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SUSTAINABLE ROADS – PARTS OF THE TRANSPORT CHAIN IN A GLOBALISED WORLD

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ABSTRACT

This report is dealing with transport corridors, combined transport and the design guidelines serving urban integration of main roads in Hungary.

The total length of the network of motorways and expressways in 1996 was about 400 km in Hungary, while it reached 815 km by the end of 2005. This extension is a considerable development, achieved by concentration of resources. Planned new constructions will result in a threefold increase of the network length in ten years from 2005 to 2015. The construction of about 160 km motorways per year, as expected, constitutes a significant challenge to highway engineers.

It has to be noted, that after the political changes in 1989, accelerated development of the infrastructure, including motorways, gained high priority in economic policy. Around the newly built M5 motorway statistical evidences were found, that the rate of unemployment decreased, while the export income as well as tax revenues paid in by local companies and their employees increased significantly. The quality of the infrastructure available and the accessibility became important factors in decisions about location of corporate activities and logistics. In recent studies decisions related to 12 foreign capital investments implemented between 2004 and 2007 were identified as closely related to a motorway built within reasonable distance.

The objective of the approved intermodal logistics' strategy is to build up a logistics' system in Hungary, enabled to provide efficient and at the same time environment-friendly supply and distribution services (preferring railways or inland navigation as transport modes), mainly in Eastern- and South-European relations. To reach this target, direct policy instruments – development tools – can be applied, but other issues, like co-ordination aiming at international harmonisation, implementing various complementary regulations or packages of long-term policy measures shall also be taken into account.

Concerning the urban integration of main roads, this report deals with the main aspects of design standards related to urban main roads. According to the Hungarian guidelines for road design, effective in urban areas, the design of the following elements have to be harmonised: car traffic facilities, public transport facilities, pedestrian traffic facilities, cyclist facilities, parking facilities, loading and unloading areas, green areas, location of public utilities, rest areas, equipments for environmental protection, street furniture, public lighting, traffic control facilities, location of signs providing information and guidance.

1. DEVELOPMENT OF THE NETWORK OF MOTORWAYS AND EXPRESSWAYS IN HUNGARY

The total length of the network of motorways and expressways in Hungary reached 815 km by the turn of 2005/2006, while its density was 8,7 km/1000km^2. In the following some elements of the prevailing regulations and government decisions, related to the development of the public road network, the completion of these programmes so far, and the results of the economic development influencing motorway construction are presented (Keleti, 2006).

1.1. Network development

According to the Decree of the Hungarian Government No. 2044/2003 (III. 14.), a network of motorways and expressways totalling 2420 km is planned to be built by the end of year 2015. The density of this network will be about 26 km per 1000 km^2, very near to the forecast value characterising the similar network of the former EU15 Member States by that time. The main elements of that network in Hungary are planned along the Pan-European transport corridors (Figure 1).

