ECONOMIC RESEARCH CENTRE

FIFTEENTH ROUND TABLE

(8th-10th December, 1971)

REPORT OF THE FIFTEENTH ROUND TABLE

ON TRANSPORT ECONOMICS

Held in Paris, on the following topic:

methodological studies for the establishment at the national and regional level of overall transport plans

EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT

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INTRODUCTION

The problems of integrated planning have, and are, attracting a great deal of attention throughout Europe. In view of current interest not improving the quality of regional and national planning, the Introductory Report published here outlines the methodology for a general approach to the problems of planning which could well serve as a base for development in relation to many problems currently being considered. The Report has been fully discussed and a summary of the main points in the discussion will be found after the report.

The E.C.M.T. wishes to take this opportunity to thank all those who took part in the meeting, particularly the Rapporteur - Dr. H. SCHAEFER and the Chairman - Dr. J. EBNER.

This publication is being distributed to institutions and individuals who are at present on the distribution list for publications of the Research Centre. The E.C.M.T. will also be pleased to consider requests for the publication from other bodies who signify their interest.

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METHODOLOGICAL STUDIES FOR THE ESTABLISHMENT AT THE NATIONAL AND REGIONAL LEVEL OF OVERALL TRANSPORT PLANS

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Classification

1. Basic definitions
2. Scheme for a comprehensive transport plan
   - Structure
   - Transport planning and the definition of political objectives
   - Division of total area
   - Parameters and behaviour patterns
   - Transport censuses
   - Traffic generation
   - Traffic distribution
   - Modal choice
   - Route choice
   - Inventories of transport facilities
   - System analysis
   - Comparison and choice of systems
   - Forecasts of parameters
   - Forecasting models and behaviour patterns
   - Forecast data
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   - Economic choice of networks
   - Step-by-step extension plans
3. Problems of integrated overall planning in the field of infra-structure

   Annex: Flow chart
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1. Basic definitions

(1) An adequate transport infra-structure is one of the essential conditions for the ability of a society to function. The role of present and future transport planning is to provide for this. A comprehensive transport plan should, therefore, include all measures which - on the basis of the present structural data - serve to attain the desired objectives of transport policy.

In the field of transport, there are a variety of arguments for comprehensive planning:

- Transport investment projects require long periods for both preparation and execution. Moreover, they are long-lived. The results of investment mistakes are, therefore, particularly serious.
- Public authorities have to provide the greatest part of the capital needed for these investments. This implies considerable preparation in public budgets and financing plans.
- Transport measures fall within the competence of a multitude of different authorities. This creates considerable problems of co-ordination.

Furthermore, it has to be considered that both structural conditions and the values of society are in a state of constant change. Therefore, a comprehensive transport plan must not be static, but has to allow continuous adjustment to the changing situation. A comprehensive transport plan should, therefore, consist of two parts:

- The long-term plan should cover a period for which forecasts with a certain degree of credibility are possible (approximately 20 years). It would represent the framework for
- the short-term plan, which provides for the phased realisation of the intended measures (approximately 5 years).

(2) All planning covers a definite geographical area. According to the level of aggregation, regional, national and supranational comprehensive transport plans can be distinguished. It is, however, not necessary in what follows to take account of these distinctions. The suggested methodology is basically valid for all levels of aggregation.

(3) "Methodology" can be understood in two ways:

- In a broader sense, the methodology of a comprehensive transport plan comprises the overall development of the plan, taking into consideration all relevant magnitudes.
- In a narrower sense, methodology comprises planning techniques and instruments.

The broader definition is used as basis in what follows.

2. Flow chart of a comprehensive transport plan

Structure

(4) The flow chart tries to present clearly the development of comprehensive transport planning from the census of existing facilities to the completed extension plan. In order to co-ordinate all considerations in a single scheme, techniques of network planning as well as phase diagram techniques are used.

A matrix scheme of rows and columns is used. The columns indicate individual planning phases:

1. Data collection
2. Analysis models
3. Forecasting models
4. Forecast data
5. Setting-up of plans

The rows correspond to the various types of data and conceptions of value.

1. Structure data
2. Transport demand data
3. Transport supply data
4. Norms

Thus, one obtains twenty fields. Some of these are allowed to remain empty. Individual fields are defined by subscripts: The first subscript gives the number of row, the second the number of column.

If a succession of operations is to be indicated, the individual fields are linked with uninterrupted arrows. Dotted arrows represent neutral connections, which merely transmit information.

(5) The flow chart must reflect the fact that transport is a complex process of mutual influences. This is represented in the flow chart by arrows. The following verbal description, which follows mainly the phases of the plan, cannot make the interdependencies sufficiently clear.

Transport planning and definition of policy objectives (field 400)

(6) Planning in the transport sector should take account of expectations of society, the State and the economy. Transport planning might include the following catalogue of - possibly competing-views on policy objectives.

- The aim to secure scope for individual freedom is of importance when satisfying the demand for transport. The choice of means of transport should, for example, be left to the individual. A pre-selection according to policy criteria can be made when selecting the system.
- Through creation of new and extension of existing transport routes one tries to obtain the highest possible improvement of productivity in the economy and a maximum contribution to economic growth.
- Through appropriate planning of transport routes, water air pollution as well as nuisance through noise should be avoided as far as possible. This includes also the selection of transport routes from the viewpoint of landscape protection.
- Transport planning should favour appropriate economic, social and cultural conditions for the desired local structures.

(7) If one understands infra-structure as the provision of all public services and utilities, it includes, besides the transport system other important sectors including the education system, town planning and dwelling construction as well as the health service. When planning infra-structure schemes, conflicts of aims can arise between the individual sectors as well as within the sectors at every planning level. These conflicts can be solved only by close co-ordination.

(8) This co-ordination depends on the administrative organisation of a State. Given that the planning autonomy of

the individual sectors and levels is far-reaching, various conditions of sensible co-ordination will have to be fulfilled:

- The aims have to be formulated in a binding way and should be co-ordinated with each other.
- All planning requires a basis of common data with consistent forecasts for key magnitudes.
- A comprehensive exchange of information in all sectors is required.
- One should aim at obtaining a formal co-ordination of planning with standardized schemes, concepts and criteria.

Division of total area (ooo)

(9) Integrated comprehensive transport planning requires a division of the total area into zones, for each of which sufficient structural and transport data has to be available. When defining the units, if would be appropriate to take into account comprehensive land-use and other infra-structure planning objectives.

Administrative divisions would fulfil these conditions only inadequately. It is, therefore, advisable to divide the area into transport zones especially suited to the demands of transport planning. Besides administrative boundaries, it is necessary to take into consideration, as far as possible, areas with structural interdependence as well as existing planning regions.

For inquiries in the field of road transport technology and traffic counts, it is necessary to divide the transport zones even further into individual districts.

Parameters and behaviour patterns (111, 112)

(10) Via specific transport objectives, transport development depends on economic, sociological and demographic determinants. The forecast of these key magnitudes with the help of a traffic generation model renders possible the forecast of transport development.

Possible determinants are chosen on the criterion of whether they would be available or easily accessible for all regions. The main sources for supply of structural data are

official statistics. To obtain information on behaviour patterns, special inquiries may have to be conducted.

(11) From pre-selected structural data those are chosen by statistical tests in the analysis phase whose influence upon transport variables is particularly strong, i.e.

- gross domestic product
- turnover by sector
- disposible income
- working population
- population by age and sex
- density of population
- territorial area
- vehicle population
- vehicle density.

