THE HUNGARIAN TRANSPORT DEVELOPMENT INFORMATION SYSTEM

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1. INTRODUCTION

In the current plan period, research and development programmes serving as a basis for transport development decisions are being carried out in the following four areas:

- interaction between the transport network and regional development,
- coordinated development of public mass transport and individual transport,
- coordinated development of freight transport processes,
- the division of labour among the transport sub-sectors.

The numerical information requirement for the four planning tasks is met with the aid of a transport development information system (hereafter TDIS) created for this purpose.

2. DEVELOPMENT GOALS

2.1. REQUIREMENTS MADE OF THE SYSTEM

The information system serves principally as a basis for implementation of the four planning tasks, while at the same time it can naturally also be used to provide data for the preparation of transport development decisions independent of the planning tasks.

- Research goals which regard transport development activity as a complex task carried out within the framework of national development activity have been formulated within the planning tasks. Consequently, the information system's data banks cover not only data related to transport, but also data on the social and economic environment generating transport and on the methods required to form this data.
- Development of the TDIS and implementation of the planning tasks are being carried out simultaneously. The information system should be created progressively in such a way that it is capable of meeting the current information requirements of the planning tasks right from the first stages of development of the system.
- The TDIS is being created with the goal of providing a flexible supply of information in dialogue mode within the preplanned framework. Within the framework of traditional data processing, it is possible to produce predetermined analytical tables with a through-put time of several months. The TDIS will eventually have a range of methods making it possible to produce analytical tables, carry out mathematical statistical methods and provide the results of models, with a through-put time ranging from several minutes to a few days, depending on the way the question is raised and the technical conditions.
- The goal is to create an information system making it possible to interrogate the data bank from terminals or in a number of computers. Until the technical conditions make it possible to establish the network, the TDIS

must be capable of carrying out the tasks set in a limited volume and with a longer reply time.

2.2. THE LIMITS OF APPLICABILITY

The system planned for introduction up to the end of the plan period and already partly implemented, according to the goals set, can be used within certain limits:

- The information system is designed not to serve day-by-day operative activity, but short, medium and long-term planning or the preparation of development decisions and consequently, an annual updating of the data banks is generally sufficient, rather than a daily or weekly updating.

- The internal structure of the TDIS is determined by the requirements of the planning tasks. The data and methodological basis of the system can serve as a basis for the use of its services for other purposes, but for this the system must be reorganized and supplemented.

- The technical conditions and the organizational and staffing framework have been adapted to the volume of planning tasks up to the end of the plan period and are therefore unable to meet any demands substantially exceeding the provision of information.

- Use of the TDIS for broader purposes than the planning tasks could make it necessary to change the structure of the data banks, to apply data base processing systems more extensively than at present and to create a terminal network.

2.3. DEMANDS MADE ON THE CONTENTS OF THE DATA BANKS

Taking into account the costs and manpower implications, the main emphasis in development of the system is being placed on the creation of data banks corresponding to requirements and their regular maintenance. The demands in this connection have been summed up by Dr. Rezsö Bajusz, director of the institute entrusted with development of the TDIS: (1)

"The principal goal of the planning tasks is development of the most important areas of the planning system in harmony with the requirements and possibilities of the national economy. To this end, complex analyses and decision alternatives must be prepared, using modern methods, for coordination of the plans of the national economy as a whole and the different sectors, to determine the development required in other sectors and to define coordinated planning goals for the sub-sectors."

The goals set for the planning tasks impose a number of demands on the information system, in particular, that it should determine the freight and transport demands and requirements arising from the activity of organizations and individuals, the individual and public transport and freight possibilities offered by the transport system, the interaction of transport and the social environment and the transport capacities being created, in such a way that the top-level decision alternatives and the anticipated effect mechanism of the decisions can be analysed on the level of all characteristic groups of individuals and organizations participating in transport and freight.

The information system must contain sociological data (activity, attitude, mobility, etc.) for social groups that can be regarded as homogeneous from

the viewpoint of transport, from which conclusions can be drawn regarding the trend in transport demands and, in the case of past travel, making it possible to determine the circumstances of the selection of means in the light of the transport possibilities offered, data characteristic of the circumstances of decisions relating to transport, such as the time balance, household statistics, etc. These can be evaluated in the light of transport possibilities and of the statistics for public transport, timetables and routes and freight performances and it is therefore of vital importance to create a computerized data base for all this.

