

ENVIRONMENTAL CONSCIOUS PLANNING PROCESS IN TRANSPORTATION DEVELOPMENT

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Abstract

The transportation will increase in local and in regional measurements throughout in Europe. The increase of transport and traffic cannot be stopped in the coming years and this will always affect the environment. The European Union treats the relation of transportation and environment so that it manages the present and protects the future. The main principle of the community strategy is the "sustainable mobility" which means that the transportation should play very significant role in future development but it does not cause any additional environmental damage. The main aims of this article to be pointed out those environmental planning methods and their practical engineering means in fields of maintenance and operation which are suitable to keep balance between the living world and the different transportation modes nowadays and in the far future.

Keywords: road planning process; road construction, maintenance and operation; protect from harmful environmental effects.

1. Introduction

The transportation of people and goods inflicts many, often overstated, negative impacts on the environment. Besides supposed or actual evaluation, it is a fact that public transport is vital for the community and is the most important form of multinational co-operation. Beyond, it is an ever more typical feature of the European citizen, that the public road network is used more extensively for private travels (tourism, culture, sport, recreation) than for official trips.

The aim of the present paper is to try to establish a compromise between a necessary and rationally sufficient public road network system within a caring nature and environment that provides a living space that optimally ensures wildlife survival.

2. Preferences of European Integration

Transportation is a local, regional but increasingly an European issue. The European Union treats the relation of transportation and environment so that it manages the present and protects the future. The core meaning of the community strategy, set

out in the “sustainable mobility” principle, is that transportation should play its very significant role in social and economic development in a way, that it does not cause any additional environmental damage.

Main premises of this strategy:

- development of transportation will always affect the environment;
- despite all efforts, increase of transport and traffic cannot be stopped in the coming years;
- a common, regional and European-wide transportation-environmental policy is necessary that deals with the above.

In this field the principle of subsidiarity has primary importance, since the practical application of strategies aiming at diminishing environmental impacts cannot be realized without regional and local initiatives.

As part of the strategy, the following measures are preferred:

- decrease transportation needs;
- propagate ‘soft’ transportation modes;
- replacing private transport with public transport;
- road tolls;
- installing electronic traffic control systems;
- high speed railway construction;
- developing systems facilitating more balanced distribution of seasonal and regional traffic;
- formulating concepts taking regional demand more extensively into consideration.

Chapter XII. of the Maastricht Treaty sets out the development and maintenance of a unified, harmonized European Transportation Network. This means that the development of networks of different modes of transportation should be synchronized in Europe.

Directives regarding the Trans-European Road Network:

- improving long distance travel conditions;
- developing bypasses in well determined distances;
- establishing connections between different transportation forms;
- transportation network harmonizing between peripheral areas and central regions.

Following the principles of hierarchy and homogeneity similar directives should prevail on the different development areas of national networks.

The paper planned to deal with the problems of road transport and environment from the aspects of maintenance and operation, and building and development, distinguishing in both groups between the primarily urban related and primarily rural related tasks. Tasks obviously overlap and the objective of the grouping is to systematize.

3. Rural Areas Development

3.1. Building and Development Tasks in Rural Areas

3.1.1. General Planning Phase

In case of unprotected nature areas the following general planning guidelines should be applied:

- At the planning of the alignment cutting biotopes or ecological corridors, has to be avoided but they have to be bypass. This results in less biotope loss or disturbance.
- As early as possible, in founding of optimal alignment it should be considered:
 - What are the likely impacts of the road on the wildlife;
 - What species are likely to be present;
 - What seasonal and daily migration patterns prevail;
 - What means and measures should be applied to ease animal migration or divert animals, e.g.:
 - pipes, culverts;
 - tunnels, passages;
 - bridges over roads, large ditches;
 - long bridges over waterway and watery areas (for amphibians).

In protected natural areas it is prohibited to build transportation line constructions, buildings, establishments that endanger, damage their characters and states, or disturb the landscape.

To change the characteristics or to use protected nature areas a licence is needed from the nature protection authorities.

For building line constructions, its utilisation contribution from the nation protection authority is necessary.

Above factors mean in case of public road the followings:

- roads can not fragment ecologically related biotopes,
- planned surface and subsurface water drainage system has to follow the natural waterways,
- service constructions must not have any negative impact on protected nature areas (e.g.: parking, outlook, fuel station, service shop, accessory store, restaurant, etc.)

