HUNGARIAN NATIONAL ENVIRONMENTAL PROTECTION PROGRAM

TRANSPORT SECTOR STUDY

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1. INTRODUCTION

In the past 25 years the environmental issues received world-wide attention, and at the same time the focus of discussion shifted considerably within the environmental profession as well. One of the most important changes was that the *environmental protection approach concentrating on the environmental factors was complemented by and partly taken over by the approach focusing on the economic sectors as the source of environmental pollution.*

When we discuss the tasks of the National Environmental Protection Program (NEPP) by sectors, it is important to *avoid the danger that the sectoral approach become a mechanical distribution* of environmental tasks. On the contrary, all the possibilities we can gain from the sectoral approach should be examined. We are trying to apply this principle in our study so that we can present and follow the results through the discussion.

The transformation of the focus of discussion from the *environmental element towards the sectors* was not a one dimensional process. It was intertwined with a shift on the prevention scale, *from focusing on the end-of-pipe approach to focusing on prevention* – and with another shift on a measures' scale from focusing on the environmental prescriptions to opening the view also on the economy and later on the whole society.

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[1] The paper was prepared in the frame of the COWI coordinated contract: Development of the Environmental Action Programme, Transport Sector Issue Paper.

1.1 Reorganization on the prevention scale

Figure 1 represents the movement of the focus on the prevention scale.

production-technology **product**

investments (EIA) **emission**

sector policy **waste**

Figure 1. The development of environmental thinking and intervention

On the *Figure 1* from right to left, we can follow the changes in the focus of environmental thinking in time. In the early period, environmental protection concentrated on *waste and emission*, followed by the focus on *product,services and technology*. (The role of sectoral experience clearly grows.) These steps are framed in a strategy and in an institutional system by the environmental impact analysis (EIA), which attempts to predict and, if possible, to reduce the negative environmental impacts of the sectoral activities already *in the investment phase*. Visually it is represented by an impact matrix that shows the relationship among the environmental factors under pressure and the sources of the pollution as branches.

Although the environmental impact analysis is a very important tool, and its introduction was a significant achievement in Hungary, nevertheless it is only an *intermediate stage* in the process of development. The impact analysis of developments never go beyond the boundaries of a sector, in which the logic of the sector is contrasted with the environmental requirements. Therefore, the alternative of a transportation investment can only be another kind of *transportation investment* and the question *whether the investment is necessary at all* in the process is not raised.

The next step towards a higher level of prevention is represented by the *environmental approach enforced on the sectoral policy level*. In the area of sectoral development policy the basis of discussion is the *objective of the society*, and in this system the environmental objectives are not confronted but harmonized with the other social objectives (it is more appropriate to say that the environmental objectives compete together with all the other objectives). In this phase the objectives are not always clear within a sector; therefore, solutions unrelated to the sector can be proposed as well (e.g. urban development measures reducing demand for transportation). This process increases the possibilities to satisfy the environmental as well as the sectoral objectives.

1.2 Changes in the measures

Along with the movement towards prevention, another kind of transformation took place concerning the methods of environmental intervention.

Administrative restrictions, including the enforcement of maximum emission levels and the occasional comprehensive prohibitions have been very exact and direct (as well as confrontational) measures for the reduction of emission. This policy did not lose its importance in areas where its use was justified; however, other methods were gradually developed as well to treat impacts that are not widely accepted, or influence different economic actors in a different way.

Such measures include economic incentives that influence the actors through the market, leaving space for the individuals (and corporations) for more thinking and for the consideration of their interests. This way these actors can adjust their interests and rational aspects with the timing, scope and priorities of imposed sanctions. Appropriately designed, market conform environmental measures are in harmony with other market factors influencing an economic actor and force him to adapt. However, even this more sophisticated forms of enforcement can not hide the fact that the regulatory authorities impose measures by artificially enforcing an external aspect (which lays beyond the horizon of the market).

To support the social acceptance of these kinds of interventions, the whole process, from the approval of a measure to its introduction, needs to be public and socially controllable. Lately, this requirement has forced the environment related economic incentive system into a social bargaining process in developed democracies. This phenomenon is not new, however: in reality only those measures and economic incentives could be approved even in the past which *had e*nough social support. Public procedures make the regulatory process more transparent through which it becomes more clear who argue for certain solutions and what their justifications are.

1.3 Some principles of the sectoral analysis

This study approaches the environmental protection action program from the aspect of a sector, the transportation sector. Before analyzing the exact problems of the transportation sector, we need to emphasize that *the interaction of environmental protection and transportation should be interpreted in a comprehensive way, discussed above*.

This means that the impact of transportation on the environment can not be limited to analyzing the emission and the induced pollution. Even if we prepare an impact matrix, the direct influence of a sector on the different environmental factors can dominate the discussion. *We do not ignore that the role of emission is significant*

among the negative and final impacts of a sector on the environment However, this does not mean that this association should be applied for a program: it is not true that the direct measures that treat emission pollution would have the largest (if any) environmental impact.

Those environmental programs that remain at the level of emission and technologies have *additional problems* as well (to the ones mentioned above, that is that they are not efficient). Such kind of an environmental protection program remain at a level of confrontation, where the environmental objectives seem to be able to win only *against* a sectoral objective by reducing its efficiency. Therefore, it is inevitable that the *transportation policy and the environmental policy cooperate at the sectoral level because this is where the objectives of the two sectors can be harmonized, making it clear that the objectives can only be achieved if they do not compete, but cooperate.*

2. EXECUTIVE SUMMARY OF THE STUDY

The study underlines that only an environmental thinking integrated on the level of a transport policy is able to face both with problems emerged from the side of the transport and problems emerged from the side of the environment.

Cocerning the present situation of the transport sector we emphasized the over-centralised structure and Budapest centered shape of the Hungarian networks. Another feature is that those networks developed historically show relative less backlog in their quantitative indices than in quality characteristics. The lack of maintenance needs to be specially mentioned. As a third speciality, we underline, that because of the cheap transport service of earlier years, the whole national economy has become very transport intensive. This was the starting point, when in the 90s the transport performance indices fall down: between 1989 and 1993 the goods transport went beck to its half, while in passenger services the decrease was 15%.

The study surveys the *harms of the environment originated from the transport sector*. Lookong over the air-, soil-, and water pollution, the noise, the waste, and the danders of landscape, wildlife and built environment it can be stated, that besides the frequently underlined emission problems, the land use questions represent a significant weigh: out of the land directly used by the transport and polluted by the transport also important to listen to the whole area that can be considered as touched as a consequence of the overall effect of the transport activity.

Analysing the direct causes of environmental problems the study draws the attention to several background mechanisms, indirect causes. The transport policy tools has to give answers to eliminate these mechanisms. The mechanisms can be

connected to different mistaken tendencies of shares within the different dimensions of the transport.

NEPP reference	NEPP-objective	Direct cause behind (problems that can be linked to the transport)	Fundamental cause, mechanism	Necessary direction of change	Transport policy target
AIR-1	In settlements polluted with dust and toxic solid materials the pollution should be reduced with 20% in six years and the pollution should not increase in other settlements.	See AIR-3			(h) technology development to longlasting decrease emissions
AIR-2	An outstanding objective is to improve the air quality of seriously polluted regions in the country so that they would satisfy the moderately polluted qualification.	See AIR-3			
AIR-3	The reduction of transportation emission.	Local level: see SET-1. National level: deteriorating share of railway/road and private/public transportation; decline of local-regional connections as opposed to long distance (mainly hierarchical) connections, inappropriate network structure, distorting tariffs.	*The trap of the existing radiant system: the strengthening of the existing system seems to be efficient that is the direct influence, development at the point of the congestion*	*Differentiated in space, time and by traffic flows too, and based on clear rules, the transport modes that less pollute the environment has to be given a priority relative to the other modes.*	(d) preference to environment friendly transport modes at the expence of most polluting modes.
AIR-6	The reduction of sulfite and nitrogen compounds to a level that the acidic deposit from the atmosphere remains under the critical level.	See AIR-3			
CAP-3	The establishment and the enforcement of a comprehensive economic and legal regulatory system.	Direct occupation of the land by transportation: speed (following distance, wide lanes) parking, extended junctions, industrial facilities. Indirect occupation of the land: restructuring settlements, streets become transit zones, deteriorating neighborhoods due to air and noise pollution.	*The trap of winning distance: while we get further with greater speed, the space in between becomes emptied and unsuited for human life.*	*The relation between the local and trunk traffic needs a new reconsideration: bigger priority has to be given to the local transport.*	(e) assisting local co-operation with transportation as opposed to developing long distance relations
SET-1	Reduction of air pollution in settlements according to the policy of the local governments.	In the short run: outdated vehicles, lack of maintenance, increasing car traffic, badly organized and not integrated public transportation. In the long run: overwhelming use of private cars, inappropriate road network, indecisive traffic control, inappropriate urban structure, transportation planning according to traffic flow, distorting price systems.	*The trap of winning time: Private car use is really quicker today. The decision of passengers to use cars if they can is justified - but results in loss for everybody in the long run. Until urban planning and urban policy does not anull this difference, can not be expected any change..*	*The advantages of the public transport has to be asserted, and for that reason occasionally, - in a differentiated way both in space and in time - the individual car traffic has to be limited.*	(c) preference of public transportation, the occasional restriction of individual transportation
SET-4	The reduction of the negative impact of noise and vibration pollution in settlements.	The lack of passive protection. See also SET-1, long term.			
SET-6	The involvement of the population in environmental decisions and enforcement.	Outdated planning and urban management, the „we know it better" approach.	*Trap of transport planning: the whole transport planning profession considered its main objective „to clear space" for the motorized transportation and the „satisfaction of demand".*	*The volume of the transport has to be decreased, occasionally also with the help of solutions out of transport. In the same time all those services are to be achived that were aimed at using the transport as a tool*	(a) reduction of the volumen of the transportation both with transport related and also with other tools
SET-7	The improvement of the cityscape and the general cleanliness of cities, the implementation of action plans.	The loss of respect for the pavement and regulations not enforced. See also SET-2.			(b) reduction of motorised traffic by preferring the possibilities of non.motorised traffic
SET-9	The rehabilitation and revitalization of settlement neighborhoods, with special emphasis on historical centers.	According the principles accepted previously, private cars should be able to pass everywhere, and the environment should be adjusted to this requirement.			
HUM-1	Reducing the micro component content (of less than 10 and 2.5 micrometer) of floating dust with at least 10%.	See AIR-3			
HUM-2	Improving the interior air pollution.	See AIR-3			
SET-2	The establishment of the national network of national parks including the Duna-Ipoly, Koros-Maros and Balaton national parks under construction	The main transit transportation corridors can not cross through protected regions (and densely populated areas).	*The trap of "free" money: the government subsidies are devoted for major projects; the local interest seems to be directing the main highways through the region, hopeing that the local transportation should also be improved through that.*	*The role of transit traffic in relation to local one has to be re-evaluated: it has to be declared that the main transit corridors of transport shouldn't cross the protected zones and densly populated areas.*	(f) preference of traffic with local destination as opposed to through (transit) traffic
SET-5	The protection of the natural areas, with special emphasis on plant and animal populatoins.	See SET-2			
LANDS-4	(..) The vision of land use should be worked out by considering the National Settlement Development Concept and environmental protection objectives.	Active: the distorted transportation network influences the distorted land use patterns. Passive: See SET-2	*The trap of the existing radiant system: the strengthening of the existing system seems to be efficient that is the direct influence, development at the point of the congestion.*	*Solving the single centred network structure has to be of great importance, The further increasing of the weight of Budapest by the help of the transport network should be avioded, as same as the similar problems within the capital and the single counties..*	(g) the structural correction of the transport network (the creation of multi-centre and multi-level network strukture).

NEPP reference	NEPP-objective	Direct cause behind (problems that can be linked to the transport)	Fundamental cause, mechanism	Necessary direction of change	Transport policy target
LANDS-5	The efficient methods of landscape protection should be developed.	See LANDS-4			

Table 0. NEPP objectives, transport activities causing the problems, the mechanisms, that maintain the activities, the direction of the necessary changes and the transport policy targets following from that

We constated, that it is useful in the survey of the problems, if we do not start from sub-sector level targets, but looking for more effective solutions for integrated transport as a whole. A possible mode for that, if we try to determine division of labour type targets along the main dimensions of the integrated transport. Table 0. summarises the principal logical path, and also enumerates the establised policy objectives for transport, namely:

(a) *The reduction of the volume of transportation with transport-, and also with out-of-transport tools*.

(b) *The reduction of motorized traffic by preferring the possibilities of non-motorized traffic.*

(c) *The support of public transportation, the occasional restriction of private transportation.*

(d) *Supporting environment friendly transportation modes as opposed to the most polluting modes.*

(e) *Assisting local cooperation with transportation as opposed to developing long distance relations.*

(f) *Supporting traffic with a local destination as opposed to transit.*

(g) *The structural correction of the transportation network.*

(h) *Technological developments to reduce emission.*

These strategic objectives impose different requirements on the *international*, *national* and *local* levels. Besides these three geographical levels we differentiated among the measures related to the *supply side* (network, vehicles, fuels) and the *demand side* (traffic, needs) of the transport. *Table 9* summarises these points (at the end of the study) giving a logical framework and help us achieve a strategic objective with more refined and differentiated measures.

