VOLUME 2 NUMBER 1 2009

TRANSACTIONS ON TRANSPORT SCIENCES

Ministry of Transport

TRANSPORT RESEARCH CENTRE

CZECH TECHNICAL UNIVERSITY

TRANSACTIONS ON TRANSPORT SCIENCES

Publisher: *Ministry of Transport*, nábř. L. Svobody 1222/12, 110 15 Praha 1, Czech Republic
E-mail: *info@transportsciences.org*
URL: *www.transportsciences.org*

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Periodicity: Quarterly
Language: English
Scope: International scientific journal for transport sciences
Print version: ISSN 1802-971X
On-line version: ISSN 1802-9876
Registration Number: MK EČ E 18012

Each paper in the journal is evaluated by two reviewers under the supervision of the International Editorial Board.

The Research and Development Council of the Government of the Czech Republic indexed this journal in the Title List of Peer-Reviewed Journals.

Distributor: CDV – Transport Research Centre, Líšeňká 33a, 636 00 Brno, Czech Republic, journal@cdv.cz

Relation between Running Time and Energy Consumption

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ABSTRACT: The traditional solution of energy efficiency has, up to now, lain in research into the design of electric traction equipment and utilizing the latest findings in electric materials, semi-conductors, driving and regulating aggregates and production technologies. Economical and ecological requirements create impulses for searching for different routes leading to the energy efficiency of electric railway operation, just like in other fields of technology. Research in this field has embarked on searching for unconventional options, characterized by the examination of the relationship between running time and energy consumption. This approach defines a rational method of the train guiding and can deduce ideal requirements for creating timetables. This paper elaborates on a particular approach to a given problem and introduces achieved outcomes.

KEY WORDS: Electric railway, running time, energy consumption, energy saving, energy navigation instrument.

1 INTRODUCTION

The examination of relations between running time and appropriate energy consumption on a given track serves as a ground for energy optimizing of the timetable. It is clear that optimal running time does not only concern energy, but also technological, commercial and other factors. The following contemplations, however, involve only the energy aspects; they need not necessarily satisfy other factors, which are not subject of this work. In an attempt to capture the relations between energy consumption, track gradient, speed (i.e. running time) in the most comprehensive form, an extensive analytical study, based on variant calculations, has been performed and documented by measurements in real train operations. A 363 Series locomotive, which is used on Czech railways, was used as the traction vehicle. Relevant tractive effort – speed and power input – speed functional relations were elaborated on the original data in the manufacturing documentation of the Company Elektrické lokomotivy, ŠKODA Plzeň, and on the author's work team's own measurements.

2 THEORETICAL BACKGROUND

The most accurate results for calculating power consumption are achieved by an integrative method, which is described in the following mathematical relations. The calculation is simulating; this means that it simulates the particular passage of a train under given operational technological conditions. For instantaneous acceleration the following applies:

$$\frac{dV}{dt} = \frac{f_t(V, \tau_x) - [r_v(V) + r_g + r_c]}{102 \,.\, \xi} \qquad [\text{m/s}^2] \qquad (1)$$

where the relative tractive effort on the driving wheels' perimeter is characterized by:

$$f_t(V, \tau_x) = \frac{102\, F_t(V, \tau_x)}{M} \qquad [\text{N/kN, kN, t}] \qquad (2)$$

Then, if we consider that in the real time interval

$$\Delta t = t_2 - t_1 \qquad [\text{s}] \qquad (3)$$

it is possible to simplify relation (2) for the selected function $\tau_x(V)$ and regard it as the function of the speed, i.e.

$$f_t(V, \tau_x) = f_t(V) \qquad (4)$$

The time function relation of the speed for $t \in \langle t_1 \,,\, t_2 \rangle$ is then determined by the Formula

$$V(t) = \frac{3{,}53 \,.\, 10^{-2}}{\xi} \int_{t_1}^{t_2} \left\{ f_t(V) - [r_v(V) + r_g + r_c] \right\} dt \qquad [\text{km/h}] \qquad (5)$$

Then, the corresponding time function of power input on the locomotive current collector is

$$P_{1t}(t) = \frac{F_t\,[V(t)] \,.\, V(t)}{3{,}6\, \eta_{TVE}\, \{F_t\,[V(t)],\, V(t)\}} \qquad [\text{kW, kN, km/h, 1}] \qquad (6)$$

and the energy consumed on the the locomotive input in the contemplated time interval (3) is

$$E_1(t) = \frac{1}{3600} \int_{t_1}^{t_2} P_{1t}(t) \,.\, dt \qquad [\text{kWh}] \qquad (7)$$

Symbols used in the above mentioned equations:

V	speed [km/h]
F_t	tractive effort on the perimeter of driving wheels [kN]
f_t	relative tractive effort on the driving wheels [N/kN]
τ_x	fictive regulation driving position – corresponds with particular tractive effort speed functional relation
ξ	coefficient of rotational mass influence [1]
r_v	relative vehicle resistance [N/kN]
r_g	relative grade resistance [N/kN]
r_c	relative resistance during passage through a track curve [N/kN]
η_{TVE}	instantaneous total energy efficiency of the locomotive [1]

The necessity to apply accurate calculations achieved by means of the above-described integrative method, which corresponds with the correct instanteneous value of the overall efficiency of the traction vehicle $\eta_{TVE,}$ is obvious in Figure 1. It is obvious that the value of energy efficiency of an electric traction vehicle largely depends on the tractive effort on the driving wheels F_t and on the speed V.

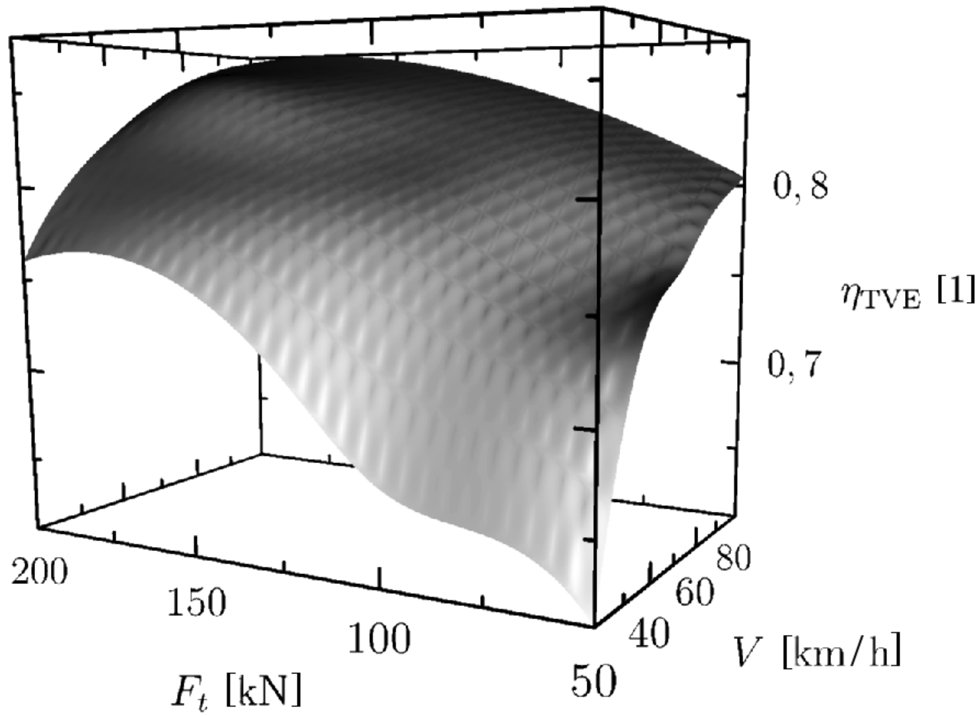


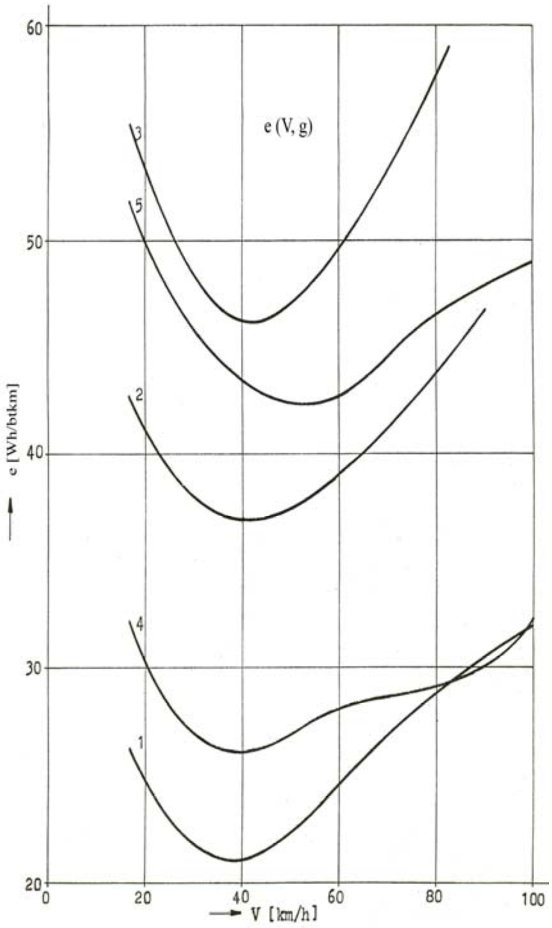
Figure 1: Values of the overall efficiency η_{TVE} for various power modes determined by the tractive effort on the driving wheels F_t and the speed V

3 RESEARCH METHOD

Figure 2 gives a graphic description of the dependence of relative energy consumption measured on the current collector *e* on vehicle velocity *V* for two types of train, which differ in vehicle resistance and total mass *M*. The influence of gradient *g* was also taken into account.

The results of this are the so-called V-curves, which provide a graphic description of the general relation between relative energy consumption *e* at a constant speed *V* and a given track gradient *g*. If we selected minimum power consumption as the optimization criterion, the optimum would become the local minimum of each displayed function corresponding to the particular velocity, in this case between 38 km/h (curve 1) and 53 km/h (curve 5). This fact suggests that the energetic optimum cannot be determined by the local minimum of individual functions *e(V,g,M),* due to practical traffic and technological reasons.

The relevant speeds are unacceptably low. Thus it is necessary to look for a different approach to power optimization criterion.



Comment on Figure 2:

Curve 1
Goods train - total mass 890t on the gradient 4 ‰

Curve 2
Identical train on the gradient 8 ‰

Curve 3
Identical train on the gradient 12 ‰

Curve 4
Express train - total mass 420t on the gradient 5 ‰

Curve 5
Identical train on the gradient

Figure 2: Relation between relative energy consumption on the locomotive's current collector *e* and speed *V*, mass of train *M* and track gradient *g* for two different types of train

A study based on variant calculations, which examined the relations between energy consumption, gradient and running time by simulating a complete running cycle between two stops in the most universal conception.

Calculations were performed with software equipment which was created by the work team under the author's guidance by utilizing his previous research activities in these model conditions:

- express train - total mass 420 t,
- maximum speed – 100 km/h,
- distance between two stops - 30 km,
- constant gradient whose values are in intervals from -16 to +16 ‰.

Graphical summery of outcomes of the studies the Figure 3.