Public road cannot be constructed in the natural surroundings of national parks or other highly protected areas of nature.

The so called 'ex lege' or by laws protected

- nature areas
- natural heritages

cannot be used for public road construction.

Motorways cannot lead through protected nature areas. Even close to it, it can only be constructed if between the planned road and the protected nature area the required safety distance can be established.

Under environmental licensing procedure the nature- and landscape protection authority should also approve the construction of highways, main roads, 1st class and 2nd class roads if they are forest roads (if the forest is bigger than 50 ha).

To save by-road biotopes and their wildlife major research and monitoring tasks arise. Primarily these could be the followings:

- Taking inventory of biotopes according to nature preservation importance in natural and close-to-natural areas;
- Identification and mapping of biotopes concerning rare and valuable species;
- Preparation of maintenance-development programme to preserve these biotopes, and diminish their disturbance;
- Creation of artificial biotopes, developing rehabilitation techniques with special attention to:
 - Considering land-ecology factors;
 - Eliminating ecological gaps in the existing ecological corridors;
 - Connecting natural biotope complexes as necessary with the establishment of green corridors;
 - Regeneration of rare or endangered biotopes.
- Determination of the species structure and population dynamics of roads and roadside;
- Determination of species avoiding, using or tolerating roads;
- Studying the wildlife relations of roadside and close to road areas;
- Studying longitudinal and crossway utilization of roadside biotopes, and species migration;
- Determination optimal quality, width and structure of roadside biotopes for the species potentially using it.

3.2. Detailed Planning Principles and Construction in Rural Areas

During the planning and construction of road networks the prevention of physical, chemical and biologic qualities of soils, the conservation of the multi-functionality of the soil should be ensured by soil protection measures, special built establishments and technical measures.

During construction on the surface or in the ground only those activities can be carried out, or only those materials can be placed that do not contaminate the quality of the soil and the elements of the environment.

During the realization of the investment, and before starting – following the dispositions of regulations – the productive layer of the land should properly be removed and recycled as fertile soil.

Following the construction work the user of the land must take care of the scheduled soil work reconstruction and re-cultivation.

During road construction the eliminated water biotopes must be compensated with equal number artificially created water biotopes (the same applies for woodlands). Construction guidelines of artificial water biotopes (engineer-made wetland) should be established.

On sloping areas the water drained from the road means erosion danger, therefore mechanical instruments should be applied to decrease the energy of the water.

To promote the application of environment-friendly water management measures, technological guidelines must be developed.

The pollutants washed off the motorways by rainwater must be collected in sensitive areas so as to prevent surface or subsurface water, or land against pollution. These should regularly be removed or if this is not possible, their natural cleaning must be ensured. These facilities should be planned as part of the road plan.

Considering that most of the micro-pollutants originating from traffic are carried by the floating or sediment particles of the water, these pollutants must be retained mechanically with sediment trap dams of soil or concrete. With chemical treatment and sand- or gravel filter better result can be achieved. The best way to retain solved and floating pollutant is to use biological filters. These structures are capable to temporarily retain water contaminating materials in cases of disasters.

Technological guidelines must be prepared for road surface rainwater drainage, cleaning and damage control.

The contamination of drinking-water reservoirs is a threat that no country can assume. Thus these water reserves must be protected with multi-zone systems, that consider the hydrologic and hydraulic conditions.

At the protection site with applying ever more rigorous regulations and restrictions as getting closer to the water resources, the water contamination of human origin can be prevented.

Protection sites must be used in case of naturally protected wet biotopes in order to ensure their existence.

In the path of public roads surface water protection areas, drinking- and industry water surface and subsurface water reservoirs and their surface reserve areas must be designated, along with nature and nature protection areas and places with environmentally sensitive soil. The border-line of sensitive areas (surface water, subsurface water and soil) has to be determined by the environmental and water authorities on 1:10 000 scale maps and this should be, in co-operation with the road authorities, marked on the locality map.

The operators of public roads should set up and operate environmental self-control systems. The sampling sites and the types of chemical analysis should be summarized in guidelines and the testing system must be approved by the local environmental authorities.

The road authorities store data the collected by the self-control system in a unified system and the data must be made available to the authorities of environment protection, the relevant communities and everybody who is interested in them.