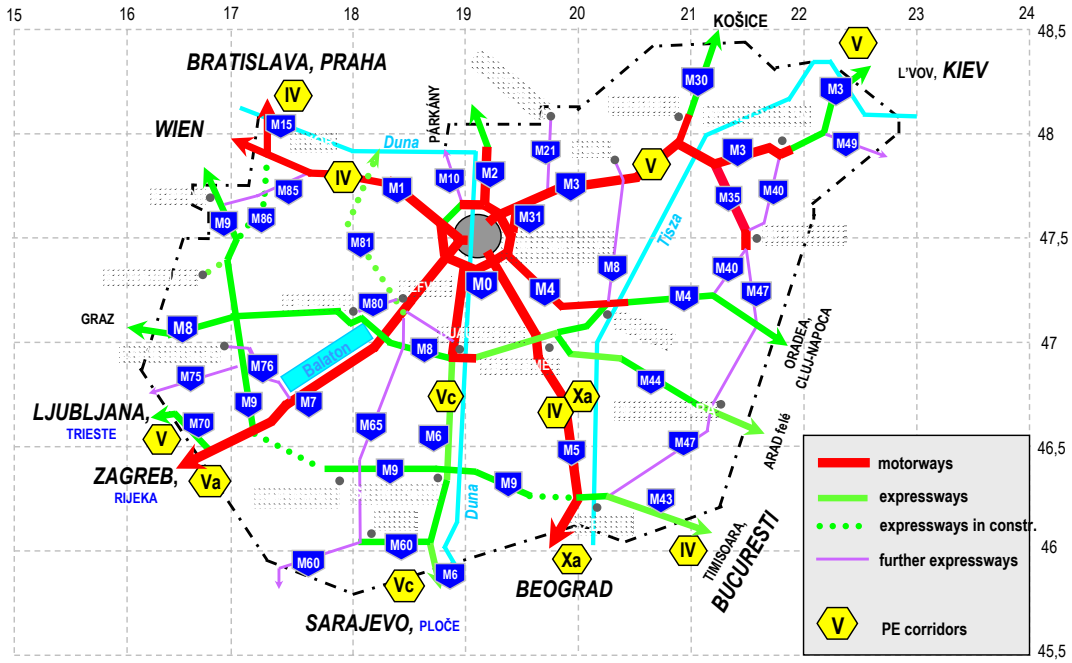

Figure 1 – The planned network of motorways and expressways in Hungary by 2015, according to the Decree of the Hungarian Government No. 2044/2003 (III. 14.)

This Decree was confirmed later by the Act No. CXXVIII./2003 on the public interest and on the development of the network of motorways and expressways in the Republic of Hungary, approved by the Hungarian Parliament.

The main objectives of this network development were defined as follows:

a) To reduce through traffic crossing the capital city, Budapest, where the M0 ring motorway is to be completed by extending its already existing southern section in compliance with growing traffic, furthermore by construction of a new Danube bridge at Dunaújváros (as part of the planned M8 motorway) and some motorway sections adjacent to it.
b) To increase the distributive role of the M0 ring motorway around Budapest, by establishing new, high-capacity road sections within the metropolitan area.
c) To connect the towns of Dunaújváros, Debrecen, Nyíregyháza and Szeged to the network of motorways and to reach Pécs by an expressway, which can be upgraded into a motorway later on.
d) To reach the state borders with Slovakia, Ukraine, Romania, Serbia, Croatia, Slovenia and the southern part of Austria by expressways.
e) To establish new crossings at the Danube and Tisza river.

f) To improve the quality of the transversal road connections in order to counterbalance the rigid radial structure of the existing public road network.
g) To improve the accessibility of the South-Eastern regions of Hungary.

443 km of new motorways and expressways were built in Hungary from 1996 to 2005. This extension is an outstanding performance in Hungarian network development to date. The dynamics of the network growth from 1996 to 2006 are presented in Figure 2.

