THE USE OF TELEMATICS FOR AN INTELLIGENT SPEED MANAGEMENT

described on the Austrian project "multifunctional noise protection facility GLEISDORF"

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1. INTRODUCTION

Traffic-management systems are used to utilise the available traffic system best possible with the help of effective short-term technology-organisational measures and new technologies. The main task of telematic is to influence traffic by informing, communicating, controlling and regulating but also monitoring to decrease the negative effects of traffic.

Telematic can for a short time influence traffic and simultaneously offer current information during or in preparation for a drive. Basically the following five parts can be influenced:

1. the choice of trip destination - generally only possible for occasional drives or leisure time trips resulting up to 50 % of all trips
2. the choice of means of transportation or transportation chain before the trip - generally only for irregular trips possible
3. the departure within a certain period of time - generally depending on the purpose of the trip
4. the route - eventually also choice of means of transportation during the drive related to changing conditions by dynamic routing
5. the motions - choice of speed, space and lane

Beside the technical aspects telematic also deals with social, economic and ecological effects of traffic control in Information and Communication Technologies. That includes a decrease in traffic's negative effects on environment, a change in society's mobility behaviour and an economic improvement of passenger and goods traffic.

From political point of view telematic offers an important impact

- to use infrastructure in an intelligent way, especially to improve traffic flow
- to build up a network of the different traffic modes
- to avoid unnecessary traffic jams and unproductive drives - also for those searching their destination or a parking space.
- to reduce negative environmental aspects
- to improve road safety

2. TRANSPORTATION TELEMATICS IN AUSTRIA

The continuously growing transport and exchange of information, goods and passengers represents an important basis for long-term economic growth of modern economies and their sections. The network of traffic and transport bodies and their infrastructures are of great significance for people and economy. These are to optimise efficiency, safety and ecology of total Austrian traffic while keeping free will of every single person respectively business.

Under the direction of the Ministry of Traffic and Innovation the initiative "Transport Telematik Systeme Austria" (TTS-A) was started to first formulate a model for the use of telematic in transport and traffic. This model names four ways to use telematic for transport and traffic and acts as driving force for development of detailed structures on a systematic, technology-political and operative basis.

The aims are defined as follows:

- increase in efficiency of traffic-infrastructure
- increase of road safety
- increase of traffic system's quality (e.g. environmental effects)
- usage of telematic services

An action-plan, as conclusion of the initiative "Transport Telematik Systeme Austria", represents the basis for the objected development procedures and for investment decisions, both public ones and for industry.

2.1. Activities of the "Autobahn- und Schnellstraßen Finanzierungs-AG"(ASFINAG)

In Austria the creation of a traffic management and information system for highway's and expressway's network of the ASFINAG is planned. This system consists basically of collective, dynamic instruments to influence traffic in conurbation and other problematic traffic areas. These instruments should help to

- improve flow of traffic
- increase road safety
- decrease negative effects on environment.

An instrument to influence traffic consists of following elements:

- registration of traffic data
- information head office (editing data, interpretation, data-exchange, ...)
- traffic information on variable message signs

In 2010, in Austria approximately 1000 cross-sections with automatic registration of traffic density and approximately 650 cross-section boards with 2000 variable message signs are to be installed.

Fig. 1 shows an instrument with possible variable message signs:

***Fig. 1**: Possible variable message signs*

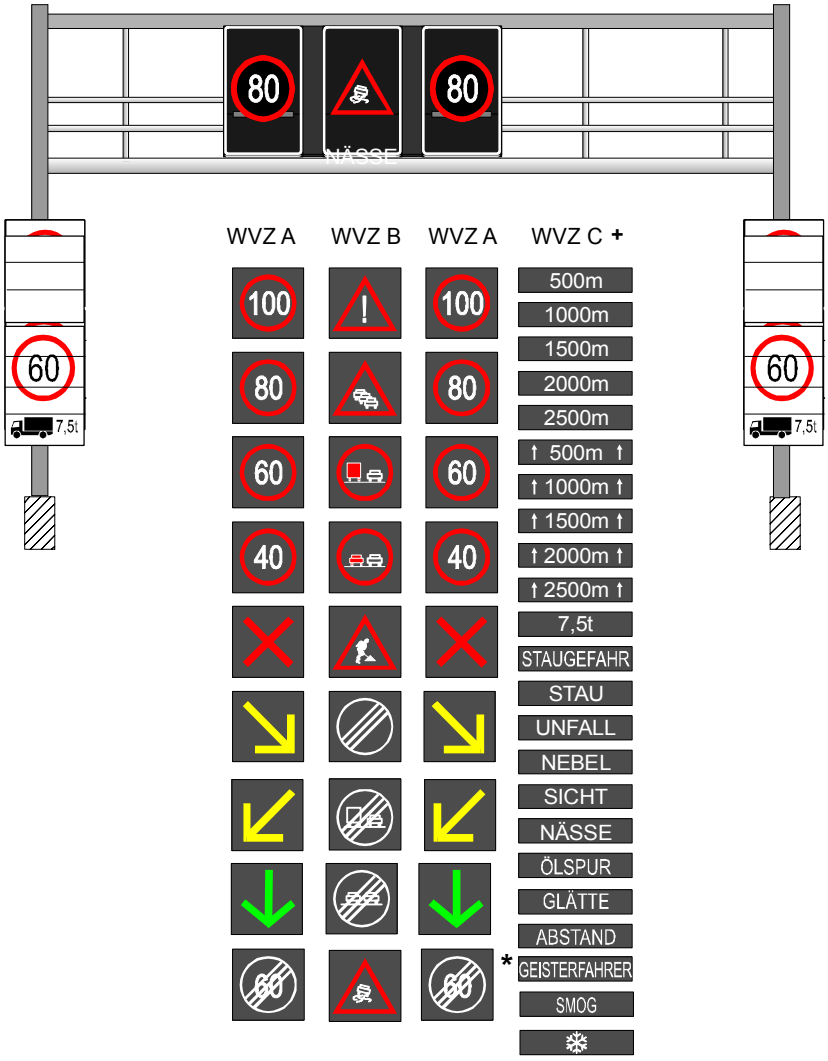


Fig. 2 gives an overview of the affected road network and those areas where these instruments are to be installed.

***Fig. 2**: planned Austrian telematic facilities to influence traffic*

The instruments marked in Fig. 2 are to be finished at following dates:

Instruments to influence traffic (VBA)	planned finishing date	length	total length
VBA Wien/Niederösterreich (1)	beginning: 27.6.2002	33,8 km	33,8 km
VBA Tirol	2004	70,3 km	104,1 km
VBA Wien/Niederösterreich (2)	2005	121,8 km	225,9 km
VBA Salzburg	2006	34,6 km	260,5 km
VBA Graz	2006	81,0 km	341,5 km
VBA Rheintal	2006	43,1 km	384,6 km
VBA Wien/Niederösterreich (3)	2006	74,2 km	458,8 km
VBA Linz	2007	41,8 km	500,6 km
VBA Klagenfurt/Villach	2007	70,0 km	570,6 km
VBA Wien/Niederösterreich (4)	2008	63,0 km	633,6 km
VBA Wien/Niederösterreich (4)	to 2020	76,4 km	710 km

As basis for the traffic and information management of the ASFINAG the planned traffic and information management head office situated in Wien-Inzersdorf is going to be set up within the first realisation phase of the VBA Wien/Niederösterreich until autumn 2003.

So the head office gets first priority both in traffic control of the ASFINAG-network and in traffic information and management. Related to the world-wide significance of these topics the head office is also in connection with other European traffic head offices.

3. THE 'MULTIFUNCTIONAL NOISE PROTECTION FACILITY GLEISDORF'

The growing demand for mobility leads to a permanent increase and change of the traffic situation. This results in the frequent need of control of individual traffic to allow an optimisation of the traffic flow.

At the same time the disadvantages of mobility like air pollution and traffic noise have to be reduced. In Austria, citizens' increased sensibility to noise resulted in lowered traffic noise levels (60 dBA during daytime and 50 dBA during night hours).

This said, it becomes clear that the need of noise protection increases and conventional noise reducing measures like noise walls or noise tunnels become impossible to finance.

Traffic management consisting in a permanent traffic slow down during night hours also turned out inefficient as changing traffic situations were not taken into account – drivers therefore hardly noticed nor accepted those speed limits.

The time had come to consider new intelligent concepts of noise reduction.

3.1. The solution: „MLA"

The MLA („Multifunktionale Lärmschutzanlage" = „Multifunctional Noise Barrier") allows a multiple use of the infrastructure highway:

Conventional methods of traffic noise reduction (that often already exist but are no longer sufficient) like sound damping road surface or noise walls provide a basic noise protection; a dynamic interactive traffic management system controlled by environmental parameters reduces noise and air pollution due to traffic, enhances road security and optimises the traffic flow; as an additional option, photovoltaic elements that form an integrated part of the noise wall produce environmentally friendly energy while reducing traffic noise.

