The 'Multifunctional Noise Protection Facility GLEISDORF'

The Use of Telematics for an Intelligent Speed Management

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SYNOPSIS

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. Up to now, noise protection is mostly realised by conventional noise reducing measures like monotonous noise barriers, noise tunnels or by the use of low-noise surfaces like porous asphalt, double layer asphalt or exposed aggregate concrete. It becomes clear that the need of noise protection increases and this conventional noise reducing measures like noise barriers or noise tunnels become impossible to finance.

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

Due to the fact that vehicles' speed has a great influence on the related noise emission, noise protection in this innovative project is realised by combining existing noise protection facilities with a dynamic speed management. The following values are measured and used as an input for the innovative speed management:

- Traffic noise
- Traffic volume
- Traffic speed
- Weather data (wind direction, wind speed, temperature, humidity, rainfall)

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 silent 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.

This idea has already been realised, the Noise Protection Facility “MLA Gleisdorf” is located at the Austrian motorway Nr. 2 in the region of Gleisdorf.

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The Use of Telematics for an Intelligent Speed Management

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 The 'multifunctional noise protection facility GLEISDORF'

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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).

Up to now, noise protection is mostly realised by conventional noise reducing measures like monotonous noise barriers, noise tunnels or by the use of low-noise surfaces like porous asphalt, double layer asphalt or exposed aggregate concrete. It becomes clear that the need of noise protection increases and this conventional noise reducing measures like noise barriers or noise tunnels become impossible to finance.

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

The residential area of the city of Gleisdorf, situated near the Austrian highway A2, is frequented by > 40.000 vehicles/24h 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. 1).

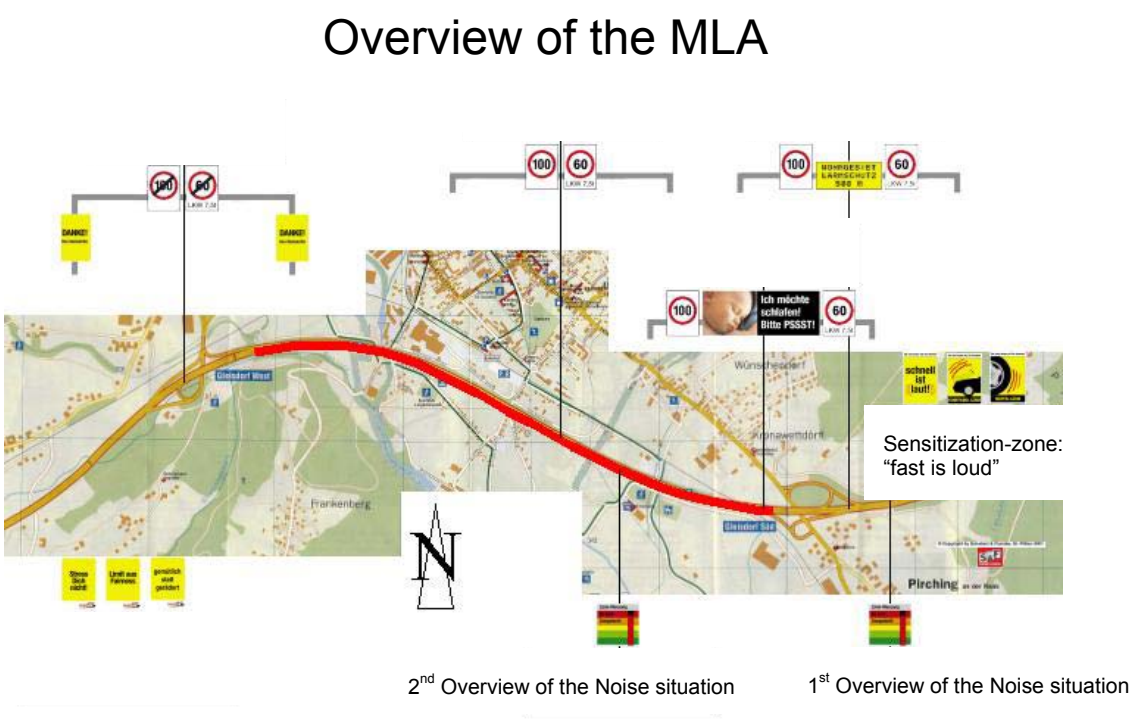


Figure 1: Site map of the MLA near Gleisdorf

In spite of already existing noise barriers, the noise limit of 50 dB (A) is exceeded in 59 % of the night hours. Furthermore a prognosis of 55.000 vehicles/24 h in 2008 made it clear, that the situation would become even more intolerable for the residents unless adequate measures be taken.

The first solution was to replace the existing noise barriers of 1,25 - 1,75 meters (Fig. 2) by new ones with an efficient height of 4 to 5 meters. On second thought however, high costs and the negative impact on the landscape showed that this solution was far from being ideal.

Figure 2: the formerly existing noise wall

The time had come to consider new intelligent concepts of noise reduction. The alternative solution was the „Multifunctional Noise Barrier“ (MLA).