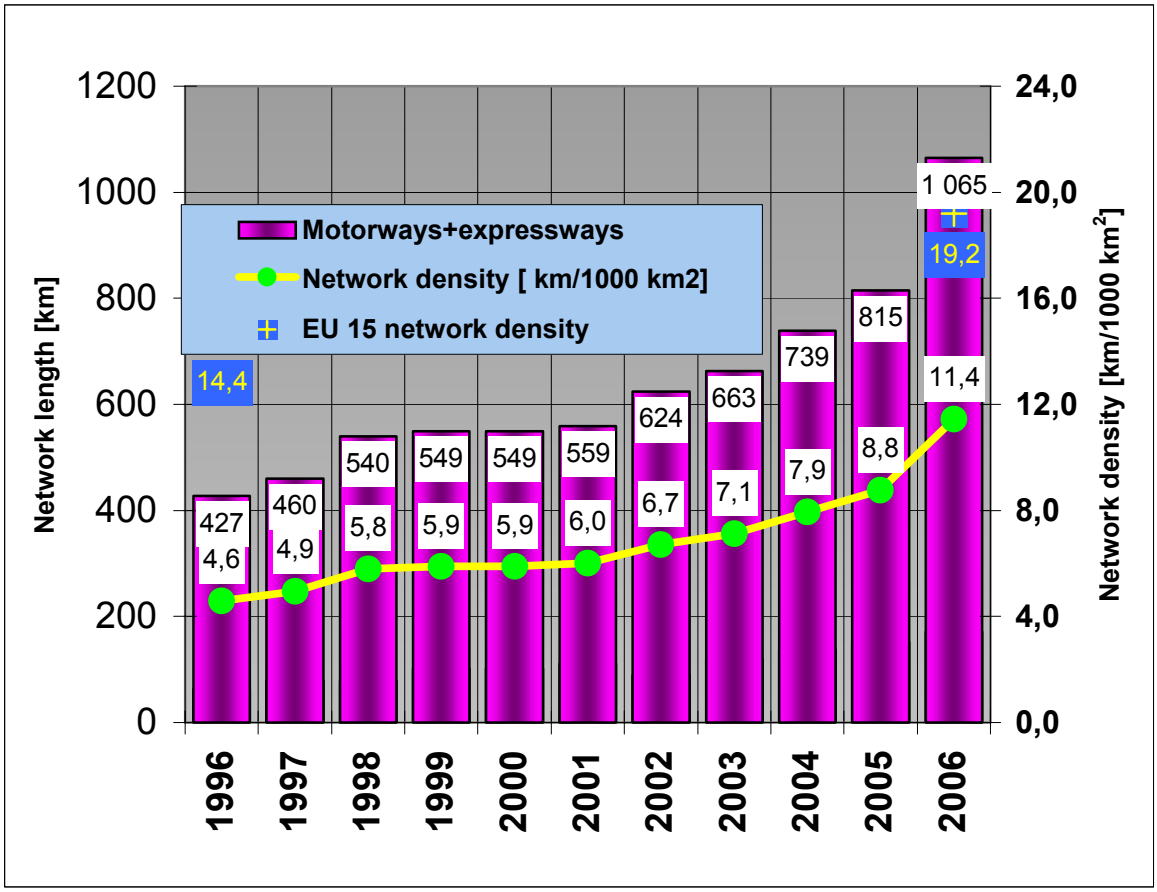

Figure 2 – The growth of the network of motorways and expressways in Hungary between 1996 and 2006

1.2. Impact of motorways onto economic development

In 2003 E. Ehrlich published the results of her research about the relationships between infrastructure supply and economic growth (Ehrlich, 2003). Several other studies revealed relatively close relationships between economic output (measured by gross domestic product, GDP) and the infrastructure supply in place. Based partly on these studies, I. Keleti emphasized in 2003, that economic history has shown evidences, that a well developed transport network providing high quality of services is a precondition to enhance and accelerate the expansion of regional economies at a higher than generally observed average rate of economic growth (Keleti, 2003). These studies have shown good correlation between some features of transport infrastructure and economic growth in West-European countries, especially with export driven economies, in certain periods. This became obvious during the development of the railway network in the 19th century as well as during the construction of motorways in the second half of the 20th century. The impact of better roads on economic output can be observed in Hungary too, where the extension of the motorway network between 1995 and 1998 has undoubtedly contributed to attract huge foreign capital investments into the Central and Western regions of the country, while

offering better opportunities to settle down modern industries and services in the Eastern regions as well.

S. Kálnoki Kis and L. A. Molnár also justified the impact of motorways on economic output (Kálnoki Kis – Molnár, 2003). Studying economic indicators of micro-regions alongside the M3 and M5 motorways, they observed that the number of unemployed people has significantly decreased while the export revenue and profit of companies, as well as the income of their employees has significantly increased there, between 1992 and 2001. These patterns are in conformity with the general trends observed in the Hungarian economy. The increase of the average rate of economic growth in the micro-regions under scrutiny was observed following the openings of newly built motorways and the government decisions aiming to speed up motorway construction. Recent studies have verified further these impacts (Tóth, 2006).

