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„MULTILANE FREE-FLOW" – AN INTELLIGENT SYSTEM FOR TOLL COLLECTION IN AUSTRIA

Construction and maintenance of road infrastructure requires determination of expenditures for its development and incurring day-to-day costs of its maintenance. A rational and effective transport policy (together with fiscal policy) should be aimed at the best linking of expenditures assigned for construction of transport infrastructure and costs of its maintenance and overload (congestion) with charges for its use. Incurring these costs will clearly depend of type of transport means, as well as time and location of used transport network. This issue is a subject for consideration for European transport policy, and at the same time the original national applications are developed, proposing a solution for this problem for the road network.

„MULTILANE FREE-FLOW" – INTELIGENTNY SYSTEM POBORU OPŁAT DROGOWYCH W AUSTRII

Budowa i utrzymanie infrastruktury drogowej wymaga określenia nakładów na jej rozwój i ponoszenia bieżących kosztów utrzymania. Racjonalna i efektywna polityka transportowa (łącznie z polityką fiskalną) powinna mieć na celu jak najlepsze powiązanie nakładów przeznaczonych na budowę infrastruktury transportowej oraz kosztów jej utrzymania i przeciążenia (kongestii) z opłatami za jej użytkowanie. Ponoszenie tych kosztów niewątpliwie zależeć powinno od rodzajów środków transportu, oraz czasu i miejsca wykorzystywania sieci transportowej. Zagadnienie to jest przedmiotem rozważań europejskiej polityki transportowej a jednocześnie pojawiają się oryginalne krajowe aplikacje proponujące rozwiązanie tego problemu dla sieci dróg.

1. POLICY OF INFRASTRUCTURE DEVELOPMENT FINANCING

The users of transport infrastructure are economical units (transport-related and others) and physical persons. The users bring in taxes and fees for use of infrastructure, these payments, however, hardly cover the real costs. Thus, the present concern are considerations on the way and amount of charges to the users of transport infrastructure with full costs resulting from its construction and maintenance. The structure of financial charges for the users should be aimed at rational, efficient and reasonably fair relationship between the costs of construction and maintenance of transport infrastructure and charges for its use. Costs of

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transport infrastructure and overload (congestion) of network should depend of type of transport means as well as time and place of use of the network H. Bronk [1] proposed that during charging the infrastructure users for costs of its use and development, two following conditions are met.:

- charges for unitary (individual) users of transport network should be as far as practical, charged with appropriate actual costs (boundary costs) that play an important role in use of transport network as they are incentive for road users and constitute for them a basis for cost reduction, and consequently lead to the decrease of charges for use of roads.
- The total of charges should cover the total infrastructure costs.

Such a concept should incite the transport companies to use such measures as to use the vehicles with the lowest axle load, reduce the number of empty travels or use combined transport. This perhaps will enable, in a longer run, to rationalize the market of transport services, distorted by a partial coverage of social costs by various branches of transport (as a result of a distorted price mechanism, the environmental advantages of railway transport over the road transport are not recognized willingly on the market.)

One of the instruments of financing policy for development of transport infrastructure is establishing of charges for the current use of road infrastructure. The discussion concerning determination of amount of such charges and methods of their differentiation is in progress for several years in the such program documents of EU as Green Book of 1995, "Towards fair and efficient pricing in transport. Policy options for internalizing the external costs of transport In the European Union", White book of 1998 "Fair payment for infrastructure use: A phased approach to transport infrastructure charging in the European Union", or White Book of 2001 "European transport Policy for 2010: Time to decide".

The strategy of reforming the charges for current use of road infrastructure is aimed at harmonization of transport operating conditions of road forwarders, and its main purpose is to achieve the optimum of economical allocation of road infrastructure costs among its users. This applies mostly to the charges resulting from road transport of loads, so the first legal act to introduce and make effective the transport policy in terms of charge reforms was Directive 1999/62/WE establishing so-called Eurovignette. The Eurovignette is criticized as an ineffective and unfair instrument, because of lack of direct link with real costs of infrastructure generated by the user paying a fixed rate, thus giving no incentive for reduction of transport external costs. In July 2003 a proposal of revision of the already invalid legal act of 1999 - Proposal for a Directive of the European and the Council amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures. Brussels, 23.07.2003, COM(2003)448 final). This proposal defines the following assumptions for fair charges for current use of the infrastructure [3]:

- Charges for actual use of roads (based upon the distance), and not a permit to use the network (vignette),
- A vehicle size threshold (3,5 tons instead of 12 ton),
- Charges on the main road network (TEN + competitive roads),
- Member countries shall be permitted to apply charges on other roads and in relation to the smaller cargo vehicles, passenger cars and other vehicles,
- Charges limited to the existing infrastructure and removed on the network of roads managed on the basis of concession contracts,
- A possibility of reduction of taxes on the cargo vehicles in the membership countries in order to reduce the total charges (this applies mainly to the annual tax on the vehicle),

- Obligation to use the income from infrastructure charges in the transportation sector (with a possibility to finance other transport areas),
- Obligation to the membership countries to establish an independent body for monitoring the functioning of a system preventing discrimination practices and check the flow of received financial resources.

This document proposes also new principles of determination and method of differentiation of charges depending on the type of vehicle, time of day, level of congestion, density of population, accident potential, ecological sensitivity etc. The purpose of transport policy at the European Union level concerning changes of charge structure in the Green and White Books and the draft of a new directive is harmonization of charges at the European Union's level, because namely in this area there is a big discrepancy in the existing charges among the countries.

The attempts of harmonization of a price policy at the European Union level, assuming interoperability of electronic charges using, among other, satellite systems and proposals of revisions in the legislation are not harmonized with initiatives of certain countries who implement these solutions in practice within their territories. These solutions apply both to intercity roads (Switzerland, Germany, Austria, United Kingdom) and to urban roads (Roma, London). Two complete systems covering the entire country were created for cargo transport:

- Switzerland since 2001,
- Austria since 2004.

Two further complete systems are planned for implementation:

- Germany – system based on satellite technology (the tentative implementation deadline was set for 2003),
- United Kingdom - planned implementation in 2006.

This situation, in one hand, causes deeper discrepancies within the area of the entire Europe, but secondly, allows to gain practical experience in the search for optimum Europe-wide solutions.

2. NEW SYSTEM OF TOLL COLLECTION IN AUSTRIA

Since 1st January 2004 there is a new toll collecting system in force on the highways and high speed roadways for the vehicles with acceptable total weight of more than 3,5 ton. The application of „Multilane free-flow" toll collection technology in the entire Austrian territory is an important technical and organizational novelty at European scale, because it allows free choice of road lane, does not require reduction of speed and stopping to pay the toll which enables maintaining the smooth traffic flow in the entire network of highest category of roads. On order of an Austrian highway operator ASFINAG (Autobahn und Schnellstrassenfinanzierungs AG) the company named EUROPPASS Lkw Mautsystem GMBH has created and implemented a fully electronic system of toll collection for the road network with length of over 2000 km (4000 km in one direction) which is shown on Fig.1.

Fig.1. Road network in Austria covered by the new toll collection system

Source: http://www.go-maut.at

The first portal was installed on 10 October 2002. Presently the system is equipped with ca. 400 gates, 800 toll collection points wherein 100 are of enforcement type, acting as checkpoints (these gates are most frequently put in the transport nodes between the entrance and the leave of highway).

The „Multilane free-flow" consists of many elements, but two of them are important for the user:

- Onboard device GO-Box
- Checkpoint portal on the highway or autoroute

The onboard device GO-Box (Fig.2) should be installed on the front window of the vehicle. During passage under the portal (Fig.3) is communicating automatically with the receivers installed in the toll collection points scattered all over Austria, which enables toll collection without disturbing the traffic.

Fig.2. Toll collection device GO-Box

Source:: http://www.go-maut.at

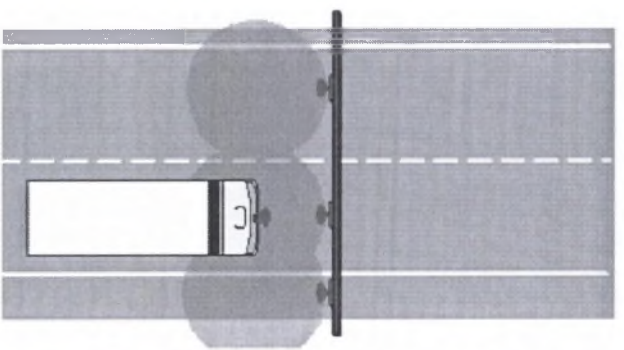

Fig.3. Cooperation of onboard device GO-Box with the receiver at the toll collection point

Source: http://www.go-maut.at

The GO-Box device has the following dimensions: 110 mm × 66 mm × 27 mm and its weight is 100 grams. They are leased against a single-time operation fee in amount of 5 € pl20% VAT. The Go-Box may be purchased in over 220 sales point in Austria and near the border of neighboring countries.

