IMPROVING COST-BENEFIT ANALYSIS METHODS WITH PUBLIC ROAD INVESTMENTS HUNGARY, 1998-2007

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ABSTRACT

The **aim** of the paper is **to summarize** the lessons and **experience** collected in recent **planning-, construction- and operation practice** of public road investments in Hungary. A "mini-project" gave some opportunity to analyze successes and failures in this field for the period 1998-2007. There is a **fundamental development** compared to the methods used before the democratic changes around 1990. However some common **typical mistakes** happen as well. Besides the **usual problems of "developed countries"** [cost overrun, traffic overestimation, operation cost underestimation, double or multiple counting of benefits, etc.], **other problems** occur frequently.
Politics [not policy!] has too big influence with many investments. Megaprojects, too expensive construction projects were implemented in a number of cases. In certain cases, extra costs should be paid to complete projects for unrealistic dates, for election purposes, for cultural or for sport events. Similar things happened in Spain or Portugal as well. The financial crisis (Credit Crunch 2008-) could have caused much less damage to Eastern European Societies if a more economical approach had been used.
Typical projects were selected for the **three main groups of investment**:

1. Constructing **new motorways**/expressways.
2. Constructing new **bypass roads** and relief roads.
3. Implementing **road rehabilitation**.

We made reviews concerning the original Cost-Benefit Analyses results of some selected projects. The expected and factual traffic-, investment-, maintenance- and operational characteristics have been collected and analyzed. **The results are mostly forecastable**,

but sometimes however **astonishing. Methodological failures** have caused considerable loss in efficiency - especially with **investment group "1".**
The following matters were observed:

1. The bad definition of the problem.
2. The limited number of reasonable alternatives.
3. The creation of artificial alternatives just after the national government decision. [- just to fit to potential "Brussels expectations")

The lessons learned in 1998-2008-2010 might help to mitigate such problems in the coming planning period of 2014 – 2020.

Keywords: road, CBA, investments, ex-post evaluation, lessons learned

INTRODUCTION

The objective of the research is:

1. to review the results of road cost-benefit analysis made between 1998-2007,
2. to develop efficiency analysis methodology of transportation investments,
3. to compose proposals for the more efficient use of EU sources.

At first the study summarizes the results of cost-benefit analysis made previously concerning road investments, which were realized in the period 1998-2007. After that it sets an aim to make recommendations and general statements by the 3 chosen typical projects.
The knowledge concerning recent CBA results may help to use EU financial resources in a more efficient way. The project list contains attributes and evaluation figures, which can be used for further examinations as a wide database.

COST BENEFIT ANALYSIS REVIEW BY THE TYPE OF INVESTMENTS.

Economic parameters related to Hungarian bypass road investments

Table 1 (on the following page) **represents characteristics of** 18+1= **19 new road projects.** Line 1 shows parameters of M0 motorway; Section East. [This was the only public data available for our contract concerning motorway/expressway projects.]