Due to the extension of the motorway network between 1996 and 2006, average travel times by road between the capital city and most of the county seat towns have shown a considerable decrease, especially in the Eastern regions of the country (Figure. 3).

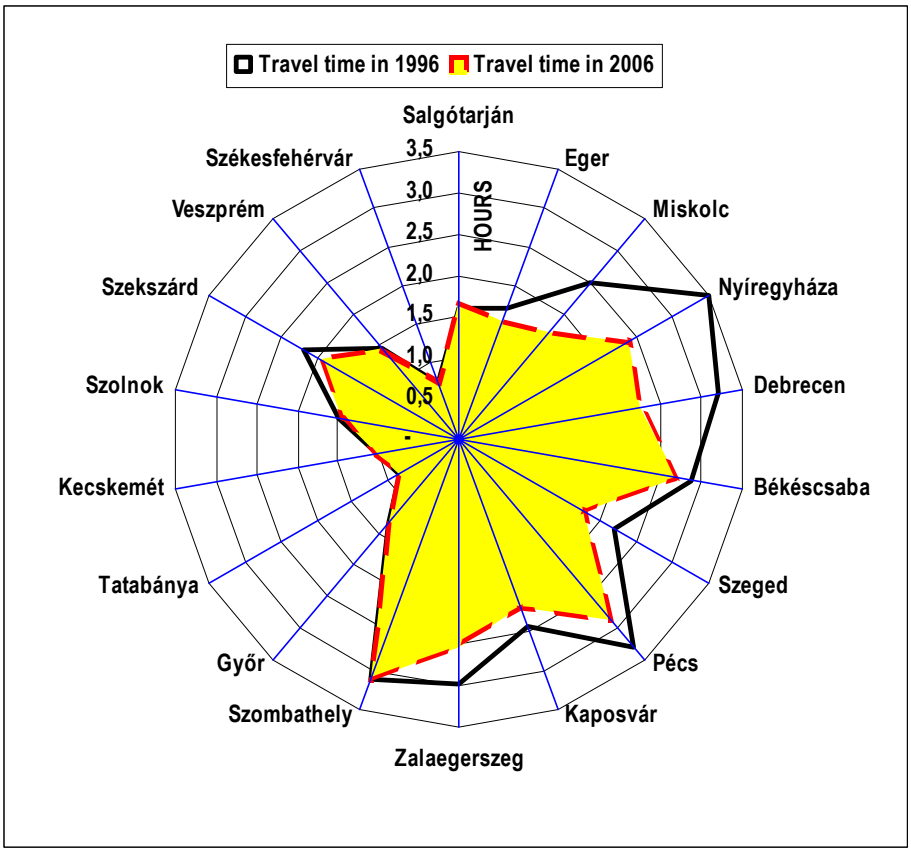

Figure 3 – Average travel times by road between Budapest and the county seat towns.

The improvement of accessibility is a significant indicator, because when choosing the location of any capital investment - besides other conditions like skilled labour force, reliable supply of energy, informatics and telecommunication, affordable conditions of urban life, good educational background, etc. – the supply of transport infrastructure and logistics is similarly an essential precondition allowing easy access to potential markets. The Ministry of Economy and Transport published a study about completed or planned foreign capital investments between 2004 and 2007, which can easily be linked to existing or planned motorway sections. This study has identified 12 such projects, financed directly by foreign capital of about 560 million Euros, creating 8600 jobs.

The examples referred to above are reflecting the positive impact of newly built motorways enhancing economic growth of the micro-regions. Nevertheless, we have to be aware of the fact, that this type of transport infrastructure development can only imply the desired impact, when and where several other material and human conditions of economic growth are met simultaneously.

2. DEVELOPMENT CONCEPT OF A SYSTEM OF INTERMODAL LOGISTICS IN HUNGARY

The following information is based on the Development Concept published on the website of the Ministry of Economy and Transport, following professional and public consultations (Bokor, 2005 and GKM, 2006).

