INNOVATIVE ROAD MANAGEMENT ARRANGEMENTS IN SLOVAKIA

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ABSTRACT RÉSUMÉ

Some regional road administrations in Slovakia have managed to implement projects with participation of a private partner. Based on the results of one of the first and larger scale project we are qualified to make initial conclusions and recommendations. The Regional Road Administration has checked the comprehensive quality of their roads for the first time in 2005 by using the Pavement Management System /PMS/. Based on the results, 252 km of roads is in the state of disrepair, pavements are at the end of their service life, they are losing their operational capability and there is an immediate need for resolute action and implementation of rehabilitation. This review shows that the immediate requirements exceed the resources of the road administrator nearly 7.5 times. Therefore, the three possible methods are available in order to ensure necessary rehabilitation: 1. to maintain the current model of financing 2.take a credit 3.private investor participation. Considering all of the aspects, the administrator has chosen the third model - the private partner participation. The paper presents the benefits of the project and analyze fundamental specifics of such cooperation.

1. INTRODUCTION

Unexpected and sudden increase of traffic volume on the roads, caused by general expansion of capital construction and development projects in recent years, incurred that road structures, not designed for such traffic load intensity, damage much faster than planned. [1] Thus the need for financial resources to maintain and repair the roads of all classes is rising proportionally. Public resources allocated for pavement maintenance and rehabilitation works are insufficient and budgets of road administrators are undersized. This means that in Slovakia, like in other countries, it is necessary to consider all options to obtain more effective and efficient management for road systems as well as to utilize potential of a private partner for larger repair projects. [12] In terms of efficiency, the Slovak Road Agency has developed a new Pavement Management System. Some regional road administrations in Slovakia have managed to implement projects with participation of a private partner in the form of PPP /public private partnership/. Based on the results of one of the first and larger scale project we are qualified to make initial conclusions and recommendations.[13]

2. PROJECT DESCRIPTION

The Road Administration of the Žilina Self-Governing Region, tackled the problem of significant degradation of pavement in its road network /roads Class 2 and 3 / and thereby also the decrease of the value of their assets, because the regional organization of the road administration is also the owner of the road network. The regional road administrator, in relation to the road network, has its receipts defined from the revenues of so-called road tax. All business entities, owning automobile transport, are obliged to pay the road tax. The road administrator shall ensure the road network routine maintenance as well as the road rehabilitation and reconstruction within the budget of these funds.

Table 1- Local administrator road network basic data [14].

Žilina region basic data	
Land area (km^2)	6,788
Population	695,874
County town	Žilina
Road Network	**(km)**
Basic data on road network of Žilina region	
Highways	66.803
Highway feeders	2.554
Length of roads	1,958.983
Class 1 roads	511.955
Class 2 roads	326.208
Class 3 roads	1,120.820
Length of roads and highways	2,028.340
Roads for motor vehicles	0
International "E- roads" (considered sections)	292.553
International routes "TEM"	215.029
Corridors "TINA"	235.528
Road network density	
km/thousand km^2	0.299
km/ thousand Population	2.915

Highways and Class 1 roads are state owned. Regional Road Administration owns roads Class 2 and 3. Given the poor condition of pavements, the Regional Road Administration has checked the comprehensive quality of their roads for the first time in 2005 by using the Pavement Management System /PMS/ in cooperation with the National Road Databank. Based on the results, the assumption that the condition of pavements is very poor was confirmed, moreover, 252 km is in the state of disrepair, pavements are at the end of their service life, losing their operational capability and there is an immediate need for resolute action and implementation of rehabilitation.