Furthermore, determinants of modal choice and route choice need to be ascertained.

Transport censuses (211, 212, 213, 214)

(12) Clear definition of the present transport picture serves as basis for the analysis and forecast of demand for transport services. As geographical frame of comparison one would adopt the above mentioned division of the total area into zones. From the censuses one should be able to gain information about volume (traffic generation), direction (origin and destination), type (of facility used) and temporal pattern (fluctuations) of transport streams. For analytical reasons it seems useful to classify the quoted criteria separately by transport purpose (professional, holiday journeys etc.). For technical and cost reasons, some of these inquiries will have to be sample surveys; others might not be carried out at all. These gaps would have to be filled by estimates. Naturally, this detracts from the predictive value of any data acquired in such a way.

(13) Analysis and forecast of demand for transport capacity are mostly carried out in four stages:

- traffic generation
- traffic distribution
- modal choice
- route choice

Information gained through census has to be examined from these aspects.

Traffic generation (221)

(14) Streams of traffic between individual transport zones are usually described in the form of a matrix (F_{ij}-Matrix). The elements of the matrix are the respective traffic volumes (measured in journeys, shipments etc.) between the zones i and j. The elements of the principal diagonal (i = j) correspond to traffic within a single zone, the row totals indicate traffic by origin ($Q_i = \sum_j F_{ij}$), the column totals, traffic by destination ($Z_j = \sum_i F_{ij}$), and their intersection, total traffic ($F = \sum_{ij} F_{ij}$).

Traffic streams within a single zone play only a secondary role in the drawing up of a comprehensive plan for a total (national) area. They constitute the object of studies of short-distance transport. This is why, in the matrix of transport streams, one deletes the principal diagonals. The marginal totals (origin and destination traffic; Q_i, Z_j) therefore exclude intra-zonal traffic.

(15) The analysis of marginal distribution (transport generation model) represents the first step when carrying out research into demand for transport services. As transport does not result from spontaneous generation, one tries to quantify reciprocal relationships between traffic volume and relevant exogenous variables with the aid of a traffic generation model. The simplest general formulation of a traffic generation model is:

$$Q_i = f(S_i)$$

$$Z_j = f(S_j)$$

S_i and S_j contain those parameters which influence traffic volume, origin and destination. (In order to render the scheme as clear as possible, only origin traffic is treated in the scheme and Q_i is put = F_i.) The "correct" choice of these parameters determines the quality of the model. It seems appropriate, therefore, to analyse traffic volume according to transport purpose.

Traffic distribution (222)

(16) After estimation of transport volume for the total area and regions, the distribution of traffic between the zones needs to be examined. The analysis of internal distribution of the matrix, the F_{ij}-values (traffic distribution model) is the second stage in this research. As an analytical instrument, one mostly applies the gravity model as used in the physical sciences, and modifies it for the purpose of passenger- and goods traffic.

The independent variables in this model are the obstacles between the individual districts (W_{ij}), from the viewpoint of transport participants. These are composed of a great number of factors (i.e. distance, cost, time, subjective reasons).

As a general principle there are two possibilities to produce transport distribution via a gravitation model. The explicit method, so far used here as basis for the discussion, analyses the marginal distribution of the F_{ij}-Matrix (traffic volume) and then distributes the transport streams by means of the gravitation model ("method from above")

$$F_{ij} = k \cdot \frac{Q_i \cdot Z_j}{W_{ij}}$$

The implicit method is based on the gravitation model, but puts in the place of 'origin-destination' data the corresponding parameters of districts i and j and obtains the traffic volume by adding up the lines and columns of elements ("method from below")

$$F_{ij} = k^{+} \cdot \frac{S_i \cdot S_j}{W_{ij}}$$

The first method, i.e. "method from above" is preferred in most cases.

Modal choice (223)

(17) After the general analysis of traffic volume and distribution, the distribution of transport streams between the individual modes of transport is, above all, of interest for the planning of demand. Such an analysis (modal-split) has to be developed in the third stage. Exogeneous variables in this

model are the so-called criteria of choice leading to the choice of one or the other means of transport. These criteria of choice enlarge the resistances W_{ij} to W_{ijm} in the modal-split model.

In the course of planning as described above, the modal-split is applied according to transport distribution. This method is called "trip-interchange" model, on the example of American studies. The distribution between modes according to traffic generation is possible as well and is called "trip-end" model. Both methods have been tested in practice. The advantage of the "trip-interchange" model is that local differences can be considered in the transport data. In the "trip-end" model, on the other hand, general characteristics of means of transport are used as the basis for the split within the total area studied.

The large number of splits necessary is the disadvantage of the "trip-interchange" model.

Route choice (224)

(18) The last stage of the analysis of the demand for transport services is the attribution of transport to the networks of individual transport modes (route-split). The gravitation model, which had been used in order to describe the distribution of traffic, must once again be enlarged for this purpose. If an obstacle W_{ijm} corresponds to a traffic flow F_{ijm}, one must replace the magnitude F_{ijmr} (representing the traffic flow between i and j, by mode m via route r) by a finer measure of the obstacle, W_{ijmr}. This independent variable includes, as noted above, many time distance and cost magnitudes, which are valued differently by individual participants in the transport process.

Inventories of transport facilities (311, 312, 313, 314)

(19) A comprehensive inventory of available and planned transport infra-structure is the basis for an analysis of transport supply and extension plans. This includes the various transport systems (road, rail, air, long-distance pipelines and shipping) with their specific transport networks (distance sections and nodes), transport establishments and means of transport, which are again split up into individual transport elements. Structural condition, capacity, average transport speed and costs are investigated down to individual elements.

These detailed technical and economic investigations require a finer spatial division into transport cells than that used for censuses of streams of transport and structure research. Only the creation of data banks will make it possible to obtain the necessary extensive surveys, censuses and calculations of cost. The inclusion of new, merely projected systems and elements depends on the stage of planning.

System analysis (321)

(20) The analysis of the existing transport supply conveys first indications of essential planning and extension measures. If the investigation covers only one element or the comparison of several elements of the same system, on speaks of system analysis. System comparison, on the other hand, compares analogous elements in various systems or entire systems with each other. A comparison of systems implies, therefore, an analysis of the individual systems and system elements with the aid of consistent technical and economic criteria.

(21) Technical research distinguishes between the traffic and construction analysis. Traffic analysis should determine the degree of utilisation (or capacity reserve) of a transport institution. Capacity utilisation is calculated by comparison of potential capacity - expressed through quantitative measure of capacity/time unit (for example vehicles/h; passengers/h; goods-units/h) - and actual utilisation.

The capacity of a road, for example, is determined by its dimensions, i.e. length, width, number of lanes, method of construction above and below ground, frequency of accidents and other elements. One calculates the future load and compares this to existing capacity; the difference is the demand for transport. Future load in terms of dimensioned structures is calculated on the basis of the same parameters.

(22) The construction analysis should reveal deficiencies and possible improvements in construction. The local need for construction is determined through comparison of the existing with the required situation. It is independent of transport demand.

(23) Besides the technical analysed, there have to be made economic inquiries in the form of cost and revenue analyses. Where the cost analysis is concerned, one should distinguish

between cost for new building (transport requirements), extension costs (construction requirements) maintenance costs and other costs. If alternatives within the same system are compared with each other, the establishment of a revenue or benefit analysis might become necessary. One tries to estimate non-transport positive effects of the alternatives and then to decide accordingly.