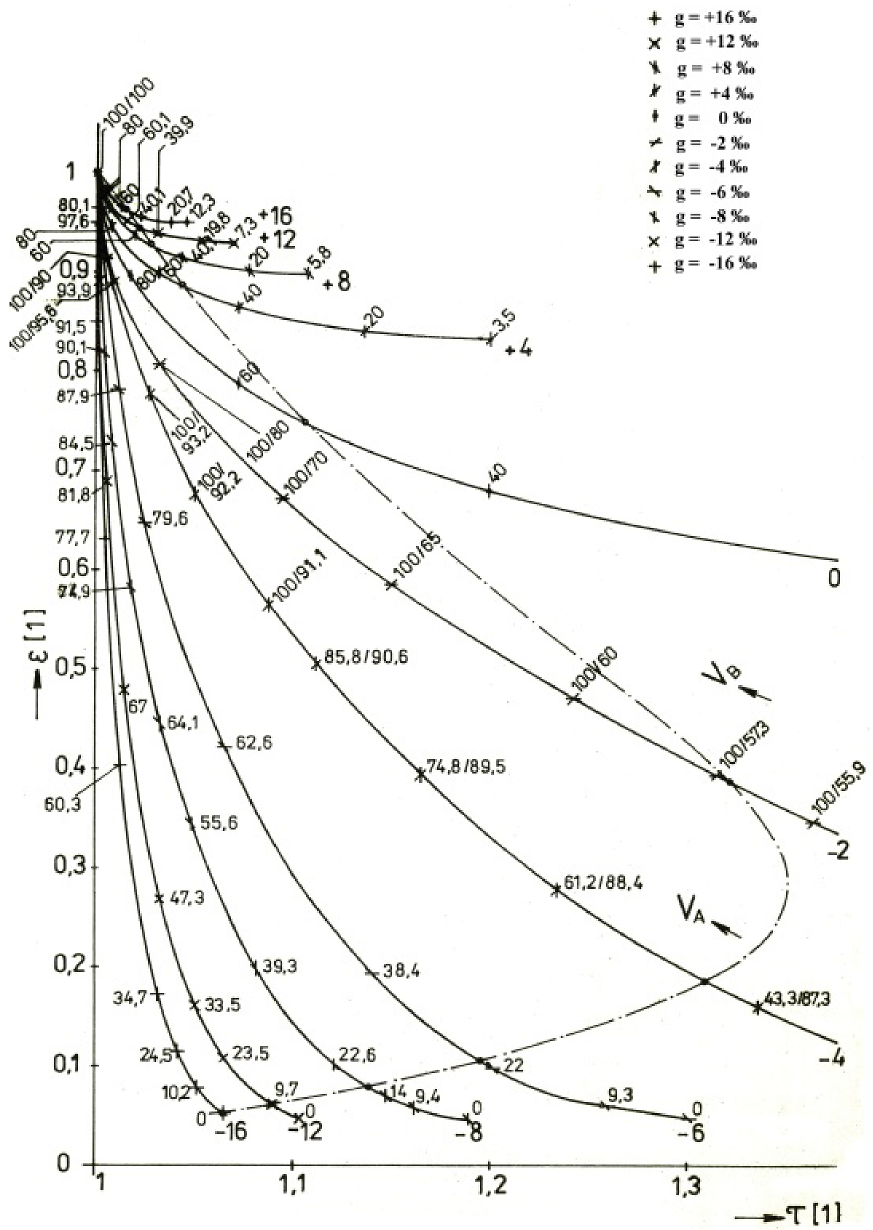


Figure 3: Relationship between energy consumption *ε* and running time *τ* at various gradients *g* in simulation of a complete driving cycle

Comment on Figure 3:

Curves *ε(τ)* for gradient -2 ‰ are marked with points and specified by fractions, where the numerator represents the speed at the beginning of the coasting and the denominator represents the speed at the beginning of braking before stopping. Speed at the beginning of the coasting is consolidated at 100 km/h. For other curves for gradients up to +16 ‰, the particular points are only marked with data on the speed reached at the beginning of braking (V_B). On curves *ε(τ)* for gradient -4 ‰, the points are specified by speed at the end of the driving with power in the numerator and speed at the beginning of braking in the denominator. Other curves for gradients up to -16 ‰ are only marked with speed at the end of the driving with power (V_A).

For the formulation of energy consumption, this holds true:

$$\varepsilon = \frac{E}{E_{\max}} \qquad [1, \text{kWh}, \text{kWh}] \qquad (8)$$

For the formulation of running time, this holds true:

$$\tau = \frac{T}{T_{\min}} \qquad [1, \text{min}, \text{min}] \qquad (9)$$

where E_{max} represents the highest energy consumption on a given route between two stops corresponding to the shortest possible running time T_{min}. Prolongation of running time T is achieved by variants, as may be observed in clarification of particular curves in Figure 3.

Each running time $T > T_{min}$ corresponds with energy consumption $E < E_{max}$. Optimal running time was achieved by means of mathematical reasoning, which determines energetically optimal running time as running time, which corresponds with a dot on the curve of a relevant functional relation $\varepsilon(\tau)$, for which the following holds true:

$$\frac{d\varepsilon}{d\tau} = -1 \qquad (10)$$

This means that it is a point where a relative increment of energy consumption will trigger an identical relative shortening of running time, and vice versa. If we connect points on individual curves in Figure 3, for which the above-mentioned mathematical relationship (10) is applicable, we will get a curve, which is marked by dot-and-dashed line and which represents an aggregate of points optimal for running times of all considered cases in the given model conditions.

4 RESULTS

If we follow above-mentioned findings with the time reserve ΔT_{opt}, for which the following is applicable

$$\Delta T_{opt} = T_{opt} - T_{\min} \qquad [\text{min}] \qquad (11)$$

then the chart in Figure 3 suggests an optimal curve of time reserve with relevance to the line gradient. In other words, if reserves in running times according to the timetable are higher than those in the mentioned chart, they may lead to energetically unfavorable running times, or else, their sustenance will lead to the uneconomical use of electrical energy after creating a particular transport act.

The symbol T_{JR} in Figure 5 means the running time according to actual timetable.

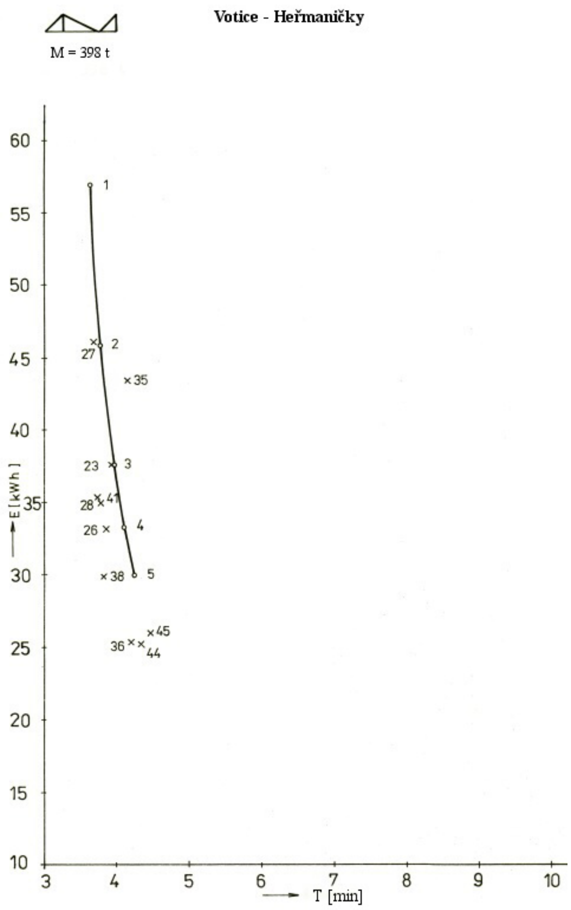


Figure 4: Relationship between energy consumption on the current collector and running time *T*. The displayed calculated values are marked with a circlet and values determined by measurement are marked with a cross

5 CONCLUSIONS

Graphic tabular aids for engine drivers, which promote energetically rational train driving, were elaborated upon in the outcomes of the above-mentioned findings. Long-term observations of the influence of running time on energy consumption was examined by variant simulation calculations and by experimental measurements in real train operation. Charts in Figures 3 and 4 present illustrations of calculations and measurements performed during the operational routine. The degree of conformity between calculations and measurements is apparent, the trains in various operational conditions discovered energy savings of between 5 – 15 %. This led to designing an automated navigation aid for locomotive drivers. This device issues guidelines, which respect relevant operational situations during driving. The equipment has been thoroughly tested with favorable result.

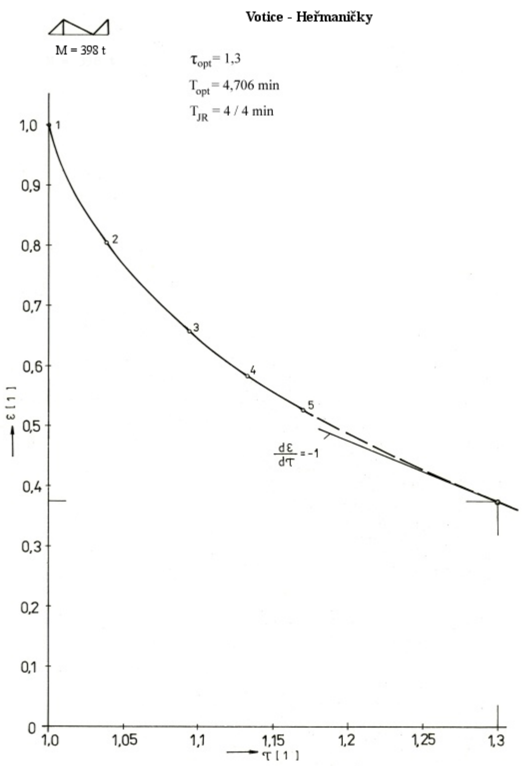


Figure 5: Relations between relative energy consumption relating to the current collector ε and relative running time τ based on variant calculations corresponding with the chart are the subject of Figure 4

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GSM- R and CDMA Network System for the Railway Industry

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ABSTRACT: Relates to the CDMA (Code Division Multiple Access) network with covering specifications and requirements which must be added in to the CDMA system. The Preliminary job is to analyze the demands and technologicaly development, mainly dealing mainly with the viability of the CDMA system in the railway industryrailway. Communication for rail transportation is vital to impulse stimulate the development of modern society. The CDMA system can bring the benefits from of voice and data services for to today's rail transportation.

KEY WORDS: CDMA network, railway, GSM-R

1 INTRODUCTION OF MOBILE COMMUNICATION DEVELOPMENT

The first cellular system were was deployed in the United state States in about in 1979, that called AMPS (Advanced Mobile Phone Service). and Iin the North-ern European countries, the system started operation in Sweden in 1981, and in Norway, Denmark and Finland with some manufacturers inventinged the NMT (Nordic Mobile Telephone) system. In 1985, TACS (Total Access Communication System) were was used in some European countries such as in the UK and Ireland. All these cellular systems used a frequency around 450MHz and /or around 900MHz, and are called the first generation (1G) mobile phone systemss.

In 1990, the second generation (2G) mobile phone systems, such as GSM (Global System for Mobile communications) with standard IS-136, and CDMA with standard IS-95, were introduced in the United States and in Finland. Soon, the second generation digital mobile system was developed with an SMS service and reached a large number of subscribers number. The specification of a version of GSM adapted to the 1800 MHz frequency band was added to the scope of the standardization group, with a frequency allocation of twice 75 MHz.