The exchange of microwave signals between the antenna in the portal and GO-Box in the vehicle during its passage through the toll collection point results in registration of the GO-Box and the charging of toll occurs in the automatic way For the driver, the operation of device is limited to the correct putting it on the front window and correct declaration of toll class, depending of the number of axles. From the information point of view, the GO-Box is equipped with the following elements:

- The pushbutton for declaration of toll class and verification of status,
- Three LEDs informing about presently set category (number of axles),
- LED informing about the status,
- Buzzer for in-travel information.

The reaction to the buzzer is mandatory. After hearing the warning signal or in the case of lack of signal the driver is obliged to immediately contact the nearest service point.

During the recording of personal data, the GO-Box is assigned vehicle license number, so the devices leased for one vehicle cannot be used in another vehicle. Before the GO-Box is mounted on the window, it is necessary to check the compatibility with the vehicle license numbers and the data contained in the GO-Box sheet or its label.

The toll check system consists in the automatic checkpoint on the gates and traditional patrols of supervision services, able to check the categories of vehicle passing under the gate and the compatibility of GO-Box settings. Information about possible discrepancies will be sent in the form of vehicle picture to the center, where the decision will be taken on collecting either a so-called replacement fee or sending a check patrol. Regardless of the automated check system the toll supervision services have been appointed. The toll supervision service personnel is entitled to check the condition of vehicles and GO-Box, inflicting penalties reaching the amount of 4000 € and in the exceptional cases also prohibit further travel of the vehicle.

Fig.4. The exapmple of a „Multilane Free-flow" portal

Source: http://www.go-maut.at

The GO-Box device is synchronized with the Swiss toll collection system, and the work on synchronization with the German toll collection system being implemented now is also under way. The German toll collection system will be based on GPS system (fall 2004).

The toll for use of highest category highways are incurred by all vehicles with acceptable mass of more than 3,5 ton (including buses and micro-buses). The amount of toll depends of number of axles and number of traveled kilometers:

- Vehicles of category 2 (2 axles) – 0.130 euro/km + 20% VAT,
- Vehicles of category 3 (3 axles) – 0,182 euro/km + 20% VAT,
- Vehicles of category 4 (4 or more axles) – 0,273 euro/km + 20% VAT.

On the sections of highways and motorways subject to special toll charge: A9 – Pyhrn Autobahn (Gleinalm and Bosruck tunnels), A10 – Tauern Autobahn (Tawern and Katschberg tunnels), A11 – Karawankenautobahn (Karawankentunnel), A13 – Brennerautobahn and S16 – high-speed motorway through Arlberg (Arlbergstraßentunnel) the raised tariff for one kilometer is applicable (Table 1).

Table 1

Special toll charges on selected motorway and highway sections (in €)

Road	Toll section	km	2- axles	3- axles	4- axes and more
A9 Pyhrn Bosruck	Spital/Pyhrn-Ardning	10	6,60	9,20	1,90
A9 Pyhrn Gleinalm	Kn.St.Michael – Übelbach	25	9,50	13,30	2,00
A10 Tauern	Flacha – Rennweg	47	13,60	19,00	3,60
A11 Karawanken	ST.Jacob/Rosental – Tunel, Südportal	10	9,00	12,60	8,90
A13 Brenner *	Innsbruck – Amras - Brenner	35	23,50	32,90	9,40
	Innsbruck-Wilten – Brenner		22,80	32,00	7,90
S16 Arlberg	ST.Anton/Arlberg – Langen/Arlberg	34	13,30	18,60	7,90

*

Category 4 vehicles pay a double charge for night transit 16 ($22^{00} – 5^{00}$)

Source: http://www.go-maut.at

The toll charges introduced in 2004 are in the international comparisons the ighest in European Union (only Switzerland has higher ones) which means increase of freighcosts by 30% in relation to the previous year. The Fig.5 presents comparison of toll charges or 50-ton cargo vehicles that travel 80 000 km/year on the highways