Comparison and choice of systems (322, 331)

(24) The comparison of systems should be used to examine the suitability of the various transport systems in technical and economic respects, and to provide quantitative data for the distribution models. Although the comparison of systems consequently forms a central part of the transport planning, there does not yet exist any body of certain knowledge in this field.

As in the case of the system analysis, the setting up of a catalogue of binding technical and economic criteria has to be the primary condition. This can be done, however, only within narrow limits: a uniform efficiency criterion for all transport systems does not exist; a satisfactory solution to the problem of track costs has not been found as yet; neither positive nor negative effects of individual transport systems on the economy and on society have even been examined systematically so far, not to speak of an assessment by confrontation of quantitative benefit and cost estimates. Benefit in existing studies is usually estimated on the basis of time gained by individuals valued on the basis of average wage rates.

All the same, this sector of comprehensive transport planning should be given higher priority in future, as only by means of a rational comparison of systems is it possible to arrive at an optimum choice between the various transport systems. The choice of transport systems is, furthermore, influenced by political considerations, e.g. the relationship between public and private means of transport.

Forecasts of parameters (141)

(25) The forecast of streams of traffic is - as indicated above - linked to the forecast of parameters. The problem of a forecast of parameters lies in the constraint of consistency between regional and total, sectoral and global data. This can

be assured through a step-by-step forecast from "top to bottom": Regional estimates of parameters are linked to those of the total area, sectoral forecasts to global estimates. In the last analysis, the problem of consistency can only be solved through a comprehensive model which takes account of interdependence.

A further difficulty is that a forecast of parameters requires figures covering a long period of time. These are, as a rule, available only for the total area. Statistical evidence for individual regions is, on the other hand, not always adequate.

Before forecasts of parameters are introduced into the model and where this is not an integral part of the forecasting technique, one must check their mutual consistency and the consistency of regional values with global values.

Forecasting models and behaviour patterns (142, 231, 232, 233, 234)

(26) Transport models constructed in the course of analysis are, in the first instance, merely able to describe the actual situation. These models reflect the present behaviour patterns and attitudes of people. A forecast with the help of these models is, therefore, only possible under "status quo" conditions. As one can assume, however, that human behaviour and policy objectives change with time, the parameters of the models are to be modified correspondingly. This requires, amongst other things, detailed research into economic and sociological behaviour patterns of the population. In the narrower field of transport, technical decision makers must, after analysis of existing and new technical systems, make a selection on the future "system-mix". All these concepts are to be included in the modification of parameters in the models.

Forecast data (241, 242, 243, 244)

(27) The relevant parameters are introduced into the forecasting model for traffic generation. As a result of the calculation one obtains the entire volume of traffic (origin-destination) of all regions together and the examined zones.

This traffic volume is allocated by the forecasting model for transport allocation to the links between individual districts.

With the modified modal-split model means of transport are allocated to the individual traffic streams.

Technical choice of network and route-split (351, 352, 353)

(28) Once the individual transport elements are determined, one has still to decide the regional distribution of networks in the individual transport systems. The procedure for choosing the network for a system (m) is described below.

The presentation of a transport network comprises the pure route itinerary and the dimensioning of individual sections of a route. The sections of a route can be determined by transport criteria alone. The airline connections between origin i and destination j of forecast transport streams F_{ijm} show a closely woven network of maximal desires in which the individual routes show widely different levels of activity.

This desired network is now confronted with the existing network (zero network). The reconciliation between these two networks can be brought about either by extension of the zero-net in the direction of the desired network via the adding of new part-sections (progressive method) or through successive extraction of sparsely used sections from the desired network (reduction method).

Both approach-methods have to consider various comprehensive development and land-use ideas. Thus one can develop regions with weak infra-structure through the creation of transport connections (demand for development purposes), or one wishes in any case to connect closely situated centres (demand for connection). Furthermore, benefit-cost-considerations, geographical data etc. will give rise to a deviation from the direct airline connections.

(29) The dimensions chosen for the routes linking the different points i and j must correspond to the loading forecast for them. Although the loading for all routes between i and j is equal to the traffic stream $\hat{F}_{ijm}$, that of each route taken separately depends on its own dimensions and that of all the other routes. The method used is interactive: one adopts dimensions for the routes, one tests with loadings, one modifies the dimensions, and so on. In this way, one determines the network for which the loading is best balanced (desired network).

Economic choice of network (151, 354, 355, 356, 451)

(30) Comparison of the technical optimum desired network with the existing network provides the network requirements. This requirement is compared with the total of financial means available for transport infra-structure. Usually, the amount will be inadequate. The selection process is then repeated: dimensions or routes must be modified and the new network tested by loading, and so on.

Should even a repeated modification produce an overload of the network, the forecast of the parameters needs to be modified: since transport represents a bottleneck, economic growth will slow down. Through models of transport generation and allocation, then, available financing constrains adaptation of the load to the network which can be realised.

Step-by-step extension plans (357, 452)

(31) At the last stage, the order of construction projects will have to be fixed with the aid of technical, economic and comprehensive planning criteria of priority.

Technical criteria are related to the utilisation of various routes over a given period and their structural condition. The comprehensive planning criteria are shown in the priorities of the individual regional development plans. Economic criteria relate to the effect of individual construction measures upon the growth of individual regions, the total area and the trend of the overall economic situation. Comprehensive transport plans result in exact extension plans of the individual networks for each time section within the total planning period.

3. Problems of integrated overall planning in the field of infra-structure

(32) The transport plans at present available in the German Federal Republic

- extension plans within the framework of the Federal programme of transport networks
- comprehensive transport plans of the Länder
- communal transport plans

show, to a great extent, the elements of transport planning as described above.

The large number of different planning decision makers (within the field of road construction alone roughly 25,000 in the Federal Republic) leads, however, to inconsistency of transport plans, mainly as far as socio-economic parameters and their forecasting are concerned.

(33) There exist even greater co-ordination difficulties at every level between "transport" and other fields of the infra-structure - such as "education" - in spite of the legally guaranteed duty of co-ordination, notification and provision of information (see amongst others the 'Raumordnungsgesetz').