In connection with freight transport, the information available must be able to "provide an answer regarding the production structure of the places producing goods, their sectoral classification and regional location; the nature of the goods, the form of packaging, storage, loading and transport, the transport costs, the ability of the enterprise or product to bear transport costs; the freight transport facilities of the transport enterprises, their technology, transport network, reloading points, vertical and horizontal division of labour, input and returns, the transport performance for each category of goods with a breakdown by region, time and distance".

A requirement made on the information system is that it should be integrally adapted to similar systems created in other sectors, it should rely on them and, at the same time, it should also draw on the data stores and data bases created in a decentralized manner for different purposes within the sector it covers.

3. METHODOLOGICAL CONSIDERATIONS

3.1. THE PROVISION OF DATA PARALLEL WITH THE DEVELOPMENT OF THE SYSTEM

One of the objectives set is that the regular supply of data must be started at the same time as the launching of development activity. Development of the information system and implementation of the research planning tasks can be carried out in interaction, in annual cycles. The different phases in development of the information system - surveying the demand, drawing up a proposal for the system, preparing the documentation for the system, setting up the installations required and planning or adapting the programmes - are carried out as parallel activities. One of the reasons for this is that it is not possible to determine the data requirements of the research projects for more than one or two years ahead while, depending on the nature of the data, it requires anything from several months to several years to obtain the data required. The relatively short throughput time on the part of the user and the time required to obtain the data are a source of contradictions which can only be resolved by carrying out this activity simultaneously.

The advantages of providing data parallel with the development of the system are:

- it makes cost-benefit considerations related to development of the information system more convincing,
- it arouses an awareness in users of the advantages of the information system and throws light on unidentified needs,
- it ensures continuous practical control over development of the information system.

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3.2. UNIFORM DECENTRALIZED AND MULTI-PURPOSE SYSTEM

In the course of development a means must be found of resolving the contradiction existing between the developers of the system and the individual researchers carrying out the planning tasks in that the developers are striving to elaborate a uniform and redundancy-free system to serve a number of research projects, while the indivdiual researchers want to obtain appropriate data for their current research projects at short notice. These contradictions impose increased demands on coordination in the course of development of the data and method basis.

It is one of the characteristics of our economic system based on a planned economy that we have very extensive statistical and factory data sources at our disposal. These data collections are not coordinated with each other and different organs dispose of the data using them for different purposes. One of the requirements for intensive development of the economy is reduction of the extent of data collection and coordination of the data collected. In the course of development of the TDIS, in line with the requirements arising from intensive development of the economy and taking cost-benefit considerations into account, we rely as far as possible on the existing - although incomplete - data bases and obtain new information primarily by creating a system to link the data bases. By carrying out sample data surveys to supplement the shortcomings of the information system created in this way, we are striving to create a "uniformly sound" system.

A data processing practice where a separate programme system is developed for the solution of each task is widespread in research institute work. This system has the advantage that the operation of the programmes is simple and to a certain extent cheaper and the disadvantage that a very large number of programmes must be operated and maintained, making further development impossible after a certain time because of personnel limitations. Use of the systems developed by the software companies to handle and analyse the bata base is in cases more expensive by several orders of magnitude than the traditional batch processing. This contradiction can be resolved with the development goal of developing only a few general-purpose programmes wherever possible, attempting to adapt these to research requirements that arise and, where it does not come up against considerations of economy, we try to use systems for handling and analysing the data basis developed by the software companies.

The processing of a number of data banks at the disposal of different organs can only be achieved in a decentralized way. As a first step, we carry out minor modifications on these data banks in the interest of coordinating them with each other and then we batch process these data banks on hired computers. We are gradually switching over to remote data processing. The final objective of the planning task is to instal a computer carrying out condensing functions, making it possible to initiate analyses from terminals and ensuring the processing of the data bases stored in the different computers by remote data processing and later in an on-line form.