There is a further need to concretise the measurements and task when an influence to be planned in a given town, given housing area or given section of route. Our study naturally was not able to get there, but we had to stop at a level of establishing the transport policy level or settlement policy level thinking. We refer again to a statement above: our target was to harmonise the measurements of environmental policy and transport policy. We consider *Table 9.* as a result that fits to that target.

3. THE CURRENT SITUATION OF THE TRANSPORTATION SECTOR

3.1 The definition of transportation from the aspect of the study

In the study we interpret transportation as a system of sub-sectors, such as inland water shipping, rail road transportation, road transportation, air transportation and complex transportation methods such as combined product transportation and public transportation in settlements. We do not discuss pipe line transportation and sea shipping which is not relevant in Hungary.

In a wider interpretation, the transportation sector includes the establishment, the operation and the maintenance of the transportation infrastructure, including equipments and vehicles in use and the performed services and movements, including the narrowly interpreted transportation and shipping activities, trips, and changes of place by foot or by bicycle. We do not deal with the material conveying processes within production facilities which can be interpreted as part of the production activity, although in a few cases it is difficult to draw a clear line between transportation and material conveying. For example, in the case of a cooperation between to firms, the semi-finished goods are transported as well.

We emphasize the growing importance of other ways of categorization beyond differentiating among sub-sectors and between passenger transportation and the shipment of goods. These additional aspects include:

- the consequent distinction among the categories of *network - vehicle - traffic*. (We already referred to this categorization when we differentiated between the infrastructure and the activities and later we will come back to this categories, when we discuss the demand side and the supply side of the sector.)
- categorization according to geographical scale: *local (settlement), national (regional) and international (continental) transportation*
- differentiation between *individual* and *public* transportation
- differentiation between *local destination and through (transit) transportation.*

Generally, the traditional interpretation, which focused on the *supply side* management, applied the sub-sectoral categorization and was dominated by the analysis of network, vehicle and traffic-regulation development issues. The *demand side* management approach attempts to approach, however, attempts to treat transportation comprehensively, in an integrated way and tries to achieve the goals by measures from outside the sector as well.

In the next two sections we are going to talk about the supply and the demand side themselves and not about influencing supply and demand. The supply side is defined as the networks and the vehicle parks of the different sub-sectors. The demand side includes the traffic statistics. Later, we discuss the issue that overestimating the traffic induced by a certain level of supply may distort the predictions which belongs to the supply side and not the demand side management.

3.2 The analysis of the supply side

The analysis of the supply side of the Hungarian transportation sector should include the following main issues:

- the spatial structure of the Hungarian transportation network;
- network characteristics by sub-sectors, and related time series;
- the quantitative and qualitative analysis of vehicles by sub-sectors, time series;

Considering that the main goal of the study is to underlie the environment related discussions, this part is rather brief. It is rather a summary of an analysis and not the analysis itself.

3.2.1 The spatial structure of the Hungarian transportation network

An essential characteristic of the Hungarian transportation network is that it is over-centralized to Budapest. The roots go back to the previous century, when a conscious development aimed at creating a strong counterpole to Vienna. After World War I., the circle of secondary settlements got outside of Hungary and the relative weight of the capital inside the country grew even further. The centralized management of the country after World War II., further developed this heritage.

While the reduction of the over-centralization of the transportation network appears in every transportation policy plan as an objective, the implemented programs in the past decades and the developments under planning at present all intensify this anomaly. These developments included the modernization of the railway lines to Budapest, the development of 12 lanes of bridge capacity in Budapest completed in the past decade, the development of highways centralizing the traffic in Budapest as opposed to other directions on the account of the existing road system, and the enlargement of the Ferihegyi Airport. The same list can be enumerated in the current plans as well, which shows that *these developments can not solve the problems*.

The national transportation structure is mirrored in Budapest as well, where the inner city areas, the institutions and the bridges receive a large proportion of the traffic and the experts plan to solve the problems of centralization by *constructing* more roads, bridges parking areas and metrolines. This seems rationale and the ar-

guments underlying it, refer to the neccesities induced by demand, however, it is obvious that this is a *trap of the supply side*, from where we can not come out by *further developing transportation facilities in the congested areas*.

The centralized system of the Hungarian transportation network guards the memories of the previous development polices and without changing this structure, it will induce similar programs supporting the survival of the current hierarchical structures (cooperation, economic, social and political power).

This centralized network contributes to the centralization of the goods traffic as well: five of the 19 terminals, which are suitable to receive combined transportation, serve 81% of the traffic. This fact shows that the terminals themselves can not disperse the traffic without developing a better network structure. The same is true for the planned 9-10 logistical centers: without developing transit routes that avoid the capital, these centers will not be able to fulfill the task to improve the logistics of the transportation.

3.2.2 The characteristics of the transportation networks and vehicles by sub-sectors; trends

Railroad

The development of the railroad network was practically completed in the Austro-Hungarian Monarchy, before World War I. The developments since then have focused on the construction of double tracks and the electrification of the *main lines*, while the same proportion of the secondary lines network (30%) was eliminated. From the secondary lines, first transboundary ones were eliminated, while in the 1970s the gradual decrease of the domestic lines with low traffic began too.

Despite of these recent trends, due to the developments in the 50 years before World War I, the density of our 7700 km long railway network is outstanding, and exceeds the average of developed Western countries considerably. Although the share of electrified and double-track lines is below the international average, the specific (par capita) density of these modernized lines satisfies the developed European level (see *Table 1*.).

Therefore we can conclude that quantitatively Hungary is not behind the most developed countries. The problems are qualitative, and can only be solved by changing priorities, attitudes and prejudices.

	EU developed	**EU South**	**Hungary**
Length of railways			
km/1000 inhabitants	0,44	0,30	0,74
Electrified railways.			
km/1000 inhabitants	0,20	0,12	0,21

Railways with double track			
km/1000 inhabitants	0,19	0,07	0,11

Table 1. Specific railway characteristics in international comparison

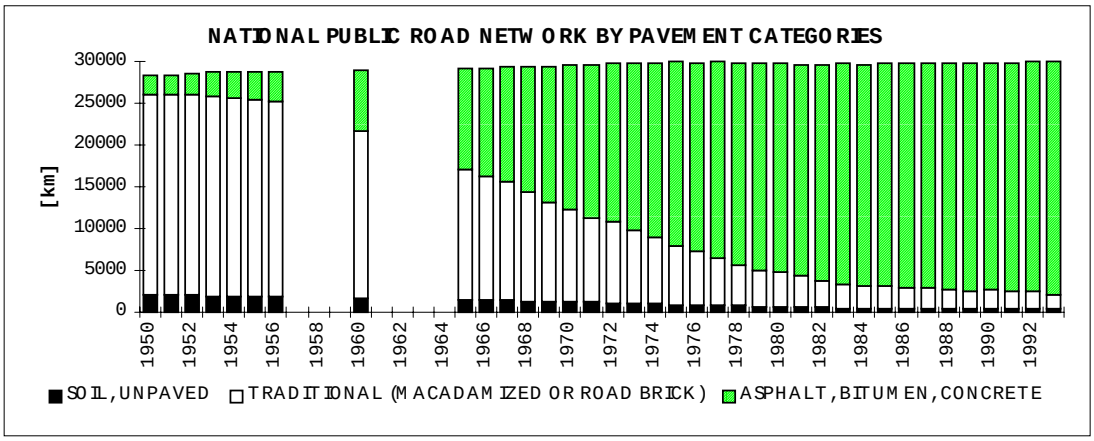
Concerning the vehicle park, the delayed maintenance and the accumulated modernization requirements should be emphasized. However, the improvement of the passenger car park has been the success story of the Hungarian Railway Lines (MAV) in 1990s. By purchasing 50-70 western passenger cars every year since 1992, a part of the stock became available for a higher quality inter-city transportation and was able to serve the high quality international transportation demand to a greater extent. This change helped the country remain on the Western railway transportation maps and assured that the railway connections are partly maintained in this direction. At the same time, the Hungarian railway system has become a transfer zone, where both the higher quality and the lower quality services are available. This situation is expected to remain the same for a longer period.

The qualitative indicators of the railway infrastructure show that the system is not modern enough (60 kg/fm share of rail lines, proportion of mixed function stations). A more comprehensive problem is delayed maintenance and the limited usability of the lines (slow-down signals on 40% length). The engine park is outdated and lacks maintenance, the proportion of motorized lines is low, the possibility of current reversing is lacking, and the waggons are not appropriate for mechanical loading. In addition, the waggon park is untidy, cleaning is suspended during the winter, and the composition of the waggons does not fit the needs. In combined transportation terminals the low number of special waggons causes problems and also the fact, that a large portion of the road vehicles is not suitable for lifting with a crane. Most of the equipments including cranes are outdated too.

Roads

If we look at the length of the national road network, we can see that surprisingly it was almost completed by 1920s (its length was 28.000 km as opposed to the length today, which is 30.000 km). In 1920 the network consisted of dirt roads (40%), and macadamized roads (60%). By 1945 the proportion of dirt roads decreased to 15%, however, the share of modern asphalt and concrete roads was not much higher either.

In the past 50 years, and especially in the 1960s and 1970s, modern pavement was laid down on these roads (*Figure 2*.). Today, the existence and the appropriate maintenance of these roads can make the Hungarian road network „European". If this network deteriorates, the Hungarian road system will not be at the European level, even if good transit highways will cross the country.



Source: Statistical Yearbooks KSH [5].

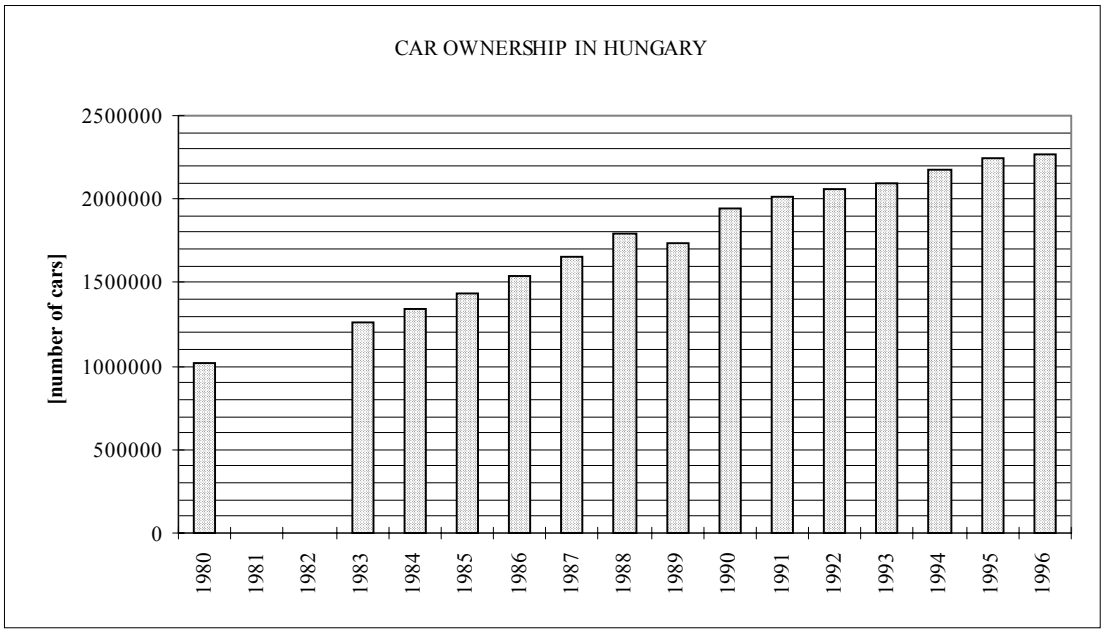
Figure 2. National public road network by pavement categories 1950-1993

The traffic on the national road network is uneven. On the most congested road sections, the exiting and entering sections of national roads to the capital, highway sections were constructed in the 1970's. These highway sections represent 1% of the national road network[2].

At the same time, transportation experts emphasize the small number of highways, the lack of satisfactory capacity of the main roads, the lack of bypasses close to settlements, the lack of satisfactory border crossing capacity, many insecure crossings, and the low rate of paved roads in settlements. According to a survey, the condition of 18% of the almost completely paved national roads is not satisfactory, 28% is acceptable and 39% is bad.

[2] In the past years, the essential question of the national road- and transportation development was the construction of the highway network (a further 2-3%). At the beginning of the 1990s the government accepted a concession policy and declared that *public funds will only finance the maintenance and the development of the basic road network*, while highways serving special long distance traffic and transit needs will be constructed under concession agreements. In two-three years it became clear that the private investors are not convinced that the solvent demand for highways is high enough in Hungary, except for the final part of M1, the highway that connects Budapest with Vienna (and Western Europe). Therefore they demanded a large government support and considerable guarantees which almost amounted to the construction costs. The government's analysis of the situation concluded that under such circumstances the concession is not justified. This problem raised the issue of *who* is going to pay for the construction of the new highways, however, did not examine whether the development is justified at all. Therefore, as opposed to the declared principles, public funds will have to be allocated between new developments, and the maintenance of existing roads. Today, when the provision of basic services are privatized, this large investment, which was rejected by the private sector, will be taken over by the government. (The situation is very similar in Budapest, concerning the maintenance of public transportation and the construction of new metro lines.)