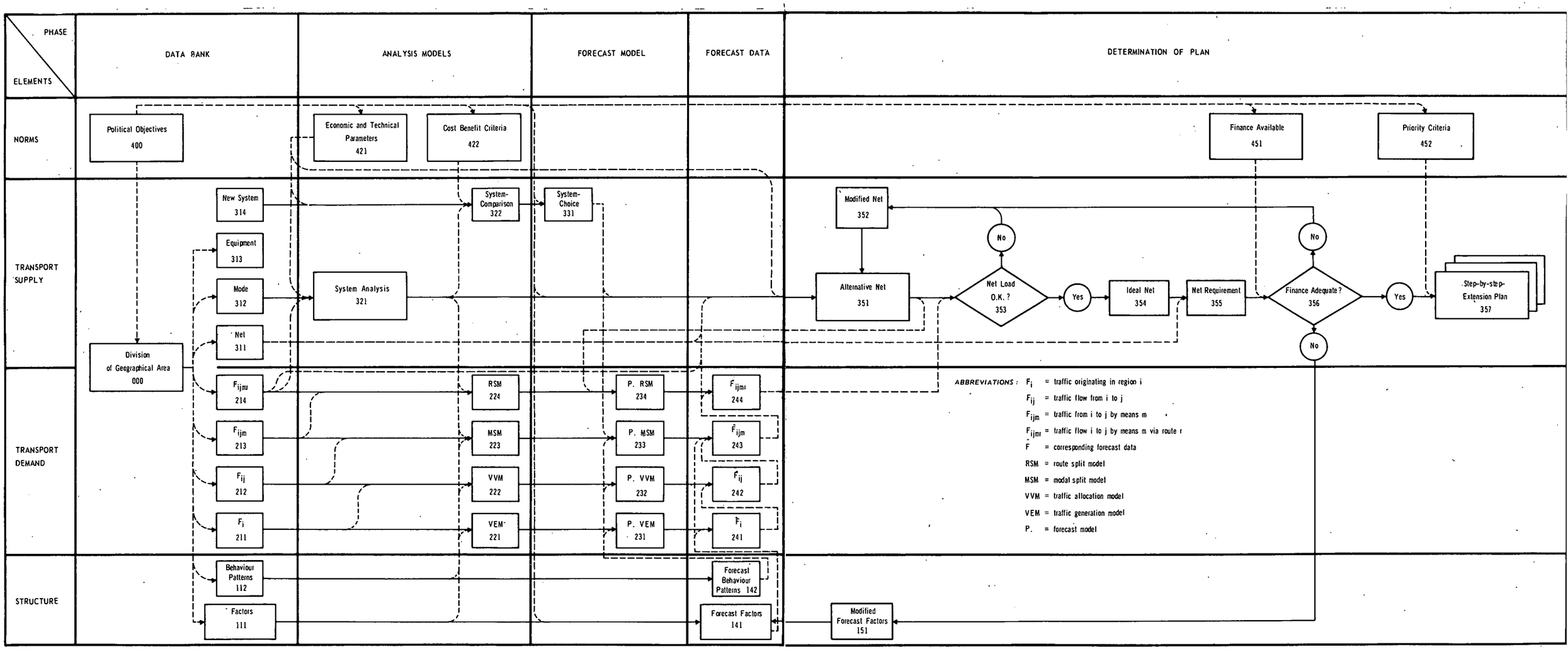
Even plans developed at the Federal level are, in some ways, isolated. They are, as a rule, directed to favourable treatment for the individual sector. Financial means required for their execution exceed by far those means which will be available in future: The plans will have to be revised according to priority and socio-political significance and will have to be adapted to income.

(34) Problems of a co-ordination of plans in the field of infra-structure lead to the question whether one should not abandon the concept of several autonomous planning authorities - at least regionally - in favour of one centralised body authorised to carry out infra-structure planning.

(35) If one intends to preserve the autonomy of individual authorities, the concept of an integrated overall planning would have to be orientated towards the following principles:

- In order to standardize the data basis of all public planning, the establishment of a public institute of research for long-term forecasting may be required. This institute should, above all, provide standardized forecasts on macro-economic, regional and sectoral structural data.
- Autonomous planning within the individual regions should, more than in the past, be subordinated compulsorily to a sensible co-ordination. This could be obtained, for example, through a stricter wording of the law ('Raumordnungsgesetz'/corresponding laws by the Länder) with a view to obligatory co-ordination of individual plans.

SCHEME FOR THE OVERALL TRANSPORT PLAN



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SUMMARY REPORT ON THE DISCUSSIONS

1. Introduction

1.1. The development of modelling techniques to facilitate the preparation of overall regional and even national transport plans is attracting considerable attention because of the benefits that this type of planning is expected to confer. Considerable experience in the techniques of modelling urban transport networks is found in many countries. Models are used to test various alternatives for the preparation of long-term plans for the future. Such studies are often criticised, frequently with some justice. However, modelling techniques represent a positive approach to fundamental problems that have to be answered. Future refinement of modelling techniques(1) combined with a better understanding of human and environmental factors will make the results of modelling techniques of even greater value to decision-makers. Process with urban modelling techniques has prompted interest in the application of similar methods elsewhere, notably in inter-urban transport planning. However, when considering the problems of integrated regional planning, it is essential to recognise the influence of cities on surrounding regions and that regional planning must be integrated with that of the cities.

1.2. The first question in relation to general-integrated planning is, can, or should, modelling techniques be extended to regional and national plans for transport? The theoretical model described in the Introductory Report is applicable to urban and regional studies. However, moving from the urban into the regional field, one can identify certain differences which increase the problems of planning, particularly when various modes are considered together. Notable difficulties concern the pattern of future land-use, which is related to employment, housing, population forecasts, the impact of infrastructure on development, etc. Whereas, in an urban area, the relevant authority can, with some reasonable certainty, lay down some

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(1) Further information on this will be found in the Report on the E.C.M.T.'s 13th Round Table: Determination of Elasticities of Demand for the Various Means of Urban Passenger Transport, by M. BARBIER, Paris, 1972.

guidelines for future developments, this is much more difficult in a regional context. The arguments for controls to ensure planning decisions are followed in urban development have much weight. However, outside urban areas, can planning be followed-up without a considerable number of direct controls to ensure planning decisions are carried out? This fundamental question of the scope of overall planning was discussed at the Round Table; differing views were expressed, as might be expected in a new and complex field such as this. The paragraphs that follow attempt to synthesize the main points touched on in the discussions, the arrangement of the notes follow basically that of the Introductory Report.

1.3. To establish the background for this synthesis of the discussions, it should be noted that the participants took an essentially catholic view of the title of the Round Table. Discussion ranged over a considerable area and took in many of the general aspects of planning.

2. The Scope of Overall Transport Planning

2.1. Difficulties in finding a common ground to discuss this question illustrated the necessity to distinguish clearly between planning and a plan. Planning can be considered as the preparation of measures which will lead towards the successful attainment of goals, the planning process involves the perception of problem areas, the development of alternative methods to attain these goals and the testing of these alternatives against available (budgetary) resources. A plan is the presentation of the results of studies which have been approved by the government as a policy statement of future action. Alternatively, a plan may be a research document published for study and comment before political decisions are finalised. The Round Table was essentially concerned with "planning" and not with implementing plans, which concerns problems of administration, the budget and politics outside the scope of the meeting.

2.2. The extent of a plan's coverage will depend on the political decisions in addition to the transport and general economic situation. Agreement was reached that a successful overall planning process has to have a field wide enough to take into account all important measures for the field under consideration. It may even be necessary, as in Switzerland where the

national situation can be greatly affected by measures taken in neighbouring countries, to include the current and future situation of these countries as inputs to planning studies.

2.3. The movement from sector planning to overall national planning presents further difficulties. It was agreed to be important in the practical sense for planners to clearly understand the association of various sector studies; they will very likely face situations where their tasks are not clearly defined and where personal judgement must determine the work they undertake. Ideally, a national transport plan will form an integral part of the preparation of a general national plan that sets out, in detail that varies according to the ideas of the government on state direction of industry, etc., lines of development for the future. However, this theoretical ideal will take time to achieve and in the meantime, transport planning cannot be left in animated suspension. At least two possibilities present themselves to transport planners in this situation. The first is to attempt to supplement key forecasts of important parameters such as G.N.P. and population by developing further statistics for the transport planning sector. The second is to take whatever plans have been made and seek to throw light on the consequences of these plans for transport by assuming present policies are continued unchanged. Both courses have advantages and drawbacks, some guides to these can hopefully be taken from these notes but again this problem illustrates the difficulties that exist in overall regional planning, more even than in the urban field. Clearly plans for transport infrastructure, such as roads, must be made but for regional transport planning to be useful, presupposes that other sectors of the economy will also prepare plans and that these plans will be directed and co-ordinated along agreed lines by some central organisation.