3.3. COORDINATION AMONG THE INSTITUTIONS COOPERATING

On the basis of the above, the development of the TDIS can only be conceived through the cooperation of numerous organs. The condition for success of the work is effective coordination among the organs cooperating, on the level:

- of the sectors (ministries),
- of the organs disposing of the data,

- of the computer centres processing the data and the computer manufacturing companies,
- of the users.

The TDIS development activity is being carried out principally to serve research planning tasks but at the same time is an integral part of the sectoral and national information systems. The development of the information system could lead to modification of the national statistical system and the individual enterprise systems or even to the introduction of new processing systems. The purpose of the modifications is to ensure that the decentralized data banks created for different purposes can be linked. Changes have to be carried out in the different data processing systems to ensure that:

- data fields or codes identified by the same concepts also have the same contents,
- the data existing in the different data banks concerning the same object have the same identifying codes.

In a number of cases, coordination of the identifying codes (place, time, vehicle registration number, personal identification number, industrial product identification, enterprise identification, road number, road section number, settlement code number, etc.) is carried out within the framework of inter-ministerial committees. At present an inter-ministerial committee is dealing with the question of a system for identifying spatial objects and specifying place.

The modification of data processing systems is highly cost-intensive. However, the costs can be recovered from benefits resulting from the reorganization and arising beyond the objectives of the TDIS.

4. DATA BANKS AND STRUCTURE OF THE TDIS

4.1. CONCEPTIONAL MODEL BASED ON DECISION-MAKING MECHANISMS

Decisions related to the development of transport can be conceptualized as an activity creating a synthesis by comparing contradictory but complementary considerations or, in a simpler case, as a choice between alternatives. The information system can become a suitable means for the decision-maker if it is capable of supporting each of the considerations or alternatives forming the contradiction with factual data and analyses and of modelling the effect mechanisms. In creating the information system it is advisable to depict schematically the conceptional constructions preceding the decisions by confronting the contradictory concept of the contradictory but complementary considerations.

Claus Heidemann has published a conceptional model for the study of the mechanism of decisions related to passenger transport. (2) In this model the formation of decisions related to transport is depicted on a number of levels of social activity by contrasting the following considerations:

population	-	environment
inhabitants	-	infrastructure
households	-	facilities
dispositions	-	opportunities.

The decision is restricted by regimens and budgets. The decision-making

situation can be characterized by the interaction of intentions and options. For the purpose of the four planning tasks the Heidemann model can be considered as fundamental for information bases leading to individual decisions.

The four planning tasks serve principally to provide a basis for ministerial decisions related to the development of transport. In their designation and theme the planning tasks are based on the evaluation of contradictory considerations:

transport development	-	regional development
individual transport	-	public transport
road - railway	-	waterway - pipeline transport
transport performances	-	input.

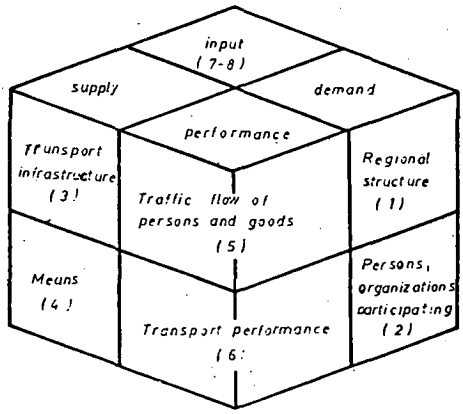
Breaking the planning tasks down into further detail, additional complementary considerations are evaluated. In the question of development of the road network, for example, the following considerations must be evaluated:

road condition	-	traffic
modernization	-	road construction
development of a local network	-	of a motorway network.

Development of the TDIS is being preceded by research based on surveys and demands that have arisen in practice in order to further develop and systematize the chain of decisions related to the development of transport. In the present initial stage, taking into account the considerations listed, we consider the following three dimensions to be fundamental:

supply	-	demand
input	-	performance
development on basic level	-	on structural level.