Table 1: Details of road investment projects part I (bypass roads) 1

	A	B	C	D	E	F	G	H	I	J	K	L
	Project name	**Length**	**Investment cost [HUF]**	**Investment cost [EUR]**	**Price level**	**Specific Investment Cost [HUF]**	**Specific Investment Cost [EUR]**	**Net Present Value**	**Benefit-Cost Ratio**	**Internal Rate of Return**	**Year of CBA**	**Remarks**
		Km	Billion HUF	Thousand EUR		Billion HUF/ km	Thousand EUR/ km	Billion HUF	PVB/PVC	%		
	Motorways and bypass roads											
1	Eastern sector of the M0 motorway (~80% EU funded)	38.70	103.50	414.00	2004	2.67	10.70	294.5	3.17	16.1	2004	positive
2	Joint section of main road no. 51. and 52. Solt bypass	5.60	3.32	13.28	2006	0.59	2.37	3.639	2	9.8	2006	
3	Joint section of main road no. 53. and 54. Soltvadkert bypass	16.20	5.68	22.71	2006	0.35	1.40	17.41	3.8	21.9	2006	positive
4	Main road no 6. Pécs south-western bypass	2.90	2.16	8.64	2002	0.74	2.98	13.017	6.637	36	2004	positive
5	Main road no. 21. Salgótarján bypass	5.00	5.13	20.53	2002	1.03	4.11	6.032	2.31	12.2	2004	
6	Main road no. 32. Hatvan bypass		2.40	9.60				22.44	9.49	43	2004	not complated data
7	Main road no. 37. Sátoraljaújhely bypass	3.10	1.62	6.47	2003	0.52	2.09	1.737	2.14	11.2	2004	
8	Main road no. 4. Berkesz bypass	5.00	1.79	7.17	2002	0.36	1.43	0.895	1.464	8.1	2004	
9	Main road no. 4. Nyírbogdány bypass	4.90	1.77	7.08	2003	0.36	1.44	0.661	1.368	7.2	2004	
10	Main road no. 4. Székely bypass	4.80	1.36	5.44	2002	0.28	1.13	0.464	1.328	7.5	2004	
11	Main road no. 44. Békéscsaba bypass, Phase II.	4.50	4.10	16.40		0.91	3.64	25.2	6.1	34	2004	positive
12	Main road no. 47. Orosháza bypass, Phase III-IV.	7.20	4.70	18.80		0.65	2.61	8.037	2.5	15	2004	
13	Main road no. 471. Nyírbátor bypass, II/A. and III/2.A allignment	12.30	4.76	19.04	2005	0.39	1.55	1.943	1.4	7.4	2005	risks, low BCR
14	Main road no. 5. Kiskunfélegyháza bypass	6.50	1.60	6.40	2003	0.25	0.98	2.17	2.199	11.3		
15	Main road no. 53. Kiskőrös bypass	11.00	5.56	22.25	2006	0.51	2.02	-4.481	0.2	-0.4	2006	not economical
16	Main road no. 71. Balatonakarattya-Balatonkenese-Balatonfűzfő bypass		29.80	119.20	2003			9.83	1.295	6.73		risks, low BCR
17	Main road no. 8. Csór bypass		6.10	24.40				8.04	2.163	9.23		
18	Main road no. 8. Márkó bypass		5.90	23.60				9.78	2.5	11.36		
19	Main road no. 86. Vát - Szeleste bypass	9.45	5.73	22.90	2006	0.61	2.42	6.391	2.0	10.5	2004	

[1] There was no available data for other Hungarian motorway/expressway projects. Certain data were not reliably available concerning lines 6, 11, 12, 16, 17, 18. - Grey cells. Values in HUF are the punctual ones. EUR data is informative. [We have calculated with 1EUR=250HUF, as EUR was between 230-**250**-316 HUF in the analyzed period.]
Figures to the right: good result [Columns I, J].
Figures to the left: bad results [Columns I, J].
Grey cells: no data.

Lines 2-19 describe 18 main road bypass projects. **Bypass projects are important** as transit traffic causes serious congestion in certain sections of the road network. This worsens the level of service for local traffic and endangers the quality of local life. The transit main roads often cut cities and settlements; congestion causes environmental damage. [Sometimes these effects are exaggerated. – "Our own traffic is low, we are suffering because of people living outside our region!" Usual unfair complaint.] The **specific cost** of the investment may vary according to details of the investment. (**Table 1** - **Column F, G**).
Analysing the economic parameters it can be stated that the benefits of the investments are higher than the costs. All but one project are positive for the 25-year-long evaluation period. [**Except line 15, - the Kiskőrös bypass** road which is not an economical investment.] **Outstanding, positive examples**: Main road no. 44 Békéscsaba bypass, phase II.; main road no. 6 Pécs south-western bypass; joint section of main roads no. 53 and 54. Soltvadkert-bypass; the Eastern Sector of the M0 motorway. [Lines 11, 4, 3, 1]
After comparing the indicators it can be stated that the results of bypass road investments are the best, when short section constructions can achieve high economical benefits. Considerable travel time savings occur where short, busy transit sections are relieved by short efficient bypass lines. Together with the constructions the total **road network length is increasing**, traffic safety is improving, but on the other hand **maintenance costs** and vehicle operating costs **go up too**. Thanks to the traffic realignment, air pollution declines. [Traffic is diverted to rural areas, noise pollution decreases as well.]
As for the individual sections, economic stimulation is not really a possible outcome of the investments. However, together with the possible future developments the bypass can have stimulating effects on the economy, local economy. Bypass road sections that are being built in more phases do not lead to measurable improvements, but the delivery of the whole road section might provide significant positive effects.

Economic Characteristics of Carriageway Widening Projects

Table 2 presents data on projects in cases of:

1. widening,
2. rehabilitation and,
3. new connecting roads.

Road capacity has substantially increased thanks to the extensions, therefore at a network level the accessibility is improving. Based on the calculated Net Present Values the benefits always exceed the costs; this way the investments are all economical for a 25-year-long period. **Looking to lines 22 and 23 in Table 2:** the 8.5 km section of **main road no. 37** has high NPV (above 5 billion HUF) and the 5.7 km section of **main road no. 4**. is also very advantageous. [Cells H22, H23]. Having observed the BCR and IRR data [Columns I and J] it is clear that the given investments are mostly cost-efficient. [Lines 24, 25, 27 represent higher risks.] Evaluating the impacts of the investments, the **main benefits clearly originate in the savings of travel time and with cost reduction of forecasted accidents**.