The professional rules of applying Government Decree No. 152/1995. (XII. 12.) on Environmental Impact Assessment (appendix 4.1.) on the cases of public road construction projects must be set out in technological guidelines. This is not ready yet.

(Some pictures of road development work aimed nature protection see below.)



Fig. 1. A basin built to protect karst water beside road No. 8



Fig. 2. Game bridge over motorway M1



Fig. 3. Game passage-with guiding fence-under motorway M3



Fig. 4. One of twelve amphibian tunnels built under motorway M3

4. Urban Area Development

4.1. Building and Development Tasks in Urban Areas

Local environmental impacts are not caused exclusively by the emission status of vehicles, but the traffic congestion on particular areas and the congestion of operating vehicles. This latter cause could be eliminated by proper developed of road infrastructure.

4.1.1. Phase of General Planning

- *Practical development of urban structure*
With harmonized planning of the functions of the different parts of the settlement and the necessary transportation network the formulation of problematic congested areas can be prevented or gradually eliminated. A part of this is the revision of the presently prevailing one-centred city structure. It contains the further planning of the living and industrial areas taking into consideration the transportation factors, the expansion of store network influenced by the driving shoppers and the distribution of facilities satisfying recreation and cultural demand across the total city area. All of these contribute to the decrease of traffic demand, therefore to the reduction of the number of official, shopping and recreation trips.
- *Building bypasses far away from the city avoiding to build up new city centres*
The elimination of transit traffic directly diminishes pollution and through reducing traffic congestion favourably affects the air quality.
- *Introducing intelligent traffic control measures.*
The traffic of a heavily used road network close to the city centre can effectively be reduced with the introduction of traffic controlling systems on the main roads. With continuous centralized working up of traffic data with the help of Variable Message Signs and the application of GPS-GMS systems alternative route suggestions can be given to relieve the overloaded parts of the network.
- *Reducing traffic demand*
With the establishment of logistic centres the freight transport demands can significantly be decreased, therefore the vehicle use is reduced, that means less air pollution.
- *The environmental measures*
- *Air quality*
To continuously have available information on the air quality of the road environment, an environmental measurement network should be established and operated. The continuous measurement facilitates that when the pollution level exceeds the air quality limit values set by regulations, necessary measures can be taken without delay.

To improve air quality, in accordance with EU policy the following regulations or directives should be applied:

- establishing standards for petrol- and diesel engine emission;
- standards on fuel quality;
- limiting sulphur-dioxide, lead, nitrogen-dioxide emission;
- establishing maximum weight and size standards for heavy vehicles;
- speed limits for heavy vehicles and buses;
- regulating hazardous material transportation;
- obligatory environmental impact assessment in new infrastructure projects;
- community discussion and approval of infrastructure development projects;

- considering and financing external costs of transportation.

During practical application of the air pollution policy the general principle of the Act on Environmental Protection should be used as a guideline, namely that 'during the use of the environment the most effective possible solution should be used'. The most effective solution is considered to be the one that under the prevailing technological and economic conditions is the most environmentally friendly.

To keep the air quality limits, in case of establishing new sources of air pollution, the creation of a protection zone, protecting distance and their maintenance is necessary. This way the prevailing adverse settlement development and industry building practice can be avoided, resulted in the overlapping of housing and industrial areas, and in the undesirable increase of air pollution in housing areas. The maintenance of protection zones is the duty of the operator of the air pollution emitting facility.

To protect the air cleaning of certain regions, and to gradually improve air quality, a regional air-quality protection programme with the related action plans has to be prepared. The regional programme can, practically, be prepared on the short-, medium- and long run affecting industrial, traffic and community spheres alike. In the programme harmony must be maintained between the regional and settlement development plans related to the region, other environment protection plans and programmes. Inputs of the population remarks must also be considered together with the air quality protection obligations determined by international treaties. The regional programmes are prepared by the environmental agencies in co-operation with the local and regional authorities and the operators of the emission sources.