With the aid of the considerations listed, 8 characteristic groups can be distinguished within the data banks of the information system, as shown in the diagram:



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4.2. THE INFORMATION REQUIREMENT OF RESEARCH PLANNING TASKS DIRECTED AT THE DEVELOPMENT OF TRANSPORT

The planning tasks are being carried out within the framework of 109 research themes. Together with the elaboration of the themes for the planning tasks, an estimation was also made of the anticipated information requirement. [3,4] In keeping with the complex objectives of the specific programmes, the researchers responsible for the different themes are planning to draw on a very large number of different statistical and enterprise data banks. The data banks are shown schematically in the table, grouped according to the considerations listed in chapter 4.1.

A considerable number of the data banks listed already exist and can be reached in the computers of different organs. Other data banks are being developed. Numerous data banks will have to be created in connection with the development of the TDIS or organs that have data at their disposal must be encouraged to computerize their data processing, rather than using the present manual methods. The most important of these are the timetable and route statistics for railway and bus services.

We are planning to establish the system of links between the data banks in the following steps:

- A survey of the population's transport demands and opportunities is planned, using known methods. [5, 6, 7] After the survey has been conducted, population groups (clusters) that are homogeneous from the viewpoint of demands and possibilities will be identified.

- Groups of production places that are homogeneous from the viewpoint of transport requirements will be defined according to the production places and the transport-intensiveness of the products.

- On the basis of the clusters, a system of links can be established among the data banks making it possible to model the effect of official decisions on the transport and freight transport opportunities of the population and production places by cluster.

4.3. DATA BANKS OF THE PRESENT INFORMATION SYSTEM

The system at present provides data of national scope on transport and on the social and economic environment generating transport and freight transport demands, drawing on the following data bases:

- transport networks (road, railways, waterways),
- means of transport (motor vehicles by registration number, railway engines and rolling stock),
- traffic in the different sections of the network,
- freight transport performance with breakdown for road vehicles and railway line sections,
- accident statistics,
- fuel consumption.

The data on transport has been supplemented with the following data on land use in the social and economic environment generating transport and on economic activity:

Table 1: The most important data groups forming the basis of the transport information systems

1 Regional structures	2 Persons, organizations participating	3 Transport infrastructure	4 Means	5 Traffic, passenger and freight transport	6 Freight transport and maintenance performance	7 Social cost /loss/	8 Private, enterprise costs
11 Sturctural data for settlements	21 Characteristics of homogeneous population groups	31 Network and coordinates data /road, railway waterways and stations/	41 Record of road vehicles by technical data and registration no.	51 Road transport by sections /cross-section and destination traffic counts/	61 Commercial road vehicles freight performance	71 Comparative time series data on Hungarian and international transport activity	81 Blance-sheets of enterprises and public organs
12 Industrial location data	22 Housing and career data from the Uniform Population Data Survey	32 Data on spatial objects /bridges, inst., railway stations, ports aux. facilities etc./	42 Maintenance of road vehicles	52 VOLÁN long-distance bus passenger counts	62 Performance of state buses and car fleets	72 Records of investments by sector	82 Transport costs by product, cost-bearing capacity
13 Agricultural plant data	23 Uniform Population Data Survey time balance	33 Council inventory of road network and public areas	43 Records of railway engines and rolling stock	53 Local transport passenger counts	63 Running performance of private car	73 Financial balance-sheets of freight transport enterprises	83 Household statistics
14 Warehouse capacity by settlement	24 Characteristics of transport habits	34 Technical data for roads by sections and junctions	44 Railway rolling stock maintenance	54 Railway traffic by sections and stations	64 Performance of railway engines	74 Records of material management by sector	
15 Tourism by settlement	25 Attitude and ther studies to estimate demand	35 Technical data for railways and waterways by sections and junctions	45 Ship, ferry and plane records and maintenance	55 Railway passenger counts	65 Performance of railway passenger and goods waggons	75 Records of fuel use	
16 Demography, social mobility by settlement	26 Data on private car owners	36 VOLÁN long-distance bus routes, destinations, shcedules	46 Container rekords	56 Freight counts based on sample surveys of way-bills	66 Water and air transport performance	76 Use of assets by sector	
17 Commuters from census data	27 Characteristics of homogeneous groups of transporters	37 Local bus routes, destinations, schedules	47 Loading, materials handling macnines and storage capacity	57 Freight flow based on processing of road way-bill archives	67 Performance of road vehicles repair shops	77 Records of manpower management by sector	
18 Output and intake of products by enterprises and organs	28 Characteristics of habits of freight transporters	38 Railways, waterways routes, destinations, schedules	48 Road and railway track conetructioa machines	58 Freight flow based on processing of railway and shipping way-bill arch	68 Railways rolling stock repair and track maintenance performance	78 Accidents, damages	
19 Forecast data for traffic districts. Traffic forecasts.	29 Freight flow data based on transporters' technological model	39 Data on postal network	49 Records of postal means	59 Postal traffic volume data	69 Road maintenance performances, estimates and costs	79 Environmental pollution	