The competitiveness of a country's economy depends heavily on how its enterprises can adapt their operation to ever changing market demand and how they organise and manage their material and information flows. This tendency of adaptation – becoming stronger and stronger – generates a gradually increasing demand for high quality and complex logistics services, which provides real opportunities for Hungary. The geographic situation of the country being on the crossroads of freight transport flows between Western- and Central-Europe and the Balkans or the Near-East, is favourable and provides great advantages. To make real use of this favourable position – considering also environmental issues – appropriate intermodal logistics infrastructures and services have to be made available in due time. These well functioning service elements could contribute to generate new demand and connect different modes of freight transport.

The development of Hungarian logistics service centres and combined transport system has been carried out for a decade or more. However, the development can not be considered as finished yet. The overall aim of the new Development Concept mentioned above, is to integrate and update the currently available development principles with special regard to changing framework conditions implied by EU accession/enlargement.

2.1. Goals

The market of logistics services has grown more rapidly than that of the average GDP growth rate observed recently. The labour-intensive activities of logistics result in considerable profits, thanks to their outstanding added values. However, it has also to be considered that increasing traffic volumes arising form logistics activities may cause additional environmental damages if they aren't planned and organised in a reasonable way.

Considering the principles, the goal of intermodal logistics strategy is to build up a transport logistics system in Hungary, which is able to provide efficient and at the same time environmental-friendly supply and distribution services (preferring railways or navigation as transport modes), mainly in the Eastern- and Southern-European relations. To reach this goal, direct policy instruments – development tools – can be implemented, but other issues, like co-ordination aiming at international harmonisation of appropriate rules, various complementary regulations or packages of long-term policy measures shall also be taken into account.

2.2. Direct development tools

The basic principle in the case of investments into intermodal logistics is that the State shall participate in ensuring basic conditions of operation, which can not be realised by private actors – due to efficiency, technology, and other factors –, although these are essential from the point of view of high-quality and less environment-damaging transport-logistics services. So, the State supports or contributes to the establishment or improvement of further logistics facilities, by:

1. developing the external logistics infrastructure: i. e. improving the accessibility of intermodal logistics centres by providing road and rail connections;
2. developing the internal logistics infrastructure: i. e. building transhipment terminals and implementing related public works, extending warehouse capacities, improving IT networks connecting intermodal logistics centres;
3. developing the intermodal vehicle fleet: managing the procurement of special vehicles (for railways or navigation), suitable for combined freight transport.

The development policy of logistics – harmonised with, and partly integrated into the 2nd National Development Plan –, means that viable market initiatives promoting/using intermodal transport-logistics shall be entitled to be supported in a complementary way. State/EU subsidies will contribute to private investments aiming to improve infrastructure elements or to purchase special vehicles, provided that the investor/operator of an intermodal facility/service engage oneself to maintain the service quality for a given period, while certain amount of goods transport are shifted to railways or waterways. Special attention will be given to projects launched in the so called prioritised regions. These regions are situated near to long-term EU borders providing good opportunities for international trade. However, the transport-logistics infrastructure is less developed there and that's why their market position may be threatened by competitive regions of neighbouring countries. It is also important that the logistics terminals situated in these prioritized regions serve as intermodal transshipment points shifting over a considerable amount of goods (transported mainly by road t actually), to alternative transport modes.

Logistics has been dealed with two distinct operative programmes (OP) of the 2nd National Development Plan: the Transport Infrastructure OP will support transport-logistics issues (e.g. enhancing the accessibility of logistics centres, improving intermodal transhipment facilities and the renewal of the intermodal vehicle fleet), while the Competitiveness and Economy OP will enhance the improvement of "in-house" conditions (e.g. warehouses, equipment and machinery, informatics). The former OP envisages pre-selection of large scale, centrally co-ordinated projects (about 4-5 terminals), while in the frame of the latter OP, projects will be chosen strictly on a competitive basis, evaluating submitted proposals. Central projects and conditions of assessment will be elaborated by taking into account the opinion of representative professional organisations functioning in the field of logistics.