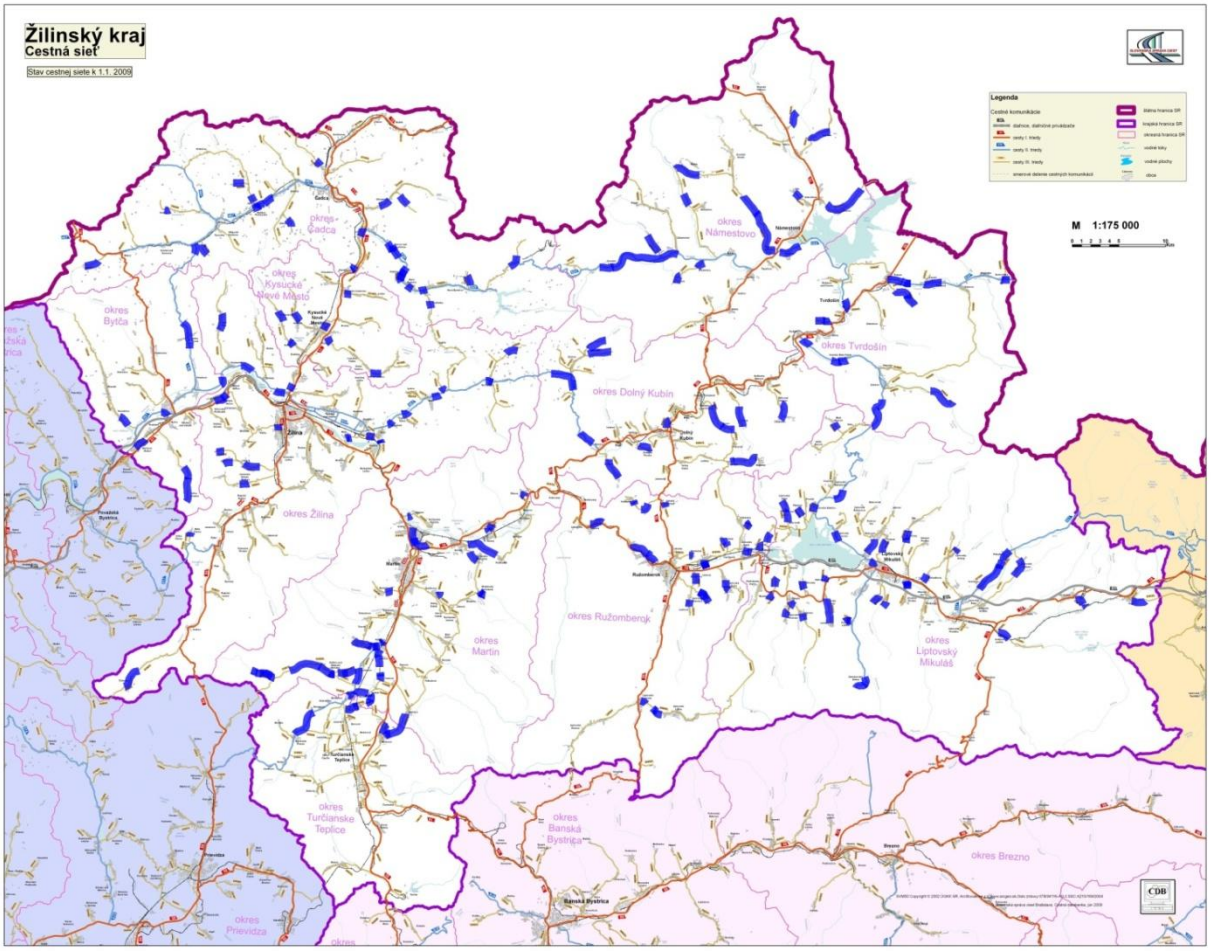

Figure 1 - Map of the road network of the Regional Administrator and road sections under the project involving a private partner [14].

The budget of the Regional Administrator of roads per year is 10.3 mil. EUR. These funds must cover the cost of winter maintenance /mountainous region/ - 3.3 mil. EUR, maintenance and repairs - 5.0 mil. EUR and bigger rehabilitation works - 2.0 mil. EUR. The structure of the Regional Administrator budget, is shown in Table 1. Estimated requirement for urgent rehabilitation of 252 sections in the state of disrepair is 15.2 mil. EUR. This review shows that the immediate requirements exceed the resources of the road administrator nearly 7.5 times. Furthermore, the requirements are 1.5 times higher than the total annual budget of the administrator.