Table 2: Details of road investment projects part II (carriageway widening, road rehabilitations, road strengthening, new constructions)[2]

	A	B	C	D	E	F	G	H	I	J	K	L
	Project name	**Length**	**Investment cost [HUF]**	**Investment cost [EUR]**	**Price level**	**Specific Investment Cost [HUF]**	**Specific Investment Cost [EUR]**	**Net Present Value**	**Benefit-Cost Ratio**	**Internal Rate of Return**	**Year of CBA**	**Remarks**
		Km	Billion HUF	Thousand EUR		Billion HUF/ km	Thousand EUR/ km	Billion HUF	PVB/PVC	%		
	Carriageway widening to four lanes or 2x2 lanes											
21	Main road no. 21. Phase III - IV.		3,49	13,94	2002			0,127	1,04	5,2	2004	
22	Main road no. 37	8,50	5,60	22,40		0,66	2,64	5,274	1,93	9,9	2004	
23	Main road no. 4. between 120+745 - 126+300	5,50	3,90	15,60		0,71	2,84	6,798	2,73	14	2004	
24	Main road no. 4. between 51+000 - 56+000	5,00	5,65	22,62	2003	1,13	4,52	0,588	1,12	6	2004	M5 competing
25	Main road no. 4. between 60+600 - 69+600	9,00	13,31	53,25	2003	1,48	5,92	1,579	1,15	6	2004	M5 competing
26	Main road no. 58. between 3+175 - 9+020	5,85	1,82	7,27		0,31	1,24	0,899	1,45	7,6		
27	Main road no. 8	110,65	65,73	262,92		0,59	2,38	1,22	1,02	6,1		"lobby route"
	Rehabilitation, upgrading											
28	Main road no. 4. between 102+075 - 104+750	2,70	0,143	0,57	2003	0,05	0,21	0,111	1,7	26,8	2004	
29	Main road no. 4. between 148+800 - 155+850	7,05	0,472	1,89	2003	0,07	0,27	0,335	1,68	28,3	2004	
30	Main road no. 4. between 165+600 - 171+640	6,05	0,4	1,60	2003	0,07	0,26	0,144	1,34	13,9	2004	
31	Main road no. 4. between 171+677 - 180+400	8,75	0,91	3,64	2003	0,10	0,42	1,35	2,43	17,2	2004	
32	Main road no. 4. between 99+700 - 101+425	1,75	0,102	0,41	2003	0,06	0,23	0,07	1,7	26,8	2004	
33	Main road no. 44.	19,15	2,30	9,20	2003	0,12	0,48	0,307	1,13	7,4	2004	
34	Main road no. 8. between 110+500 - 116+800	6,30	0,68	2,72	2003	0,11	0,43	0,049	1,07	5,9	2004	
35	Main road no. 8. between 116+800 - 127+800	11,00	1,00	4,00	2003	0,09	0,36	0,092	1,09	6,22	2004	
36	Main road no. 86.	5,00	0,96	3,84	2005	0,19	0,77	0,323	1,32	12,2	2004	
	Strenghtenings to 11.5 tons axle load (financed by ISPA)											
37	Main road no. 2.	39,00	64,00	256,00	2001	1,64	6,56	0,375	1,15	12,4	2001	
38	Main road no. 3. between Nyékládháza - Debrecen				2001						2001	
39	Main road no. 3. between Nyékládháza - Tornyosnémeti				2001						2001	
40	Main road no. 31.	10,00	2,50	10,00	2007	0,25	1,00	3,364	2,5	20,38	2008	
41	Main road no. 41.	16,35	1,49	5,96	2007	0,09	0,36	0,571	1,42	10,23	2008	
42	Main road no. 42.	55,10	54,00	216,00	2001	0,98	3,92	0,35	1,09	11,7	2001	
43	Main road no. 47.	30,00	49,00	196,00	2001	1,63	6,53	0,5	1,33	14,2	2001	
44	Main road no. 56.	50,00	147,50	590,00	2001	2,95	11,80	0,275	1,04	10,7	2001	
45	Main road no. 6.	121,00	72,50	290,00	2001	0,60	2,40	12,675	2,44	27,9	2001	Then why M6?
46	Main road no. 81.	21,85	2,43	9,72	2007	0,11	0,44	6,825	4,13	28,89	2008	
	Constructing new roads, motorways and new connecting roads											
47	Connecting road between M30 motorway and main road no. 37.							14,279		30,777	2004	
48	Connecting road no. 561. between Majs and Villány		6,83	27,33				2,596	1,44	7,778	2004	
49	M6 and M56 motorways		168,00	672,00	2002			14,033	1,1	7	2003	white elephant?
50	M7 motorway between Balatonszárszó-Ordacsehi	20,00	65,10	260,40	2005	3,26		~2,55	~1,05	~5,1	-	mixed sources
52	M7 motorway between Ordacsehi - Balatonkeresztur	26,00	62,00	248,00	2006	2,38		~4,4	~1,1	~5,3	-	mixed sources
53	Main road no. 10. between Budapest and Dorog				2003			57,5	2,1	11,3		inside Budapest?