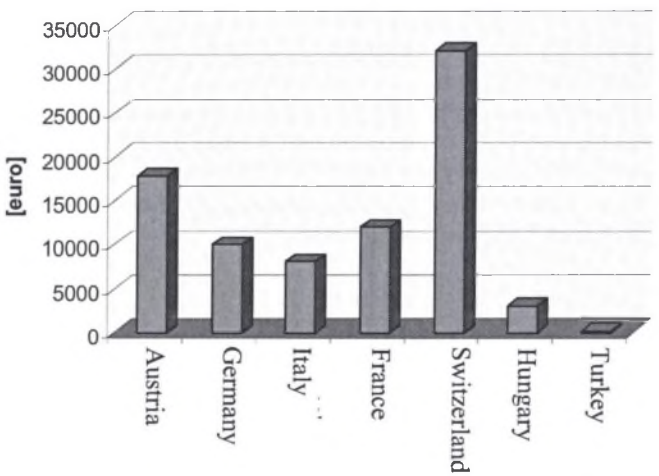

Fig.5. Costs of toll charges in the selected European countries

Source: Niederoesterreichische Wirtschaft, 25.07.2003

3. EXPERIENCES OF THE FIRST MONTHS OF SYSTEM'S OPERATION

The Austrian highway operator ASFINAG (Autobahnen und Schnellstraßen Finanzierungs AG) has assigned in 2003 an amount of 925 M€ for road works. This amount served to build 47 km of highways, as well as overhaul of civil structures such as tunnels. In relation to 2002 this amount was 20% higher and twice as high as the amount assigned in 2000. The expenditures forecast in 2004 will reach 1100 M€ constituting a total of toll charges. The collected funds (1 100 M€) will be spent for construction of 54 km of new highways and express motorways. The amount of 48 M€ will be use3d for renovation of tunnels.

The first 100 days of new system operation have expired on 9th April 2004. The balance of this period is as follows:

- 135 mln transactions were performed electronically,
- 700 mln of kilometers traveled by the vehicles were taxed fairly and clearly,
- the income from toll amounted to 190 mln €,
- the income lost is estimated for 1,6 mln €, which amounts to 1,8% (this applies mainly to the foreign vehicles for which the principles of payment are usually not well known),
- almost 100% of Austrian vehicles (with acceptable weight of more than 3,5 t) is already equipped with GO-Box devices,
- for 370 000 foreign vehicles (with acceptable weight of more than 3,5 t) almost 310 000 is already equipped with GO-Box, herein 90 000 of Pre-pay type.

The forecast of income in 2004 is as follows:

- 721 mln € for normal toll charges,
- 107 mln € for special toll charges,
- 295 mln € for vignettes.

Implementation of the new toll collection system for use of highways and high speed motorways increased the cost of transport n through Austria by 20% in average. The charges for buses and trucks in this country are about 30% higher than in Germany for example. Maybe for this reason certain European forwarders bypass Austria, choosing their routes through Switzerland, Czech Republic and Slovakia

4. SUMMARY

During the EU summit in Helsinki, in December 1999, the President of European Commission has announced the initiative entitled „e-Europe – Information Society for All". The member countries have undertaken to realize three main strategic objectives of this initiative:

- Spreading information civilization among the European citizens, schools, companies and public administration bodies,
- Support the development of new information and communication technologies,
- Strengthening the social cohesion.

For the purpose of realization of these objectives, the European Commission has assigned 10 topical areas, wherein 9 is named "intelligent transport". The European Union in its transport policy takes this issue into account, and an important initiative in this respect is a program called TEMPO (Trans-European intelligent transport systems Project). It is to be realized in the period 2001-2006 and it is aimed at stimulation of development of a trans-European transport network and ensure its consistency. This project constitutes a part of a broader program named MIP (Multi-annual Indicative Programme), whose realization involves such issues as monitoring of road infrastructure, creation of European network of traffic centers, removal of jams and making the traffic easier by application of control measures and traffic management, development of easy access to the high quality information service for travelers, increase of safety and efficiency of cargo transport through fleet management and shipment management systems, development of easy and efficient systems of electronic toll collection for use of roads and promotion of road safety by accident management. Independent of European efforts, certain countries implement the fee collection systems of their own. This article presents a Multilane free-flow system implemented on 1st January 2004 in Austria.

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