Despite the general decline of the economy, the motorozation level, that is the number of privately owned cars, did not decrease in the 1990s, although the pace of development slowed down (*Figure 3*). Out of the 2.3 million privately owned cars, 1.5 million was made in Eastern-Europe, most of them with a 30 year old technical design, of which the average age exceeds 10 years. However, from the aspect of the mileage, the share is reversed: the more modern cars dominate.



Source: Transport Data 1980-1996. Infrafüzetek, KHVM 1997 Budapest

Figure 3. Car ownership in Hungary, 1980-1996

The truck park, consisting of 4800 vehicles (1993), is similar in composition; only every 10th can satisfy the Western standards. The condition of the vans is even worse due to the high number of new small shipping entrepreneurs entering the market. The average age of the 21,500 coaches exceed 10 years as well, renewal programs could only be launched from loans (BKV).

Inland waterways

The length of permanently passable water ways is 1373 km in Hungary, of which 417 km is the main branch of the Duna. More than half of the ship park is over 15 years old. The domestic ports do not satisfy the current shipping requirements, the size of the ships and legal barriers hinder sailing on Western inland waters. During a part the year certain sections of the Duna are not available for the passage of fully loaded, Western, deep sinking ships; however, the RO-RO ships (truck transporting ships) can navigate full time. Legally, the passage of EU ships is clear. In international agreements Hungary pledged to enlarge the bed of the Duna, an objective that

does not comply with the conditions of the river and that are not satisfied by the other sections of the river either, not to speak about the Duna-Majna-Rajna channel.

Airways

At the beginning of the 1990s, the enlargement of the Ferihegy Airport was completed and the second Terminal was opened. The future of about 40 airports depends on whether the government can pass the ownership of them to the hands of local governments and whether the municipalities will be able to find a way to operate them with a profit.

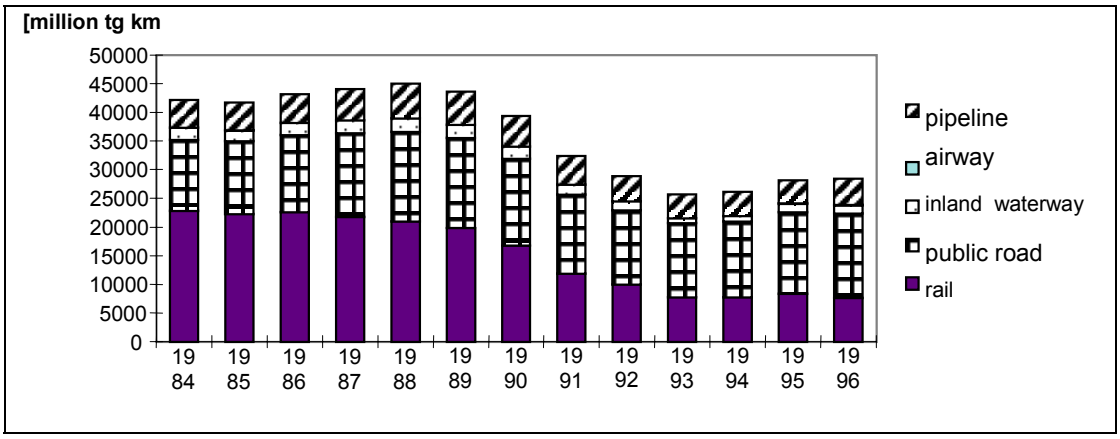
MALEV (Hungarian Airlines) operates 30 airplanes, which are being replaced continuously. Half of the planes were made in Western countries.

3.3 The analysis of the demand side

3.3.1 Freight transportation

Concerning the transportation sector as a whole, the structural adjustment, the decline of certain industries and the transformation of companies resulted in a 43% decrease of the volume of good shipping between 1989 and 1993. The volume of rail transportation decreased in relative terms too, to less than half. While in 1980 two thirds of the total goods/ton-km was transported on railway, this level decreased to one third by 1993. (see *Figure 6* later)

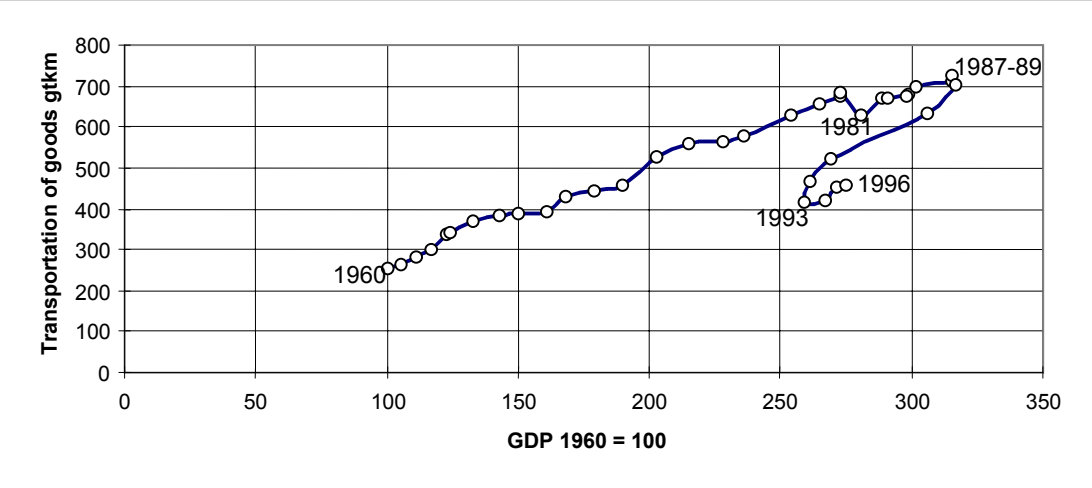
Transport of goods by sub-sectors is demonstrated by *Figure 4*.



Source: Transport Data 1984-1996. Infrafüzetek, KHVM 1997 Budapest

Figure 4. Change of the output of the transport of goods by sub-sectors, 1984-1996 [goodstonnakilometer]

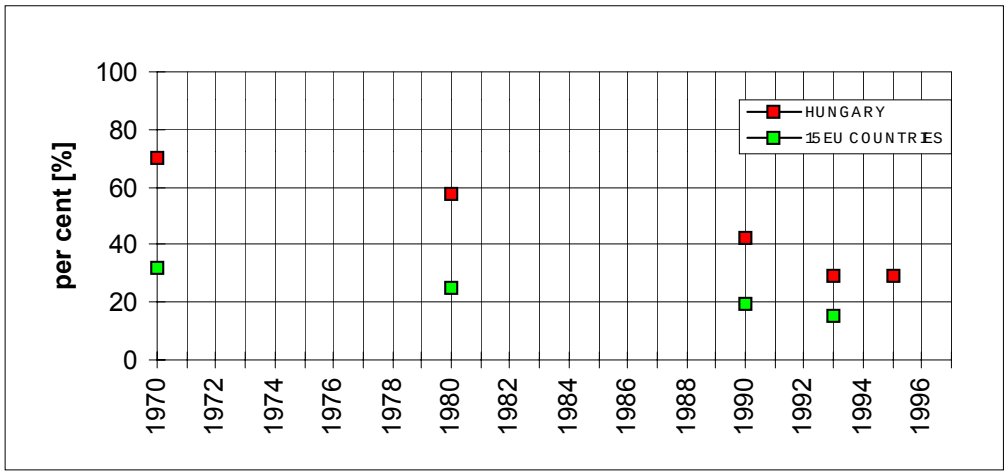
Figure 5. shows the long term trend of freight transportation in Hungary, between 1960 and 1996, compared to the changes of the GDP. Both the GDP and good shipping increased continuously until 1980. In the 1980s the pace of increase slowed down. he breaking-point took place in 1987-1989; both the GDP and the transportation output decreased. The indicators reached the bottom point in 1993, since then the transportation and the GDP have started to increase again. During the recession period the transportation need favorably decreased: the same level of GDP as before generated less transportation output. However, the new growth shows a less positive trend: the increasing production output needs induce and increasing level of transportation need.



Source: Statistical Yearbook Of Hungary 1996 KSH, 1997, in case of goods transport Közlekedési adatok 1984-1996. Infrafüzetek, KHVM 1997 Budapest

Figure 5. Connection between the GDP and the transport of goods in Hungary

Figure 6 presents how the share of the rail transportation of goods decreased in the past 25 years in Hungary, giving also a comparison to the trend of 15 EU countries..



Source: Infrastruktúra és szolgáltatásai Európai Tükör 9. Integrációs és Stratégiai Munkabiz. 1997

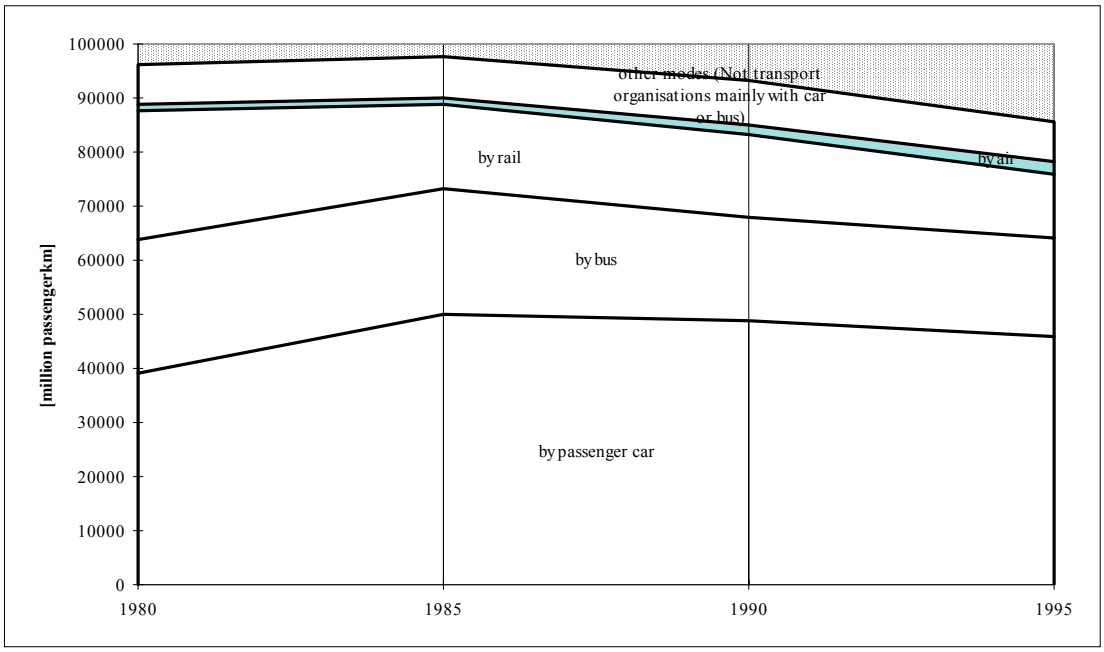
Figure 6. . Share of railway transportation of goods in Hungary in comparison with Europe

The road transportation companies can not enter the Western markets due to the already discussed quality problems (and also to the counter-interests). The *inland navigation* in centrally planned countries was operated by monopol firms with considerable government subsidies. The elimination of the subsidy resulted in the total collapse of the sector. (Note: In Western countries shipping could only survive with government subsidies too, and even so they could only maintain their operation between 1980-1990. In countries where inland navigation was significant, in Germany, Belgium and the Netherlands, a slight increase was achived. The other countries can be characterized by considerable decline.)

The output of combined transportation in Western-Europe grew to more than 250% during ten years. Meanwhile, the container transportation capacity of the Hungarian railways decreased to one third. The rail transportation of trucks grew dynamically, however the water transportation was ceased due to efficiency reasons.

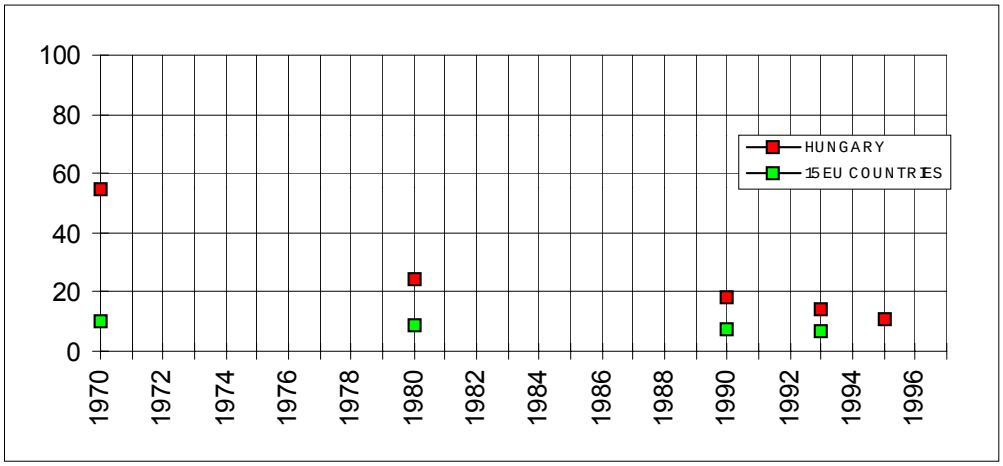
3.3.2 Passenger transportation

Figure 7 shows the development in passenger transport demand and the relative distribution on transport modes. Data confirms that the economic downturn during the years around 1990 has reduced transport demand also for passenger transport. Further, the data clearly shows that passenger car transport has gained considerable market shares since 1980. Also air transport has grown significantly (from 1.2% to 3.2% in pass.kolometre). Bus and rail transport have reduced their market shares, particularly rail transport which has halved its market share of passenger transport in 15 years.