[2] There was not available public data for the most of motorway projects

Economic Characteristics of the Rehabilitation Projects

Reconstructions [**Lines 28-46 in Table 2**] improve the technical quality of a given (usually recently badly deteriorated) road section and they also improve the **axle-load** bearing to **11.5 tons**. Within the framework of a subgroup of projects [**Lines 28-36 in Table 2**], the "Finnish **HIPS**" system was used to examine the rehabilitation processes. According to the model calculations the benefits of the investments arise by savings of travel time, the decrease in maintenance and operating costs. [However it concludes that the benefits by the changes in accident costs are not significant.] The efficiency, - the Benefit to Cost Ratio (BCR) of the investments changes from 1.07 [Cell I34] to 2.43 [Cell I31].
The calculated **NPV data** indicate (**Column H**) that in case of the planned investments, benefits are always beyond costs, hence all the project elements are profitable for the country as a whole.
The project main road no. 6, [**Line 45**, financed by "ISPA"] should be highlighted. This rehabilitation had been done along a section of 121 km. This investment has the biggest budget among all. The cost-benefit ratio shows that this was an efficient investment.

Analysis of the economic characteristics of the newly built roads

New roads are extending the network's length and establish connections between the network elements and settlements.
Based on the calculated Net Present Values we can say that the benefits always exceed the costs so the investments are all profitable for the economy. The M6-M56 investment, which concerns the Budapest-Hungarian border section, was an extremely significant project element. Construction costs amounted to 168 billion HUF.

Summary of the cost-benefit analyses

To sum it up, **most of the analyzed projects are cost-effective**, while the others are necessary to realise. The NPV values are positive and the BCR is more than one for the greatest part of the projects. These are useful investments for the national economy.
After the comparison of the efficiency indexes it is clear that from some parts of the results it is not easily decidable, which are the best possible investments analysing the situation from the economical point of view. The position in the road network seems to be the most definitive factor.
It is clear that the **advantages are mainly the savings in travel time and accident costs**. With the reconstructions the traffic safety is improving, but the maintenance and vehicle operating costs (due to the higher speeds) are increasing.
The number of the most cost-effective investments will decrease after the most advantegous links will be constructed. **The cost-benefit analyses may help the experts and politicians to choose the most cost-effective projects**.
The general purpose is to create a traffic infrastructure, which uses the available resources with the best possible cost-effectiveness regarding the short-term investment and long-term operating factors.

The proposed interventions – reconstruction and expansion of the current infrastructure - are about to create a modern road network, which can satisfy the increased traffic demands. A modern network could support the improvement of the back-warded region's economy.
The CBA results of the inspected investments are in **Table 1** and **Table 2**.

METHODOLOGY OF THE EX-POST EVALUTIONS

In the comparison of the realized typical projects we analysed the differences between the planned and actual data and the reasons of these differences.
The analysed typical projects:

1. **Main road no. 4. Berkesz bypass (299+500 – 304+500)** – bypass road construction: The designed road length is 5.0 km and built with 2x1 lanes. It decreases the truck traffic in the settlement.

2. **Main road no. 37 (0+000 – 8+500)** – carriageway extension to four lanes, to 2*2 lanes. The carriageway widening to 2*2 lanes has been constructed in a length of 8.5 km. The road has 2x2 lanes with expressway parameters, and main road regulation. The project joins to section 8+500 – 9+700. The lane extension here had been constructed earlier. The road fits to the previous sections and this way it creates a unified route in a length of 11 kilometres.

3. **M7 motorway between Balatonszárszó and Balatonkeresztertur** – new motorway construction: The proposed start of the works was early 2001, and decision makers originally planned to finish construction in the middle of 2008.