Shortly afterwards the third generation (3G) systems were researched (Lee and Miller, 1998). The first 3G network was launched by NTT DoCoMo in Japan in 2001 using the WCDMA (Wideband CDMA) technology (H. and A. Toskala, 2004). In tThe IMT-2000 standardization for 3G system supports a set of requirements such as data rates indoors reachesing 2 Mbit/s and 384 kbit/s outdoors. In 2002, the CDMA2000 1xEV-DO system was launched with high data rate services. Beside In the mean time, 2.5G systems such as CDMA 2000 1x and GPRS were extended from the existing 2G system (Yang, 2004).

Characteristics of the next generation mobile communication are to support a larger number of subscribers and gain high data access speeds, as well as wider coverage. Up to now, with the rapid expansion of thein communication, many projects about on mobile communication have been implemented to satisfy the needs of telecommunications. In turn, mobile communication networks, from the first general 1G to 2G, 2.5G, and now 3G and 4G networks using new technology, have been deployed all over the world, especially in the developed countries. By the end of 2007 there were 295milion subscribers on 3G networks over the world. Revenue from 3G services makes uptotalled 120 billion dollars during 2007.

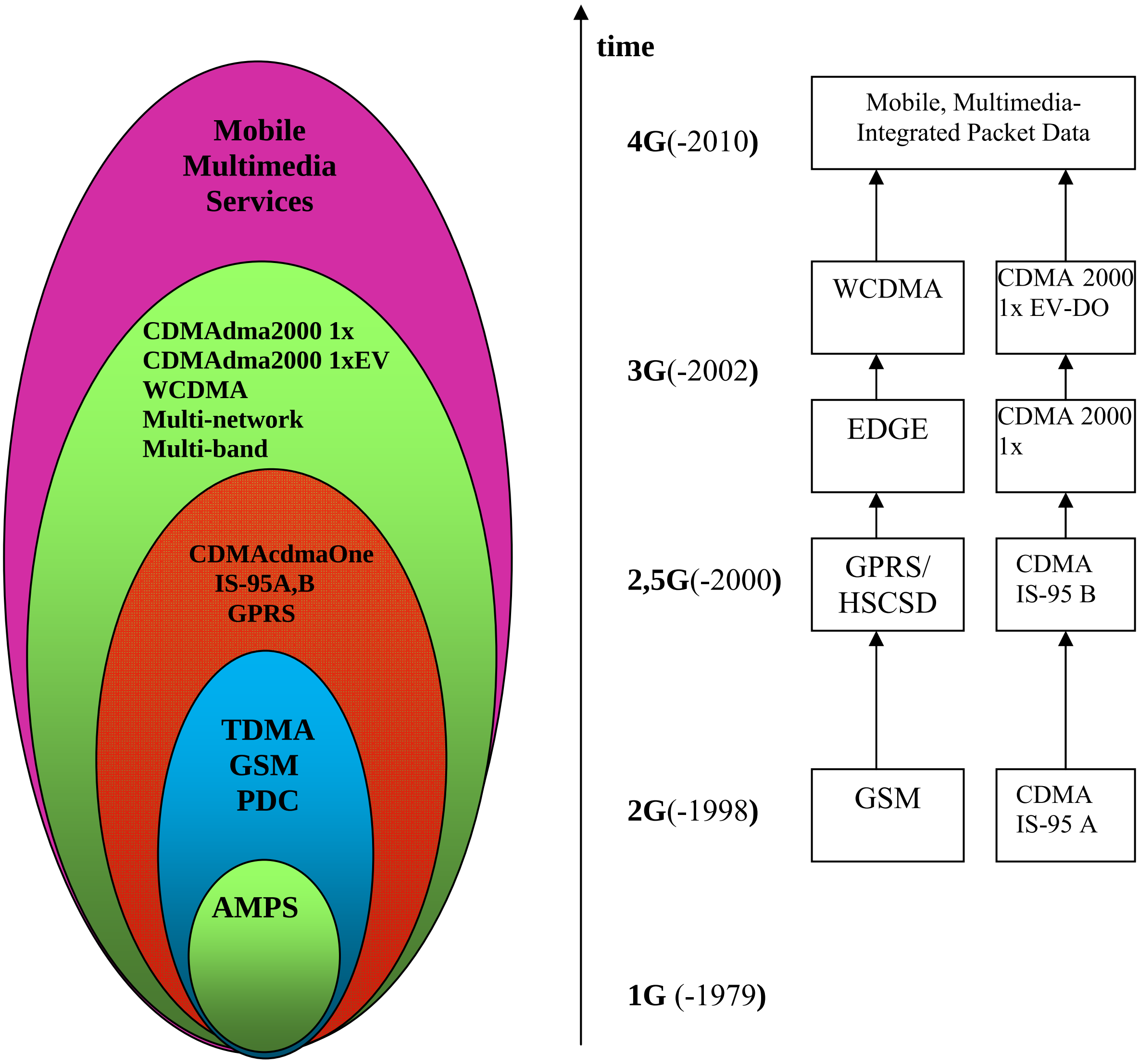

Figure 1: Development of mobile network generations

2 GSM-R FOR EUROPEAN RAILWAY NETWORK

GSM-R (GSM-Railway) was the leader in MORANE trials and blazed the trail in commercial GSM-R deployments, rolling out a full-fledged infrastructure in 1998, deploying in 2000 in Sweden, and bringing the first high speed GSM-R application on line in Spain in 2003 (Nokia Siemens Networks, 2008).

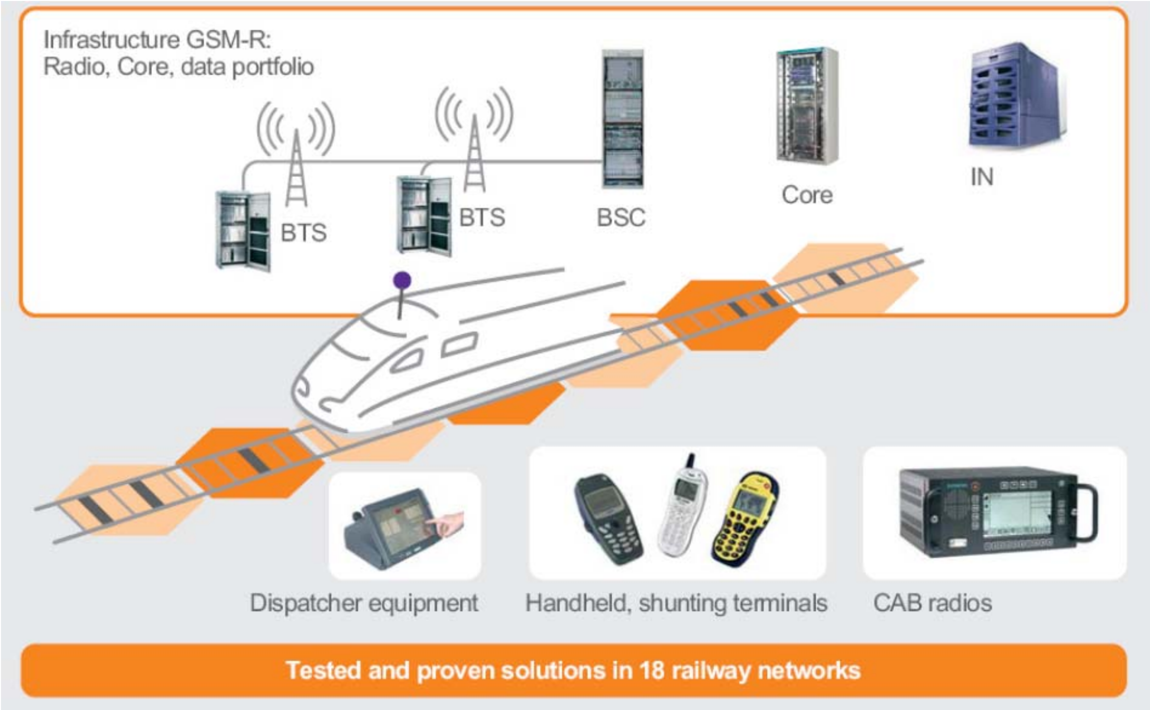

Figure 2: Infrastructure GSM-R (Nokia Siemens Network, 2008)

EIRENE (European Integrated Railway Radio Enhanced Network) specifications predetermine a radio system satisfying the mobile communications requirement of the European railway. These specifications consist of ground-train voice and data communication, together with the ground-base mobile communications needs of trackside workers, station and depot staff and railway administrative and managerial personal. The application of specification requirements will ensure interoperability for trains and staff crossing national and other borders between systems (Neele, 2007). The EIRENE specifications include:

EIRENE Functional Requirements Specification (E-FRS): this is a set of high-level functional requirements of the GSM-R railway radio system which facilitates international interoperability between national railways.

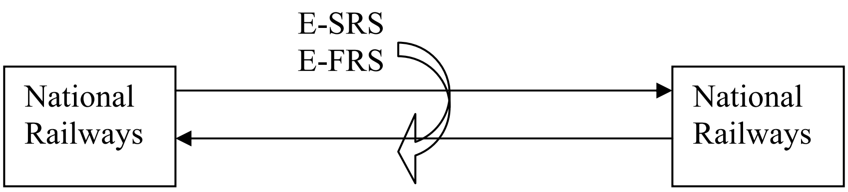

Figure 3: E-FRS and E-SRS facilitate and ensure internal railways

EIRENE system requirements specification (E-SRS) encompasses technical requirements and constraints in order to ensure international interoperability between national railways and support information as specification key to perform international interoperability.

MORANE specifications (Mobile radio for Railway Networks in Europe) consist of MORANE Sub System Requirements Specification (SSRS), MORANE Form Fit Functional Specification (FFFS), and MORANE Functional Interface Specifications (FIS). The SSRS certifies all the functions to perform on the GSM equipment in order to fulfill all requirements identified in the E-FRES and E-SRS. The FFFS indicates the technical system requirements defined in the higher level system specifications. The FIS defines the interfaces between network components.

The EIRENE and MORANE specifications are the minimum set of requirements necessary to ensure international interoperability of GSM-R network. The E-SRS can be included in a network service that provides an overview of the network services that must be supported by a mobile radio system and network planning that is to provide guidance on target performance levels for GSM coverage, hand-over and cell selection, call set-up time requirement and broadcast and group call areas. In addition, mobile equipment specification is taken by system specification as follows:

- Core specification: consist of basic services, facilities and features to ensure interoperability.
- Cab radio specification identifies the system requirements for the radio and the human-machine interface and the functionality.
- General purpose radio requires the functions and physical properties taken from an EIRENE- compliant general purpose radio.
- Operational radio is basesd on the general purpose radio, but with the addition of functions to support railway operations.
- Numbering plan and call routing conclude numbering plan requirements, numbering plan constraints and structure of functional numbers and EIRENE numbering plan.

3 CDMA NETWORK FOR RAILWAY

In recent years, mobile communication networks have been rapidly researched and developed. Demands for multimedia services as voice, image and data are increasing more and more. The next generation mobile CDMA networks, which have been are being proposed now, offer high speed and a large capacity to satisfy multi-ple users. The system capacity of CDMA networks is a necessary problem for design engineering. The CDMA network shares a fixed resource, that is the frequency spectrum, to provide access channels for users.