Source: Transport Data 1980-1996. Infrafüzetek, KHVM 1997 Budapest

Figure 7. Development in passenger transport demand by transport modes 1980-1995 [million passengerkilometer]



Source: Infrastruktúra és szolgáltatásai Európai Tükör 9. Integrációs és Stratégiai Munkabiz. 1997

Figure 8. Share of railway passanger transportation in Hungary in comparison with Europe

The decline in *passenger* rail transportation has, however, been smaller than the decline in *freight* rail transport (except for certain lines, particularly international lines). However, considering that the loss of passenger transportation was covered by crossfinancing from the revenues of freight transportation, this change created a new situation for the Hungarian Railroad Company. *Figure 8* shows that the market share

of rail transportation of total passenger transport has been steadily declining since 1970. The level is currently close to the level of the 15 EU countries.

In the area of urban public transportation, the service density , the number of passengers and the quality of the service all declined. The ratio of public transportation and private transportation decreases continuously, although it is still higher than in the Western countries.

3.3.3 International transportation with special emphasis on the transit traffic

Transit transportation is closely connected to the issues of geographical location and the main transportation lines. The Hungarian Transportation Policy emphasizes the need for increasing the attractiveness of the domestic sections of the main European transportation routes and believes that it is clearly beneficial not only for the transportation sector but also for the whole country if more transit vehicles go through Hungary.

In freight transportation , the advantages of the transit location of the country could be exploited by increasing the local manipulation of goods flowing thorough the country. These services can be provided in transportation junctions (transfer and vehicle changing points, logistical servicing locations). These junctions can be developed naturally at the borders, inside the country where it is practical from the geographical point of view, and where the energy and infrastructure necessary for freight transportation can be assured without disturbing local functions. The ability of a particular settlement or region to benefit from such a possibility does not only depend on the technical conditions but also on whether this function can be integrated into the local economy. *This part of the transit economy presents a real benefit for the country because it induces domestic activities, therefore, ceases to being transit.* In this case the transit activity generates industrial and service functions, building on the transit activity as a *source of raw materials*. From the aspect of this development it is advantageous that the country is located along the European transit routes. However, beyond this, the further increase of transit traffic can not be supported.

The 3,500 kilometer long transit water route created by the Rajna-Majna-Duna channel raises the possibility of developing accessory services connected to shipping. It is not probable though, that this service could be operated profitably without a domestic shipping base, only building on the demand of international shipping. Transit shipping does not promise revenues in itself because the passage on international waters is free; on the contrary it imposes large burdens on the country.

The situation of the railway transportation is different. Here the transportation of transit goods is profitable and contributes to the costs of maintaining and developing a modern infrastructure. It would be advisable to transport an increasing portion of

the goods, transported by road, by railway (directly or by combined transportation). Bulk goods suitable for water transportation can also be transported by rail.

The ground transit transportation is a given fact, therefore we need to deal with it. The growth of truck traffic is not desirable because it is not economical and considerably pollutes the environment. The existing transit should be channeled through the country in a way that it does not create much environmental pressure. There are expectations that the transit traffic can potentially be transformed into tourism. However those seem to be more correct, who argue that we have to assure the easy transit of everybody, who needs to go through the country, without directing them to valuable regions. In the long run, the regions protected from heavy traffic this way, will benefit more than what they would gain from transit tourism.

Institutional reform

In the following we are going to discuss some more important problems that are part of the factors influencing the supply side of transportation. These problems are significant subjects of debate in the transportation (and other infrastructure related) profession.

In Hungary, similarly to other less developed countries, the pressure and slogan of liberalism influences the country in a period when the extensive development phase of infrastructure has not even ended. The quick changes in the economic conditions hit the poorest layers of the society the most. Most of the population faces increased user fees, however, in settlements where the basic infrastructure is underdeveloped, the investment expenses are directly imposed on the customers as well. While nothing has happened to deal with this issue, *the government faces serious pressures to finance quality services from public funds of which the privatization would be justified* (highways, extensive logistical centers, regularization of river ways for shipping).

Another typical problem in Hungary is that while the development strategy of several sectors have not even been worked out and the objectives of the sub-sectors have not even been put together as a system, the development of the country is measured on a particular scale: the extent to which the country satisfies the requirements of the EU (worked out for the member countries) which is sometimes quantified as the number of harmonizing regulations. *This indicator does not really correspond with the actual needs of a sector.* Although it can be used as a kind of thermometer to describe the general situation of a sector, however, *it is a serious mistake to think that the direct changes in the indicator can induce actual development*.

The main problems concerning the main sectors of the Hungarian economy can be categorized as follows:

- the changes in the role of the government,
- the challenges of liberalization,
- problems of financing,
- spatial centralization of infrastructure and the conservation of this condition by new developments,
- the challenges and consequences of transit,
- lack of strategy and the lack of comprehensive concept,
- lack of dealing with social issues,
- disintegration and reorganization of institutions[3].

These issues have transportation policy connections, and can be related to an environmental approach too. However, such a joint analysis would exceed the limits of this study. We could only discuss those issues (the centralization and the transit) which suit the required subjects. We would like to emphasize the importance of all these issues, however.

3.4 General development trends in transportation

Under this section we will discuss the international trends of transportation development. The trends in Hungary have already been discussed and will be treated in the next section at the analysis of the Hungarian transportation development strategies (3.5).

3.4.1 The changes on the demand side (relevant consumer behavior)

The global situation can be characterized by an extreme duality: the limits and the dangers of the traditional technology oriented development are becoming clear, and on the level of transportation policy new strategies are worked out (which can deal with the environmental issues in a new way). However, the new developments reflect these new approaches only to a very limited extent. While *on the level of principles* the comprehensive approach has already been accepted, *the actual polices* are guided by narrow market and technical interests.

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[3] The enumerated issues are extensively analyzed in „Infrastructure: a summary and evaluation of the situation. An overview and supplements by Tamas Fleischer." ISM Workshop study, MTA Vilaggazdasagi Kutato Intezet. Manuscript, 1996 November.

In the past two decades, probably *in the energy sector* the most explicitly, it became obvious that the „more energy consumption = bigger development" slogan is *not true*. Induced by the oil crisis in 1973, which increased the worries concerning the exhaustion of natural resources, several significant changes were introduced towards the reduction of energy consumption. Although the concentrated attention has decreased by today, the measures launched during this period and the *new vocabulary* remained and you can not discuss policy issues without taking into consideration essential environmental and energy saving aspects in this sector any longer. The principle of energy saving became a declared objective, what is more, in certain developed countries the reduction of energy consumption can be detected in the statistics as well.

It was a bit later when the „more transportation = more development" equation was proved to be wrong in the transportation sector. In this sector, the real breakthrough was not straightforward in the more developed countries either, and where it took place, it only influenced the transportation profession and not the whole sector. Also the reverse of the statement is accepted in connection with public transportation inside settlements (where the explicit goal is to provide a service with less movement) . The expert studies explicitly advocate the general protection of the environment but do not always accept that the satisfaction of this principle does not only require technical solutions for emission control, but should involve the evaluation of the whole transportation sector. It is not typical that they advocate for the reduction of passenger and freight transportation .

However, these mixed trends show an obvious development: the realization of environmental barriers, and the fact that these considerations began to influence the relevant sector from inside and changed the guiding principles. Instead of achieving more output (kwh, tonkn, m3, kbyte) the objective was to provide a service the best way possible. The quantitative indicators mentioned above are only one of the tools; in the long run the question is, how you can provide a better service with less consumption and pressure (pollution, environmental degradation etc.).

It is clear, that these aspects will only influence the professional materials on the level of declarations (which is a great development in itself) for the next 5-10 years, and in practice the monopol, profit oriented investors, who want to solve everything with technological improvement, will survive.

3.4.2 Technological development: changes in long term cycles

Naturally the principles guided by the faith in technological development are underlied by analysis and theories. In the following we present such a line of thought.

Nakinovic [4]drew his conclusions by examining the 200 year long history of transportation and energy networks in the US and Europe, and the findings were analyzed for Europe by Marchetti[5]

Nakicenovic showed the length of sewage, railway lines, paved roads and air routes in a time series. By using the absolute length, he counted the proportion of transportation routes belonging to a particular technology. He concluded that the way a new technology becomes dominant corresponds with the evolution model of populations competing for a certain niche (and surprisingly, the peaks and saturation of technological waves follow each other according to the 55 year long Kondratyev cycles). The same Kondratyev cycles were experienced in the expansion of energy resources: animal/manpower, coal, crude oil, natural gas and nuclear energy. The fuels and the transportation vehicles correspond with each other: channels were constructed when shipping dominated the economy, the development of ground transportation was the period of animal and manpower driven energy. Coal induced steam-shipping, however railway grew to be the dominant method. Even though the railroad transportation changed from coal to crude oil, the winner of the crude oil period was the car. According to this logic, the analysis predicts that in 2030 the length of air routes will exceed the length of roads peaking on the 1980s in the US (road transportation is still dominant, although it has lost from its relative leading position). The study expects the natural gas (the dominant resource between 1990 and 2060) to become the leading fuel in the total consumption around 2030, and after 2060 the nuclear energy will take its place.

The study predicts that the cycle will continue, and *increasingly dense energy sources* will appear and transportation will aim at achieving an *increasing speed*. This is the point where the whole theory can be questioned: due *to the limited external resources, the expansion of more dense energy sources and the neurotic linear growth of transportation power and speed, should be reversed*. In other words, we have to note that the whole trend can be cyclical too, for a while it can induce growth, afterwards it can turn to a decline (there are signals for the beginning of the decline).

3.4.3 New trends: technological change

The technological change experienced in *communication* should be treated in a distinguished way. The emphasis is justified by the fact that these changes influence other sectors as well.

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[4] Nakicenovic, Nebojsa: Dynamics of Change and Long Waves. Proceedings. Laxenburg, Austria: International Institute for Applied Systems Analysis 1987

[5] Marchetti, Caesare: The dynamic nature of European transport during the past 50 years and the next 20 years. Laxenburg, Austria: International Institute for Applied Systems Analysis 1987

The main consequences of the changes can be categorized in four layers. The inner layer is the development of *telecommunication* : the digitalized information unit becomes the mutual basis for every technological development and induces integration among the telecommunication technologies. In addition, the different branches of communication (telecommunication, data transformation and broadcasting) begin to approach each other (technically, and taking over tasks from each other). On the third level we experience the integration of *communication, computer technology and entertainment electronics*. Finally, the most exterior layer shows that *the indicator of the modernization of all other sectors becomes the extent to which a branch can apply information technology.*

This is certainly true for other network systems as well, which are not treated here (such as banking and financial services, trade, industrial production technologies), however we are going to focus only on transportation. Nevertheless, it is true that only those sectors can modernize themselves that have found the role for modern informastics *in their operation*.

The application of informatics renews the storing technologies and the technologies of logistical processes and enables programmed product transportation. Logistics takes over much from the culture of informatics and telecommunication at the level of approach as well: first in informatics and telecommunication made the technological integration possible to shift from the technology based organization (based on the rationality of the operator) to the marketing based organization (adjusting to the rationality of the user). In logistics, appropriate data transformation can reduce transportation needs (the transportation needs are taken as given).

As other sectors aim at gaining a larger information content, the transported products changed themselves. The transportation of large volume mass products decreases, and the demand for special, high level transportation services grows. This presents a general problem and a new challenge for inflexible transportation branches accommodated to transport bulk products (shipping, railway).

The existing railway system concentrates on 4 activities at present: inter-city passenger transportation, suburban commuter transportation, public transportation in settlements and long-distance product shipping. Even in these areas, only through the high quality satisfaction of mass demand and flexible cooperation (tariff associations, combined transportation, logistics) can railway protect its competitiveness.

The shipping technology which replaced the steam shipping technology in the 1960's in Europe (self-propelling motorboat) is more flexible than the tolohajozas adjusted to the shallow waters in Eastern-Europe. Even though it can push out the tolohajozas (especially if it is possible by deepening the bed), it does not satisfy the modernization requirements. It is not clear what technology will dominate the shipping technology in the future.

*

We conclude that there are trends and theories that underlie a *completely new organization of services and products* (therefore, the realization of environmental barriers and the appearance of this principle in service provision) and the opposite trend too which predicts the *unchanged continuation of the previous processes* (that is the technocratic development). These two different approaches compete with each other in each sector, on the global level; therefore, the believers of both theories can refer to the necessity to follow the principles guiding the developed part of Europe.