Noise protection

To assist national regulation a unified emission regulation is needed at EU level, first. This regulation should, in general, contain the followings:

- Set unified evaluation criteria;
At present the different member states use different characteristics to describe noise conditions of the environment, therefore it is impossible to compare the conditions of the individual countries.
- Establishing and obliging unified sampling method (measurement and analysis);
- Establishing unified calculation method;
At present various calculation methods are available in the member states both for calculation the individual noise sources and for calculation of noise expansion. There is a very strong trend that measurement-based examination should in a very short period of time be replaced by calculation-based examination and evaluation.
- Unified information reporting, representation;
Examination results should be represented. Creating exact "noise maps" is the proper solution.

Detailed Planning and Construction

With new city highways and main road constructions planned for high level of services, planting protecting vegetation can decrease dust pollution of traffic origin (see pictures below).



Fig. 5.

Applying silent, absorbent surface layers, and noise barriers are the most commonly used measures to decrease traffic noise.

More effective or valuable solutions are building noise barriers or noise protecting wall from vegetation.

Should the above solutions be not sufficient, the acoustical insulation of building front wall has to be significantly increased, so as to achieve at least the indoor noise limits.

5. Operation of Roads in Rural Areas

Many measures can be introduced in the operation of the existing roads that could diminish threats or could improve the conditions for the wildlife:

- Alerter signs (signs, lights),
- Speed limit and control,

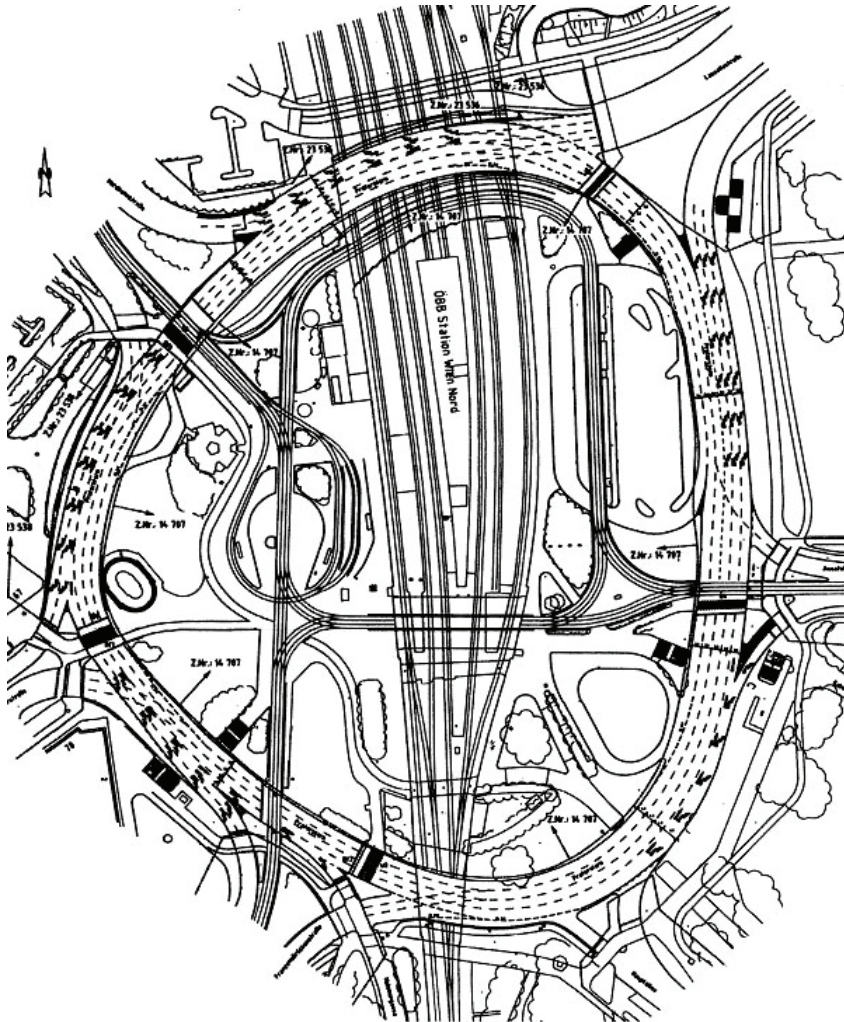


Fig. 6. View and general site plan of Roundabout with traffic control in Vienna

- Fencing at dangerous road sections,
- Planting vegetation on clear spots
- Identification of critical migration and crossing sites, their protection to minimize wildlife collisions
- Limiting pollution
- Fragmentation effect of roads should be decreased
- Emphasis must be placed on expanding natural biotopes
- During issuing route licenses for hazardous material transportation, environmental sensitivity of the route should be considered from the aspect of

surface waters. In the transportation of hazardous materials highly sensitive areas should be avoided, if it is not possible the necessary environment safety measures should be applied.