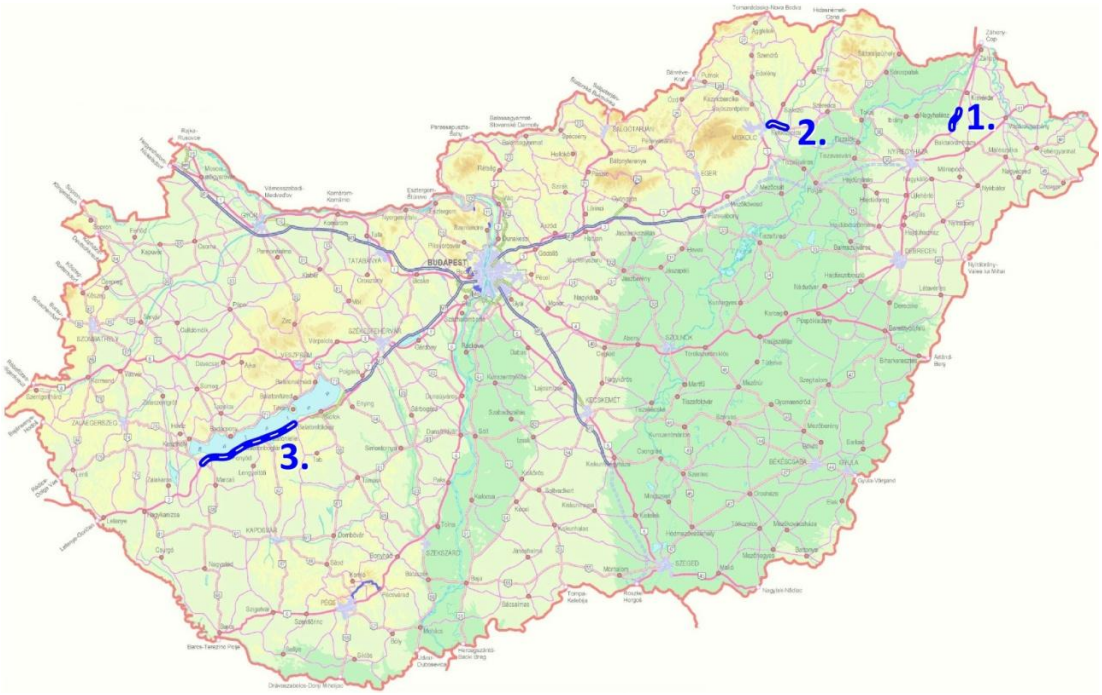

Figure 1: Location of the typical projects

Changes in the investment costs

The investment cost contains the expenditures regarding the realization, which can be summed up from the expenditure of the different sections. Differences in the partial costs separately and cumulatively influence the whole investment cost. During the analysis we have compared the original and the actual costs.

Based on the domestic and international experiences the **investment costs are often underestimated**. In general slight increases in the investment costs are expectable. These increases are causing drops in the financial and social effectiveness of the projects.

Changes in the schedule of the investment

Time schedule changes generally have two important effects: the increase of the investment costs and the decrease in the predicted traffic. So if the investment cannot be realized within the original timeframe, it is always a cost increasing factor.

The shortfalls from the original schedule are causing drops in the financial and social effectiveness of the projects.

Changes in the operating and maintenance costs

The operating and maintenance costs are playing an important role in the analysis, as these costs can be highly different than the predicted ones.

The collection of the facts for the comparison of these costs are usually very hard, and often there are not so well detailed and divided values. The operational costs are **planned by specific costs**.

Similarly to the investment costs the operating and maintenance costs will probably increase also slightly.

Changes in the traffic flows

The tendency of the vehicle traffic is a fundamental factor of the assessment. The economical analysis almost fully depends on the traffic flows. The evaluation indicates the differences between the predicted and actual data; verify or deny the correctness. Based on the domestic and international experience the **traffic flows are often overestimated**. The actual traffic probably does not reach the planned level, and as a consequence the benefits become lower.

The decreased benefits are causing drops in the financial and social effectiveness of the projects. The financial analysis should be changed due to this factor if the assessed road is part of the toll/vignette collection system.

Advantages and barriers of ex-post evaluations

The economic ex-post evaluations of the completed investments give important information. From the analysis it appears how accurate the estimated parameters were [like forecasted traffic flow]. The schedule of the project and the implementation costs can be determined exactly. At the same time we can run into some barriers due to the short time gap since the finish of the investments. This makes it more difficult to evaluate the available facts and find

the right conclusions. It is difficult to make clear and exact statistics. The trends are not stable due to the short time period between the end of the investment and the ex-post analysis.
The impacts of the parallel investments have to be underlined as an important indicative factor. The parallel investments may cause significant traffic realignment, mainly related to motorway constructions.
The advantages and barriers of the ex-post evaluation are the following:
Advantages:

1. The analysis can compare the planned and the actual values of the project.

2. The main differences can be determined. The change of the main parameters can be analyzed.

3. Recommendations can be made. These are useful to create more accurate analysis in the future.

Barriers:

1. Limited time since the investments had been finished (just 3 -5 years). This short time period is not sufficient for the analysis of long term data. [However it can show the initial impact and result of the project. Though trends are not stable; travel behaviour is yet changing; immediate traffic changes are “Poisson-processes” sometimes.]