3.5 The transportation development strategies in Hungary

3.5.1 Official strategies (approved by the government and the Parliament)

The Transportation Policy of the Hungarian Government was prepared under the management of the Ministry of Transportation, Telecommunication and Water Management in 1993-1994 and was approved by the government and the Parliament. The policy declares 5 strategic directions:

- supporting the integration to the European Union,
- improving the conditions of cooperation with the neighboring countries,
- promoting a more balanced regional development in the country,
- protecting human life and the environment,
- efficient and market conform transportation regulation.

The Transportation Policy orders tasks to each strategic direction and present them as the main objectives by sub-sectors. Finally, it deals with the measures of implementation (the economic and legal background).

Although the strategic directions are equal in principle, in practice their order determined the structure of the sub-sector objectives and also the fact that the Parliament emphasized only the need to promote transit traffic in its brief decree. (The Transportation Policy itself, with the above-described priorities was presented only as the Appendix of the Decree.)

The objectives of *railway transportation* (31% of tkm , and 11% of pkm) include the modernization of the main lines emphasized by the EU to assure 160 km/h speed, joining the international information systems, the maintenance of the connecting lines, reduced operation on the lines with low traffic, and the temporary suspension or the elimination of the lines with low traffic, where the careful analysis proves it to be justified. In addition to sorting out a considerable part of the rolling stock, the se-

lective development is necessary too, and particularly the establishment of the vehicle park of combined transportation.

The main objectives of *road transportation* (49% of tkm, and 87% of pkm) include the construction of highways until the country border as soon as possible, to help both the interior and the transboundary regional development, the completion of the existing radiate road system with rings and intersecting connections, the development of the capacity of the main roads, the construction of the beltways around settlements, the construction of bridges and missing elements in the system, and the improvement of the capacity, increasing the number of different level railway crossings, expanding the system of bike routes, and paved roads within settlements and the renewal of the deteriorated commercial vehicle park.

The priorities of *water transportation* (3% of tkm, and 0.1% of pkm) are as follows: the improvement of the Duna water way section above Budapest to category VI.b, the development of commercial ports in Gyõr, Csepel, Nagytétény, Dunaújváros, Szekszárd, Baja, and Szeged, construction of ports of combined shipping, the establishment of appropriate ground and railway transportation connections to ports, the development, that is the replacement with government subsidies, of the Hungarian ship park to enable them to travel on Western water ways, the revitalization of ocean shipping, the development of shipping on the Tisza and the long term establishment of the Duna-Tisza channel.

The objectives of *air transportation* (0.1% of tkm , and 3% of pkm) are: the gradual development of airports matching the demand of traffic, in the case of Ferihegy and possibly Kiskunlachaza meeting the demand of international air transportation, the continuous development of air traffic control, and the subsidization of MALEV in harmony with the subsidization of the EU member states.

Concerning *pipeline transportation* (16% of tkm) the dominant reliance on Eastern systems decreased by connecting to the Slovak natural gas system. (In the case of crude oil, the Adriatic pipelines assured this earlier.)

In combined transportation, the aim is to ship 3-4% of the export-import and 15-20% of the transit traffic with the supporting investments of sub-sectors and the development of the transfer terminal system.

The priorities of urban and suburban transportation are: to reduce and stop the decline of public transportation, for achieving it, the renewal of the vehicle park, the establishment of P+R parking and bicycle storage, the creation of transportation alliances and tariff zones. Limiting car traffic in historic, recreational and resort areas, the establishment of comprehensive regulations in general restricted traffic and pedestrian zones, and the regulation of commercial traffic. Priorities in Budapest include the enlargement of the crossing capacity over the Duna, the reconstruction of

the traffic level railway crossings, the construction of large capacity parking areas, and increasing the capacity of the roads to Ferihegy (in the long run the improvement of public transportation to the Airport). The development of the exterior ring road network, the examination of the possibility to connect railway transportation into the public transportation system and the development of the metro system in the long run.

We can conclude that these objectives do not follow any of the strategic objectives, only the initiatives of the sub-sectors. The transportation policy did not define functions and priorities, which would have guided the sub-sectors in defining their objectives and a distribution of functions. Under these circumstances, each subsector attempted to connect to the goal of developing our transit role, and considered it the successful strategy from the point of view of joining the EU as well as for obtaining government subsidies. In the lack of guiding principles, these initiatives became part of the porgram without any selection.

In this system, the analysis whether the environmental policy objectives are present in the transportation policy or not, is not relevant. As the transportation policy does not have an underlying concept, the well-defined objectives could be omitted or could be used but they do not present a real guiding principle.

The period since the approval of the policy reflects this conceptual uncertainty. The approved transportation policy does not play a role in the currently discussed strategy of MAV, neither in highway developments. The decision between government subsidy or concession, the priorities of highway construction in terms of timing and direction, takes place without any underlying concept (instead of M8, M6; Slovene railway connection, the use of the road fund for highway construction, immediate development of the metro, the analysis of the shipping on the Duna).
To conclude: the transportation policy has been approved, however it does not have any significance. It did not present a firm guidance in issues it should have; therefore, it does not serve as guidance even for those who prepared it. The environmental analysis does not have any significance either, although the fact that the protection of the environment appears as a strategic direction shows that at least on the level of principles you can not ignore environmental considerations any more.

3.5.2 Other development strategies

We will discuss three additional development strategies:

a. Sub-sector strategies, which strengthen their own approach. These strategies always exist and the role of the approved transportation policy should have been to set limits to these intentions. As we could see this did not happen.

b. Government policies, which overrule the sector level policy (relationship with the neighboring countries, EU). Another objective of the transportation policy would be to offer a consistent framework for the government on the possible alternatives. This did not happen either. The problem is not that the improvement of Croatian, Slovene or Romanian political relationships raises the issue of developing the transportation to a certain direction. The real problem is that there is no sectoral concept that would enable us to follow at least those measures that correspond with the strategic directions within the transportation policy (the promotion of the EU relationship, and the relationship with the neighboring countries), and on the basis of which we could evaluate the new possibilities and the ways they could be incorporated into our plans for the interest of the country. Instead of this, every new idea completely overturns the strategies declared previously.

c. Alternative development concepts, that take into consideration the environmental considerations. These concepts exist, the Ministry of the Environment commissioned their preparation in line with the transportation policy.

Obviously, the detailed analysis of the alternative strategies is not relevant for the current study. The differences between the alternative strategies and the approved strategy include not only the content but also the social integration of the transportation policy and the flexibility of the method of discussion. In addition, the difference in priorities and as a consequence, the differences in the results should be underlined. The objectives can be satisfied in an integrated context of regional policy, urban development and transportation policy. As part of this approach, the transportation policy appears as a comprehensive system and is not dissected into sub-sectors.

- The international, national and local levels should satisfy their own tasks in this order, the development of the higher level can not deteriorate the maintenance of the lower levels.

- The key issue of *local or urban transportation* is that the use of cars should not appear more preferable than public transportation. Otherwise, everybody who can, will chose the car which will result in the deterioration of the quality of transportation. (By increasing road capacity this problem can only be delayed and aggravated.) The solution can be approached from two directions: first, from the development of public transportation (preferring public transportation, separate lanes, good transfer possibilities, alternative routes, high number of relations, connection of the railway into urban public transportation etc.) and second from restricting the abilities of private transportation (traffic free zones, equal rights to bicycles in calmed traffic zones, making the crossing of residential areas more difficult, strict parking order, the restoration of the

respect for the pavements, imposing the costs on those who use the services etc.)

- The role of the car increases considerably in *regional transportation* (however, not in metropolitan areas, where the railway can remain profitable too.) The cooperation and the relationship of smaller settlements depend primarily on the well-maintained road system, enabling both private and public transportation. The well operating secondary road system is the precondition that the local residents could realize the regional benefits from the connections to the basic road systems and to the major routes. In the case of national connections, the railway has a major role both in passenger and in product transportation (e.g. inter-city).

- In international, long distance lines, the railway should receive priority. However, we have to accept, that if there will be enough solvent demand for the maintenance of a toll highway system, it will be constructed. The trends that the renewal of the main railway lines is prioritized after the construction of a new highway in a particular direction, is unacceptable.

- If we summarize the above-mentioned principles by sub-sectors, we conclude that *road transportation* serves mainly the local public transportation and the short distance regional passenger and product transportation and in other relations the special, occasional connections. The areas of *railway transportation* include the metropolitan area, including commuter passengers, inter-city traffic, long distance and international transportation, with special emphasis on transit. The *air transportation* serves primarily international connections, (which does not necessarily mean that the destination is has to be Budapest). *Shipping* can take over the traffic from the railway close to waterways in addition to satisfying the needs of tourists and crossing.

A concept and measures, based on these principles, discussed in public by the sector, would assure considerable environmental impacts as well, without compromising the objectives of transportation for environmental considerations.

4. THE OBJECTIVES OF THE NEPP CONNECTED TO TRANSPORTATION

4.1 The enumeration of objectives of the NEPP and the underlying environmental problems connected to transportation (*Table 2*)

NEPP code	NEPP objective	Underlying problems (related to transportation)	Essential cause, mechanism
AIR-1	In settlements polluted with dust and toxic solid materials the pollution should be reduced with 20% in six years and the pollution should not increase in other settlements.	See AIR-3	
AIR-2	An outstanding objective is to improve the air quality of seriously polluted regions in the country so that they would satisfy the moderately polluted qualification.	See AIR-3	
AIR-3	The reduction of transportation emission.	Local level: see SET-1. National level: deteriorating share of railway/road and private/public transportation; decline of local-regional connections as opposed to long distance (mainly hierarchical) connections, inappropriate network structure, distorting tariffs.	*The trap of the existing radiant system: the strengthening of the existing system seems to be efficient all the time. More development in the point of congestion.*
AIR-6	The reduction of sulfite and nitrogen compounds to a level that the acidic deposit from the atmosphere remains under the critical level.	See AIR-3	
CAP-3	The establishment and the enforcement of a comprehensive economic and legal regulatory system.	Direct occupation of the land by transportation: speed (following distance, wide lanes) parking, extended junctions, industrial facilities. Indirect occupation of the land: restructuring settlements, streets become transit zones, deteriorating neighborhoods due to air and noise pollution.	*The trap of winning distance: while we get further with greater speed, the space in between becomes unsuited for human life.*
SET-1	Reduction of air pollution in settlements according to the policy of	In the short run: outdated vehicles, lack of maintenance, in-	*Private transportation is quicker today. The decision*

NEPP code	NEPP objective	Underlying problems (related to transportation)	Essential cause, mechanism
	the local governments.	creasing car traffic, badly organized and not integrated public transportation. In the long run: overwhelming use of private cars, inappropriate road network, indecisive traffic control, inappropriate urban structure, transportation planning according to traffic flow, distorting price systems.	*of passengers to use cars if they can is justified which results in loss for everybody in the long run. Until urban planning and urban policy does not change this difference, we can not expect a change.*
SET-4	The reduction of the negative impact of noise and vibration pollution in settlements.	The lack of passive protection. See also SET-1, long term.	
SET-6	The involvement of the population in environmental decisions and enforcement.	Outdated planning and urban management, the „we know it better" approach.	*The transportation policy sector considered its main objective to clear space for the motorized transportation and the satisfaction of demand.*
SET-7	The improvement of the cityscape and the general cleanliness of cities, the implementation of action plans.	The loss of respect for the pavement and regulations not enforced. See also SET-2.	
SET-9	The rehabilitation and revitalization of settlement neighborhoods, with special emphasis on historical centers.	According the principles accepted previously, private cars should be able to pass everywhere, and the environment should be adjusted to this requirement.	
HUM-1	Reducing the micro component content (of less than 10 and 2.5 micrometer) of floating dust with at least 10%.	See AIR-3	
HUM-2	Improving the interior air pollution.	See AIR-3	
SET-2	The establishment of the national network of national parks including the Duna-Ipoly, Koros-Maros and Balaton national parks under construction	The main transit transportation corridors can not cross through protected regions (and densely populated areas).	*The government subsidies are devoted for major projects; the local interest is to assure that by directing the main highways through a region, the local transportation can also be improved as well.*
SET-5	The protection of the natural areas, with special emphasis on plant and animal populatoins.	See SET-2	
LANDS-	(..) The vision of land use should	Active: the distorted transpor-	*The trap of the existing*

NEPP code	NEPP objective	Underlying problems (related to transportation)	Essential cause, mechanism
4	be worked out by considering the National Settlement Development Concept and environmental protection objectives.	tation network influences the distorted land use patterns. Passive: See SET-2	*radiant system: the strengthening of the existing system seems to be efficient all the time. More development in the point of congestion.*
LANDS-5	The efficient methods of landscape protection should be developed.	See LANDS-4	

4.3 Relevant international requirements

Although the Fifth Environmental Action Program (5AP)can not be considered as an international obligation in the strict legal sense, as a direct precedent of this study, it requires outstanding attention. The objectives and the approach presented in this program is in perfect harmony with the analysis we would like to present here, therefore, we think it is justified to accept and further refine the objectives of the 5AP as a basis of our national discussion.

The 5AP enumerates six main strategic objectives to reduce the increasing congestion and environmental pollution caused by transportation:

1. improving urban development and planning (land use)
2. better management to use the existing tools more efficiently and the enforcement of the external costs (including the environmental costs) of transportation in investment planning and operating fees
3. the improvement of the competitive position of the „clear" transportation subsectors : railway, inland shipping, ocean shipping and combined transportation,
4. the development of public transportation
5. the development of technology leading to less polluting vehicles and fuels,
6. The promotion of the reduction of private car use.