Table 2 - Budget of the Regional Administrator of roads /year 2005

Allocation of resources	[MIL. €/ year]	[MIL. €/ km]
Annual budget	10.300	
Of which:		
- Winter maintenance	-3.207	
From that the costs to ensure the operational capability and performance:		
- Continuous pavement repairs in critical sections - 30km	-2.001	0.067
- Repair and maintenance of roads in critical sections - 222 km	-0.811	0.004
- Repair and maintenance of roads in other sections - 1148km	4.281	0.003
Total	7.093	0.005

Therefore, the following solutions are available to the Regional Administrator of roads in order to ensure necessary rehabilitation:

1. To maintain the current model of financing the operation and maintenance of the road network: repair the road network only within the budget available to the road administrator/rehabilitation would be carried out only on about 30 km and 222 km would be left without intervention/
2. Take a credit - with the guarantee of a public administration
3. Private investor participation

1. Own available resources

Maintaining the current model of financing the operation and maintenance of the road network would cause that only about 30 km of roads would be rehabilitated and the remaining 222 km would be left without construction intervention. Given the overall state of roads and the length of the road /1450 km/ network, it is anticipated that the number of sections in the state of disrepair, which will require immediate rehabilitation will increase in coming years. /assumption about 40 km per year/. However, 252 km of road sections in the state of disrepair will cause depreciation of the road assets, because the degradation of the technical condition after no executed rehabilitation of pavements would continue at the higher rate. Administrator, within its budget, would be able only to continually fill cracks and potholes, which would with difficulty, maintain a certain functionality of pavements, but the construction condition would continue to deteriorate rapidly. This would lead to the point where pavement rehabilitation would be of no help and it would be necessary to proceed with the reconstruction. Such situation would ultimately increase the costs by several-fold.

2. Credit

Each Regional Self-Government has by law limited possibilities to obtain a credit, which are based on the overall budget and already obtained credits. The criterion is that the aggregate amount of loans shall not exceed 60% of the annual budget of the regional road administrator. Since the self-government has such limit defined also for investment projects and currently it is nearly exhausted, it is not possible to use a standard loan with a public guarantee for the rehabilitation of pavements.

3. Private partner

Road Administration commissioned a group of experts to process a case study focused on the possibility to involve a private capital in the road rehabilitation. Based on the case study outputs there was developed an innovative method or a model, which covers all aspects of road administration, including financing, construction works, maintenance and operation on the section of the road network under the consideration. Participation of private investors was considered in the form of so-called supplier credit. Within this supplier credit the private investor /Construction Company, Bank/ at his own expense performs pavement rehabilitation and will maintain and repair it over a period of ten years. After completion of construction works and following the transfer of roads to the private investor for the duration of the project /ten years/, the Road Administration will repay the expenses in regular instalments.

Considering that the first model would not address the state of disrepair of roads, but it would only prolong the unsatisfactory conditions; and the second model is not feasible, the administrator has chosen the third model - the private partner participation. The model itself was set on these basic assumptions[4]:

- Payments to the private partner shall be paid from the receipts of the road administrator, i.e. from the road tax. The extend of participation of the private partner and thereby the size of the project is to be limited by the administrator's ability to repay private partner's receivables. This defines also the duration of the project,

- Not all requirements of local administrators are to be implemented, therefore, the decision making process shall be transparent and based on the objective and verifiable criteria,
- The whole model should be set in such a way that the majority of risks is on the side of the private partner,
- Private partner is to be selected by a public procurement provided that after fulfilling the technical terms, the lowest bid is selected,
- Cost will be contractually understood as final.

3. PAVEMENT MANAGEMENT SYSTEM

The basic prerequisite for the success of the project was the selection of road sections to be addressed within the project. At the renewal and modernization of the road network in the Slovak Republic is currently being used the Pavement Management System (PMS). PMS is the process pursuing the effective use of pavements of the road network in given sections, in certain operating conditions, involving systematically organized maintenance, repairs and rehabilitation of pavements, in terms of the most economic use of financial, material and energy resources.
PMS in question is applied at the given project and the following procedure was observed. On the basis of diagnostic measurements and technological possibilities of repairs are by means of optimizing and economic criteria selected sections of roads in accordance with the order of urgency. The process itself is shown in Fig. No.2. Final allocation of available financial resources for particular sections of the road network is performed on the basis of economic efficiency, expressed by the percentage of the internal rate of return from the costs of proposed rehabilitation technology. Currently so-called PMS – preferred, based on the current technical condition of pavement, are used.
The Regional Administrator of the road network requested all 11 local organizations of the road administration to select, on the basis of visual inspections and assessment of pavement surface conditions, sections which require rehabilitation investment. These sections were subsequently subjected to a thorough diagnosis of technical conditions of the road, implemented by the National Road Databank. Department of Pavement Diagnostics collected the data on pavement operational capability and performance parameters better said pavement efficiency parameters/ skid resistance, roughness, surface condition and pavement distress - bearing capacity/ of sections of roads proposed for rehabilitation. The processing of accumulated data and determination of the order of importance of repairs based on the internal rate of return (IRR) was also processed by the National Road Agency. Diagnostics/Pavement evaluation/ consisted of assessment of all relevant variable pavement parameters: [2]

- Bearing capacity - Kuab FWD 50: bearing capacity and residual life of pavement construction [9], [14].