2. The changes of the macroeconomic environment (GDP, inflation) can be different. There was no relevant forecast for a credit crunch.

EX-POST EVALUATION OF TYPICAL PROJECTS

Ex-post evaluation of main road no. 4, Berkesz bypass [5,0 kms, 299+500 – 304+500 – bypass road construction, Table 1 Line 8; 1.79 bn HUF]

Changes in traffic flows

There are differences in the rate of passenger car traffic and heavy vehicle traffic. The number of passenger cars was overestimated. The number of heavy vehicles was underestimated. The estimation of the total traffic volume was correct (around 3600 vehicles/day). The number of buses has increased by 32%. That shows that the level of service of the regional public transport is better by 49%. International bus traffic is also increasing. The heavy vehicle traffic was higher than it was estimated; that further justifies the construction of the bypass road. The lower noise and air pollution – due to the realigned heavy vehicles traffic – improves the economic performance. The project had a significant contribution to change Berkesz settlement to a more liveable place. The reductions of traffic flows have other positive effects.

Changes in the investment costs

The actual investment cost was higher by 3.78% than the estimated (1.75 billion HUF). The investment cost was slightly underestimated.

Changes in the schedule of the investment

The project was realized in 2005. The estimated length of the construction period was punctual, but the construction work started 6 months later. As the construction was finished in 2005, the delay has no effect on the supposed calculations, which assume that the first operational year is 2006. The increase in the investment cost was mainly caused by the change in the schedule of the works.

Changes in the operating and maintenance costs

The specific operating and maintenance costs of the new bypass section are in the **Table 3**.

Table 3: Comparison of the estimated and actual operating and maintenance costs at main road no. 4 “Berkesz bypass section”

Operating and maintenance costs (million EUR)			
	Estimated	**Actual**	**Difference**
2006	19,31	17,00	-12%
2007	19,31	15,71	-19%
2008	19,31	15,35	-21%

Table 3 shows that the actual cost has been lower than it was estimated. This extra saving is a positive effect on the return of the project, which is around 20%. However, it can be possible, that the savings are because of budget cuts; thus the savings would cause extra costs in the future.

Ex-post evaluation of main road no. 37; carriageway extension to 2*2 lanes [0+000 – 8+500, Table 2 Line 22; 5.6 bn HUF]

Changes in the traffic flows

The developments of the regional expressway network had a much bigger (+30-50%) effect on the generated traffic of this section, than it was predicted (6700 vehicle/day). This traffic increase has some positive effects. The extra traffic further justifies the necessity of the project, and improves the economical efficiency. There were also changes in the proportions of traffic. The heavy vehicle traffic ratio has increased by 5-10%, which is a consequence of the realignment caused by motorway investments. Passenger car traffic has increased by 40-60%. The traffic realignment also has a positive effect on efficiency.

Changes in the investment costs

The actual investment cost was higher by 3.22% than the estimated (7.495 billion HUF). Investment cost was only slightly underestimated.

Changes in the schedule of the investment

The realized time plan of the project was generally the same as the proposed schedule (2006-2007).

Changes in the operating and maintenance costs

The actual operating and maintenance costs are higher by 10-15% than the estimated. It has decreased the economical efficiency.

Detailed Economical Analysis of New Motorway Construction between Balatonszárszó and Balatonkeresztur (M7)

Changes in the traffic flows

The traffic forecast on the M7 motorway Balatonszárszó – Ordacsehi – Balatonkeresztur section was created by simulation. The actual traffic data of the new section is compared to the simulated values. **Table 4** shows traffic data of 2006 compared with the forecasted ones.

Table 4: Comparison of the traffic flows at M7 motorway, Balatonöszöd – Balatonfenyves. (2006)

	Estimated traffic [ADT]	Counted traffic [ADT]	Difference
Balatonöszöd	12,450	8,908	**-28.45%**
Balatonlelle	12,450	8,541	**-31.40%**
Balatonfenyves	12,450	7,550	**-39.35%**

From the comparison it is clear that the traffic was overestimated. This fact may considerably extend the return period. 2007 is the first year of operation. The real traffic trend cannot be defined yet. It is evident that the demand was even lower in the first two years than it had been expected. The credit crunch has another negative effect. The traffic flows were generally overestimated, which has a negative effect on the project.