- regional structural data with breakdown for settlements or so-called transport districts grouping several settlements (smaller than an administrative region). (The data base contains demographic data and data on the housing stock, educational institutions, commercial network, public utilities, land use, industrial and agricultural activity),

- data of the enterprises and public organs operating fleets of vehicles,

- data on industrial and agricultural activity with breakdown to industrial plant and enterprise level; this data can be combined on the specialized branch, sub-sector or sectoral level,

- data on the products given in breakdown sufficient to enable the formation of an indicator showing transport intensiveness per product.

5. RESULTS, OPERATION OF THE SYSTEM

5.1. USE OF A GIVEN DATA BANK FOR NUMEROUS PURPOSES

The TDIS makes it possible to use a given data bank created for a specific purpose, in a variety of research tasks differing from the original purpose.

Information on the distribution of motor vehicles by make and year in county breakdown was required for planning of a vehicle repairs service network. It was possible to draw up the analytical tables on the basis of vehicle registration number records.

Data on distribution by type of product, distance covered and time, traffic volume data for railway stations and lines were lacking for the analysis of railway freight transport. These data are essential for the coordinated development of freight transport. We succeeded in elaborating an origin-destination matrix for each type of product on the basis of data stored in the way-bill archives; this matrix forms the basis for numerous further analyses. For example, a study of the extent to which railway transport demands can be met by water transport can be carried out with a knowledge of the volume of goods sent and delivered in the vicinity of waterways.

5.2. ADDITIONAL INFORMATION OBTAINED BY LINKING DATA BANKS CREATED FOR DIFFERENT PURPOSES

Through the operation of the TDIS additional information can be obtained by linking a number of data banks created for different purposes rather than by providing for the collection of new data.

The commercial vehicles stock planning model created within the framework of cooperation between the Computer Centre of the National Planning Authority and the Institute for Transport Sciences obtained the data on the stock required for its operation by linking the data banks on freight transport performances and the stock of vehicles by registration number. By linking these two data banks it has been possible to eliminate faulty items accumulated over the years - as operators take vehicles off the roads - in the national records of commercial vehicles. It is well known from UN statistics that many countries have not yet succeeded in eliminating these faults, thereby distorting the international statistics. (8)

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Through the combined use of a number of data banks, it is possible to determine the most important factors that play a role in vehicle use and the types and groups of settlements related to vehicle use and traffic. Such studies can be made by drawing on the structural and demographic data banks for settlements, records of vehicles by registration number and data on the volume of traffic on road sections passing through settlements.

The fact that accident data can be complemented with data on the volume of traffic at the site of the accident, and technical or freight performance data of the vehicle causing the accident opens up new perspectives in the area of research into the causes of accidents. Mathematical-statistical regularities can be determined by comparing the number of accidents that occur in a given area, the demographic data and the number of vehicles based in a given area.

5.3. SUPPLEMENTING THE SAMPLE DATA COLLECTION FILES WITH INFORMATION FROM THE TDIS DATA BANKS

An outstandingly important possibility for use of the TDIS which also brings cost savings is supplementing the data from sample surveys with information from the TDIS data banks, thus reducing the size of the data survey without reducing the quantity of information desired.

A sample data survey was conducted in the AFIT service stations to examine the extent of manpower capacity and the spare parts requirements for certain repair and service activities by car make and year and by the owner's occupation and also to determine the distribution of man hours for the different repair and service operations. Apart from the registration number, the data survey covered only the cost of the work done in the service station and these data were supplemented with the further data required by drawing on the other TDIS data bases.