When considering financing opportunities, special attention has to be paid to the potential resources provided by EU Structural Funds and Cohesion Fund, to be allocated to and within Hungary, according to the 2nd National Development Plan between 2007-2013. These funds – complementing national resources – will be the main financing sources of development programmes because of the strict constraints on the public budgets. Preferences concerning intermodality can be identified among the priorities of the EU Cohesion Fund as well as of the Regional Development Fund. However, the allocation of

EU funds may affect the most developed Central Region of Hungary in a disadvantageous way. These disadvantages can be (partly) compensated by selecting appropriate transport infrastructure and logistics projects in compliance with the priorities of the Cohesion Fund.

2.3. Regulation and co-ordination measures

The priorities of combined transport as defined in the Hungarian Development Concept are in harmony with EU common rules: exemptions from HGV stops, permissions and road vehicle taxes in case of short distance road freight integrated into combined transport chains. Another measure could be to introduce an EU-conform operational subsidy system for intermodal services or their providers. It can be justified by the fact that social cost based pricing systems have not been implemented yet in the transport sector, which distorts decisions related to modal choice. The application of such public subsidies may be complicated, however, because of the relevant EU approval mechanism. Additional preferences can be granted when the new electronic toll collection system starts working. Here lower or even zero toll may be applied to road freight movements connected to combined transport.

Effective participation and representation of national interests shall be carried out on the forums of international co-ordination and innovation of intermodality. The scope of bilateral agreements promoting combined transport shall be extended by taking also into account that multilateral agreements may be more common in the future. Hungary intends to contribute to the work of dedicated EU and UN-ECE committees responsible for standardisation and interoperability facilitating at the same time the adoption of international/common directives.

It is also important that Hungarian enterprises take advantages from EU Marco Polo II and the 7th R&D Framework programmes, by joining different consortiums or pilot projects so that they can have access to state of the art intermodal knowledge. Intermodality and related innovative topics shall be included into different levels of educational and training systems, too.

2.4. Complementary issues

The factors determining the competitiveness of Hungarian logistics services or service providers have to be revised among complementary issues. Here customs procedures and taxation rules are to be mentioned, which can be influenced by the government. Problem areas are: immediate and direct VAT for import transactions, complicated customs procedures not (really) supported by efficient IT tools. These problems shall be solved by continuous co-operation of the interested parties.

The Development Concept concentrates onto the nodes (centres and terminals) of logistics network and does not deal directly with transport networks. However, it is obvious that intermodal logistics services can be competitive only if the service quality of freight transport by railways and inland navigation increases. It requires additional investment into the infrastructure and vehicle fleet – harmonised with logistics demand and supply – as well as the efficient use of existing capacities, mainly in rail transport. Integrated improvement of logistics centres, their connections and the network services can ensure that the desired results will be yield.

The EU common transport policy is committed to introduce (gradually) the social cost based pricing system in transport – Hungary has to prepare for it, too. Such pricing

systems favour transport and logistics solutions with lower social cost – e.g. integrated intermodal chains – and will probably modify transport-logistics related business decisions. To be able to implement these new pricing principles determined by the transport policy, commonly used methods for internalising external costs and revenues shall be elaborated and applied. The amendment of transport cost and price structure shall be achieved in a way, which does not weaken the international competitiveness of Hungarian market actors. Last but not least, it is also worth considering that the EU – and other international organisations – is expected to make freight transport regulations stricter in the field of environmental protection, technology and social norms, which also may provide favourable conditions for intermodality.

3. URBAN INTEGRATION OF MAIN ROADS

The principles related to the urban main roads are analysed below, based on the effective Hungarian road design guidelines (GKM, 2004).

In urban areas the following elements have to be designed in harmony with each other.