2.4. In further discussion of the scope of planning and work of planners, the doubt was raised as to whether planning was regarded too often as a theoretical exercise that was useful but not to be confused with practical policy-making. In support of this viewpoint, it was held that if planning is confined only to the evaluation of new investment, much of its potential practical value will be missed. The plan will be cast in a vacuum away from the realities of pricing and general management of the system. Clearly the use that is made of their efforts is of

concern to planners. No general answer can be given to this problem but it might be beneficial for planners concerned with this question to study the basis of decision theory, in this field the work of the Tavistock Institute in London was cited as being of special interest.

3. Forming Objectives for Overall Planning

3.1. A first essential step for planning is to establish clearly and precisely what the planners are asked to do and with what criteria should they "measure" the various alternatives open. The terminology of this subject is not immediately clear, hence some preliminary agreement on terms is necessary.

First, the processes of society depend on the current VALUES which form its structure, and are the basic aims of the population.

Secondly, the values of society at a particular time or in relation to specific questions can be termed GOALS, these are still of a very imprecise and general nature.

Thirdly, when the goals are expressed in a way that permits their attainment to be measured, they can be termed OBJECTIVES. The process of arriving at objectives was of principal concern to the participants of the Round Table.

3.2. A three-stage process of arriving at objectives was considered to illustrate the complex processes that were involved:

(a) General Objectives

These are essentially political in nature and will take account of the current "ranking" of various general goals of society. An economist is one among equals in the process of selecting these general objectives. However, even at this early stage, the expertise of the economist was considered to be relevant. Particular points for the advice of economists relate to the feasibility of objectives and their mutual compatibility. For planning, it is clear that fundamental inputs to the process, such as distribution of income, population distribution, etc., must come from this source. To facilitate this, a clear interface between planners and politicians must be established.

(b) Specific Objectives

Following a process of discussion between politicians and planners, specific objectives can be developed that related to general economic and social possibilities that now exist and are likely to exist in the future. Specific objectives might stipulate such points as the development of free competition, the development of effective measures to protect the environment or that public subsidies should be minimized.

(c) Working Objectives

Given the "specific" objectives, it is necessary to develop even more precise criteria for planners. The working objectives will establish precisely what the planner is to examine. In addition, a guide to the relevant criteria to be used to measure the attainment of objectives should be given.

3.3. Political objectives are seldom phrased in a manner that permit their direct use as working objectives for the planning process. In this position, to avoid problems at the final evaluation stages, it is essential to have a dialogue between planners and politicians to clarify objectives and criteria to be employed. Even when a satisfactory degree of agreement has been reached, a continuing monitoring process is necessary that ensures planners are made aware of, and take appropriate action, changes in the political position relevant to the objectives.

4. Particular Objectives for Overall Transport Planning

4.1. An overall transport plan aims to integrate within the same framework planning for all modes of transport. Additionally, overall planning is expected to relate to planning in other sectors, although sector planning can also meet this requirement. Overall plans are especially necessary in relation to long-term developments where the elasticity of substitution between modes is important and where considerable changes in technology or basic parameters may occur.

4.2. Areas of special interest for the application of an integrated planning process were discussed; two were noted as being particularly relevant for this type of approach.

First, research into the general principles of regional development.

Second, specific work on assessing the impact of transport developments on national land-use development.

5. Problems in Elaborating Objectives

5.1. The division of objectives above into general, specific and working, was questioned on the grounds that the links between these factors required an iterative process that makes such a division of little practical value. Emphasis was placed on the need, especially in connection with large-scale plans with long gestation periods, to incorporate changes in policy over time. As no overall objectives can be devised to measure national welfare the working objectives should be framed in such a way that they are comparable, Planning, Programming and Budgeting systems aim to provide a framework in which comparisons can be made but do not appear capable at this time of operating at a general level without large inputs of time and money (see E.C.M.T. Round Table No. 10).

6. The Place of Politicians in the Planning Process

6.1. The need to establish a process to develop political goals into planning objectives has already been noted. This process in no way implies any criticism of political practices but is rather because planning needs to be more definite and, if possible, more numerate than is normal for political discussion. Hence, in order to avoid a major area of difficulty for the development of planning and the later political acceptance of plans, clarification is necessary. A solution to this, that found support in the discussions, was to attempt to involve politicians in the planning process. Such a system might be along the lines shown below:

Firstly, the politician sets general objectives;

Secondly, the planner examines objectives for:

(a) Classification in economic terms

(b) Internal compatibility

(c) Feasibility within time-scale of plan

(d) Formulation in a form working objectives

From this, working objectives are formulated;

Thirdly, the politician considers the working objectives for acceptability and, if necessary, the system is re-cycled until agreement is reached. Upon final agreement the specific

time-scale can be settled, as well as criteria to be applied to evaluated achievement of the objectives.

6.2. However, even after an integrated approach of this nature, it is still possible that the results of research will put into question certain general objectives. An example that might be cited of a possible change in the general objectives concerns mobility which is currently a basic general objective. In the future, notably in urban areas, it is unlikely to be possible to provide for total mobility objectives of the inhabitants. The problem then arises of how to ensure that general objectives - like mobility - can be re-examined when evidence is available of the increasing amount of resources that have to be devoted to their attainment. Such a re-evaluation clearly requires a flexible, yet clearly structured, process that ensures a feed-back of information between planners and decision-makers at all stages of the process.

6.3. Between the inception of planning and the final stages, the rôle of economists in relation to decision-makers changes with the planning process. Initially, a dialogue should be set up which will elaborate goals. During the planning process, formal contacts exist only to clarify issues. Coming to the implementation stage the planners will present the best alternatives; at this stage, the decision-maker will, owing to the impossibility of evaluating political factors in the planning process, possibly wish to amend the ranking for the final plan. For the final plan, the planner will advise on programming in relation to available resources, the current and future situations.

6.4. For the second stage of the planning process, the planner will require that information is available on all relevant planning elements - the broad areas of supply and demand factors. The elements will need to be quantified to as great a degree as possible in order that their future magnitude can be estimated. Inevitably, certain elements, possibly even important elements, cannot be encompassed in tangible measures, hence these will need separate analytical treatment to ensure that they are not under-weighted in the ranking process.

6.5. The problems of estimating future demand illustrates the difficulties that can be experienced in planning on a detailed and even more on a regional or national level. Some success has

been experienced, notably for urban land-use transportation studies, in combining the techniques of survey and enquiry used in psychological research into the process of constructing economic models that seek to explain and forecast demand. However, the preparation, calibration and use of economic models, even in the well researched urban field, still poses many problems; these grow correspondingly greater when one moves into regional planning.

6.6. This can be thought to lead on to the problem of how to ensure that the desired balance in planning is achieved in practice - this point led to the view that planning carried out without the assurance of suitable measures to enforce the plans is inefficient. This point is referred to later in connection with pricing.

7. The Choice of a Time Horizon for Planning

7.1. With the rate of discount currently around 10 per cent benefits which accrue after 20 years have a discounted present value of approximately 10 per cent of their monitary value. This imposes a very effective time ceiling of between 20 and 30 years on economic planning, especially as with forecasts over 20 years the value of any figures must be treated with considerable caution. If, as was proposed, a "rolling" planning approach was adopted involving the regular adaptation of plans as the time horizon is moved forward, a degree of sub-optimisation was inevitable but the degree of sub-optimality would be small (see below "Dynamic Planning"). A further argument that points to a time horizon of 20-30 years is that the economic life of much road and rail equipment falls within this period and hence coincide well with this planning horizon.