Among these objectives point (1) is connected to urban policy, point (2) is related to the (expansion of) economic measures, (3) to the distribution of functions among the sub-sectors, (4) and (6) to the distribution of functions between private and public transportation and only (5) deals with emission reduction and the enabling technology. These strategic objectives were defined on a level from where we expect results too.

To achieve these objectives, measures could be taken *both on the demand as well as on the supply side* (only the technological development under (5) concerns the

producers of vehicles and fuels, that is the strict interpretation of the supply side, but we can interpret the supply side as the system of *every* technological development that reduces emission.)

The measures for each strategic objective, which influence both the demand as well as the supply side, are summarized *in Table 3*.

	Strategic objective	**Measures (examples)**	**Tool**
SUPPLY: Infrastructure	(1) (2) (3) (4-6)	(1) Transit routes and highways avoiding the capital and the protected regions, restricted traffic zones and passenger zones in settlements. (2) Highway construction in concession (3) The immediate reconstruction of railway lines to reach the 120 km/h speed (4-6) The improvement of urban public transportation and the restriction of private transportation	(2)
SUPPLY: Fuels and vehicles	(2) (3) (4-6) (5)	(2) (3) Purchasing vehicles for combined transportation (4-6) Comfortable and reliable urban public transportation vehicles (5) Technological development to reduce emission	(2)
DEMAND: Traffic and customer behavior	(1) (2) (3) (4-6)	(1) Cityscape, density of shops, pavement expansion, moderation of traffic, improving transfer possibilities, (2) Urban paying zones, the fee depending on the part of the day and the zone, (3) Development of suburban trains routes, combined transportation, reduction of road transit traffic (weekend, summer, weight) (4-6) Preferring ground public transportation: bus lanes, the exclusive use of certain streets and bridges, transportation alliance.	(2)

Reminder: Strategic objectives

(1) Urban and land use planning

(2) Cost sensitivity on externalities as well

(3) Better distribution of labor among sectors

(4-6) Better distribution of functions between private and public transportation

(4) Technological development to reduce emission.

We tried to show that it is important to consider both the demand as well as the supply side measures on the basis of the strategies. The actual situation is even more complex: not only do the demand and the supply sides need separate measure but also the international, national and local levels require targeted measures. Therefore the third column in the table should be separated into three parts. This new table will be presented in section 6, at the analysis of the proposed measures. The strategic objectives will also be refined; therefore, the table will be slightly modified.

5. THE ENVIRONMENTAL IMPACT OF THE TRANSPORTATION SECTOR RELATED TO THE NEPP OBJECTIVES

The background materials of the Hungarian Transportation Policy enumerated the main environmental problems caused by the transportation sector, including the following (in the order of significance): air pollution from private cars, noise and vibration, noise from air and railway transportation, collection storage elimination and recycling of waste, solid and water pollution from cars and their operation, maintenance and repair related nature and landscape protection, risk of hazardous material transportation. The list and the order of significance is characteristically focuses on emission. The list should be completed with the impact of transportation on land use and the built environment. We should not forget however, that (according to the principles of this study) cars with theoretically 0 emission, 0 consumption, and 0 cost, would induce environmental problems as well, which would require strict restrictions on car traffic in cities. Nevertheless, we believe it is important to describe the influence of transportation on each environmental factor. The basis of our analysis is the background studies of the Hungarian Transportation Policy completed with available uptodate data.

5.1 Air

Air pollution is a serious problem in the country and it influences the most densely populated areas. Forty-forty two percent of the population live in areas with polluted air.

Air pollution generated by fuels, including transportation function, is presented in the next Table for the period 1990-1995. Transportation contributes to the carbon monoxide and nitrogen oxide emission considerably (with 80 and 56% respectively). In addition, the emission of volatile organic particulate (VOC) of the transportation sector is significant as well.

In 1991, car traffic was responsible for 44% of the nitrogen oxide, 53 % of the carbon monoxide, 58% of the carbohydrate and 10% of the carbon dioxide emission according to the background studies. These data are difficult to compare, but give a picture on the determining role of car traffic in the emission of certain compounds. From the emitted materials 26% of the nitrogen oxide, and 68-68% of the carbon monoxide and carbon hydrate pollute the air of cities.

POLLUTANT	TOTAL	TRANSPORT	TRANSP/TOTAL	TOTAL	TRANSPORT	TRANSP/TOTAL	TRANSPORT
	1990	1990	1990 [%]	1995	1995	1995 [%]	1990=100
CO [Gg]	733,6	564,8	77,0	606	497,9	82,2	88,2
NO_X [Gg]	199,6	111,3	55,8	180,5	101,5	56,2	91,2
N_2O [Gg]	7,25	0,86	11,9	5,75	0,77	13,4	89,5
CH_4 [Gg]	16,13	1,55	9,6	12,06	1,4	11,6	90,3
CO_2 [Gg]	74200	8780	11,8	65875	7906	12,0	90,0

Source: Hungary: Stabilisation of the Greenhouse Gas Emissions. Hungarian Commission on Sustainable Development 1994

Table 4. Share of transport in the air pollution of total fuel emission

According to *Table 5*. the main source of emissions from the transport sector is road transport

	CO	CH	NO2	SO2	Pb	Solid	CO2
Road vehicles	433,51	68,62	82,75	6,71	107	12,3	6260,23
Rail	1,45	0,48	6,72	0,39	0	0,05	300,81
Inland waterways	1,73	1,21	4,59	0,26	0	0,41	252,88
Ferihegy airport	0,5	0,23	0,18	0,01	0	0,01	110,96
Total	437,19	70,54	94,24	7,37	107	12,77	6924,88

	CO	CH	NO2	SO2	Pb	Solid	CO2
Road vehicles	99,16%	97,28%	87,81%	91,04%	100,00%	96,32%	90,40%
Rail	0,33%	0,68%	7,13%	5,29%	0,00%	0,39%	4,34%
Inland waterways	0,40%	1,72%	4,87%	3,53%	0,00%	3,21%	3,65%
Ferihegy airport	0,11%	0,33%	0,19%	0,14%	0,00%	0,08%	1,60%
Total	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%

Source: KTM 1996 (Adatok a környezet állapotáról)

Table 5. Total emissions in 1994 [kt/year]

The lead emission from transport of 673 kt/y in 1980 and 387 kt/y in 1991 has been reduced to 107 kt/y by 1994. Also the asbest emission was reduced considerably compared to the beginning of the 1990s due to their serious and depicted health consequences. The introduction of unleaded gas in commercial sale resulted in an

important positive imission change: earlier the lead imission on the main roads of Budapest reached 6-8 times and in outstanding cases 20 times of the limit. This is a good example for when a direct, immediate intervention to reduce emission is justified due to the health hazards. (Although the reduction was achieved when gas production was increased to an appropriate capacity with the help of technological developments.)

There have been several attempts to reduce emission with technological intervention, such as the introduction if catalytic converters and diesel engines in public buses. In these cases partial problems were solved without reducing the traffic. At the same time the pollution map of the capital corresponds with the most frequented transportation lines; therefore, it is justified to examine other long term methods of emission control that aim at eliminating the sources of emission which may not even be present at this time. These methods include (from inside to the outskirts of settlements): restricted traffic zones, passenger zones, traffic free zones, high level public transportation, seasonal and weekend restrictions, bypasses around settlements, directing transit traffic to railway, and prohibiting transit traffic, including urban policy and land use programs that reduce traffic. The same is true for all the other types of emission as well.

As a conclusion: the traditional interventions target fuels and vehicles, which should be completed with measures, aiming at infrastructure and traffic (demand side) on the national, international and local levels.

5.2 Water

Concerning water pollution, the background studies mainly focus on sewage and oil emission problems, adding that the share of the transportation sector in these emissions do not exceed 5%. These issues emphasize vehicle maintenance and refueling technologies and consumer behavior.

Two other areas need attention. The first is the ground waters in resort destination areas and the induced transportation. The experience with Balaton, reservoirs and rivers show that when the barriers of limited access to these places are eliminated, it results in the quick deterioration of the resort. Later considerable amounts of money are devoted to artificially maintain acceptable living conditions in these waters. It is not acceptable that accessibility and the considerations of local environmental capacity are separated from each other, even temporarily. This is true for every resort, as well as for inner cities, or for a whole country. The transit highway close to the Balaton currently under planning would result in a new source of environmental pressure as well.

The other important issue is water transportation: the river is not only the subject of pollution (this aspect has been mentioned at other sectors as well) but it is also the infrastructure of the water transportation. Experts refer to the needs of water transportation when they prepare plans to restructure the bed of the Duna. Therefore, water transportation can be considered as a source of environmental pressure and related costs. In harmony with our principles, the reduction of traffic should be considered here as well. The traffic and the size of the vehicles should match the capacity of the environment, that is the waterways.

As a conclusion, we need to consider water transportation as a source of direct environmental pressure on our waters, as well as the long term and direct impacts on ground waters in resort areas and on the infrastructure of water transportation.

5.3 Land

The most widely discussed aspects include the land as the receiver of waste and a part of the food chain transferring pollution to plants and animals. Lead pollution, mentioned related to air, is an important source of hazard here as well.

Similarly to waters, the recreational functions of the green areas are served by transportation. However, after a certain point the development of transportation may lead to overloading a region or may get into conflict with the other functions of an area, for example if the transportation functions are developed at the expense of the green areas.

Finally, the surface, as a limited source of living space, should be considered here, of which transportation directly uses increasingly larger areas, and more importantly, devalues and vacates even larger areas, while concentrates values in other regions. Altogether, this process results in a loss of land, which is definitely a kind of pollution (you can debate whether the financial balance of the process if positive or not: if the concentrated capital in one area exceeds the amount deprived of the other).

As a conclusion, we considered three important impact categories of the transportation sector: the land used by transportation, the land polluted by transportation and finally the land under the indirect pressure of transportation.

5.4 Communal and built environment, human health

The local environment corresponds with the target area of our examination as the local dimension of transportation. In the Table under section 6, we enumerate the different functional zones of a settlement, which present different protection categories. The protection is sough to be assured along the three dimensions of transporta-

tion: local/transit, non-motorized/motorized, and public/ private transportation, enforcing different priorities locally.

5.5 The nature and the landscape

Separate legal regulations guide the protection of outstanding natural values. Nevertheless, according to the background studies of the Environmental Protection Policy, from the conflict between nature and landscape protection and transportation development (land use, separation, and traffic control) always nature and landscape protection got out as a loser. The result is the deterioration of living space, the narrowing of the natural space of certain plant and animal species and the reduction in the number and the expansion of species. The perdition of amphibious and the migration of certain species, especially that of the birds, is particularly high.

Concerning the landscape, the lack of order in the built environment is a pollution factor, including remaining building plants, transportation lines, and depositories after the equipments start to operate in traffic.

We should also emphasize the possible disadvantageous impacts of the completed facilities as well, if the transit traffic is not in proportion with the environmental capacity of the area. In these cases the recommended principle is *bypassing* the area, that is already in the phase of planning the conflict with valuable areas should be prevented.

Transportation infrastructure, vehicles and traffic all play a role in the deterioration of the landscape and the nature. The disadvantageous impacts strengthen each other; therefore, it is advisable to begin protection at the planning phase when the direction of the routes is defined.

5.6 Landscape

Traffic, vehicles, fuels as well as infrastructure have a different, but significant impact on waste emission.

The railway, air and water transportation sectors all produce waste in a considerably concentrated way, which remains in the vehicles or is collected in ports, railway stations under industrial conditions. Car traffic and the urban passenger traffic produce dispersed waste.

The oil pollution of fuels and vehicle maintenance has been discussed under the sections on sewage and land. A separate category is the bodies of the cars and the tires themselves. The recycling or the reprocessing is not solved in other of the cases, and nobody is interested in collecting the waste. Production fees and deposits would

be significant incentives. However, the actual processing of this waste should also be solved.

The closed and deserted facilities of infrastructure, such as airports, certain sections of railway lines and stations are seldom considered as waste. The problem is the same as in the case of construction sites: the lack of the renovation of the area after the facility is closed. The difference is that in this case, the remainders of the facilities are buildings that are more difficult to eliminate. What is more, they do not have a real owner; the local municipality takes them over as an obligation.

In addition to waste emitted during the operation of the traffic, the equipments and facilities present a considerable environmental problem too.

5.7 Noise and vibration

In Hungary, every third apartment is noisy and 90% of the complaints are originated in transportation.

At the beginning of the 1990s, the increase of noise pollution generated by transportation slowed down, due to the gradual modernization of the vehicle park (or that the use of modern vehicles expanded). Even then, in the neighborhood of highways and main roadways, the noise emission exceeded the 65 dB standard noise level with 10dB.

In Ferihegy, the area polluted by noise decreased, due to a change in the composition of the vehicle park. There was no change in the area of railway transportation. Especially in resort areas, water banks, during the night, and around marshaling yards, the disturbing influence of the railway transportation can be depicted. The problem of trams in cities is similar as well.