3.2. The „Making of the MLA"

1998	Wolfgang Nagele, CEO of m2 Master Management GmbH conceives the idea of a multiple and cost efficient use of noise barriers
1998 – 1999	Research work about traffic, noise and photovoltaics
09/1999 – 02/2000	m2 Master Management GmbH investigates the possibility of implementing an MLA near Gleisdorf
03/2000	fonds for the MLA Gleisdorf are approved by the ASFINAG
03/2000 – 11/2000	m2 Master Management GmbH develops the concept of the MLA Gleisdorf in cooperation with ASFINAG and the Styrian government
12/2000 – 06/2001	Project management by m2 Master Management
03/2000 – 01/2001	Planning and call for tenders for the MLA Gleisdorf
09/2000 – 12/2001	Construction of the MLA Gleisdorf
01/2002	Start of the test operation of the MLA Gleisdorf
04/2002	Official opening of the MLA Gleisdorf

3.3. How it works

The concept of an "Emission controlled traffic management system" is based on the fact that vehicles' speed has a great influence on the related noise emission. In addition to conventional sound damping methods like walls and a noise absorbing road surface, noise protection is realised by a dynamic speed management that allows to reduce noise especially during those hours when the residents in the neighbourhood of a highway suffer from considerable infringements of the maximum noise level. The speed limits are determined according to a ten years' prognosis in a way to assure that traffic noise will stay within the legal limits.

A complex noise measurement system that registers and processes noise emission and immission data, traffic parameter and environmental data allows to identify noise caused by traffic and activate the telematic system when the noise levels are exceeded.

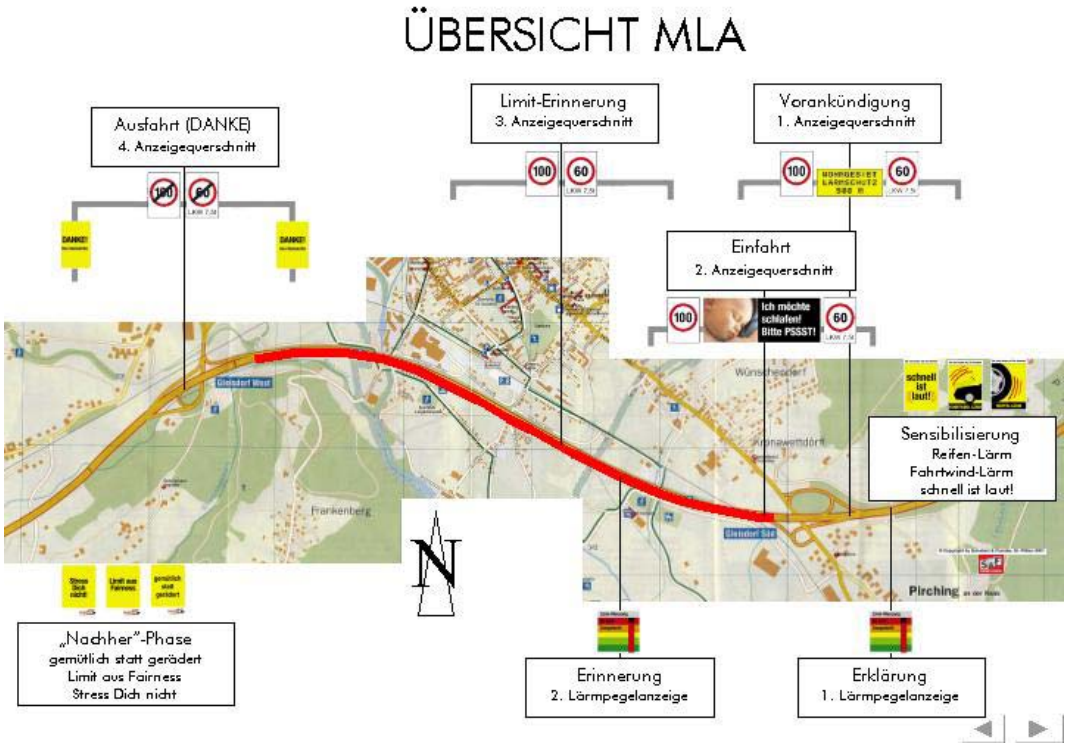
In relation to the noise intensity, the maximum permissible speed is reduced sufficiently to avoid exceedance of the noise limit.

3.4. Structure of the MLA in Gleisdorf

The target zone is a residential area situated near the highway A2 frequented by 34.000 vehicles/24h (1998) with heavy traffic contributing up to 20% to the total traffic during night hours.

The area to be protected is approximately 2.950 meters long and is situated between the two links Gleisdorf-Süd and Gleisdorf-West.

***Fig. 3**: Site map of the MLA near Gleisdorf*



In spite of already existing noise barriers, the noise limit of 50 dB (A) was exceeded in 59 % of the night hours. Furthermore a prognosis of 51.000 vehicles/24 h in 2008 made it clear that the situation would become even more intolerable for the residents unless adequate measures be taken.