7.2. Another possibility which received general support for certain applications on a wide level consists of forming a planning horizon in terms of certain key economic or social circumstances - population achieving a given level or density, income per head a certain level, etc. From these basic concepts, planning can be developed to provide infrastructure for the forecast situation.

8. Statistical Requirements for Planning

8.1. Examining the general problem of statistics for transport research, it was felt that many gaps still existed. There were still many important statistics that were missing - especially in relation to freight activities. Better statistics were needed notably to permit improved modelling techniques to be used but the types of models used often define the type of statistics that are necessary. It was suggested that specific statistical requirements for modelling could well form the basis of a study on a European basis of the requirements in this field. Problems can also be caused if official statistics are collected by persons not having any research experience and it was recommended that planners be consulted at all stages of the data collection process.

9. Geographical Zoning

The ideal zonal structure would consist of small sub-divisions of the planning area but this is not normally possible due to the non-availability of data. In this situation, a compromise has to be found between zones that are too large to be valuable and zones that are too small for data to be available. The solution adopted in the Netherlands has been to use a grid of 85 zones on which all economic forecasts were based. For the road system, 350 zones were "loaded", this was dictated by the flows of passengers. For the railways, a finer grid was desirable as it was necessary to have information on the "hinterland" served by each station. In order to fulfil this requirement, a 1,000 zone grid was utilised. For the freight study by commodities, 43 zones were held to be satisfactory.

9.2. In the field of data analysis, administrative limits are seldom convenient. Further difficulties can be presented when mergers occur which results in changes in previous administrative divisions. A possible solution to this problem is to use single zones or cells which can be built-up to form a nucleus for divisional or regional planning.

9.3. Various aspects of planning require different types of approach to data analysis. Demand forecasts need a much finer distribution than is practically possible for demographic statistics. It is possible to make a distinction between forecasting data and data for studies, the data necessary for

forecasting can be of general nature as the nature of the forecasting exercise normally makes very "finely detailed" information superfluous.

9.4. The work carried out in Switzerland to establish a data collection and storage system on a national grid basis was considered to be a great interest. The grid pattern is unrelated to political boundaries, land use, houses, industry, etc.

9.5. The Choice of Planning Boundaries

The form of overall political boundaries will clearly play an important part in determining the limits of planning. However, it is likely that some scope will exist to modify the boundaries dictated by political factors. Two important criteria in this context were noted:

First, the planning areas must relate to a region, or regions, that is relevant to political decision-making.

Second, a decision has to be made as to the major requirements for planning that relate to various configurations of the boundary, e.g. in planning transport for an urban area, the planning boundary can well be set at the limit of extensive commuting into the area.

9.6. A Databank for Planning

Participants were generally agreed on the potential value of national databanks. A databank in the transport context should not be regarded as an isolated unit but rather in its composition and in its construction as part of a general attempt to collect and display information on a co-ordinated national basis.

9.7. Cost of a Databank

Although in certain situations the degree of fineness of zoning can be increased, this involves a high cost in both effort and money. Some doubts were also expressed as to whether increasing the finesse of a data grid notably increased the accuracy of the final results. With regard to the calibration of models, it was argued that sufficient information to estimate their accuracy is not available. Another difficulty, of an equally basic nature, is that the estimation of the degree of accuracy of information necessary for models of different types is not clearly understood and generally accepted. In this

situation and where, as was often the case, planners had only a limited budget available for their work, the principal task is to decide how to allocate resources in the optimum manner, i.e. to look at the marginal costs and benefits of different systems.

9.8. In opposition to the view that no evidence was available to indicate conclusively that fine zones did not confer benefits, some participants felt that for large planning problems, collecting and projecting data to a finer grid would yield worthwhile benefits.

9.9. The answer to this problem seemed to depend on the answer to the question for what purpose is the data to be used? It was argued that a well-designed system, operated in an efficient manner, to collect data on a grid pattern, need not be very expensive; the example of the databank created in Switzerland was cited in evidence of this. However, it was noted that a major hurdle in relation to the Swiss work was rather a psychological problem of "selling" the system to agencies currently collecting and retaining data; there had been a reluctance to give addresses with data before evidence was available on the soundness of the project.

9.10. A further advantage of a "fine" grid is that the possibility of achieving any real modification of political boundaries is not very great; in this situation with a "fine" grid, the plan can more easily be arranged to fit an existing political framework.

10. Availability of Data for Planning

10.1. The difficulty of planning is often increased by the obstacles that are placed in the way of free and easy access to information; a databank, as found in Switzerland, would greatly reduce these problems. Members of the Round Table were agreed that governmental departments and others concerned with the collection of statistics should re-examine their systems to ensure:

(a) that the data being collected was really useful

(b) that data was stored in the most convenient way for studies and all information not absolutely confidential was made available

(c) that useful information not at present collected be included in the programme if the benefits justified the costs

11. Problems of a Grid Planning System

11.1. A problem with a grid system occurs with the interface between zones. For certain large urban areas, the interface with a regional or national system is not vital as the vast majority of movements are intra-zonal and cross-boundary trips are of minimal importance. However, for smaller centres and important "corridor" areas, the interface is important if the data is to convey a real impression of the situation regarding traffic flows.

11.2. With all such systems of data collection, it is important to consider the marginal benefit if increasingly complex arrangements as compared with the marginal cost. In Norway, a grid system examined for transport studies had proved to be too expensive, in terms of marginal benefits over a more orthodox approach, to justify its further development. However, the value of a grid system will vary from purpose to purpose. In Sweden, it was reported that a grid system had been adopted for population statistics. Raising a question about a national data system, it was suggested that data requirements vary according to the purpose of the planning study and the political goals of the period. Should an overall system be adapted, something of a compromise would be necessary which could be a drawback to special studies if it resulted in a limit being imposed on the possibilities of collecting additional information.

12. A Co-ordinated Grid Planning System for Europe?

12.1. A proposal that won support in the discussion was the possibility to institute for Western Europe a computerised system of data collection based on grid co-ordinates. It was noted that a proposal to establish data collection on grid co-ordinates had been made for the United Kingdom but had not yet been followed up. Such a system could have three basic features:

(a) Data collection based on 100^2 ms.

(b) Zone level for aggregation

(c) Presentation of results with a standard format

13. Survey Requirements

13.1. The difficulties in collecting data relative to the behaviour of transport users (i.e. the population) causes particular problems for research workers. It is clear that simple studies often fail because travellers are frequently unclear about the basic choices that face them in making trips. This calls for careful and painstaking preparation of the basic survey work to ensure questions are clearly set out and explained; the successful completion of the work is crucial for planning.

13.2. The two basic survey methods mentioned were:

Firstly, cordon surveys;

Secondly, surveys based on workplace or residence.

For either method to succeed, it is essential to establish clearly the goal for which the data is intended and how the results are to be processed. Only with these fundamental points clarified can a survey hope to obtain the correct information to complete the study. An additional problem, whatever the survey method, is the problem of unsatisfied demand. This remains a major shortcoming of studies and leaves a blank area in the field of overall planning, at least in a social sense, which clearly calls for further study.

13.3. Further problems are often experienced when attempts are made to study the relationship between infrastructure and trip-making. New developments, such as new high-speed ground links, generate traffic but studies on the wider aspects of the relationship of infrastructure to usage of transport facilities have not yet produced general results. Yet another problem relates to the availability of information on a time series basis to enable trends over time to be identified clearly.

14. The Stages of the Modelling Process

14.1. The present modelling process cannot take into account the relationship between trip generation and such factors as route choice. This indicates that even with considerable research having been accomplished there are still considerable gaps to be filled.