- Car traffic facilities,
- Public transport facilities,
- Pedestrian traffic facilities,
- Cyclist facilities,
- Facilities for parking, loading and unloading,
- Green areas,
- Location of public utilities,
- Rest areas,
- Environment protection equipments,
- Street furniture, lighting equipment,
- Traffic control facilities,
- Location of equipment providing information and directional signs.

3.1. Classification and technical parameters of roads in urban areas

According to their network functions, roads within built-up areas are classified in four categories, as follows.

Roads with network function “a” are essential elements of the urban structure. In this case the “connection” function (to ensure through traffic) has priority over the “access” function. These roads are:

- Urban sections of first and second class rural main roads, providing regional connections;
- Significant radial or transversal roads connecting various distant parts of the city;
- Roads leading to facilities attracting high volume of traffic (e.g. industrial centers, shopping centers);
- Relief roads of city centres.

Roads with network function “b” are important elements of the urban structure. In this case the “connection” function has priority, while the “access” function is also relevant. These roads are:

- Urban sections of rural main roads, providing connections between small regions;
- Urban sections of secondary national roads carrying long distance traffic;
- Radial or transversal roads connecting neighbouring parts of the city.

Roads with network function “c” are local elements of the urban structure. In this case the right ratio between “access” and “service” functions has to be defined on a case by case basis and taken into consideration, while limiting the “connection” function. These are:

- Urban sections of secondary rural roads, with relatively low traffic volumes;
- Road leading to railway stations, outside built-up areas;
- Roads within residential areas having “connection” function, sometimes with public transport;
- Main roads of city centres and historic areas also with through traffic;
- Sections of secondary roads within small settlements;
- Roads connecting various parts of settlements.

Roads with function “d” are insignificant elements of the urban structure. In this case the “service” function has priority, while the “access” function has to be kept under control, and the “connection” function should be neglected. These are:

- Residential streets, service streets, mixed-use streets;
- Streets serving local needs, e.g. service streets of industrial, agricultural commercial services, green and logistic areas.

The guidelines define several parameters in function of the design category and the network function, concerning:

- Cross section of streets,
- Location and crossing of pedestrian and cycling facilities,
- Location and crossing of public transport lanes,
- Location, distance and possible types of junctions,
- Servicing roadside properties,
- Stopping and parking along roadside curbs.

3.2. Some technicalities

The cross section of a road within built-up areas has to be designed in the context of the whole surrounding area. The elements within the road as well as outside of it (sidewalks, cycle paths, green strips, etc.) have to be designed in harmony with each other and with the neighbouring buildings, in a safe and aesthetic manner.

Within built-up areas, the cross section, or width of the road is not always constant. It is the designer’s responsibility to select among the cross sections available that which is best suitable to satisfy the road users’ various needs (e.g. priority to public transport, joint pedestrian and cycle paths, loading and parking areas).

In built-up areas, parking and access to neighbouring properties have to be designed in accordance with the design category and the network functions as follows.

Along streets with network function “a”:

- Direct access to neighbouring properties is not allowed;
- Stopping lanes has to be provided;
- Parking and access to neighbouring properties is only allowed in parking areas, connected to the main street by junctions.

Along streets with network function “b”:

- Access to neighbouring properties is allowed only in limited hours of the day, but from parking lanes it is allowed without restriction;
- Curbside parallel parking may be used, but tilted or 90^{o} parking is allowed only within an extra lane.

Along streets with network function “c”:

- Direct access to neighbouring properties, curbside parking and loading is allowed only if mainstream traffic is not disturbed;
- One traffic lane per direction has to be provided.

Along streets with network function “d”:

- The sharing of the whole street area has to be designed according to access and service functions, considering priorities;
- In mixed use and service streets the objective is to satisfy parking needs, therefore any type of parking arrangement is possible;
- Green areas, street furniture, speed limiting facilities and other equipment can be provided within the street area, improving urban aesthetics (see Figure 4.)