A CDMA-R (CDMA-Railway) system is a mobile communication system for the railway industry which uses CDMA technology. Some specifications needed to satisfy for CDMA-R are the following: high safety and security, good cover quality, comfortable for the railway system, enable to link communication systems, roaming between other areas, integrated flexible high voice and data.

CDMA-R offers premium technical solutions, comprising of value added services, as well as train control, for example automatic ticketing cargo tracking and passenger information systems. The CDMA networks' lifecycle consists of design, implementation, and operation to long-term maintenance with using all the tools necessary for planning and managing networks and providing supporting services. Brief elements of CDMA-R include:

- Core network and associated equipments
- Interfaces to with railway equipments
- Roaming with other national and international networks

The CDMA-R also comprises of the same elements as same as the standards of the CDMA network:

- TE (terminal equipments): are user terminal equipments such as dispatcher equipment, handheld shunting terminals, and CAB radios.

- BSC (base station controller): Functions of iIts function are is to controls a group of BTSs (Base Transceiver Station) that are connected. BSC has a function as a mobility management when a mobile moves from one BTS to the next BTS. and another important function of the BSC is transcoding. Transcoding converts the voice format used in the air interface and the voice format used in the PSTN.
- MSC (mobile switching center) is to switches connections between the MS (Mobile subscribers) and PSTN (public Public sServiceswitcheds telephone Telephone networkNetwork) or between the MS and another MSC.
- HLR (home location register): A database contains home subscriber information. Each subscriber, the HLR holds her the subscriber information, such as the international mobile subscriber identity (IMSI) and the selected long distance carrier.
- VLR (visitor location register): A database contains visiting subscriber information which is active on a current MSC.
- AC (authentication center): the AC authenticates user to provide service to that user.
- IWF (interworking function) that is to perform circuit switched data service. The IWF converts from one transmission format to another, and vice versa. Data flow originatinged from the MS is switched by the MSC to the IWF. The IWF converts the data stream into modem and transmits it over the PSTN.

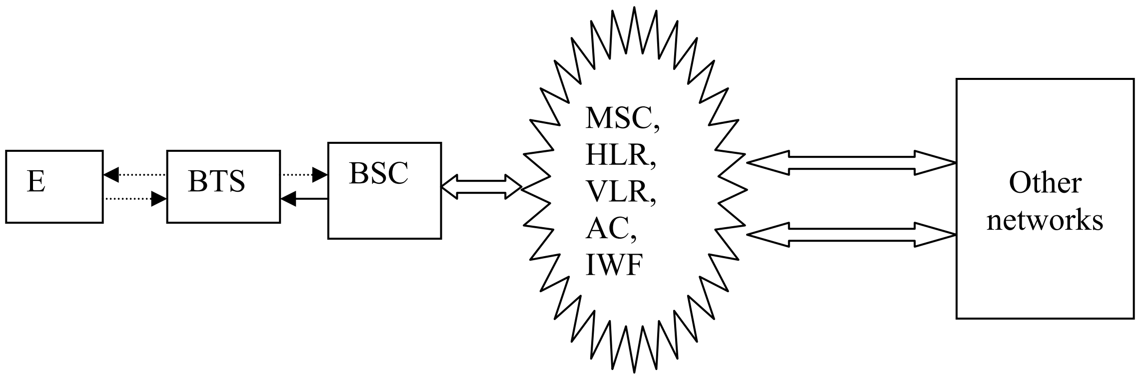

Figure 4: Simple structure of CDMA network

4 ADVANTAGES AND DISADVANTAGES OF CDMA-R

One of the main advantages of CDMA systems is their ability to use signals that arrive in the receivers with different time delays (Qualcomm, 2002). So the CDMA-R will resolve multipath phenomenon to improve link quality. The CDMA-R is based on code division multiple access technique, each user uses a common frequency with a different code that saves resources, which that make it a cost-effective, high quality wireless solution, easy and exact handoff. Fast and accurate power control to ensure that the base station receives all signals at the appropriate power. A CDMA rake receiver identifies the three strongest multi-path signals and combines them to achieve one very strong signal, so reducinge the power the transmitter must send, easy handoff.

Disadvantages of CDMA technology is channel pollution because due toof the same frequency. Otherwise, CDMA-R is not popular yet due to the expense of the technology and the starting of the GSM-G service.

TDMA (Time DMA) triples the capacity of FDMA (Frequency DMA), but CDMA capacity can be up to seven times that of TDMA.

Table 1: Comparison of multiple access systems (Qualcomm, 2000)

	Cellular band			PSC band		
	CDMA	TDMA	FDMA	CDMA	TDMA	FDMA
Channel bandwidth	1.25 MHz	30 KHz	30 KHz	1.25 MHz	30KHz	200 KHz
Users/sector/channel	22/14	3	1	22/14	3	8
Standard	IS-95A	IS-54	EIA/TIA-553	ANSI-J-STD008	IS-136	GSM

5 CONCLUSION

This paper mentions some rasespects of railway telecommunication to take the discussion to CDMA-R. This will begin the process and lead to the design of a private railway communication network that has applied CDMA technology perfectly. The role of telecommunications in railways is very important. It ensures the safe working of trains such as the signaling or train control function and also supports other train operations, without difficulty, a high safety response and security.

6 ACKNOLEDGEMENT

The work has been supported by Czech Ministry of Education No. MSM 6840 7700 43. This support is very gratefully acknowledged.

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Transport and Environment

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ABSTRACT: This article compares the impact of road and railway transport on the environment. A great amount of resources of the European Union's funds are assigned for transport and environment. It is necessary to overcome some obstacles for attaining the money, i.e. administrative demands, to have own sufficient funds, to overcome the activities of NGOs and there is also not a satisfactory process of transition to the post-industrial, knowledge-based society of services with a completely changing structure of economics. The influence of the NGO was proved within two studies; the main findings are that NGOs are closely bound with administration and cause problems with information service and secondly that the delay in completion causes economical and environmental losses. The railways have to find the limits of efficiency in passenger transport and freight transport and transform its technical equipment and service to be efficient by all means. We also pointed out that the potential capacity of roads is in general higher than that of the railways with the typical weight of goods trains and liners.

KEY WORDS: Road transport, railway transport and environment.

1 IMPACT OF ROAD AND RAILWAY TRANSPORT ON ENVIRONMENT AND ECONOMY

As an impletion of the principle of solidarity, the Czech Republic could receive from the European funds about €29.5 billion during the period 2007-2013. It could receive even more if the Czech Republic would successfully participate in some projects of the 7th frame programme R&D. To this amount the operational programme "Transport" could participate with €5.574 billion and with amounts from other operational programmes of nearly €6.4 billion. Transport, as one of the most important segments of the national economy, could receive nearly 22%. The 2nd highest share of funding is provided for the environment. Transport and environment together could receive support totalling about 42% of the total sum for co- financing. There have been some prerequisites to reach it:

- To have prepared proposals of projects to the highest quality. This is not easy because one of the hidden conditions is a necessary deep understanding of the basic principles and rules of the European Union - it is not only knowledge of the technical aspects on how to fill in the blank forms of requests, rather to the highly "bureaucratic" rules, as they are often labelled by the Czech VIPs.
- To reach possible support it is necessary to have own funds: in the case of eligible capital costs it is about 15% of the total amount and the same share falls on capital costs not eligible for co-financing. It is also impossible to eliminate some attempts to decrease own funding on account of co-financed share.

- To succeed in the preparation of projects it is necessary to deal relatively successfully with some groups of NGOs that regard it as a success to block in fact all major infrastructure projects based on the idea that transport with any negative effects on the environment really does not exist (for example there are no internal combustion engines without greenhouse emissions).
- There is not always a satisfactory awareness that the economy is in a process of transition from the industrial to the post-industrial, knowledge-based society of services with a completely changing structure of economics:
  - Decrease of primary products sectors and in the case of energy, a change of structure enabling transmissions, instead of transporting sources of energy, especially solid fossil fuels.
  - Decrease of secondary sectors – manufacturing; the share of these industries in the Czech Republic has been twice as high as about one decade earlier in the Member States of EU 15.
  - Relatively lower share of services means that in the Czech Republic the process of transition has not yet been fully in accordance with the general trends of post-industrial society.
  - Before the start of the financial, and later real economic, crisis within the EU there were: - about 23 million of craft and small- and medium- sized enterprises with the share of the total amount of entrepreneurial entities 98% to 99 %, their share on new employment in the private sector was about 80 %, the share of GDP was growing and has reached nearly 50%; - only about 41 000 large enterprises. Due to the recent financial and economic crises, this number should decline. Additionally, the decrease in employment in these sectors shall be, after labour-saving measures, much greater.

2 DEVELOPMENT OF TRANSPORT INFRASTRUCTURE AND NGOS

Within the two studies we tried:

- To compare the compliance of transition of the Community law concerning protection of environment according to all aspects of the environmental protection, from the very beginning (intention of investment) up to its implementation.
- The conclusions:
  - We found full consent as to the content, but more severe conditions for the public administration to respond to the questions and objections even based on false presumptions; it is far enough from the code of good behaviour of the staff of the EU institutions - protecting it from the misused right to be informed.
  - A very close relationship between NGOs and public administrations concerning environmental protection that could be deemed to be on the boundary of a conflicts of interests, enabling them to repeatedly put very similar questions and to repeatedly ask for a response in a much broader extent than necessary to write up any topic.
  - A greater advantage of baseless complaints is the allowance in publishing information first and based mostly on very old-fashioned myths, e.g., in the case of environmental friendliness of modes of transport.

In the second study we have tried, contrary to the more widespread attitude, not only to calculate the costs of the infrastructure projects and the harmful effects of transport, but also the negative impact of doing nothing - not only on the economy, but even the environmental costs caused by the delayed construction. We have simply ignored the very oversimplified idea that the less transport infrastructure, the better for the society as a whole. As a criterion, we used provisions of the chapter XIX. “Environment” of the Treaty of European Communities: - saved fuel, - lower emissions of greenhouse gases influencing climate change, - lower number of accidents, namely fatal accidents per performed vehicle kilometres using motorways and speedways instead of roads of a lower level. We omitted a comparison of the number of accidents according to the modes of transport as a starting position of evaluation; the starting points in our approach are demand for mode of transport, the others have been the specific consumption of fuel (in passenger traffic consumption per passenger) and the specific emissions to prove firstly the environmental efficiency in comparable conditions. The results are:

- A smoother flow of traffic on a quarter of the finished Prague Circle have accelerated the average speed of vehicle by more than twice, according to the test runs, - from less than 40 kilometres per hour to more than 80 kilometres per hour; the lower average speed on the unfinished three quarters of the Prague Circle is mostly caused by an average of nearly 10 stops every quarter, due to traffic signalling or traffic jams in the streets temporary substituting the Prague Circle. The increase in average speed will be higher after the Prague Circle enters full operation as a whole (holistic effects).
- Accordingly, there should be more than a twofold decrease of emissions of greenhouse gases.
- The share of savings accrued to the saved fuel and emissions was, using some global estimates, about 3:1, depending very much on the estimates of prices of oil – and it is a very difficult task. Now after the approved values of emissions due to the future Directive oriented towards “greener” road vehicles, emissions are priced lower and the rate is about 5:1 in favour of fuel.