Roughness - Profilograph GE: - The average longitudinal and transverse unevenness/mean rut depth, IRI [9], [14] [10].

- Surface condition – Videocar: - surface condition expressed by Pavement Serviceability Index [9], [14].
- Skid resistance: Skidometer BV 11: - skid resistance measurement [9], [14].

PMS on the basis of the described method determined the priority order of urgency for rehabilitation of roads. It turned out that there are 251.728 km of roads in the state of disrepair, which require immediate rehabilitation.
The term itself "the Pavement Rehabilitation" is in our case understood as a pavement strengthening - on average 40 mm new asphalt layer, in order to secure pavement

operational capability as well as operational performance / pavement efficiency/ for a period of 10 to 15 years. [8]
The economic efficiency evaluation of costs of rehabilitation PMS of selected sections was carried out by ISEH (Integrated System for Economic Evaluation) developed by the University of Zilina in cooperation with the Slovak Road Administration. [7]
The program calculates the Road user costs (RUC) before investment and compares it with RUC after investment. (time delaying or saving, Vehicle operation costs – fuel and oil consumption, tires degradation, maintenance costs) The outputs are Payback Period (PP), Net Present Value (NPV) and Internal Rate of Return (IRR). This software uses the SRA every year on the level of road network for decision making process. [6] Based on demands of a local road administrator, economic effectiveness of planned maintenance works on selected sections, SRA made the rank of road section for evaluated year. The main criterion is IRR and it does decide which of the planned investment to maintenance works will take place.