14.2. The four stages of the modelling process discussed were:

Generation

Distribution

Modal Split
Route Assignment

14.3. Data necessary for the first three of these is very similar but the fourth is much more complex and requires special studies. Often data developed by the use of other studies has to be used for this approach. Research here is centred around the development of integrated models and the application of probability theory to these questions. However, considerable problems remain at the data stage of the work and in assessing, from a behavioural point of view, users' comprehension of the existing network.

14.4. The opinion was also expressed that combining route and modal choice was not a logical approach in view of the basically different nature of the factors involved. Modal choice can be identified on the basis of established determinants. Route choice tends to vary much more according to various psychological factors that can change from decision to decision.

14.5. However, the major problems to be tackled will vary from country to country according to circumstances. For instance, in Norway route choice is not as important as in central Europe where large volumes of transit traffic using major links. A similar factor of importance is to describe what can be termed the "hinterland" related to urban neucleii. It was argued that problems such as these are too specific and important to rely on national statistics for relevant information, hence it is essential to carry out special studies.

15. Criteria for Models

The proliferation of attempts to use models for planning calls for the development of criteria to test the value of the attempts. Four main points were noted:

(i) The models must be good at explaining the observed data.

(ii) They must be plausible in a behavioural sense.

(iii) The models must be capable of calibration with data available and which will be available for the future.

(iv) The models should be responsive to variables that can be affected by political decisions.

16. Parameters and Behaviour Patterns

16.1. The importance of a close study of the key determinants of overall economic activity needs close attention in planning. Macro-economic analysis is capable of throwing much useful light on these factors. The development in Norway of a 25 sector input-output model for the country has produced much basic information for use in planning. The only exogenous input into studies with the model is population which is given by political decisions. If it then appears that the working population is not in harmony with the population forecast, the onus of resolving the problem is put back onto the political decision-makers. The experience of this research had indicated that the development of parameters out of an integrated macro-economic model had much to commend it.

17. Forecasting Behaviour Patterns

17.1. Models based on existing parameters projected into the future applied to commuter and business travel were thought to be generally useful. For recreational journeys, the situation is more complex due to the major changes that have and are occuring in habits and customs. This "cultural explosion" as it was termed, gives rise to a difficult problem for planners notably when forecast traffic flows exceed available road surface or require very heavy investment to meet these peak demands. In these situations, a decision has to be taken whether to fit the network for the traffic or to impose some form of constraint.

17.2. Given this problem, the possibility was discussed of restraining the excess demand in some way either by physical means (i.e. not providing capacity), or, an economic charging system. A fundamental point discussed in relation to this important problem was that the subject involves the relationship of mobility to society, a very difficult point. This point was noted earlier in connection with reviewing of general objectives of planning.

17.3. For planning in connection with peak flows, the system of planning capacity, on the basis of the 30th highest hourly flow in the year, was mentioned as a solution. However, although this method is simple and direct, it was pointed out that the 30th hour had no more significance than any other hour during

the year. The overall view of participants was that a decision has to be made if planning was to be practical and it was for politicians to present planners with their views.

17.4. A further problem discussed in this general context was to the relationship between demand and major changes in supply conditions. There is also the possibility of changes in the degree to which users perceive costs and hence on demand. These problems again were thought to justify attention in future research studies.

17.5. Changes over time in the general economy also require careful consideration. This subject was particularly important in the long-term as changes occur in the pattern and structure of housing and industrial development. The question was posed as to whether with planning limited to transport, the effects of, for instance, imposing controls on entry into cities or requiring urban transport to be viable could be adequately defined? Further, if they could be defined, would it be possible to make any accurate forecasts as to the impact of the changes on the wider framework of society? The answer to this was "No", which added weight to the views, noted above, on the need to integrate transport planning with wider economic planning.

18. Realities of Planning on a Regional Level and Possibilities for Co-ordination

18.1. Although economic calculations have not yet reached a sufficient degree of sophistication, to believe that substantial modifications, not to say improvements, to plans will be introduced through the political process. The possibility of integrating politicians into the planning process has already been noted and further steps to integrate other bodies, such as associations of users and operators into the process should be considered. A further important point to consider is the proper co-ordination of plans between executive bodies to ensure that implementation was properly co-ordinated.

19. Some Practical Planning Experiences

19.1. The Netherlands Transport Plan

A. An overall integrated transport study for the Netherlands commenced in 1967 and a final report is expected to emerge at the beginning of 1972. The study is essentially concerned with the main links in the national road and rail networks; although

due account is taken of the influence of urban regions on traffic flows on the main links. The study horizon was divided into three parts: 1980, 1990 and 2000.

B. The study follows a basically similar approach to that described in the Introductory Report. Explanatory equations are divised for existing traffic flows and are used to provide forecasts of future demand.

C. The basic data available was probably rather than one might normally expect to find for similar studies elsewhere. The research was able to take advantage of the data provided by surveys carried out by the West Netherlands Public Transport Promotion Committee (Commissie Bevordering Openbarr Vervoer Westen des Lands). The data available included the results of a home interview survey of three most populous provinces of the Netherlands and a motivation survey. The Netherlands Railways also provided data. On the freight side data was available from the Central Bureau of Statistics relating to 1968, and this was supplemented by specially collected material.

D. Research into the explanatory variables of traffic flow showed a similar range of factors to that found in other countries - disposable income after tax, travel, time and costs, etc. These factors were projected forward to provide the basis of future traffic forecasts.

E. Looking to the supply side of the situation, quite severe constraints existed on the degree of planning freedom available for new or expanded links. This is a feature presumably shared with countries and regions which have a closely knit pattern of residential and industrial development. In this situation, it is clearly necessary to consider how available space should be allocated. The Study postulated that users should, as far as possible, be acquainted with the costs of using the network and that wherever feasible the price mechanism should be the preferred system of regulation. Evaluation of the alternative possibilities open was carried out by the use of cost-benefit analysis with the addition of other relevant information as and when necessary.

F. The study consisted of 10 basic stages:

(a) The preparation of models to explain traffic generation, distribution and modal choice.

(b) Data collection and manipulation, on a zonal basis.

(c) Testing and necessary modification to the models to explain existing and forecast future flows.

(d) Construction for the computer process of a full calibrated network taking the existing system into account.

(e) The construction of traffic flow matrices by mode of transport (modal split) with "high" and "low" road/rail alternatives.

(f) Formulation of a simulation model for the railways and an optimisation model for the roads

(g) Determination by the computer routine of link loads and the consequent investment requirements for links which satisfy the investment criteria

(h) Comparison of the investment requirements of various models and available national resources

(i) Preparation of broad conclusions on future planning requirements

G. A notable feature of an already elaborate and complex study is the additional "spin off" type research that has been carried out. The fields studied include:

(a) Population trends in the Randstad (the highly populated Western Netherlands)

(b) Population and employment distribution

(c) Ecological criteria for infrastructure investment

H. Main Results and Limitations

The specific results are clearly only of national interest but several conclusions of general interest should be noted. A notable aspect is that flows were not adapted to accord with decisions on likely future infrastructure but were left untreated to place final decisions, with full information available, on to the political decision markers. This procedure accords with the principle of illuminating planning decisions that arise rather than assuming them away in the process of planning, possibly to be resurrected later and cause a severe reverse in the planning work. Other problem areas the study brought into prominance were:

First, the distribution of work and population between the densely populated Western areas (Randstad) and the rest of the country.

Second, the principle of mobility; should trips and trip kilometers be reduced possibly by increasing their cost.