The official plans support the technological solutions, the introduction of more silent vehicles, the modernization of railways and the replacement of pavement in cities. We should add however, that an important active protection method is the reduction of mobility in densely populated zones, by creating restricted traffic or traffic free zones, and by bypassing the settlements.

For the reduction if noise and vibration, the intervention can target both the vehicles and the route as well. In the area of traffic control, the direction of traffic and the introduction of restriction measures are possible.

5.8 Environmental security

Under this point we discuss the transportation of hazardous materials and the security of transportation.

Between 1985 and 1995, similarly to other Eastern-European countries, the number of traffic accidents increased heavily in Hungary. Since then the situation has improved somewhat, but the earlier low level could not be achieved. Road transportation has an outstanding role in this process: it is responsible for 98% of injuries and 93 % of deaths from traffic accidents.

The level of seriousness of the accidents in Hungary exceeds that of the Western countries significantly.

6. TRANSPORTATION SOLUTION ALTERNATIVES RELATED TO THE NEPP OBJECTIVES

It is important to emphasize that solutions *can not be directly related to environmental problems*. First we should find what generates the environmental problems (including transportation) and relate the solutions to the underlying mechanisms *(see 4.1 section)*. The programs should change *these mechanisms* and replace them with new ones. The new programs are projected by the strategic objectives of the transportation sector, emphasizing that the satisfaction of certain conditions outside of the sector are required as well (economic, social and political conditions). The existence of these conditions, their actual level should be examined, while the transportation policy and other government policies can support them.

Let’s enumerate these five mechanisms again:

Basic cause, mechanism
The trap of the existing radiant system: the strengthening of the existing system seems to be efficient all the time. More development in the point of congestion.
The trap of winning distance: while we get further with greater speed, the space in between becomes unsuited for human life.
The trap of winning time: Private transportation is quicker today. The decision of passengers to use cars if they can is justified which results in loss for everybody in the long run. Until urban planning and urban policy does not change this difference, we can not expect a change.
The whole transportation policy sector considered its main objective „to clear space" for the motorized transportation and the „satisfaction of demand".
The government subsidies are devoted for major projects; the local interest is to assure that by directing the main highways through a region, the local transportation can also be improved as well.

All of the mechanisms can be considered as traps; the solution seems to be evident and straightforward, the most urgent measures are always introduced immediately, however the situation does not improve in the long run, what is more, the same problems are raised again and again, even more seriously. The repeated failures should make the urban planners and transportation experts consider new ideas. However, finding a new solution requires to step out of the earlier line of reasoning, that was evident for us.

- The trap of developing the road network warns us that the local developments are incorrect reactions to the congestion problem (for example with the local widening of roads to locally reduce congestion). The aim is to realize that it was the transportation policy itself which caused the current level of congestion with „:similar solutions": instead of adjusting the space to the transportation, on the contrary, the transportation should be adjusted to the capacity of the environment (positive examples: the Castle, Margaret Island, the traffic regulations in some inner cities .)

- The trap of winning distance should make us realize that with the increasing speed we can not reach more destinations in the long run, but rather we cut the number of and pull closer the same destinations. What used to make a whole street colorful, became a concentrated mall, accessible only by car, and in any case we are required to cover a longer distance.

- A traveler can chose only from the available possibilities. If he thinks that with car *he can get somewhere with more certainty,* despite of the con-

gestion of the traffic, he will take his car. He will not realize that the situation is deteriorating *because* we all decide this way. Even if he does admit it, he can not change the situation, because the car is a better solution for him. This situation can only be changed by the leaders of the city: the solution is to deteriorate and not to improve the conditions of car transportation as everybody requires, so that cars will not be preferred to public transportation.

- The phase of transportation planning when the improvement of the traffic flow was the objective even at the expense of taking over pavements, placing stops away, forcing passengers to make a detour, and spoiling transferring possibilities. The priorities should be reversed, the interests of walking passengers, passengers on public transportation, bicyclists what is more of cars should preceded the improvement of transportation flow in inhabited areas.

- The number of *transit regions* is increasing if we travel by a quicker vehicle which can take us further, especially if we consider that there is only one departure and destination point of such a trip too. The transportation policy profession forgot the importance of destination, and was only concerned with industrializing the transit. Servicing the destinations should be first priority, even by giving preference to transit, if needed.

A sustainable transportation policy should clearly interpret the existing alternative pairs listed above. The two sides of the alternatives do not exclude each other, but can exist together and complete each other in a distribution of functions, however, we can not avoid prioritizing them. (or as we have shown above, to point out that the previous policies created such priorities too, on purpose or unintentionally, not in a good direction.) In the following we will examine the next categories:

- non-transportation solution / transportation solution
- environmental friendly transportation methods / environment polluting transportation methods
- pedestrians / motorized traffic
- local traffic / long distance traffic
- public transportation / private transportation
- traffic with a local destination / transit

Non-transportation solution / transportation solution

We can not declare a priority which would suit all cases. We have to emphasize however, that the improvement of certain services may not be related to transportation. It is well known for example that the under-priced public transportation induced more pressure on the sector for the rational interest of other sectors (e.g. concentration of administrative functions, schools, health care and trade). The local provision of goods seemed to be inefficient because transportation was so cheap. We can not state that in all cases not using transportation is the best solution, however only if the consideration of the actual costs, including external costs, makes it possible to compare the alternatives.

Environment friendly transportation / environment polluting transportation methods

The selection can not be reduced to water-rail- air transportation. On the one hand this order is not generally true, on the other hand, the following considerations along different dimensions are equally important.

Pedestrian vs. motorized traffic

Most of the mobility inside a settlement and overall is pedestrian traffic. By increasing the respect, priority and protection for pedestrian, traffic does not mean that long distance motorized traffic can be replaced by walking. On the contrary, we would like to point out that the process is more complicated: the unfavorable conditions in the street frighten the inhabitants from walking even for shorter distances, and due to the decrease of the traffic, the destination closes down, and even those will take their cars, who would not have done so.

Bicycle transportation is not a question of developing expensive bicycles routes (e.g. in Adrassy Street) but on the contrary to even professional opinions, the normal use of dense inner city areas (not the pavements). We could achieve this if the city introduced a 30 km/h speed limit which would reduce the traffic and the bicycle became an equal participant in transportation.

The *push-cart* can replace the car in passenger zones, such as in railway stations and malls.

Strollers and wheelchairs would require clear and appropriately formed pavements, and would contribute to the comfortable pedestrian traffic.

Local traffic / long distance traffic

Half of the total traffic, 75% of the number of trips and 100% of the destinations emerge inside settlements. Therefore this sub-sector categorized under urban transportation, requires greater attention.

The *conflict* of transportation and *other activities* and the lifestyle of residents is the clearest in this sub-sector. It is not by chance that this was the first area, where the principle of better transportation was replaced by the principle of an environmentally more suitable transportation.

Furthermore, those measures that can be introduced in settlements and become accepted, directly influence *long distance transportation* as well. Those residents who use their cars in cities, tend to use their cars in long distance transportation as well. If, however, car traffic is uncomfortable in a settlement, passengers may consider the train, especially if they expect the same problem in the destination too.

Public transportation / private transportation

We have already explained that the difference in time between public and private transportation directly influences the decision of a passenger. An essential question of traffic management is that the measures and the induced changes in traffic correspond with the declared objectives. The use of public transportation can be supported in two ways. First pedestrian passengers should be preferred and second car traffic should be restricted (in a differentiated and justified way). The two approaches together lead to the improvement of urban transportation.

Table 6: Development tasks according to zoning and sectoral priorities

ZONE / SECTOR	PROTECTED TRANSPORTATION AREAS	ZONE 1 IN INNER CITIES AND THE CENRTRAL CORE OF OTHER ZONES	MOUNTAINIOUS AND GREEN AREAS	ZONE 2 IN INNER CITIES AND THE OUTER CIRCLES OF OTHER ZONES	TRANSPORTATION CORRIDORS OF MIXED ZONES	TRANSPORTATION CHANNELS IN SUBURBAN ZONES
PEDESTRIAN	developing pedestrian zones and corridors	developing pedestrian zones and pavement	development of streets with small traffic as yards	development of pedestrian corridors	separated lanes next to high-ways	f separated lanes next to highways
BICYCLE	development, in pedestrian zones restric-tions	development, new regula-tions of traffic lanes	development, securing traffic priori-ties	development, new regula-tions of traffic lanes	f separated lanes next to highways	separated lanes next to highways
PUBLIC TRANSPORTATION	differentiated restrictions by tools	analysis and the improve-ment of serv-ices within the zone	analysis, environment friendly de-velopment of transporta-tion routes	development of railway routes and diagonal connections	radiant and diagonal rapid public trans-portation, the development of interior con-nection	radiant and diagonal rapid public transporta-tion, the development of interior connection
PRIVATE CARS (DESITNATION TRAFFIC)	significant restrictions differentiated by sources in tome and area	restriction differentiated in time and speed limit	development, the better enforcement of local inter-ests	development, the better enforcement of local inter-ests	development, P+R centers	develop-ment, P+R centers
TRUCK TRAFFIC AND LOADING (LOCAL TRAFFIC)	significant restriction by volume, time and area	significant restriction by volume, time and area, night hours preferred	significant restrictions, night hours preferred	development of regulations on volume by time and area, restric-tions	development, storing and processing services	develop-ment, stor-ing and processing services
PARKING	occasional restrictions, restrictions differentiated by source, time and space	restrictions differentiated by sources, time and area	supporting private devel-opments, restriction on public areas	development outside of road surface, on roads and pavements restrictions	development, construction of P+R systems	develop-ment, con-struction of P+R systems
PASSENGER TRANSIT	prohibition	prohibition	significant restrictions, occasional prohibition	restrictions, reducing advantages for transit	development on main high-ways, other-wise restric-tions	development on main highways, otherwise restrictions
GOODS TRANSIT	prohibition	prohibition	prohibition	significant restrictions and occa-sional prohi-bition	development on main high-ways, other-wise restric-tions	development on main highways, otherwise restrictions

Source: The main objectives of the transportation development of Budapest. Fomterv, Budapest. August, 1994. Further developed in: The Hungarian Transportation Policy in an Environmental Value System. Hungarian Transportation Club, Budapest, November, 1994.

Local destination traffic/ transit traffic

Transportation management focusing only on the smooth flow of traffic often subordinates even car transportation to this objective (by restricting stopping, turning, one way streets etc.) (At the same time, these policies disadvantage pedestrians and public transportation passengers as well. In this section we discuss the need for changing the priorities within car transportation only.)

The transportation regulations do not consider the transit of trucks as an important congestion factor, however the stopping of these trucks for unloading they do. From the aspect of the traffic flow this differentiation is justified, however from the point of view of the life of a city it is completely unjustified: why would trucks go through areas where they can not transport goods?

The same conflicts of priorities can be depicted in regulating commercial traffic and the stopping restrictions of private cars in densely populated streets.

The conflict of local and transit transportation is intense in long distance (national and international) traffic as well. The legal regulations took out the management of the transit sections of the main highways in settlements from the hands of the municipalities and declared the national transportation authority to be in charge of them (while the management of the other parts of the road system is under local management). This policy subordinates the integrity of settlements to the smooth national traffic flow. The situation is similar when we attempt to establish a higher level system (highways, metro) by breaking down or reducing the existing system and by establishing forced connections between them. (This is what happens when the traffic needs do not justify a new investment, and the forced connections channel the traffic to where it would not go.)

- *Table 6* on the previous page presents a development concept for Budapest that differentiates transit and local traffic by zones, including restrictions and developments. The darker tones show the increase in the strictness of restrictions. (the table gets darker from right to left (protected zones) and top to bottom (transit traffic)). The concept is a good example for the priorities mentioned earlier, because it prefers pedestrian traffic as opposed car traffic and public transportation as opposed to private transportation.

The development of the main transit arteries (highways, TGV, metro) require huge investments, and significant interest groups lobby for their construction. For the

sake of their acceptance and for gaining larger government support, the myth and propaganda for the economic multiplicator effect of transit routes is strong. On the contrary, the long distance connection does not induce economic development in itself, only if it can strengthen existing local capacities. One of the main incentives of the vitality and competitive potentials of a region is the level of local cooperation which is supported by the connections inside a region. The construction of transit routes at the expense of these essential systems, hinder the possibility of a local economy to gain anything from the transiting goods. We have to accept that transit transportation can not be eliminated, but its disturbing influence can be reduced. The available measures include the substitution of railway transportation for road transportation by charging high tolls that include the external costs, and directing transit routes away from valuable regions.

The regional, national and local connections need to develop in a harmonized way, this is the only way we can benefit from the advantages of these connections.

Water / railway / road / air transportation

While shipping goods by a natural river is considered to be the cheapest and the most environment friendly method of transportation, the reality is more complicated, if a river, the ports or the vehicles do not satisfy our requirements and would need further investments or if the volume of goods (that can be transported by water) is so small that it does not assure our profit, and the railway is our competitor. As we have seen 3% of the transported goods is shipped by water even today. The basis of the development of this sub-sector could be the difference between the transportation costs by water and by railway.