In Borsod-Abauj-Zemplén County (northern Hungary) passenger counts per service and per stop were made and timetable data recorded for the purpose of drawing up a model timetable in connection with the planning of local bus services between settlements. These data were supplemented with demographic and structural data for each settlement, drawn from the TDIS data banks.

The analytical traffic forecasting model that has already been partly developed in our Institute draws on the TDIS data banks for the regional demographic and structural data and the structural data on enterprises and public organs and their branches required for the operation of the model on the basis of a sample survey of passenger and freight transport habit characteristics.

The data derived from the almost full data collection conducted for the analysis of the situation regarding bus transport operated by enterprises and public organs were analysed after being supplemented with data drawn from records of transport performances and registration numbers.

It is clear that the present services offered by the TDIS are very limited compared to the demands that arise. The limitations are due above all to the fact that many necessary data banks are lacking. The nomenclature of the data fields and codes and their contents vary from case to case in the data banks

available and within a given data bank the organs concerned use different procedures to obtain the data supplied.

Despite all the limitations, the examples of application listed show that the development and application of the TDIS have represented an advance in a few important areas. Almost all of the examples of application have been research projects carried out over a period of several years with the cooperation of numerous organs and a number of their results have already been introduced bringing considerable savings in costs, as was the case of the local bus transport planning system developed for Borsod-Abauj-Zemplén County. The further development and standardization of the information system will ensure its more efficient and extensive application.

6. SUMMARY

An information system is being developed to serve as a basis for transport development decisions, incorporating data bases on transport and the socio-economic environment. Since the system relies partly on statistical and factory data banks that have already been created for purposes other than research, it is possible for the system to provide data continuously, right from the beginning of its development. The data provided and the partial results obtained in the course of elaboration of the system have greatly contributed to development of the system and to covering the costs of development. It is planned to complete the development programme by 1985, the end of the five-year period, supplementing the existing data banks with sample data surveys and ensuring the handling of the data banks by creating the conditions for remote data processing and on-line operation.

In the course of developing the system, we have become increasingly convinced that long-term traffic forecasting (over a period of 30-40 years) and the preparation of decisions related to development of the infrastructure can only be carried out reliably on a regional scale, through international co-operation. A possibility for such international cooperation has already arisen with the launching of development of the TEM information system (TEMIS) with the participation of 10 countries in the form of an expanded activity within the framework of the UNDP development planning task for the North-South Trans-European Motorway (TEM). We are developing the TDIS in such a way that the Hungarian system will be able to form an integral part of the TEMIS.

NOTES

1) Dr. Rezsö Bajusz: Information system for the specific sectoral programmes, with special regard to the attainment of coordinated goods transport processes. (In Hungarian) Paper presented to the session held on 12 June 1982 of the Hungarian Association of Transport Sciences.

2) Claus Heidemann: Spatial Behavior. Studies: Concepts and Contexts. New Horizons in Travel Behavior Research. Eds: P.R.Stopher, A.H.Meyburg, W.Brög.

3) Árpád Skrabski: Role of the information system for the management of road transport in research and in the preparation of decisions. (In Hungarian) Közlekedéstudományi Szemle vol. XXXI, No. 12.

4) Árpád Skrabski: The information system for the management of road trans-

port. (In Hungarian) Institute for Transport Sciences, Budapest, 1980.

5) D. Bannister: Latent demand and transport deprivation - concepts, measurement and policy relevance. World Conference on Transport Research 1980. London. Transport Research for Social and Economic Progress. Ed: J. Stuart Yerrell.

6) P.J. Hills and Ch.G.B. Mitchell: New Approaches to Understanding Travel Behavior. New Horizons in Travel Behavior Research. Eds: P.R. Stopher, A.M. Meyburg, W. Brög.

7) P.M. Jones: Activity Approaches to Understanding Travel Behavior. New Horizons in Travel Behavior Research. Eds: P.R. Stopher, A.M. Meyburg, W. Brög.

8) Economic Commission for Europe. Annual Bulletin of Transport Statistics for Europe. U.N. Sales No. E/F/R. 77. II. E. 20.