Changes in the investment costs

The difference between the various investments costs are not the same. However, the two sections were constructed by 2 different contractors. The reason for the differences in the specific costs is that the sections are technically different. [Too ambitious bridge construction on the west of Balatonszárszó. Geotechnical complications close to Balatonfenyves (line 52). The area used to be a mud; high groundwater level.] The planned cost on the

Balatonszárszó - Ordacsehi section (65.1 billion HUF) was higher by 7.73% than the actual. The planned cost on the Ordacsehi – Balatonkeresztur section (62 billion HUF) was higher by 6.28%. The investment costs are underestimated. In case of such large investments, considerable efforts should be made to handle financing problems.

Changes in the schedule of the investment

There were significant delays in the schedule of the investment, which were probably the main reasons for the increase of the investment cost. Furthermore there is a decrease in the financial and social efficiency.

Changes in the operating and maintenance costs

The estimated yearly specific operating and maintenance cost is **12.3 million HUF/km/year**. (at 2001 price level).
The latest available specific operating and maintenance cost of the expressways from COWI guide is **16.3 million HUF / km / year** (at 2005 price level, 2x2 lanes, toll road).

EXECUTIVE SUMMARY: CONCLUSIONS, PROPOSALS AND RESULTS

Conclusions related to typical projects

We have **selected typical projects** for three main investment types – constructing motorways, constructing bypass roads and road rehabilitations. These projects have been presented as case studies. After having carefully reviewed the preliminary Cost-benefit analyses of the selected projects, we have collected their **planned** traffic, investment, maintenance and operational characteristics and **compared them to the actual data**.
A general goal is to create a transport infrastructure using available resources that is **as cost effective** as possible in terms of both short term investment indicators and long term operational indicators.
Based on the comparisons, we have come to the following conclusions:

1. Investment costs usually exceed the planned amount (See **Figure 2**),
2. The actual schedule usually suffers delays compared to the plans (See **Figure 3**),
3. Operational and maintenance costs are usually lower than planned for main roads,
4. Road traffic data is sufficiently precise, but usually somewhat overestimated.

The comparison of Cost-benefit analyses is a bit problematic as they were created **based on five different guides** over the past ten years. Another issue is that the method of determining specific operational costs is also changes; a fact that cannot be justified by different price levels. Determining specific time and accident costs was not coherent in subsequent guides either.

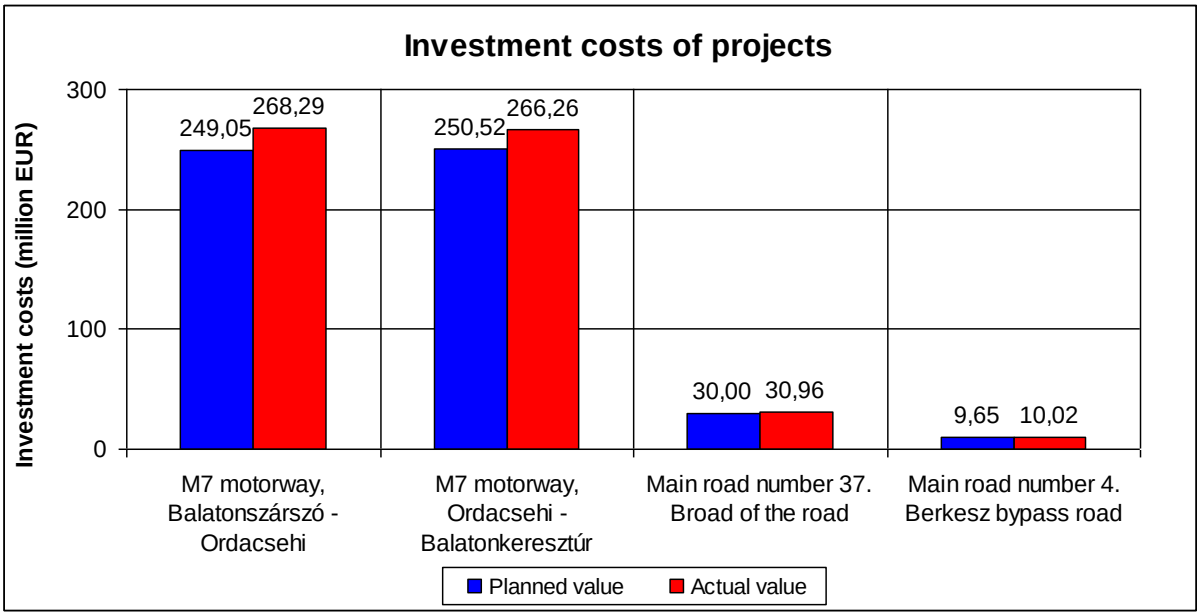

Figure 2: Investment costs (3 typical projects)