How it works

The concept of an “Immission 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 surfaces, noise protection in Gleisdorf is now realised by a dynamic speed management that allows reducing noise (vehicles´speed) especially during those hours when the residents in the neighbourhood of a highway suffer from considerable infringements of the maximum noise level.

A complex noise measurement system that registers and processes noise emission and immission data, traffic parameter and environmental data allow identifying noise caused by traffic. In this case, the telematic system (dynamic speed management) will be activated.

So the total system consists of 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 (Fig. 3) and a dynamic speed management (up to 80 km/h for cars and 60 km/h for trucks).

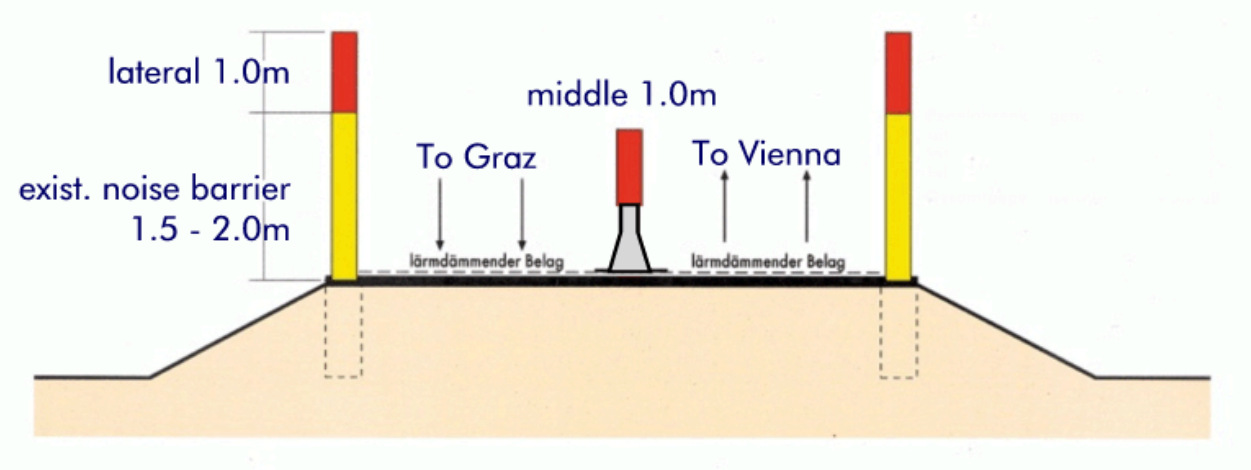


Figure 3: basic noise protection in Gleisdorf

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.

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 (Fig. 4).

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.

Information on the Noise wall

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)

Figure 4: the new wall with integrated photovoltaics

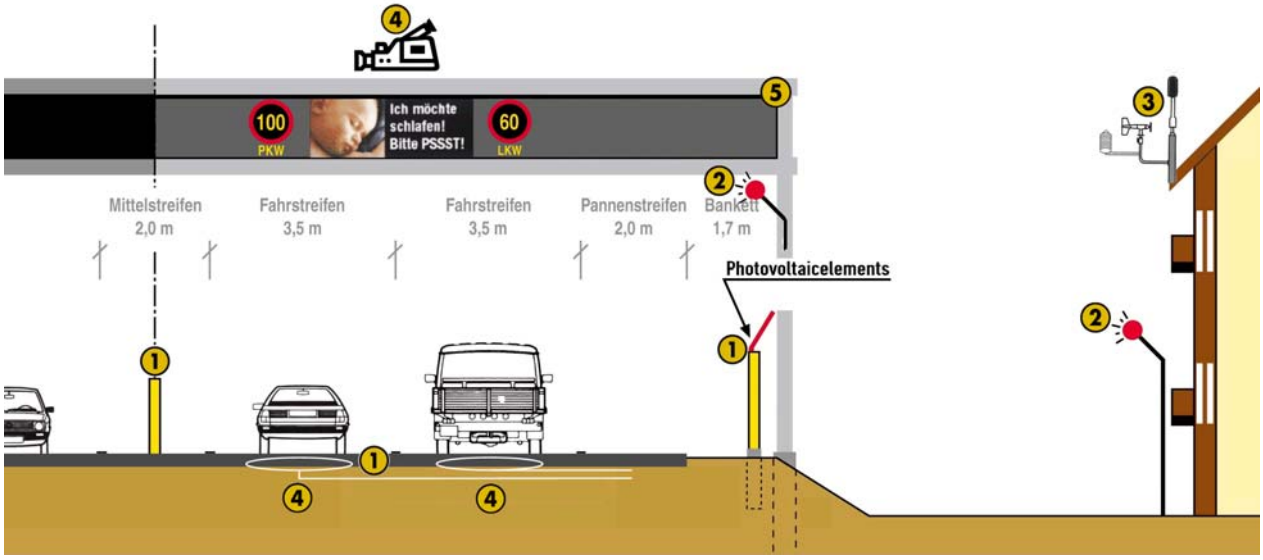
Noise measurements

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 immission measuring points in the living area nearby (Fig. 5).

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).



