper a group of administrators manage the road network of Slovak republic. For securing a complex asset management system a decision was made to implement an asset management system for every administrator and try to make them cooperate. Of course since these administrators have separated budgets the cooperation we speak of consists mostly of data sharing. The analysis process and decision making process thus have to be individual for each and every administrator.

A scheme for infrastructure asset management as we propose is shown in fig 6.

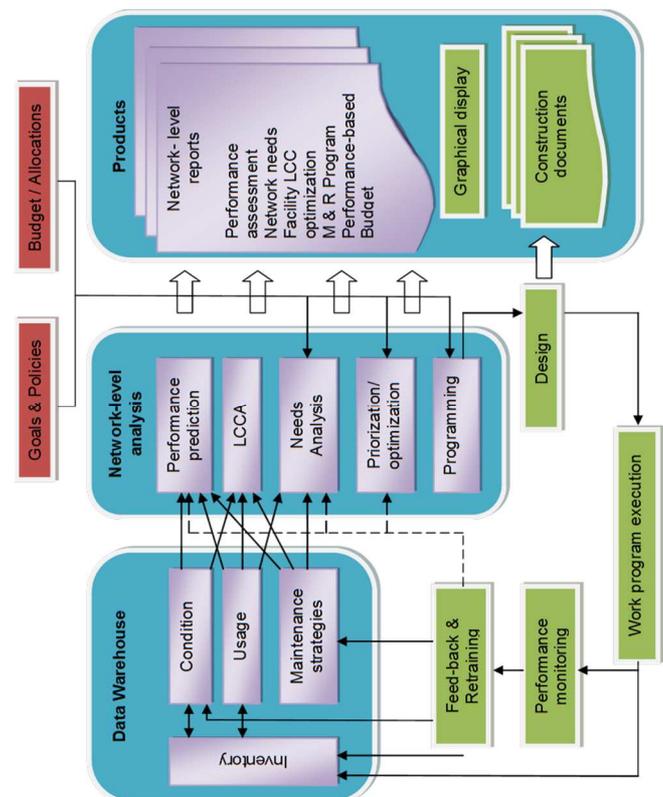


Figure 6 Infrastructure Asset management system

While looking frightening at first glance it's simple in its essence. A data warehouse stores the main input data and should be separated for every administrator, these data are then used in network-level analysis. The network level analysis will use the same mechanic for every administrator with different inputs from data warehouse (internal inputs) and data regarding goals policies and budget (external inputs). The products will then be the outputs listed in fig. 6.

3.1 Data warehouse

Currently the internal data which should be stored in a data warehouse are currently collected by Slovak road administration for 1st class roads in a road databank

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(fig. 7). Slovak road administration is also collecting data for limited access roads as contractual agreement with National Highway Agency and keeps them up-to-date.

The problem lays in 2nd and 3rd class roads which volume exceeds the capabilities of Slovak road administration to for monitoring and updating. Therefore, to compile with this need for working asset management additional resources must be infused to boost the the data gathering capacity of Slovak road association, or to a 3rd party tasked with the data collection. Various maintenance strategies for different roads are well defined, tested and broadly used in the environment of Slovak republic; therefore the data gathering stays the main concern on this level.