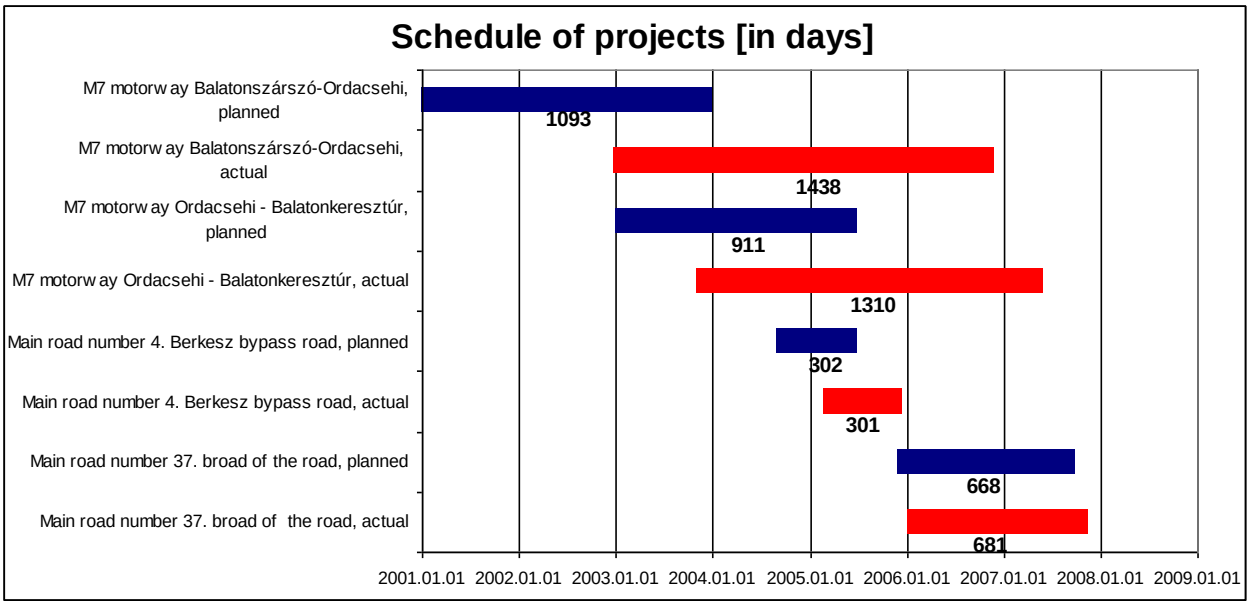

Figure 3: Schedules (3 typical projects) 3

[3] The numbers represent the duration of construction in days.

Possible amendments to the methodology of guides

Cost-benefit analyses are based on assumptions. When the methodological background is precise, the assumptions will be punctual. As this analysis shows, actual data can differ from plans. The effects of these differences are analysed by **Sensitivity Analysis and Risk Assessment**, enabling identification and forecasting. The development of the methodologies should be based on **background studies containing national surveys and analyses**. At present, these are unavailable.

Besides the typical problems

Besides the typical problems of the CBA studies [overestimated investment cost, underestimation of the operational cost, shortfalls in the schedules], there are **other notable errors**:

1. The **bad definition of the problems**;

2. The **limited numbers of reasonable alternatives**, and also the creation of artificial alternatives afterward just to fulfil the expectation of Brussels [justifying the past];

3. The **political influence** in a great number of projects [implementation of too expensive “white elephant” or megaprojects, eg. M6 motorway from Budapest to Pecs – in 16 months with 2 winter-times included, tunnels on the plain, after strengthening main road no. 6 for 72.5 bn HUF, completed just before elections];

4. **Pre-preferred alternatives** [distortion of the analysis to reason the selected alternative].

The credit crunch and the measures to prevent of a further crisis encourage avoiding or at least mitigating these kinds of problems because cost-effectiveness will become more and more important.
It is also notable that newly joined EU countries can use the experiences of the planning period 2007-2013, and can learn from the “best- and worst-practices”.

Further proposed research topics:

1. Detailed traffic study on the motorway sections constructed in Hungary in the last 10 years.

2. A uniform review of the cost-benefit analyses made for all the investments related to planning and development programs. Organizing the data into a database, publications, making the results usable in analyses.

3. A comprehensive analysis on the operating and reconstruction costs of expressways and public roads.

4. Extending and developing the methodology for Sensitivity Analysis and Risk Assessment.

5. Extending the review of road investments with international experiences. Analysing investments on an international level [among projects in new EU member states].

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