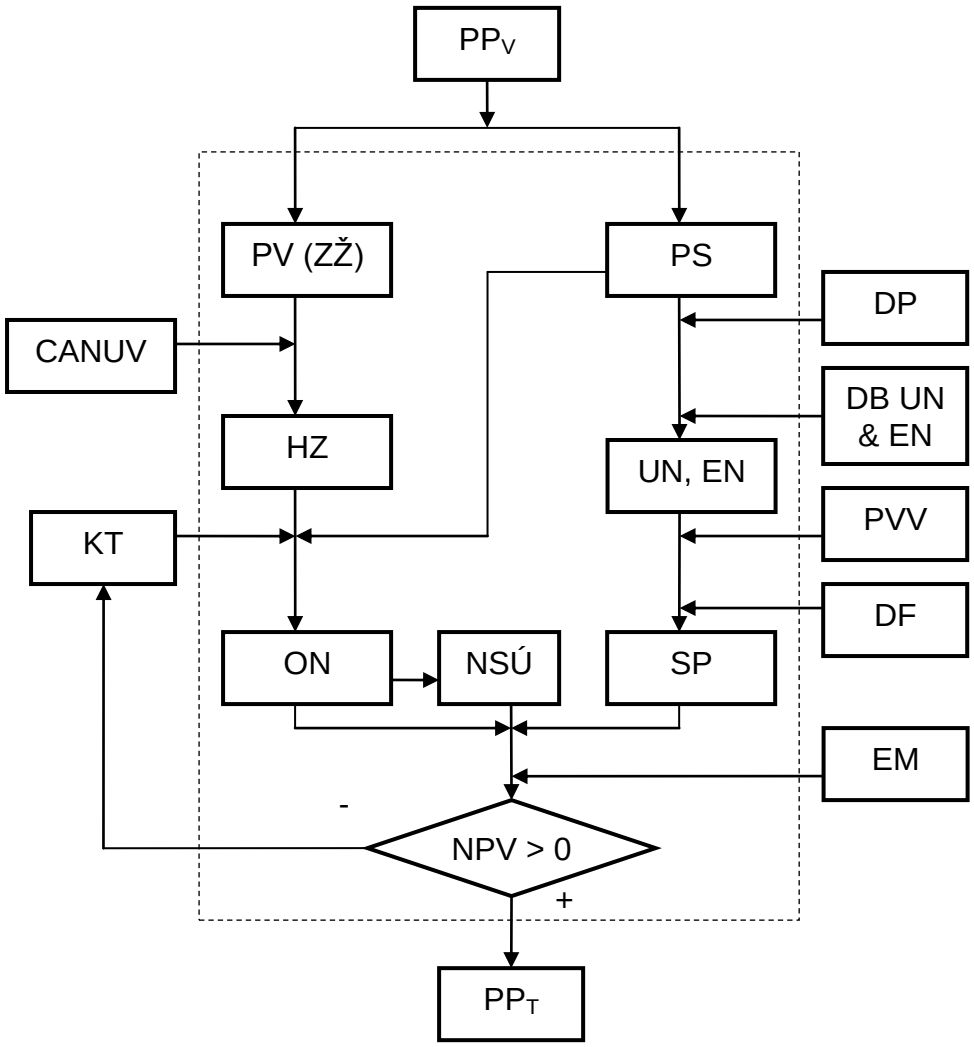

Figure 2 - PMS as a transformation system represented by the block scheme[1].

where:

PP_V - input variable parameters describing the state of the pavement in terms of PV and PS
PV - Operational Performance
PS - Operational Capability
ZZ - Residual Life
HZ - Thickness of Strengthening

ON - Cost of construction work
NSU - Cost of continuous maintenance
UN - User Costs
EN - External Costs
SP - Social Benefits
NPV - Net Present Value
CANUV - Data obtained by measurements on pavement by the CANUV system
KT - Library of Technologies
DP - Transport parameters
DB EN&UN - Database of User and External Costs
PVV - Pavement Surface Characteristics
DF - Degradation Function
EM - Ekonomic Methods
PP_T – Variable parameters transformed (output)

4. RISKS

Pavement rehabilitation project with the use of private partnership assumed that the final cost of investment will be determined in the procurement process. This should have ensured that the project was implemented at minimum cost, offered on the market in Slovakia in 2005, when it was implemented. The model was based on the principle that a private partner will implement the reconstruction of selected sections of the road network with the use of his own resources or with the use of a commercial credit and the investor - the road network administrator will gradually repay the investment. Project boundary conditions have been set in such a way that the project proposal was submitted by the investor (administrator) and a private partner provided finances, construction works itself and especially maintenance of reconstructed sections for a period of 10 years. [5] The main advantage of the project is that the private partner submitted an effective design of the technology and carried out the works in the highest possible quality, because all extra works /repairs/ would have to be paid by him.
Risks and their distribution are a bearing part of the project. The allocation of risks influences the cost-effectiveness, quality and ultimately the success of the project. [3] Actual definition of risks is distributed among project participants: road administrator and the contractor /private partner/.
Road Network Administrator Risks:

- The risk of raising enough money from the road tax /over 10 years/ to pay back the private partner;
- The risk of sections selection /using PMS/ and technology design /overall/ in relation to the degradation of sub- base layers and subgrade;
- The risk associated with the ability of the contractor to meet his obligations under the contract (warranty or repairs and maintenance for 10 years). Given that the selected contractor may get into financial difficulties and subsequent bankruptcy;

Contractor Risks / private partner /:

- The risk of construction works completion deadline ;
- The responsibility for the quality of carried out works ;
- The risk of pavement quality in terms of increased traffic and climate load and the contractor is obliged to repair, for the period of 10 years, all defects arising on road sections under the warranty;
- The risk arising from terms of the contract in regards to the own Cash-Flow, as the contractor must provide finances for the project at the beginning of the

project and paying back the profit as well as the the cost of the project is spread over 10 years;
- Contractor bears the risk of the cost of money over the period of 10 years.

5. SWOT ANALYSIS

To describe the project more transparent, we will try to highlight the project advantages and disadvantages by the SWOT analysis.