3 ENVIRONMENTAL EFFICIENCY OF LOCAL AND REGIONAL PASSENGER RAILWAY AND ROAD (BUS) TRAFFIC

There is a myth concerning the generally more environmentally friendly railways and inland waterway transport as opposed to road transport. The environmental friendliness of railways and of goods trafficked using water-borne transport was generally valid in the days when horse carriages were used for road transport as the only competitors of railways in overland transport, and in the case of states with extensive canals. But the limits of efficiency in the period of immense development of transport technology have transformed – development of railway technology however could not change the basic characteristics of this branch of transport – mass transportation. Mass transportation needs, in passenger traffic, enough passengers to transport them in an efficient way, as viewed through energy efficiency, and this is particularly difficult for domestic traffic in such a small territory as the Czech Republic, than at the pan-European level. Naturally, there are many examples of well-organised domestic rail traffic in small territories (Switzerland, Austria or some regions like Bavaria). It is, however, very demanding. We try to find the minimum passengers necessary to reach the least specific consumption per passenger - because a great part of local and regional transport units use vehicles of similar capacity, comparable both in bus and rail transport, and in a similar way, we have tried to find the lower limits of occupation regarding specific emissions. In many comparisons of road and rail for road the direct consumption of road vehicles is considered and the whole consumption of the railway system is considered for rail. In our comparisons, because of diesel traction in the case of local and regional rail transport, there are no problems with the calculations of the compunctions at the level of sources. After having compared these two environmental parameters there is the problem of a satisfactory number of trains meeting the costs of the infrastructure. Therefore, new solutions for the operation of regional infrastructure are necessary (and maybe a field of the research). This means simple signalling systems and adequate operational rules, which enable the low-cost operation of low-demand lines, sustainable on account of the possibilities of public subsidies. In case of low-demand for passenger railway transport, there could be the possibility to support a better modal split using some negative impacts in favour of the higher charging of road transport - even passenger mass transport. (But on local and regional lines, with the exception of commuting in large conurbations, the main competitors are cars.). In addition, it is necessary to re-evaluate some of the functions of local and regional railways as historical technological landmarks – with the changing function of railways from predominantly commuting – and therefore with reorientation of usage of its infrastructure in favour of tourism, within the framework of regional activities; with the possibility to improve the productivity of traffic staff adding other, up to now, unusual activities. Because a railway line with 3 pairs of trains per day could hardly employ anybody as a full time worker and full time work in the above mentioned case - and it could be typical for many stretches of local and regional lines only used for traffic operations - could not earn money enough to cover costs with only an acceptable level of subsidies. It is therefore necessary to develop innovative solutions for the operation of this infrastructure.

4 MARGINAL AND FULL COSTS OF TRANSPORT

After long discussions it was concluded that in the case of transport costs, especially in the case of transport infrastructure, marginal costs should be used instead of full costs. In the case of railway, it could be clear if the more important segment has had enough capacity of transport infrastructure in the railway sector or a part of the other shadow subsidies of railways. It may be that the reaction of greater subsidies in favour of railways as opposed to the necessity to build new infrastructure capacities is that it would be easier and cheaper to remove bottlenecks in the transport network as a whole. Let us now compare in a very simplified form the capacities of typical segments of infrastructure in road and railway transport. We suppose only one lane of motorway or speedway for haulage and a single track railway line for goods traffic. We can suppose that the second or other lane of road is used for other road users (cars, other vehicles). Such a precondition is disadvantageous for road transport and gives the advantage to rail transport. We suppose the unique average speed in both modes of transport to be 85 kilometres per hour. For the railways it is rather a goal for at least next decade rather than a reality. We have taken one kilometre stretch of lane and calculated the necessary occupied part of road for safety traffic: the maximum length of a lorry (semi-trailer unit) is in the Czech Republic 22 m, in case of a speed of 85 kilometres/hour the stopping (braking) distance is about 61.4 m; the total necessary length is 83.4 meters, on one kilometre of carriageway (lane) it is possible to put 1000/83.4 which equals about 12 vehicles. In the case of bad weather or not full braking we have taken the coefficient of adhesion to be 0.4; the braking distance is about 97 m, the necessary segment of carriageway of the lane occupied by one semitrailer unit is 119 m, on one kilometre is possible to drive safely 1000/119 = 8.4 vehicles. [1]

We suppose that the lorry (semi-trailer unit) with a gross weight of 40 tonnes transports 24 tonnes of goods. In the first case it is possible to transport 288 tonnes, in the second case 201.6 tonnes. In the case of a single track railway line it is necessary to count with the length of blocking stretches for competitive railways with the allowed maximum speed of 100 km/hour, even if at this time the speed of liners is up to 60 km/hour; for one train it is necessary to block 3 one kilometre stretches. The gross weight of an average goods train in the year 2007 was 997 tonnes; weight of goods carried is about 50% - 498.5 tonnes,

[1] Calculation of stopping distance computed by I. Drahotský

on one kilometre fall on one third, which means 498.8/3= 166.2 tonnes. Contrary to the central command economy and more generally industrial society with a huge output of mining and traffic of coal, construction materials, fertilizers, ores, with a high share of block trains heavier than 2000t gross weight and a lesser weight of liner, where the railway could compete under some other conditions with road transport, the gross weight of liners was about 60% to 75 % of the average weight of a goods train. Now the maximum gross weight of liners in a range from 100% to about 125 % gross weight of the average goods train can be estimated. To reach the compatible capacity of the railway under the above mentioned conditions the net weight should be from 604.8 tonnes to 864 tonnes; gross weight should than be doubled - from nearly 1210 tonnes to nearly 1728 tonnes. But the probability of the greater weight of liners in domestic traffic in a society of services based on knowledge and the dominance of craft and small- and medium- sized enterprises is rather low; the capacity of the railway single line track, at least in internal traffic, would probably be much lower. And as we have mentioned that the average speed of 85 km/hour is rather a future goal, it is necessary to mention one aspect that handicaps railway transport: the system of the fix length of blocking stretches decreases with the decreasing speed of trains the capacity of railway line. In the case of motorways is it an opposite case: decreased average speed has abbreviated the stopping distance. However a lower speed does not always cause a higher capacity in road traffic. This is to simplify the determination of the limit capacity for the safe movement of vehicles on the road, so that in the case of dangerous situations is possible to stop the vehicle immediately. In terms of the calculation, this is the use of the basic physical relationship for steady movement, equally fast or slow. These are the exact mathematical calculations. Considered is the distance between the vehicles corresponding to the trajectory necessary to stop the vehicle during braking, including reaction time and start of reaction time. The underlying assumption is:

- Response time of driver 1s
- Time of the start of the braking effect of road freight 0,2 s
- Coefficient of adhesion 0.8 - then 0.8 / 2 = 0.4
- Considered road is dry (adhesion coefficient of 0.4 represents half of the value obtainable brake deceleration - the vehicle do not break critically, but ordinary)

Table 1: Mathematical calculations

Option	1	2	3	4
Initial speed [km.h-1]	60	60	85	85
Response time of driver [s]	1	1	1	1
Rise time of braking effect [s]	0,2	0,2	0,2	0,2
Coefficient of adhesion [1]	0,8	0,4	0,8	0,4
Achievable braking rate (deceleration) [m.s-2]	9,80665 x 0,8 = 7,845	9,80665 x 0,4 = 3,923	9,80665 x 0,8 = 7,845	9,80665 x 0,4 = 3,923
Distance necessary to stop the vehicle (including driver reaction time) [m]	36	53,7	61,4	97

5 OCCUPIED LAND

Concerning the amount of occupied land, railway and road transport are comparable. One of the often-false paroles is a saving of land. We would like to prove it. The total length of the Czech railway network is about 9450 km. On this network, there are 1026 stations open for goods traffic. According to the Railway Act the rail zone is either 30 or 60 meters (without

yard areas). To follow the text in the previous section we suppose the railway line to have one track; for this purpose it is enough to make the rail zone 30 m and because of other sub-conditions it is possible in this rail zone to build another track necessary for the handling of goods or containers in the stations. So it is possible to make as a very global presumption that on one kilometre it is possible to count with a land of about 60000 m2. According to the Act of ground communications, the protective zone of motorways or speedways are the protective zones of:
- motorways and speedways 100 m,
- roads of the first class 50 meters,
- roads of II. and III. class 15 meters.

Because we calculated in the previous section with only one lane, we could in an overestimated case count for this one lane with 15 m to 30 m - in the worst case – 30 m. And the ration of used land in railways and roads is very similar to the ratio of capacities in the previous part.

6 SHORT EPILOGUE

In course of the completed parts of research work we have found many reasons for revaluating the "classical" doctrines of modal split as a reason to continue in our present work.

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The Backseat Passenger Protection Point of View in Car Design Requirements

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ABSTRACT: Backseat passenger protection, either for the protection of children or adults, is more limited than on the front seats. It is caused by the smaller possibility to secure the passenger in the appropriate seating position and, in the case of children, reduce control of their behaviour during the journey by the driver. Any misuse causes serious injuries and fatalities, which, moreover, have a significant impact on national economies and society (serious injuries, loss of workforce, life-long treatment, etc.), and which should be decreased. Even though there is no regulation dedicated to this area, the producer should take it into account in the designing stage – in cooperation with suppliers of the respective parts. Quality Function Deployment and Voice of Customer, where society is the customer of the car producer can be implemented.

KEY WORDS: Passive safety, child restraint system, passenger protection, QFD, VoC.

1 INTRODUCTION

Based on the statistics and results of local researchers, there is a high percentage of rear seatbelt misuse. Especially with children, permanent control is necessary. It was proved through various research led in Europe and in the USA that in the majority of all uses of CRS there was some kind of misuse found – either lack of CRS harness adjustment, improper fixation of the CRS in the car or the child was not properly fastened. In the case of a collision with an unfastened child there is the risk of firing the child out of the car or serious injuries caused by the possibility to move around the interior of the car. Of course we can find some misuse with adult passengers, but in case of adults, the case doesn't involve so many different failure sources.

2 EXPERIMENTS

Department of Transportation Technology has performed various crash test experiments. Some of these experiments involved a backseat passenger – a P3 dummy in CRS. There were, among others, a frontal collision of small vehicle and rigid barrier, vehicle-vehicle collision, and side collision of car and motorbike where the dummy was situated on the crash side. The conditions with the experiments were set in accordance with the EU regulations for vehicle testing – ECE R 12, ECE R 94, ECE R 95 as the key regulations. The CRS in experiments was approved in accordance to ECE R 44 for the appropriate mass category. As the dummies were equipped with the three-axis sensors for acceleration measurement, the resulting experimental data can be considered to be reliable. For further evaluation, the performance of the child dummy is significant. In both cases, the Head Performance Criteria of the child dummies in restraint systems is low enough to assure a moderate injury in worst cases: Situation: Frontal collision Renault 5 vs. rigid barrier, 40% overlap in the collision, child dummy situated on the left-rear seat. Collision speed: 50 kph.