1	Noise barrier (with photovoltaic elements)	4	traffic count station
2	noise emission record stations	5	gantry with LC-Display
3	acquisition of weather data		

Figure 5: principle system of the noise protection facility in Gleisdorf

Slow Down Choreography

Not the fear of punishment (radar!) shall make drivers stick to the maximum speed but a subtle choreography (Fig. 6) 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!").

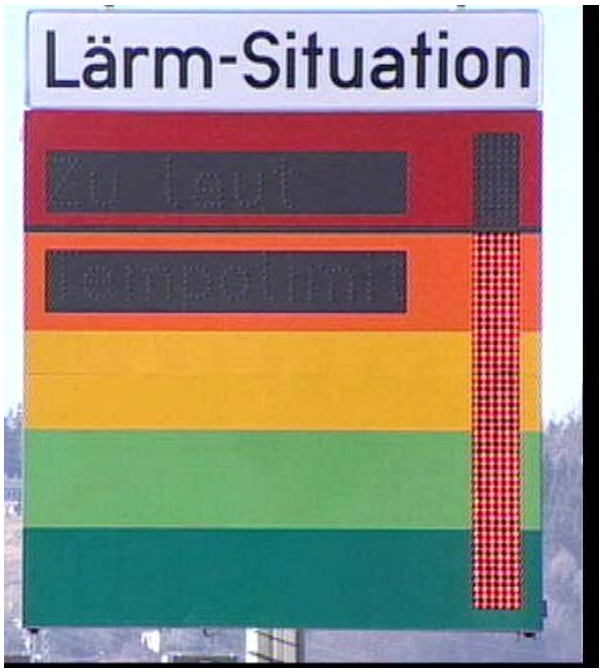
"fast is loud" "I would like to sleep! Please psssssst!"

Figure 6: Elements of the Slow Down Choreography

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.)

Additionally, a graphical sign is presented to the driver to give an overview about the current noise situation (Fig. 7):



"noise-situation"

"noise-situation – too loud – speed-limit"

Figure 7: overview about the current noise situation

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 is 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.

2.1 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 road safety is improved.

2.2 (First) Evaluation of the MLA

After installing the speed management, a first evaluation has been realised (Fig. 8). It is documented, that the speed management in combination with the slow down choreography has positive influence

on the driver's behaviour. In summer 2004 a completely evaluation is planned, first results will be available in fall 2004.

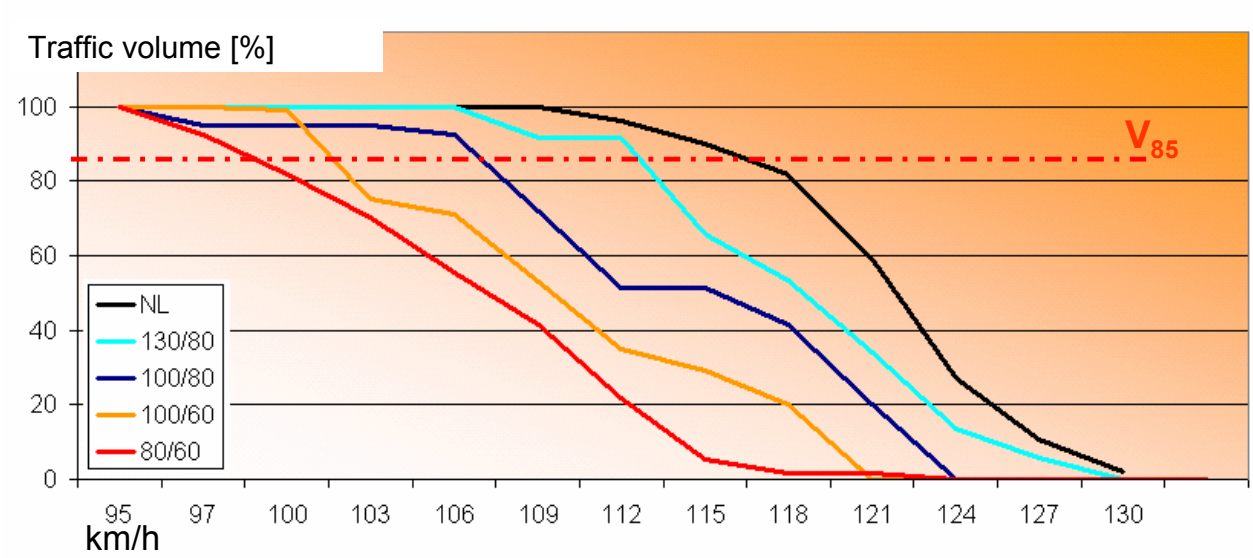


Figure 8: (first) evaluation on speed changes

2.3 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 Summary and Conclusions

The residential area of the city of Gleisdorf, situated near the Austrian highway A2, is frequented by > 40.000 vehicles/24h with heavy traffic contributing up to 20% to the total traffic during night hours.

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After installing the speed management, a first evaluation has been realised. It is documented, that the speed management in combination with the slow down choreography has positive influence on the driver's behaviour. A completely evaluation is planned; first results will be available in fall 2004.

The described noise reduction concept is easy to integrate in planned or existing speed management systems.