- Signs marking water protection and nature protection areas crossed by roads should be introduced in Hungary to initiate environment conscious thinking of traffic participants and road operators. Signs should be placed on properly determined areas gradually.
- Soil quality of roadsides should be maintained by environmentally sound, soil improving vegetation technologies.
- Materials used in winter operation technologies should be revised from an environment-friendliness aspect and development of new, environment-friendly technologies can significantly protect water resources.
- Creating environmental guidelines for applying winter operation techniques in the cool period could make protection unified.
- Guidelines should be set up to prevent hazardous material freighting accidents, to retain soil contaminating materials, to minimize damage caused by streamed out materials and to determine recovery actions.
- Listening to the environmental priorities, development stage of roads and their average daily traffic, have to determine the soil protection tasks with keeping cost effectiveness in mind.
- Areas of high fertility lands and regions with environmentally sensitive soils should be highly protected.
- Dust roads should be maintained and used according to the characteristics of the soil (structure, water- and air management, biological activity, etc.).

6. Road Operation in Urban Areas

The most important measures in this field are the followings:

- Propagation of environment-friendly methods of transportation. Pollutant emission traffic of origin can be reduced if other, less polluting methods of transport are propagated and developed.
- Maintaining the ratio of public transport. A good means of reducing the pollution pressure on the environment is to promote public transport in cities instead of using private cars.
- Decreasing pollutant emission from vehicles. It should be mentioned here, that one of the major problems in Hungary is that aged vehicles are used in traffic.
- Improving fuel quality. The amount of emitted pollutants can be reduced by using purer fuels. A means of this is to improve the quality of diesel and petrol fuels with gradually increasing the severity of quality standards.

- Environment friendly vehicle operation. Environment friendly vehicle operation is also an effective means of reducing air pollution, through maintaining vehicles in a state when they emit the least possible amount of air pollutants. Data prove that proper maintenance of the operating vehicles is very important. With proper settings the emission of air pollutants can be reduced by 30-40%.
- Altering traffic direction. The environmental quality of smaller cities with heavy pollution can be improved with altering traffic directions. Direction changes can ease the critical environment pollution level on the city centre or heavily loaded road sections by distributing pollution. This, of course, is not really an environment protection solution, but can ease prevailing critical situations.
- The final means of eliminating local environment pollution is traffic limitation. In all decisions it must be considered, that the part of the city where the transportation is prohibited cannot be sustained.
- Concerning the present noise regulations has to be mentioned that the *limit values of noise pollution caused by traffic* can only be applied on newly built roads and in cases of altered land uses. Many problems – however – probably the most severe ones – arise along existing roads. The application of environmentally friendly technologies and resolving the noise pollution related public complaints are general demands. For the evaluation of the eligibility of the complaint it is proposed to make noise inventory of the operation road network, by means of which the areas exceeding the noise limits can be identified. According to the present regulations the environmental agency can initiate the application of noise reduction measures in case of significant excess of the limit.
The noise of operating vehicles can effectively be reduced with static or dynamic traffic control measures. These can be:
 - Limiting the speed of traffic,
 - Limiting the volume of traffic,
 - Limiting the traffic of certain vehicle types,
 - Traffic control by traffic volume controlled traffic lights,
 - Special lanes for different speed and function vehicles (public transport).

6.1. Conclusions

The primary role of transportation government is the execution of the programme detailed above. The provision of financial resources, the co-ordination with the environmental authorities and the co-operative execution of tasks can only be successful, however, if the decision makers are devoted to environment protection. It is important that people dealing with environmental issues be in positions where they can influence any of the actions, and can identify the operational conditions of an environment-based control system. At present at the level of medium management it is characteristic that the environmental engineer is mainly an employee of the

maintenance and operational department, and usually is engaged in other activities as well.

The proposed change promotes the position of the environmental engineer higher in the organizational structure, right up to under the head decision maker as an independent, full-time employee. This way the environmental engineer receives his/her orders directly from the head decision maker, has full overview of the activities of the organization that he/she can more effectively influence.

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