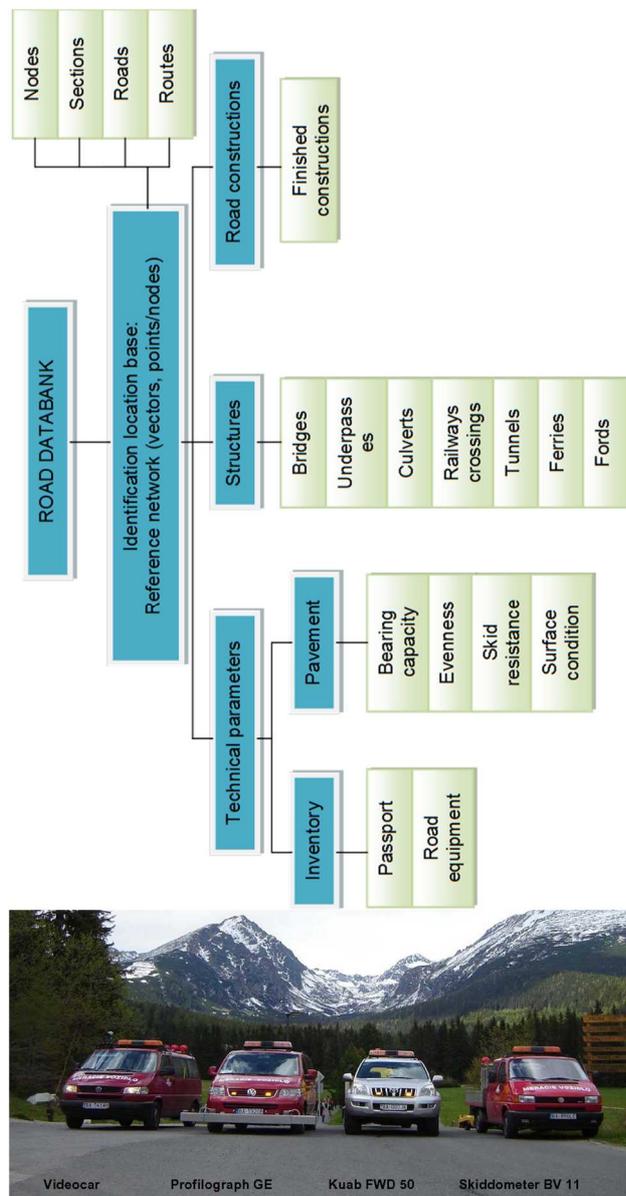


Figure 7 Road database scheme and Data gathering fleet of Slovak Road Administration

Conclusion

The decision to implement an Asset Management or to integrate the existing commonly used separate systems is now being considered by road administrators of Slovak republic. A major consideration in this decision is the potential benefits that are available over those provided by the separate systems. Clearly there is a need for efficient management systems given the common background of ageing infrastructure, reduced budgets, reduced staff resources and increased public expectations.

There is also a need for engineers to be able to clearly communicate with financial managers in understandable accounting terms rather than with just engineering condition indices. While asset management encourages road administrations to be more business-like, and uses recognised accounting principles and practices, it also assists in budget justification within the framework and the recognition of various competing government programmes.

This paper describes the road network of SR and its road administrators. It describes the problematic of asset management in road administration and gives an insight into foreign experiences related to road asset management implementation. The last part introduces a framework for infrastructure asset management system and examines the current state of things regarding its implementation. The research implies the need for more resources towards data gathering and managing of a data warehouse as the main input source for asset management. It also underlines the need for transparent software for assessing of life cycle cost of new construction.

There are still issues that need to be solved. For one it's the asset valuation which plays an important role in asset management because one of the main purposes of valuation is to enable reporting in monetary terms to reflect the physical conditions of the road network, and to assist asset managers in informing asset owners of the effects of different financing strategies.

Or the issue of monitoring of the performance of the asset against defined required outcomes or targets of performance. One approach for this is the use of performance indicators to measure progress towards achieving the road administration objectives. Other simpler approaches include the straightforward recording of condition of the asset with time.

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References

- [1] QUEIROZ C., GAUTAM S., "Road Infrastructure and Economic Development- Some Economic Indicators", Working Paper WPS 921, Western Africa Development and Infrastructure and Urban Development, The World Bank, Washington, DC, 1992.
- [2] THE WORLD BANK, "World Development Report 1994" TWB, Washington DC, 1994.
- [3] <http://www.scksk.sk>
- [4] GESTION DU PATRIMOINE D'INFRASTRUCTURE DANS LE SECTEUR ROUTIER, "Asset management for road sector", OECD Organisation for economic co-operation and development, ISBN 92-64-18697-2 – No. 51897 2001, 2001.
- [5] CAUSEY W., "Guide & Sourcebook asset management", ENERGYBIZ MAGAZINE 99, 2003.
- [6] FLINTSCH G. W., MEDINA A. M., "Framework for a Web-based Intelligent Infrastructure Asset Management System", 5th International Conference on Managing Pavements, 2001.
- [7] ZGÚTOVÁ K., PEPUCHA L., PITOŇÁK M., REMEK L., "Financial resources allocation based on impact coefficients in Road administration", XIX. rusko - slovensko - poľský seminár, 2011.
- [8] MIKOLAJ J., VALUCH M., "Systém hospodárenia s vozovkami na Slovensku, teoretické aspekty, praktické skúsenosti" [Pavement Management System in Slovakia, theoretical aspects, practical experiences]. In: 1st European pavement management system conference : proceedings. – Budapest, p. 8, 2000.
- [9] TROJANOVÁ M., "Riadenie aktív", [Asset management], BTO print Žilina, p. 89, 2009.
- [10] <http://www.cdb.sk/>