Advantages:

- Considering the situation of the administrator extensive pavement rehabilitation is performed which would be under normal, traditional conditions impossible;
- By carrying out the repairs further degradation of pavements is prevented and thereby the increased cost of later rehabilitation or even reconstruction is avoided;
- Timely implementation of rehabilitation will reduce operational /user/ costs of the road transport;
- The advantage of inflation is utilized. Price of construction works is determined at the time of implementation thus at the beginning of the project. Private contractor bears the costs of maintenance and repairs throughout the project / 10 years /. Revenues of the road administrator will grow in line with inflation and business development, thus with regards to the project - 10 year instalments, the price of inflation is favourable;
- By tendering, the competition will seek to reduce the cost of construction works, maximize the quality and reduce the cost of credit condition;
- Expansion of business activities is expected in connection to improved road infrastructure and also with the growth of the economy in Slovakia, which belongs to the medium-term fastest growing economies in the EU. This also generates more revenue from the road tax over 10 years.

Disadvantages:

- The self-government, in contrast to the classic ways, will pay because of the commercial /private/ credit in its instalments a higher price as if it borrowed itself;
- By transferring a portion of risks to the private partner, the administrator must anticipate that risks will be reflected in the higher price of rehabilitation and will have to pay for them. Regardless of whether the risks will arise or not.

6. PROJECT RESULTS

Before presenting the benefits of the project with the use of the public and private sector it is appropriate to recall certain specifics of such cooperation. The European Commission defines PPP projects as a form of cooperation between the public and the private sector for the purpose of financing the construction, reconstruction, operation and maintenance of infrastructure and the provision of public services through this infrastructure. It follows that also rehabilitation, which may take the form of reconstruction is a subject of such projects. However, the European Commission also requires that the following conditions are met, in order to consider the project to be a PPP:

- Private partner provides rehabilitation and operation of Works and

as a counter value provides services associated with the Works for payments either from the users (e.g. tolls, admission tickets) or from the public partner (so-called availability payment).

- Public and private partners are to share the risks of the rehabilitation and project operation, depending on which of them is able to bear the given risk better,

- There must be a long-term relationships.

Rehabilitation performed by the PPP would bring greater efficiency to the public sector than implementation by a traditional method.
For economic comparison of traditional methods in the form of a public contract with the partnership of public and private sector is applied the method of expression of the Value for Money (VfM) in combination with the method of Life Cycle Cost Analysis (LCCA) of rehabilitation technology.[11] This methodology of expressing the value for money requires comprehensive analysis and comparison in this case of the rehabilitation project of selected sections of the road network in the Žilina Self-Governing Region of the Slovak Republic through a public procurement contract of the public constructor: Žilina Self-Governing Region in the form of implementation with the private partner participation.
The private contractor has performed, on the basis of mutual agreement, in the agreed period from: 16th of May to 31st of October 2005; the rehabilitation of selected sections at the length of: 251. 728 km of roads Class 2 and 3 at the agreed acquisition price: 22.315 178 mil.€, without VAT and the price: 26.555 062 mil. €, including VAT. The price includes the cost of rehabilitation construction works, the cost arising from the risk of possible repairs and maintenance works during the ten years period and cost of obtaining the credit /interest, margin, the principal / for ten years.
The crucial effect is particularly in stopping the significantly adverse development of operational capability and performance of sections prepared for rehabilitation, where the optimal time for repair was significantly and negatively shifted. Operational, user and environmental costs would have increased rapidly together with the accident rate. The later necessary reconstruction of 222 km was avoided.

7. ECONOMIC ANALYSIS

In terms of economic efficiency it is necessary to compare all three possible alternatives.

1. *Funding from resources available to the road administrator.*

Financial costs are the costs of rehabilitation works on the road section of 30 km and repair of potholes and cracks on 222 km stretch for ten years.

Costs:	Rehabilitation	2,0 mil. EUR
	Repairs /10 years/	8,0 mil. EUR

Financial losses arise from non-executed rehabilitation on section of 220 km and thus from deterioration of construction condition and increased costs of maintenance and repair. Losses are incurred also by the users hence by the road-vehicle traffic. The calculation of user costs, estimated increased costs of transport accident rate and environmental burdens was carried out by using a PMS computer programs and programs for evaluating the efficiency of investment. It was found that the impacts of non-executed rehabilitation are:

Losses:	User Costs	27.01%.
	Environmental	17.4%
	Accident rate	14.5%

In the total financial expression the cost of losses over a period of ten years is 14.354 mil.EUR.

2. *Credit*

Based on the already obtained credits by the regional road administration it is possible to assume that the credit burden will not be high, as it is guaranteed by the public administration. By the estimate, the cost of credit obtained by the public administration / interest rate, banks margin/ would be about 2 - 2.5% lower than a commercial loan.