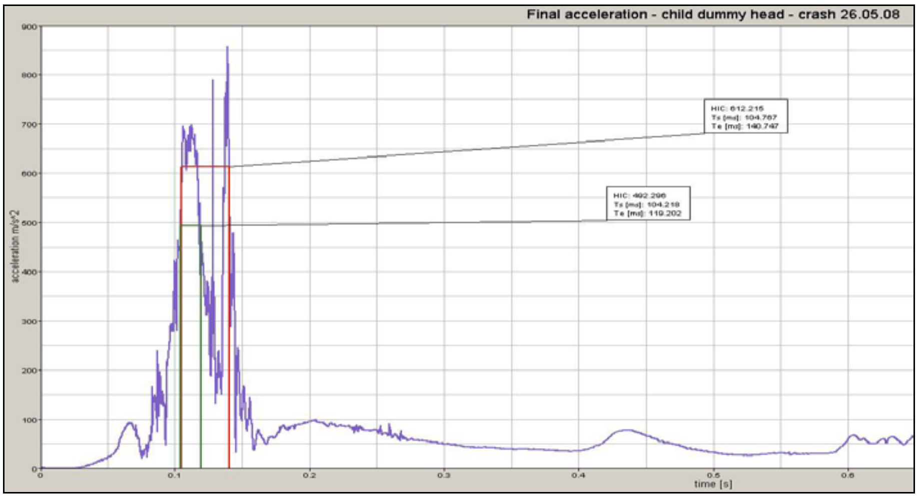

Figure 1: Performance criteria Vehicle-Rigid Barrier

Head Performance Criteria: $HPC_{15} = 492$; $HPC_{36} = 612$. **Expected injury:** The child will probably suffer minor to moderate head injuries resulting from the head contact with backrest and front seat (was not apparent due to outer parts of the car body, but is expected from the measured data). As there was no performance measured in the abdominal and thorax area, we cannot presume other injuries. In the second recently performed experiment, a car with a child passenger was crashed into by a motorbike. The child dummy was positioned on the collision-side of the vehicle and the CRS was again conforming to the ECE R 44 requirements. Situation: Skoda Octavia Estate collided by a motorbike at the area of back door (dummy positioned at the door). Collision speed 59 kph (motorbike), the car is static.

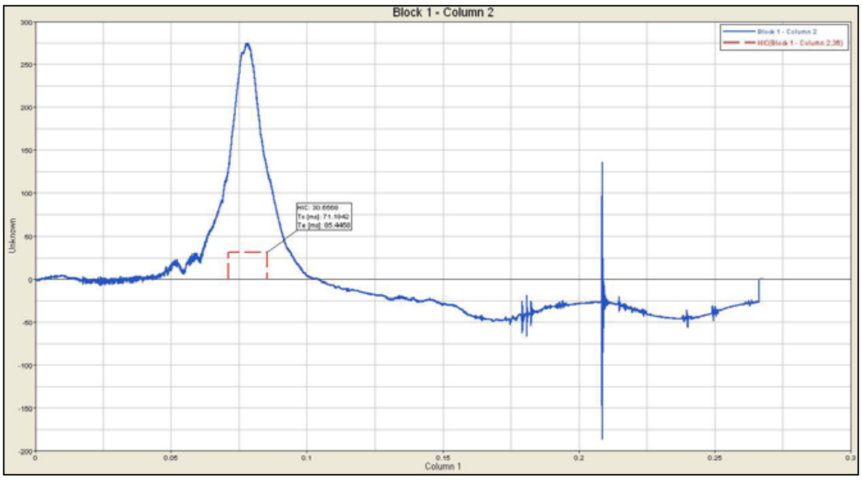

Figure 2: Performance criteria Vehicle-Motorbike

Head Performance Criteria: HPC_{15} = 31. In this case, the child should not suffer from any long-lasting pain cause by head injury (thorax and abdominal area are not measured; therefore no assumption can be made). To be able to evaluate the overall likelihood of serious injuries with children on the back seats, it is necessary to measure other performance criteria. Based on Head Performance Criteria, we can expect the children should not attain injuries leading to long-time unconsciousness and resulting brain damage. In the above mentioned experiments, the dummies were well protected as there was no misuse in the CRS use. Based on the statistics of child injuries in crashes, there is a very significant difference between the level of children injured/fatally injured in crashes in the EU countries and in the USA (the level can slightly differ because of the national statistics). As there is no relevant detailed information about the accident conditions, we can only presume that, ceteris paribus, in the USA, more spacious cars are more often used, and therefore the passengers in CRS (those are the passengers under 14) are less likely to get in touch with the interior of the vehicle and are more prevented from contact with the interior, e. g. the front seat. Especially in side-collisions, it is very important for older children using booster seats, that prove lower protection levels against side impact and the internal seatbelts of the car are used.

3 IMPLEMENTATION

The implementation of the experiment and statistics results is therefore done according to this scheme:

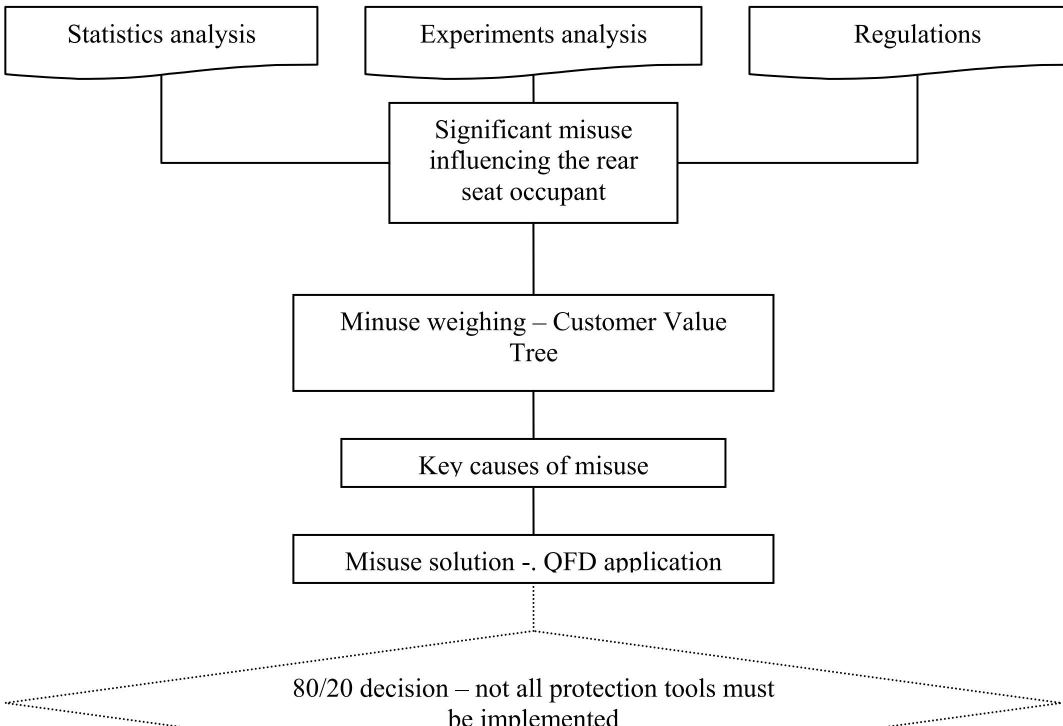

Figure 3: Workout procedure

The data that can be obtained from modelling the possible frontal collision situations show the restraints are the most important point in life protection on back seats (Hoščuk, 2001). The information is taken into account for Customer Value Tree design (seatbelt vs. signalisation importance):

Table 1: Performance criteria

	Unrestrained	Restrained	Airbag	Restrained, airbag	Critical value
GSI	**12624,0**	208,0	**4026,9**	193,3	1000
HIC	**4550,2**	93,7	**3236,9**	107,8	1000

Based on the Customer Value Tree results and Quality Function Deployment results it is clearly apparent that the seatbelt control is the key issue to improving the CRS misuse values and the quality of rear passenger protection.

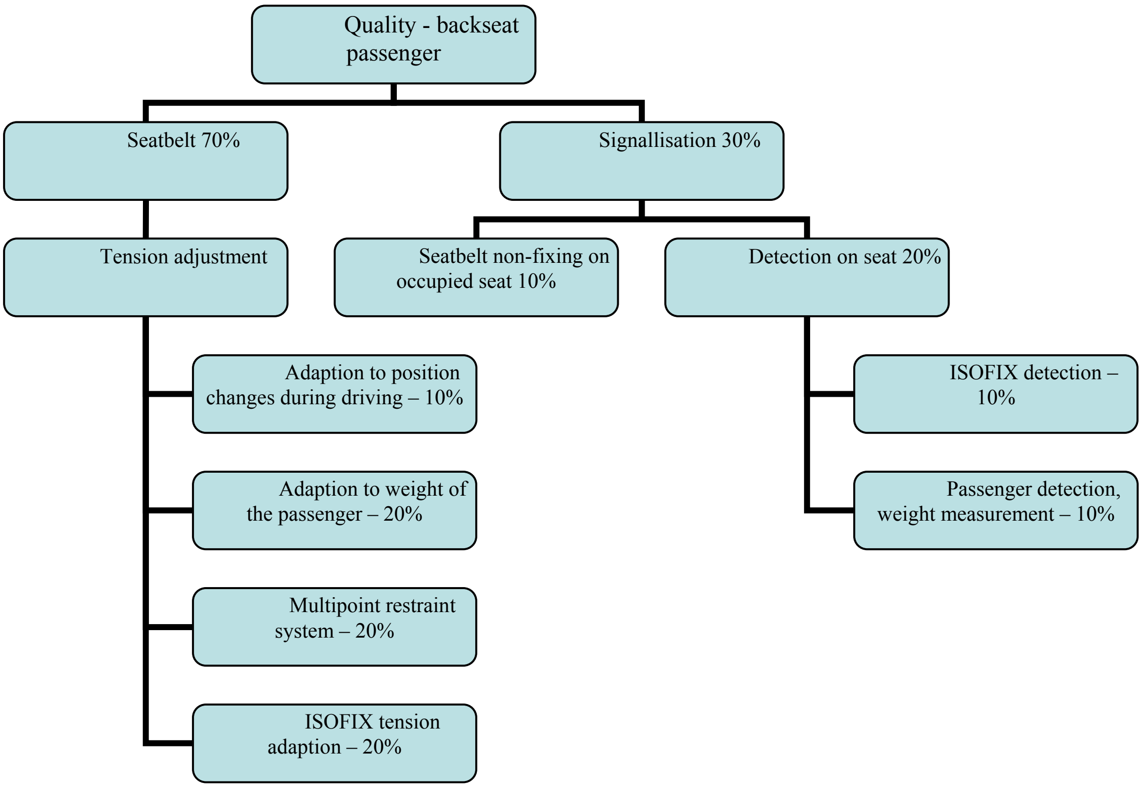

Figure 4: Customer Tree Analysis

The percentages of the above mentioned chart are partly taken from modelling (for lower levels), and partly from injury statistics (the division of restrained/unrestrained cases and the impact on passenger). More about the topic can be found in (Kadlecova, 2009).

In case the rear seatbelt functionality can be adjusted according to the passenger on the seat, it may be possible to reduce the misuse of seatbelt by the older children travelling in booster seats. It can happen intentionally – when the seatbelt pretension is universally set, when the CRS is improperly positioned or the CRS is fixed by the seatbelt only; or unintentionally – the sleeping child is leaning out of the CRS (booster seat without harness) when, for example, they have fallen asleep on a longer journey. In case this situation happens, with standard equipment, the child travels in the following position, without any possibility of the driver to improve the outcome.

It is very understandable that the older children have bigger freedom to re-set the transport conditions to a completely different setting, due to the lack of possibility to fix the situation or just due to their free will.