***Fig. 4**: the formerly existing noise wall*

Replacing the existing noise barriers of 1,25 - 1,75 meters by new ones with an efficient height of 4 to 5 meters seemed – at first thought – the logic solution.
On second thought however, high costs and the negative impact on the landscape showed that this solution was far from being ideal.
The alternative solution was the „Multifunctional Noise Barrier" (MLA):
A noise damping concrete road surface, a noise barrier of 1 m between the two directional lanes and lateral noise barriers with only 1 m of additional height are complemented by a temporary speed limit (up to 80 km/h for cars and 60 km/h for trucks) to result in a consistent noise reduction.

This allows to use about 8.200 m2 less of noise barrier surface than originally planned. In addition, photovoltaic elements were integrated into the noise barrier producing environmentally friendly energy while helping to reduce noise due to their sound proof design.

***Fig. 5**: the new wall with integrated photovoltaics*

<u>Information on the Noise wall</u>

Total length: 7.500 m, consisting of
2.900 m middle wall made of aluminium, (height: 1,0 m)
440 m acrylic glass elements on bridges
460 m effective prolongation outside the residential area
3.700 m increase of height of 0,5 - 1,0 m of the lateral walls

Total surface: 14.350 m² (including 1.660 m² photovoltaic elements)

Photovoltaics

The solar generator, with a length of about 1.325 m and a total surface of about 1.660 m², is aligned from east to west along the directional lane from Vienna to Graz.

With a maximum capacity of 101 kW it was at its opening the most powerful solar plant in Austria. The energy output of approx. 85.000 kWh per year allows an annual turnover of more than 30.000,--€ (at the current rate of 0,36€ per kWh).

The solar elements are inclined at an angle of 60° and show south.

Noise measurements

The evaluation of the current noise situation and the highway's responsibility for it is based on data from a weather station, from noise emission measuring points along the highway and emission measuring points in the living area nearby.

The maximum speed for cars and trucks is reduced corresponding to the traffic noise situation and to the noise limit in effect at this time (60 dBA between 6:00 a.m. and 10:00 p.m.; 50 dbA between 10:00 p.m. and 6:00 a.m.) thus permitting to abate the noise level at a rate of up to 6 dBA.

The sound damping road surface and the middle and lateral walls cause a further noise reduction of about 6 dBA which adds up to a total of 12 dBA - a clearly noticeable noise abatement for the residents.

So the speed limits come only into effect when necessary. Changing traffic, environmental and weather situations are taken into account as well as the residents' changing need of rest (day / night).

Slow Down Choreography

Not the fear of punishment (radar!) shall make drivers stick to the maximum speed but a subtle choreography designed to make them aware of the fact that the amount of noise they produce is in direct relation to their vehicle's speed: "fast is loud" ("schnell ist laut") and "You are louder than what you think!" ("Sie sind lauter als Sie denken!"). It's up to the driver to reduce this noise by sticking to the speed limits.

This is achieved by a specially designed choreography stretching over 10 km and using different elements (starting with an explanation and an announcement, leading to the proper noise abatement zone and ending with a thank you for the drivers.)

***Fig. 6**: Elements of the Slow Down Choreography*

Documentation

The performance of the traffic management system - especially the operating times - is permanently documented. Interesting data like energy output, weather and traffic situation will soon be accessible via internet. The current noise situation as well as the traffic situation documented by video cameras are constantly available in the internet. This traffic monitoring results in a unique traffic and environment data base and may also be used as a basis for mobile speed surveillance by the police if necessary.

3.5. Advantages of the MLA

The main advantage of this dynamic speed management compared to a static speed limit is that the control of the traffic flow comes only into effect when necessary and in an extend corresponding to the exceedance of the noise limit. The result is a speed limit adapted to the situation and therefore understood and readily accepted by drivers. At the same time the traffic flows more smoothly and the road security is improved.

3.6. Potential of the MLA

On condition that the speed limits of 100/80 km/h, 100/60 km/h or 80/60 km/h (for cars/trucks) are observed by the drivers, the noise level can be reduced at a rate of up to 6 dBA. In Gleisdorf a motivating slow down choreography is used to reach this target but given the fact that these speed limits are legally decreed, policing and punishment in case of infringements are also possible.

The MLA can easily be adapted to changing situations like new noise limits.

If required, the speed management can also be based on parameters other than noise emission, e. g. special traffic situations (like risk of traffic jam, road works…) or weather conditions (like fog, heavy snowfall or rain…).

3.7. Future perspectives of the MLA

The MLA is constantly improved by m2 Master Management GmbH. After assuring the intellectual property rights, m2 Master Management GmbH now focuses on establishing the MLA in the European market. But also in the USA and in Australia this innovative concept met with considerable interest. In Austria a network of traffic management systems planned for the next future opens up a wide range of additional applications of the MLA concept.