However, the credit does not take into account the level of risk for the quality of civil works and the warranty for civil works is only 3 years.

Costs:

Construction works, credit 23,2 mil.EUR

3. *PPP project*

The price of a private partner originated from the tender. It consists of the cost of construction-rehabilitation works, the risk of possible repairs on rehabilitated road sections over 10 years of operation, interest rates and margins of banks providing a credit.

Costs:

Construction work, risk, credit: 26.56 mil. EUR.

Savings are in no need to perform repairs during a period of ten years and in the user costs on the rehabilitated road sections.

Savings:

- No need to carry out repairs on rehabilitated sections 8,0 mil. EUR
- User-costs 7,52 mil. EUR
- Accident rate 4,1 mil. EUR
- Environment 4,7 mil. EUR

Summary: 24,32 mi.EUR

8. Conclusion

Currently, when we are in the sixth year of the project, we can say that it is likely to be a successful project. 252 km of pavement were rehabilitated successfully. New quality surface has improved conditions for the road vehicle traffic significantly, which has in its implication an impact on lowering their costs but also the costs of accident rate. The road administrator has managed to keep the road property in a good condition at a relatively low cost. The private partner, mainly due to concerns of extra costs, performed construction works in an excellent quality. This is proved by the fact that the contractor did not carry our so far any serious repairs.

Financial comparison shows that the first alternative, where the administrator is unable, within his own resources, to carry out immediate rehabilitation of the sections in the status of disrepair at the length of 252 km, he must spent on repairs over ten years up to 8 mil. EUR. That is nearly 33% of the total cost of rehabilitation, while this structural repair is still to come, because the road is not rehabilitated only maintained. From this perspective, the 8.5 mil. EUR is a net loss to the administrator. What matters is also the loss for the users, hence for the road-vehicle traffic. Taking into account that this loss is 14.35 mil.EUR it is a substantial loss.

The second model is for the administrator in comparison to the first alternative more expensive by the credit terms, which for the period of ten years is about 80% of extra costs. However, it can be reduced by the user costs of the road transport. Compared with the PPP project, this option is cheaper only by 2% as the remaining 10% are risks of the quality construction works. If we realize that the warranty under the public construction works is only three years and at the PPP it is 10 years, the question of expedience is open, and it will be possible to answer it after project completion /in four years/. However, as mentioned above, this evaluation will be only theoretical, because administrator's credit options are exhausted and thus this option could not have been put in practice.

The third model is based on the offer of a private partner. Even if the price of 26.55 mil. EUR is the highest of all, by adding all advantages and disadvantages; it appears to the administrator at the given time and at the current pavement technical conditions to be an optimal solution. The third model is an alternative where the administrator is unable to carry out the rehabilitation works from his own disposable revenues /alternative no.1/

because the volume of road sections in the status of disrepair exceeded in 2005, the capacity for the rehabilitation by 8.5 times. Given that the administrator owns 1456 km of roads, the annual additional need for rehabilitation is 50 to 60 km of newly degraded road sections. If 252 km of degraded roads were not rehabilitated, the necessity to execute rehabilitation would be pushed forward by the administrator and the need to rehabilitate per year would not be 20 to 30 km, but 250 to 280 km. This would cause the administrator a financial and technical collapse.

The price submitted by the private entrepreneur was slightly lower than expected. This was mainly due to the competition in the tender, but also due to the favourable credit conditions, because banks knew that even if the private contractor is involved, eventually the loan will be paid back by the public sector, by the road administrator. Price submitted by the private partner is higher by about 12% versus conventional loan obtained by the public administration. /alternative no.2/. If credit terms amount to 2.0% so the difference is mainly within the risk of the construction works quality. However, in case of a public loan, the road administrator bears this risk too as the warranty for public works is provided for three years only. After that time, the entire risk of the public works quality is borne by the administrator. However, it is never expressed financially or in the accounting.

Based on these results the PPP method can be evaluated positively. The last question is, whether the project is to be a success for the private contractor. He has four years of the project duration still ahead of him. Success of a private partner is subject to no major pavement damages by the next four years. Well, this is one of the main reasons why the PPP projects can be advantageous for the public sector.

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