The values from the above mentioned Picture 4 were used to make up a part of the QFD chart, and, as shown in the field Relative weight, the seatbelt adjustment is a key point in possible improvement of passengers:

Relationship Between Requirements: 9 - Strong 3 - Moderate 1 - Weak

Row Number	Max Relationship Value in Row	Relative Weight									
			Column Number	1	2	3	4	5	6	7	8
			Max Relationship Value in Column	9	9	9	9	9	9	9	9
			Requirement Weight	640	580	220	420	460	540	360	280
			Relative Weight	18,29	16,57	6,29	12,00	13,14	15,43	10,29	8,00
			Difficulty (0=Easy to Accomplish, 10=Extremely Difficult)	2	3	1	5	3	7	3	4
			Minimize (▼), Maximize (▲), or Target (x)	▲	▲	▲	▲	▲	▲	▲	▲
			Target or Limit Value								
			Quality Characteristics (a.k.a. "Functional Requirements" or "Hows") / Demanded Quality (a.k.a. "Customer Requirements" or "Whats")	sensors for weight measurement	multipositioned sensors in seat	wireless signals in buckles	continuous change of pre-tension at each seatbelt	ISOFIX lock signal	anchorage for multipoint seatbelts	CRS connectable buckle for tension adjustment	Seatbelt extension
1	9	10,00	seat belt fastening signallisation	1	1	9	3	9	1	1	1
2	9	10,00	seat occupation detection	9	9	3	3	1	1	1	3
3	9	10,00	ISOFIX detection	3	1	3	3	9	1	3	1
4	9	20,00	ISOFIX seatbelt tension adjustment	9	1	1	3	9	9	9	3
5	9	10,00	asynchronous tensioning	9	9	1	3	1	9	1	9
6	9	20,00	multipoint seatbelts on back seats	3	9	1	9	1	9	3	1
7	9	20,00	adaption to weight of the passenger	9	9	1	3	3	3	3	3

Figure 5: QFD Chart

The chart represents the results of the evaluation for the backseat restrain system parts and installation. It is necessary to mention the values in QFD charts are always the result of subsequent analyses of different professionals with a deep knowledge of their field of work

– in this case, at least knowledge of car body design, vehicle dynamics and electrical engineering is significant.

There are new tasks to solve before the elements are incorporated and final price is set. Therefore it is now the task of the producer to arrange the conditions on the back seat to improve possible manageability by the driver and lower the possibility of misuse by the backseat occupant. To do so, technical changes should be implemented and tests undertaken. As shown in Picture 1, this procedure is not a part of quality tools application at this stage.

4 ACKNOWLEDGMENT

Here with the authors would like to express the grateful thanks to Prof. Zdeněk Votruba for the inspiring ideas related to the subject of this article.

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The Development and Economic Impact of Cultural Tourism and Sustainable Heritage Management

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ABSTRACT: Cultural heritage records and expresses the long processes of historic development, it forms the essence of diverse national, indigenous and local identities and it is an integral part of modern life. The dynamic interaction between tourism and cultural heritage continues to be among the foremost vehicles for cultural exchange providing a personal experience from the past, as well as of the contemporary life and society. It is appreciated as a positive force for natural and cultural conservation. Tourism can underline the economic characteristics of the heritage and points out the need for conservation by generating funding, educating the community and influencing policy. The achievement of a beneficial interaction between the conflicting expectations of visitors and the host or local communities presents many challenges and opportunities. The natural and cultural heritage, diversities and living cultures are major tourism attractions.

KEY WORDS: Cultural tourism, heritage, environment, management, sustainability.

1 SUSTAINABLE CULTURAL TOURISM

The idea of sustainable development is about 20 years old and the concept of sustainable cultural tourism is even younger. No destination or business can be everything to all tourists. Destinations and businesses must make a series of hard decisions about where it is best to allocate limited resources to achieve the best optimum results. No two destinations are the same, and the choices made and the paths taken to sustainability will vary from destination to destination. What does the sustainable tourist development question involve? It has to take into account both economical and ecological concerns. The World Tourist Organization defines sustainable tourism as “tourism which leads to the management of all resources in such a way that economic, social and aesthetic needs can be filled while maintaining cultural integrity, essential ecological processes, biological diversity and life support systems” (Rosicka, 2008). Considering the historical point of view, tourism has often been unsustainable, as it is a strong competitor for resources – the provision of cultural and ecotourism opportunities for tourist may mean that local residents are sometimes displaced. The requirements of tourists are different from those of local residents and serving tourists may not always suit the needs of local residents. Tourism is often focused on local communities, in particular, on rural and minority communities at a speed that may cause disruptions. However, sustainable tourism is a hot issue how best to encourage tourism while minimizing its cost. Cultural diversity exists in time and space, and demands respect for other cultures and aspects of their belief systems. In cases where cultural values appear to be in conflict, respect for cultural diversity requires acknowledgement of the legitimacy of the cultural values of all times. The diversity of cultures and heritage is an irreplaceable source of spiritual and intellectual richness for all humankind. The protection and enhancement of cultural and heritage diversity should be promoted as an essential aspect of human development. Tourists are usually fascinated by nature and culture. Visiting natural and cultural heritage sites takes us back to the roots of civilization, we are taught to experience the past and absorb our planet's natural and cultural variety. Biodiversity and ecology are being endangered world-wide. Even the natural sites, like national parks, are under growing pressure caused by the growing number of population, economical growth and uncontrolled tourism development. Many cultural heritage sites also have to tackle adverse impacts of the enormous number of visitors who seek access to them. Sometimes we are focused too much on the negative impacts of tourism on nature and cultural heritage. However, many natural and cultural sites would welcome tourism as a source of much needed income, and it is even a tool for sustainable development involving the local community actively in tourism and in conservation. Cooperation with the tourism industry is no longer a taboo topic. Both tourists and visitors are getting more experienced, and therefore more demanding. They search for and seek new experiences, they try to discover new knowledge horizons and require high level facilities and services. Value for money and quality is the hot issue of the day.

The idea of sustainable tourism has been developed for more than 15 years considering four basic supports, i.e. ecological, economic, culture and community sustainability. Ecological sustainability, being compatible with the maintenance of essential ecological processes, biological diversity and biological resources, specifies local, regional and national tourism policies and development strategies resulting from the objective of sustainable development. An ecological approach establishes guidelines for tourism operations, ensures tourism in protected areas, such as national parks, conducts research on the impacts of tourism, promotes acceptability and responsibility, etc. Economic sustainability should be profitable in both the short and long term horizon. It provides financial incentives for the business to adopt sustainability principles, contributes to the income, it diversifies the products by developing a wide spectrum of tourist activities, and helps to promote an ethical and environmentally conscious behavior among clients. Cultural sustainability should be compatible with the culture and values in question and support the community identity. It is to improve and manage heritage and natural resources, initiate tourism, conserve cultural diversity, guarantee the protection of the countryside, local indigenous cultures and traditional knowledge, encourage the community ability to maintain and use traditional skills and educate tourists about desirable behavior. Community sustainability is designed to benefit local communities, generate income, maintain control over tourism development, encourage businesses to minimize negative effects on local communities, provide quality employment to community residents and improve local human resource capacity. Developing sustainable tourism within heritage sites is a challenging task for site managers that usually have an ecological, historic, art, archeological, biological and other sciences background. It also calls for a pro-active relationship with communities and regions that find themselves within the site proximity; it fits well into new management approaches for heritage sites. Integrated management of natural and cultural heritage sites deals with the sustainable use of natural and cultural resources targeted both at conservation and development goals.

It draws particular attention to the communities that live in and around natural and cultural heritage sites and tries to improve the quality of life in those communities. It results from cooperation with other stakeholders, such as tourism industry, travel agencies and various non-government and government organizations.

2 HERITAGE SITE MANAGEMENT

Management of heritage sites has undergone crucial and remarkable changes over the last decades. The level of professional know-how and skills has been rising. Heritage sites and areas are no longer characterized as protected territories, which have to be defended and protected against the outer world. Heritage management used to be the sphere of interest of scientists devoted to their surrounding world. Fortunately, heritage is being accepted and perceived as a value, which can only survive under a pro-active management. Effective protection and restoration of natural and cultural heritage has to be based on adapting to a continuously changing environment. Urban planning departments, real estate developers are seen as potential allies not a potential threat. Therefore sustainable tourism could be one of those allies as well. Heritage management is a managerial approach for heritage sites, resulting from a new philosophy. It integrates the site with its environment, its stakeholders and visitors. The approach and perception of the visitors is changing as well. They are no longer just subjects of education, objects of sharing information and targets of applied regulations and rules. Tourism marketing is gradually accepted as a tool for delivering services and products to specific target groups of population. Local, regional and national institutions are focusing more on the benefits of tourism development for conservation and economic goals. Tourist consumers are becoming more demanding, sophisticated and making ethical choices. Cultural assets are one of a few unique features of regions providing a highly competitive advantage. However, there are problems resulting from transition from a demand to a market economy in some countries. Unfortunately, various new destinations promote sustainability and at the same time follow negative old practices that had been troubling the tourism domain before. Theory and practice are often on the opposite banks of the river and we may just hope in narrowing the flowing river or finding a ford at least. Large scale mass tourism is pursued because of the foreign direct investment and foreign exchange it generates. It attracts foreign aid for large scale infrastructure development, improving the economic well-being of residents through economic growth and job creation; it also supports a conservation priority. There are many tourism products to be offered: ethical and sustainable high quality products and services benefiting local communities. Services should be targeted at educated tourists willing to find special interest destinations where tourist industry and host communities are able to cooperate profitably.

3 CULTURAL TOURISM CHARTER

ICOMOS, the International Council on Monuments and Sites, adopted the International Cultural Tourism Charter at the 12th General Assembly in Mexico, October 1999. The Charter seeks to encourage a wide public appreciation of cultural heritage sites as centers of learning and reflection about the past, as well as vital local resources for sustainable community development. Cultural traditions and local historical perceptions are part of a site's significance and interpretation should recognize and respect the coexistance of scientific and cultural values as they can enrich the visitor's appreciation of the site. On one hand, conservation should provide responsible and well-managed opportunities for members of the host community and visitors to experience and understand the community heritage and culture, and on the other hand, domestic and international tourism can be characterized as an efficient means for cultural exchange. Heritage includes the natural as well as cultural environment, and it covers landscapes, historic places, sites, built environments, biodiversity collections, past and continuing cultural practices, living experience and knowledge. It records the long processes of historic development. The natural and cultural heritage is a material and spiritual resource, which provides a narrative of historical development. Programs for the protection and conservation of the physical attributes, contemporary cultural expressions should facilitate the appreciation and understanding of the significance of heritage by the host community and the visitor. The long-term protection and conservation of living cultures, heritage places, collections, their physical and ecological integrity and environmental background should be a crucial component of economic, social, political, cultural and tourism development policies. Before heritage places are promoted or developed for increased tourism, management plans should assess the natural and cultural values of the resource. They should establish appropriate limits of acceptable change, particularly in relation to the impact of visitor numbers on the physical characteristics, integrity, ecology and biodiversity of the place, transportation systems, social and economical well-being of the host community. Respect for the sanctity of spiritual places and traditions are an important consideration for site managers, visitors, planners and tourism operators. Visitors should be encouraged to behave as welcomed guests, respecting values and lifestyles of the host community and conducting themselves in a responsible manner which would generate a renewed welcome.