The environmental and economic advantages of railway transportation is not absolute. The monopol situation of the railway in long distance transportation in the last century will not be repeated again, because at that time, its only alternative was the carriage which could transport goods to maximum 20-30 kilometers. Even so, some of the analysis compare the situation today with that of the last century. Railway transportation, including trams, metro and commuter trains, can be efficient where the demand is concentrated towards a certain direction. In these areas the high costs of operation and maintenance can be allocated among a large number of passengers. The consequent enforcement of external costs would put the railway to a much better position as opposed to road transportation. However, even then, the competitive potentials of the railway would be limited to metropolitan commuter transportation, public transportation (connecting radiant metro lines in Budapest eg.) long distance inter-city transportation and concentrated freight transportation (primarily long distance and international relations.)

We have extensively discussed the possibilities to reduce road transportation. The reduction is desirable in large cities and in those relations where concentrated

freight transportation can be taken over by the railway.(Road transportation can only be reduced if we can replace it by e.g railway transportation, and where the alternative method can prove its ability.) The potential territory of cars include regional transportation among scattered settlements and the satisfaction of occasional and special transportation needs. This list does not seem to be large at the first sight, however, we do not expect a quick break through.

One of the main competitors of air transportation is the high-speed rail which takes over the service among settlements in relatively close distance with each other (500-600 km) in Western-Europe and Asia. In Hungary the traffic does not justify such an investment yet to any direction. The other competitor is informatics, that can replace personal contacts. However, electronic contacts not only substitute but create relationships too which may induce more personal contacts and freight transportation.

6.1 Technical solutions

Our approach aims at solving environmental problems together with transportation problems. As a consequence, our solutions are not special environmental solutions and do not require funds from the environmental sector.

Our solutions differ from the recommended solutions of the Hungarian Transportation Policy. However, we selected from the listed measures and we also completed them with new programs. The main difference is that the Hungarian Transportation Policy did not define detailed guidelines for the large developments of the sub-sectors. These open investment possibilities practically satisfy (or exceed) the available resources until 2010. What is more, these investments attempt to achieve the same goal: the servicing of the desired transit traffic.

The large investments include the completion of the main highways (M3, M5,M7) from Budapest until the border (in the meantime M6 was added too), in the case of railway transportation, the development of the same routes (in the meantime the development of the lines to Slovenia was added). In the case of shipping, the goal is the increase of the capacity on the Duna (along the already completed M1 highway) by widening the river bed and replacing the ship park. A similar large investment is the construction of the 4^{th} metro line through the inner city.

In our proposal we emphasize the strategic objectives and main directions first, and on this basis we question the investments that are against these objectives and propose programs that are in line with them. We can not work out an alternative transportation policy in this study, therefore we would like to compare only the main directions. We include rough cost estimates too.

Costs

The background studies of the Hungarian Transportation Policy present a table on the costs of proposed developments and maintenance. The development expenses and the maintenance costs are not separated, the calculation was prepared for the years 1994-2000 on the 1994 price level. We do not know whether these numbers were taken seriously at all. Since then some of the tasks have been implemented (for example the due maintenance) some of them have been delayed, some of them were replaced by new ideas. Despite these facts, we think it is important to show this table as a comprehensive cost estimate of the transportation sector. (see Table 5.).

The experts who prepared the calculations regarded the total costs of railway infrastructure investments as a government responsibility, and thought that the development of highways, ports and airports can be implemented in concession with relatively low government subsidy.

The total cost for the 7 years is HUF 2,800 billion, the annual need is HUF 400 billion, out of which HUF 700 billion, an annual HUF 100 billion, is financed by the government.

(billion HUF, 1994 price level)

Objective	Total costs	Financed by the government	Notes
State owned public roads	355-395	248-276	
Railway infrastructure	290-320	290-320	
Water ways and ports	32-43	8-11	
Airports and facilities	56-71	14-18	
Total infrastructure	*733-829*	*560-625*	
Vehicles on roads	1390-2010	34-46	including private cars
Railway cars and operation	198-238	65-78	
Water vehicles and facilities	45-51	9-10	
Air transportation vehicles and facilities	56-61	11-12	
Total vehicles	1889-2360	119-146	
Total	**2622-3189**	**679-771**	

Source: The Transportation Policy of the Hungarian Government, Aug. 1995.

Table 7. The estimated costs of development and maintenance of the transportation sector (1994-2000)

The recent development proposals of the sub-sectors constitute a part of their preparation for the integration to the EU. However their proposals do not correspond with the items above neither in their schedule nor in their objective. It is important to look at these ideas too:

(billion HUF, 1994 price level)

Objective	Costs	Notes
Public transit road system until 2002	300	
Border stations of public roads until 2002	50	
Developments of the national main and connecting road system	not included	
Making the public pass park competitive	160	
Making the truck park competitive (200) and the establishment of the truck shippers' association (40) until 2005	240	
Further development of express ways (1500 km), one third is highway development until 2010	900	
Total public roads	1650	
Lifting of speed limits on main railway lines	130	
Rehabilitation of railway lines (120-160 km/h) until 2005	110	
Renewal of main railway lines (pressure, 2nd rail)	115	
Railway car investments 199802010	160-240	Min. 70 until 2002
Freight train car investments until 2000	17	
Electrification of 14 railway lines	105	
Total railways	637-717	
The section of the Duna above Budapest until 2010	30	
The section of Duna below Budapest 2006-2015	25	
Border stations on waterways until 2000	3	
Port developments until 2010	35	
Purchase of ships until 2005	40	
Subsidies for sorting out and operating water vehicles for 10 years	15	
Ships suitable for combined transportation 1998-2002	10	
Total water transportation	158	
Terminals for combined transportation	20-25	
Rail cars and ships for combined transportation (included in the sub-sector)	9	
Total combined, not aggregated	20-25	

Objective	Costs	Notes
Total	2500	

Source: Infrastructure and services. Workshop studies 18. Integration Strategies Workshop, February, 1998.

Table 8. The important development needs of the transportation sub-sectors (1998-2010)

Due to the enthusiasm over the integration to the EU, only those development needs received attention which were important from this point of view. Public transportation, including metro development, was omitted. Due to the lack of completed budgets, airports and the facilities of air traffic control were not included in Table 6. The annual costs of sub-sectors with investments before 2005, could be calculated by evenly allocating the total costs for the whole development period. The transportation combined will require HUF 5 billion/year (without vehicles), the mentioned developments of water transportation will amount to HUF 16 billion, railway transportation HUF 70 billion and the mentioned developments of road transportation, HUF 200 billion annually.

We have not considered environmental protection costs explicitly, but we can already state that those investments which can be justified from the point of view of environmental considerations do not exceed 25% of the total costs of investments.

It is important to compare the above presented numbers with the latest budget allowances[6]. According to these plans, the road fund will spend HUF 85.5 billion for public roads by 1998, and the planned railway developments require HUF 150 billion (HUF 25 billion/year). It is also interesting to add a correction, according to which the dam at Pilismarot will not cost HUF 600 billion but the construction will need only HUF 150 billion and the ecological, water cleaning and other complementary activities will require another HUF 150 billion.

Effects, benefits:

	gtkm* %	pkm %	Trans Pol 1994 Bn HUF/year	EU integ.1997 Bn HUF/year	Cost 1998 Bn HUF/year	
Publi road	60%	86%		200	82	
Railway	37%	11%		70	25	
Water	3%	0%		16	30-40	
Air	0%	3%				

[6] K.Sz.A: Forty billion forints for thirty thousand kilometers of public road construction. Nepszabadsag, February, 1998.

Total	100%	100%	400 (state 100)	kb. 300	kb. 150	

* without pipeline 100%

7. THE REALISTIC ENVIRONMENTAL SOLUTIONS FROM THE ASPECT OF THE TRANSPORTATION SECTOR

Under section 4.2, we explained some trap mechanisms that are hidden behind the environmental problems induced by transportation and are enumerated in the NEPP. In the introductory part of point 6, these mechanisms were attributed to the inappropriate allocation of functions in the transportation sector, along different dimensions. We concluded that we should not enumerate the problems of transportation and base our analysis on the objectives of the sub-sectors, but should attempt to solve the comprehensive tasks of transportation the most efficient way possible. One possible way is to define objectives according to the main dimensions of the integrated transportation sector. This is what was partly presented under section 4.3. The 5AP table aimed at correcting the allocation of functions along the sub-sectoral dimensions and the public/private alternative.

In the following we connect these strategic objectives with our subject with small corrections.

5AP strategic objectives:	Comment
Regional development, land use planning	In this interpretation rather a tool
Cost sensitivity for externalities too	Rather a tool, important
Better allocation of tasks among sub-sectors	Approved
Better allocation of functions between private and public transportation	Approved, consolidated in one dimension
Technological developments to reduce emission	Approved, although the starting point is different.

We completed the list with the following dimensions:

- non-transportation solution / transportation solution
- pedestrian / motorized traffic
- local traffic / long distance traffic
- traffic with local destination/ transit
-

Finally we determined the following environment-related strategic objectives at the transportation policy level:

a. *The reduction of the volume of transportation with transport-, and also with out-of-transport tools.*

b. *The reduction of motorized traffic by preferring the possibilities of non-motorized traffic.*

c. *The support of public transportation, the occasional restriction of private transportation.*

d. *Supporting environment friendly transportation modes as opposed to the most polluting modes.*

e. *Assisting local cooperation with transportation as opposed to developing long distance relations.*

f. *Supporting traffic with a local destination as opposed to transit.*

g. *The structural correction of the transportation network.*

h. *Technological developments to reduce emission.*

These strategic objectives impose different requirements on the international, national and local levels. In the next summary *Table 9* we differentiate among the measures related to the three geographical levels and the supply (network, vehicles, fuels) and demand side (traffic, needs). The table is a logical framework and helps us achieve a strategic objective with more refined and differentiated measures.

	Strategic objective	Local level	National level	International level
Supply side Infrastructure	a. b. c. d. e. f. g.	(a) zones with mixed functions (a,e) dense shop network, expanded services (b,f) restricted traffic and pedestrian zones, widening of pavements (c) good transfer possibilities (c,d) separate lanes, streets and bridges for public transportation (c) improvement of public transportation in cities, the deterioration of private transportation (g) grid structure, diagonal connections and rings	(a,b,e) developing local services (b,f) Bypass routes around settlements (c) improving railway and airport connections (d) immediate reconstruction of railway transit and suburban lines to assure 120 km/h speed (d) Highway construction exclusively in concession (e,f) the development of subordinate routes, and the crossing sections according to the interests of the settlements (g) transit and expressways bypassing the capital and protected areas	(a) promoting domestic production and employment (c) better access to the airport (d) immediate reconstruction of railway transit lines to assure 120 km/h speed (d,g) development of connecting railway lines among Eastern-European countries (d) highway construction exclusively in concession (e.g) restoring local relations near the border, regional cooperation with every neighbor (g) transit lines and expressways bypassing the capital and other protected areas
Supply side Fuels and vehicles	c. d. h.	(c) comfortable and reliable public transportation vehicles (c,h) supporting the research of the Budapesti Transportation Co. and other firms, introduction of diesel and gas fueled buses.	(d) purchasing and producing vehicles suitable for combined transportation (d) comfortable and reliable public transportation vehicles in cities (h) technological developments to reduce emission (h) the monitoring of vehicles in traffic	(d) purchasing and producing vehicles suitable for combined transportation (d) purchasing and producing railway passenger and freight cars required in international traffic
Demand side Traffic and consumer behavior	a. b. c. d. e. f. g.	(a)city scape, street facilities, shop density (b,e) the reinstitution of the respect for the pavement, preferring pedestrians, improving transfer conditions (b) traffic free and restricted traffic zones, with the equalization of bicycle riders' rights (a) preferring ground transportation.: bus lanes, exclusive use of certain streets and bridges, transportation alliance (c) paying zones in cities, with different tariffs depending on the part of the day and the location. (c.d.f) development of commuter railway, restriction of road transit (weekend, summer, weight)	(a,b,e) maintaining and expanding the local services and administration, supporting local shops (b,c,d,e,f) financial regulations allowing for the calculation with externalities (c,d) developing suburban railway lines, and combined transportation (d) restricting public road transit (weekend, summer, weight) (d) railway security, guarantees, product protection (e,f) local management of the total road network in a settlement including the crossing sections of national roads	(a,d,e,f,g) reduction of transit, directing part of the unavoidable transit to the railway, making transit more expensive, directing transit to areas where it does not disturb the local life (c) harmonizing schedules of transboundary regions (d,g) developing the railway connections among Eastern-European countries.

Strategic objectives (reminder):
a. The reduction of the volume of transportation with transport- and also with out-of-transport tools.
b. The reduction of motorized traffic by preferring the possibilities of non-motorized traffic.
c. The support of public transportation, the occasional restriction of private transportation.
d. Supporting environment friendly transportation modes as opposed to the most polluting modes.
e. Assisting local cooperation with transportation as opposed to developing long distance relations.
f. Supporting traffic with a local destination as opposed to transit.
g. The structural correction of the transportation network.
h. Technological developments to reduce emission.

Table 9. Tasks derived from the strategic goals by different requirements on the local, national and international levels. and the supply and demand side.

HUNGARIAN NATIONAL ENVIRONMENTAL PROTECTION PROGRAM

TRANSPORT SECTOR STUDY

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Budapest, February, 1998