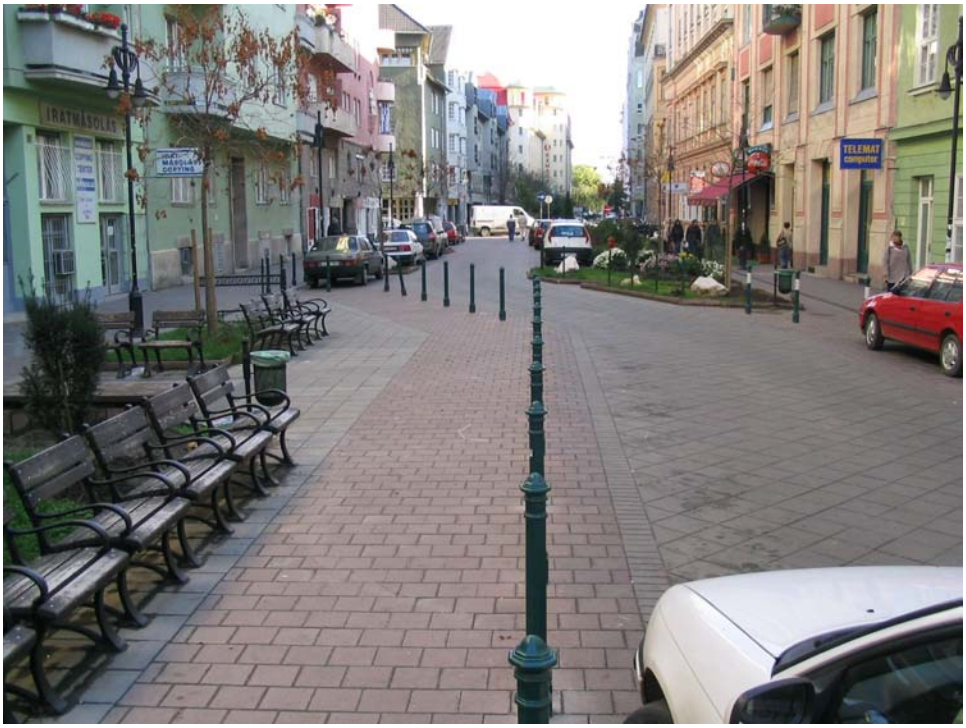

Figure 4 – Reconstructed street in Budapest, taking into consideration various users’ needs

The facilities for pedestrians and cyclists have to be designed simultaneously with the road network. The main facilities serving pedestrians and cyclists have to be defined within the Urban Structure Plans, and their area has to be preserved and protected by the Urban Regulatory Plans. On urban roads with “a”, “b” and “c” network functions, pedestrians have to be separated from car traffic by elevated curbs or other facilities. The motorised traffic and the facilities for pedestrians and cyclists can be separated by:

- Green strips,
- Parking and loading lanes,
- Curbs of various types,
- Culverts and ditches.

According to the building type and land-use along the road, the width of the sidewalks and pedestrian paths has to insure a proper quality of service and safety for pedestrians. Around transfer points and stops of public transport as well as around pedestrian crossings, the appropriate dimensions of pedestrian facilities have to be designed with special care.

Pedestrian facilities have to be designed as obstacle-free ones, taking into account people in wheelchair and with infants’ prams.

Within the street area, noise protection equipment, street furniture, urban space shaping facilities, sculptures and information signs can be used too. These equipments have to be designed according to traffic safety and good visibility requirements, giving priority to aesthetic considerations.

In urban roads with network functions “a”, “b” and “c” the following additional equipments can be used:

- “Entrance gates” at the borders of urban areas, to make drivers aware, that they arrived to a built-up area, so driving conditions have changed, they have to slow down;
- Middle islands to help pedestrians’ crossing double carriageways;
- Other equipments of traffic engineering (e.g. reflecting studs, flashing amber signals);
- Roadside vegetation, other facilities in the public space.

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