4 CONCLUSION

Conservation management and tourism activities should provide equitable economic, cultural and social benefits to people of the host or local community at all levels via education, training and the creation of full-time employment opportunities. Heritage interpretation and education programs among the people of the host community should encourage the involvement of local site interpreters. Places and collections of heritage significance should be promoted and managed in ways which protect their authenticity and enhance the visitors´ experience. In case the heritage of any specific place may have a universal dimension, the needs and wishes of some communities to restrict or manage physical, spiritual or intellectual access to certain cultural practices, knowledge artifacts or sites should be respected.

5 ACKNOWLEDGMENT

This paper has been supported by the University of Pardubice; it is the result of cooperation between the Faculty of Restoration and Jan Perner Transport Faculty.

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Technical Notes on Mobile Measuring System for Road Passport

1 MOBILE MEASURING SYSTEM TECHNOLOGY

CDV has developed a new road passport technology. The process included design, processing and development of both technical and software means – the result is a mobile road and traffic data measuring system. The greatest benefit is the complex creation of a road passport using a video recorder. The main observed data are as follows:

- horizontal and vertical road alignment (with the use of GPS)
- video capture of the road at a given density according to road stationing (density is chosen by client or author of passport)
- location of traffic signing, marking and devices (amount of recorded data is chosen by client or author of passport)
- connection to nodal localization system of Road Data Bank Ostrava (managed by the Road and Motorway Directorate of the Czech Republic)
- road video recording

With the CDV's above-mentioned technology, the road passport can be taken on-the-run at normal driving speeds (this principle is called "floating vehicle"), using a vehicle equipped with the described measuring system. This technology is protected by a Czech utility patent (Industrial Property Office #18277).

2 ROAD PASSPORT

The road passport is a complex digital documentation of a road section taken on-the-run in real traffic conditions with a so called "floating vehicle". During documentation, video recorders and other measuring devices are used. All the data are collected by the main unit and is related to time and/or GPS position. After processing, the user can view a video record with custom localization and technical route parameters. The final passport can be used to document road alignment, width parameters and cross-section layout, traffic signing and marking condition, etc. Technical layout is displayed in Fig 1. It includes the main unit (ŘJ), recording module (MU), video device (VCR), portable PC with SW for calibration, measuring and processing (NB), wireless data transfer module and GPS for precise position and time data. The road passport procedure will be described in five following parts.

2.1 Choosing the route for the road passport

The selection of route depends on choosing the origin and terminal point of the route in ArcGIS map interface. SW operates with the nodal localization system of the Road Data Bank Ostrava (managed by the Czech Road and Motorway Directorate). The selected route nodes are exported to custom-made Fcar2 SW. The route is related to road network nodes which guarantees data precision..

2.2 Road passport data collection

In the course of the route, "events" are recorded. The term "events" includes, for example, traffic sign posts, change of road marking, location of traffic equipment and devices, kilometre posts, etc.

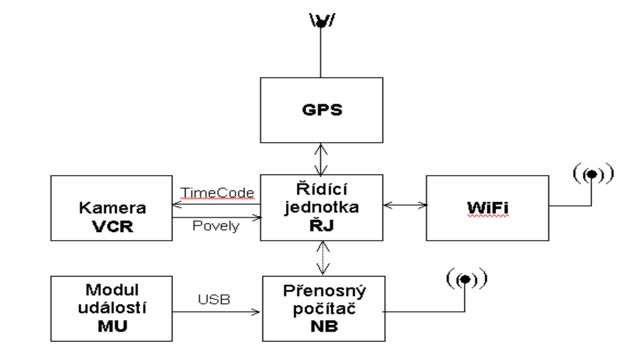

Figure 1: Technical layout of system

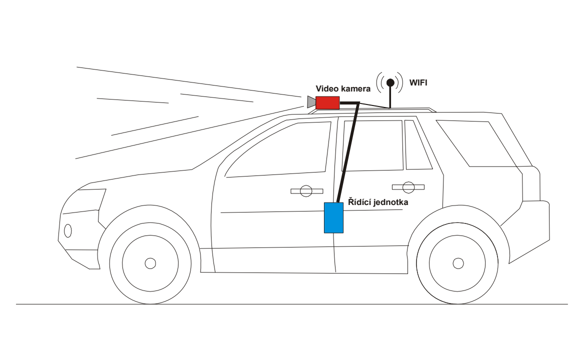

Figure 2: Design of measuring vehicle with mobile measuring system

2.3 Video passport processing

At this stage, the "raw" passport is being processed, ie. field data are being precised and completed with other parameters. Eventually, the operator can edit the position of events or add new "events" according to viewing the video record in the office. A graphic symbol of a traffic sign is added to each traffic sign "event". The output file is synchronized with the road stationing.

2.4 Road passport printouts

Road passport printouts are intended to ease and streamline outputs of the whole passport process. Their objectives are to automate final output documentation in paper form. FCar2 SW disposes of the following printout features: eg. creation of directional signs with destination descriptions or typical bearing constructions (post, gate, cantilever, etc.). Traffic signs positions, precised with the help of a video record, can be supplemented with photographs (video screen captures). Another feature is the export of passport data in the HTML/XML format.

2.5 Road passport export (FCar2 to ArcGIS)

Road passports can be processed, visualized and/or edited in the ArcGIS interface. Due to the size of the resulting passport file, it has to be split into parts divided by road network nodes. After the split and export, output files can be viewed in GIS or on the client's PC using the FCar2 data viewer.

3 CONCLUSION

The mobile measuring system produces complex digital documentation of the road. Main outputs include a video document of the road, traffic signs localization and a crossfall/gradient analysis. Such a passport can be used in the course of traffic signing/marking implementation, high risk sites investigation, as a background for accident analysis and/or road safety inspection. All resulting data are related to nodal localization system and can be visualized in GIS.

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BRNO DECLARATION

ON NEW EUROPEAN PRINCIPLES IN URBAN MOBILITY

European Transport Research Innovation Week / 11 - 15 May 2009 / Brno / Czech Republic

We, ECTRI, EURNEX, FEHRL, FERSI, HUMANIST VCE,

- Meeting in Brno, Czech Republic at the opportunity of the Czech EU Presidency event "European Transport Research and Innovation Week" organised by CDV – Czech Transport Research Centre,
- Representing an active part of the European Surface Transport scientific community,
- Having in mind the European Economic Recovery Plan announced by the European Commission on 26 November 2008,
- Having regard to the Commission Green Paper of 25 September 2007 entitled 'Towards a new culture for urban mobility' (COM(2007)0551),
- Having regard to the Commission White Paper of 12 September 2001 entitled 'European transport policy for 2010: time to decide' (COM(2001)0370),
- Having regard to European Parliament resolution of 23 April 2009 on an action plan on urban mobility (2008/2217(INI)),
- Having regards to the Opinion of the Committee of the Regions on the European Parliament's Report on 21 April 2009,
- Committed to the success of the European Research Area in the field of urban transport research,

- Recognising the fact that sixty per cent of the European population lives in urban areas and that number will rise to eighty per cent in 2020, making urban transport a major component of goods and passenger transport in Europe, which has also very significant impact on the environment and health,
- welcoming the European Parliament resolution of 23 April 2009 on an Action Plan on Urban Mobility,
- supporting the European Commission activities on urban mobility and encouraging the rapid publication of the announced Commission Action Plan,
- being convinced that there is added value of action at EU level in the field of urban mobility and especially in the field of research and its application.

- We agree the following Brno Declaration, and invite all urban transport related research stakeholders, municipalities, transport operators and political decision makers to join with us to support it by discussions, actions, and further developments:

Our commitment

1. We are committed to establish partnership between transport research institutions and city and transport authorities and organisations in order to tackle the urban mobility problems and contribute to their solution.
2. We are committed to the common conviction that the application of innovation will provide solutions to the challenges of sustaining transport and mobility in urban areas.
3. We are committed to furthering and expanding the partnership established through the Lyon Declaration of 11 December 2008.

Subsidiarity principles

4. We stress that this partnership should be based on a strict compliance with the principle of subsidiarity and the right to local autonomy on one hand and need to address certain areas through a common effort of stakeholders and key players on the other hand;
5. We recognise that an efficient and sustainable urban transport policy for the benefit of both European citizens and the European economy will only be guaranteed by ensuring equitable treatment between the transport of goods and of passengers and between the different modes and forms of transport;
6. We note that local authorities frequently cannot meet these challenges without European cooperation and coordination, and that the EU must therefore provide studies and a legal framework, finance research and training, and promote and disseminate best practices.

Accelerating European research and innovation in the field of urban mobility

7. We confirm that cooperation between European cities and research has proved its vital importance in CIVITAS and other programmes. We consider it important that these initiatives of the European Commission should continue under FP7 and further funding and expansion of scope must be ensured.
8. We fully agree with the need of upgrading of statistics and databases on urban mobility including data on soft transport modes, road safety, infrastructure quality, environmental and health impact and quantitative and qualitative transport services indicators;
9. We urge that outcomes of publically funded research should be made public in order to promote sustainable ways of mobility and lifestyle;
10. We support the proposal for the further FP7 calls on research and development of ITS technologies, targeting the urban mobility and needs of the urban residents including traffic management, safety and security in urban transport and bringing innovative solutions for goods transport. Furthermore the economical benefits of exploiting the resulting technologies internationally should be supported.

Improvement of public transport services and extension of soft mobility modes

11. We support the proposed measures on improvement of public transport services and stress the need of cooperation between the research community, municipalities and operators for reaching such goal.
12. We recognise the important role that soft transport modes – cycling and walking - are playing for mobility in many cities. Collaboration of cities and research will contribute to exchange of best practices on the European level and enhance the use of these modes.
13. We agree that the rights of urban public transport users, cyclists and pedestrians should be guaranteed by the proposed Users´ Charter, emerging from the cooperation of research community, municipalities, operators and political decision makers.
14. We stress that EU cooperation should be encouraged by putting these issues on the FP7 agenda.

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Infrastructure, planning and land-use

15. We will support developments towards urban transport infrastructure that has a lower environmental impact and is more resilient to anticipated extremes of climate conditions.
16. We call for measures that encourage the greater integration all modes (including soft-modes, park and ride etc) within an overall infrastructure system that integrates electric vehicles power supplies.
17. We draw attention to the need for streets to be designed and maintained in ways that maintain accessibility and security for both able-bodied and disabled users.
18. We call for greater cohesion between urban and extra-urban areas in addressing transport and related land-use issues. We urge the Commission to proactively support greater cooperation whilst respecting the principles of Subsidiarity.

Research and industry commitment to sustainable mobility

19. There is an urgent need for innovative solutions contributing to the sustainable mobility and sustainable urban development. Some of those steps are in the hands of the local stakeholders; however most of them require joint effort of all players. The EU should play a major role in this issue and direct its research programmes towards the objective of world-leading scientific and technical excellence.
20. We welcome the EC's initiatives on electrification of urban transport and will take a leading role in assessment of the challenges of their deployment.

We underline the need to balance enhanced mobility for Europe's citizens with urgent environmental and traffic safety requirements based on solutions ensuring cost-effectiveness and social cohesion.

Signatories

ECTRI
Guy Bourgeois, President

EURNEX
Wolfgang H. Steinicke, Secretary General

FEHRL
Claude van Rooten, President

FERSI
Jindřich Frič, Authorised Member

HUMANIST VCE
Jean Pierre Medevielle, President

TRANSACTIONS ON TRANSPORT SCIENCES

Volume 2 2009 Number 1

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