Third, the distribution of traffic over time and mode. Can the pricing mechanism be applied effectively to influence trends in the desired direction.

J. A general problem with this type of study is how to incorporate sufficient feed-backs into the process. There is clearly a connection between trip-making and infrastructure available, modal choice, etc. However, it has not yet proved possible to incorporate these factors in a satisfactory manner. A further general problem, found in this study, was the difficulty of incorporating environmental factors into the optimisation process. Although account was taken of planning and environmental factors in the study of the computer output this is a limited process only.

K. Some practical shortcomings of the study are:

Firstly, time series data is very difficult to obtain, hence changes over time may not be completely taken into account.

Secondly, the elasticities of price and substitution are not as thorough as is necessary. A further study is planned to provide more detailed information on the behaviour patterns of transport users.

Thirdly, the computer processing requirements are too great and the various programmes are not sufficiently co-ordinated; to be really efficient for policy planning, these aspects must be re-examined and solutions found.

Fourthly, insufficient information prevented any account being taken in the optimisation process of the costs of road and rail networks within conurbations.

L. As concerns new techniques, the possibility of incorporating new rail lines with speeds of 200 and 300 km. p.h. was considered but rejected mainly as no account was taken in the survey of international passenger traffic. However, the impression given by preliminary examination was that trains of 200 km. p.h. were not beneficial as costs are little different

from trains of 300 km. p.h. while benefits over 160 km. p.h. are very small.

M. General Points to Note from the Study

There is a clear need to improve and co-ordinate the various models used in this type of operation if they are to be really fully useable. As a first step, attention should be concentrated on the quality of the input data, specific studies, well designed and implemented, are needed to provide information for such questions as modal choice. Although overall the final plan has run into difficulties of a budgetary nature, and doubts over general planning and environmental factors, it has provided the basis for a thorough review of the situation and consideration of comprehensive measures provide the best transport situation for the future. The study can be considered a good example of the new integrated planning approach that although being capable of refinement, introduces many new possibilities for planners.

19.2. The Norwegian Road Plan

A. The decision on the scope and nature of the planning process will turn to a large extent on the political and economic situation. In Norway, viewing the situation from an efficiency viewpoint, the problems associated with the development of the road network were such as to justify the preparation of a plan for this sector separately, although, of course, considering other modes. Ideally, a road plan should form part of an overall transport plan, as in the case of the Netherlands, and then form a key section of the national economic and social plan. However, this would be a time-consuming process calling for very detailed and extensive research effort. In these circumstances, an isolated plan was justified in order to produce quickly plans for the road system. A difficulty found in the Norwegian studies with the use of models, as described in the Introductory Report, was that intra-zonal traffic flows were necessary but this information was not available. The final technique adopted was to use traffic flows between 84 zones and apply a growth (Fratar) type approach to produce future traffic estimates.

B. In order to set up a priority rating for the network, calculations were made for each sector of the following:

Maintenance cost savings

Investment cost

A 10 per cent D.C.F. calculation was then made to prepare the economic priority ranking. From this, an overall long-term plan for road development was prepared.

20. Selection of Planning Strategies

20.1. The evaluation process for transport planning consists normally of the evaluation of alternative networks - these are evaluated against the general objectives that have been established for the overall planning exercise.

20.2. The possibility of applying Cost-Benefit Analysis (C.B.A.) to the planning process on a regional or national level led to discussions on the practical possibilities that were available for the use of this technique. The main difficulty with the use of C.B.A. was agreed to be involved in establishing tangible values. Because of the difficulty with C.B.A., cost-effectiveness analysis was considered by some members to be a more useful tool. However, other views were expressed in support of the general application of C.B.A. to planning problems whenever possible. The diverse views expressed could be summarised as amounting to a recommendation that various techniques of evaluation could be applied within the same administrative structure.

21. Cost Benefit Analysis in Planning

21.1. Varied opinions were expressed on the value of the C.B.A. One view was that C.B.A. could not be used for the overall evaluation of projects and that other criteria must be used. According to this view, C.B.A. was not yet capable of evaluating major factors, intangibles and hence reliance had to be placed on other approaches. This view contrasted with that expressed by certain other delegates who considered that C.B.A. was of primary importance in planning and must be an integral part of the process.

21.2. The question of whether to use C.B.A., what value to attach to the results, etc., has much concerned decision-makers and following-up this interest, the participants expressed different views. On reflection, the various ideas expressed seemed to be closer than the discussion might have indicated and the major differences turned on the emphasis that is given

to C.B.A. in the planning process. The problem is a complex one that requires a decision between the following:

Firstly, whether making C.B.A. central to the planning process was not force analysis into paths which might not produce good rest.

Secondly, is close association between analysis and planning essential to ensure that full attention is given to the results of analysis in the final stages of preparing the plan?

Once again, the answer to this problem seemed to be dependent on the nature of the planning process and the problem to be tackled.

21.3. Technically speaking, and notably on a national or regional level, it was generally accepted that although C.B.A. had integrated much behavioural information with the economic system, progress still remained slow in certain fields; notably concerning the results on regional development of improving transport facilities and in relation to the environmental aspects of projects. The formulation of C.B.A. along Planning, Programming and Budgeting principles might enable analysis to be extended into general aspects of budgetary allocation, however this stage had not yet been achieved in practice. Some closer co-ordination was thought especially necessary even in the early methodological studies for planning to ensure that the eventual results of C.B.A.'s conducted in various sectors were comparable. This might well require, and hopefully even aid, the necessary development of a common system of cost accountancy over government projects that facilitated "across the board" comparisons. Mention was also made of the differences between problems of "E" roads and problems between borders, and also of joint studies in Holland/Germany border financed partly by the E.E.C.

22. Sub-Optimal Planning

22.1. This was a question that attracted particular attention in relation to budgeting. The essential problem is to choose, within a plan, the best mix and sequence for implementing schemes. Three reasons were given to show why the use of techniques of "dynamic programming" is likely to be of great value in this field:

(a) Dynamic programming aims to provide the best plan over time. An example of this occurs when the benefits of one project grow much more rapidly over time than another, because of differences in economic and social growth rates, and the ranking of the projects can, therefore, be reversed. This situation requires that different values for the costs, benefits and net benefits should be fed into each project according to the period in which it is built. Dynamic programming can tackle this as it can use different values at different stages as well as producing optimal solutions over different time periods.

(b) Dynamic programming methods can also be valuable in the situation where there are very many possible projects and combination of alternatives staging of projects. In this situation, dynamic programming can reduce the comparisons to a more manageable number.

(c) The third argument in support of dynamic programming is that unlike other methods, such as C.B.A., it considers all alternatives that can give an optimum use of the budget. Hence, there is no possibility of a possible solution being omitted.

23. Pricing Policy and its Relevance for Planning

23.1. The Round Table agreed that notwithstanding the development of a greater understanding of the "generalised cost" concept of explaining trip-making, pricing policy is most important and can also react back on G.N.P. in the sense of affecting consumption patterns. These factors argue for the inclusion of prices in a planning study and a sufficient recognition of the necessary feedbacks between various stages of the demand analysis.

23.2. In relation to transport, state intervention in the market is very important, not only in relation to policy related to the use of basic infrastructure but also as far as concerns the policy of nationalised or semi-nationalised public transport undertakings. In view of the state's involvement in the field of pricing (and by consequence investment) the general views of the state in relation to nationalised concerns, including new policy changes in the future, should be taken fully into account. This requirement reduces the abstraction of the planning process

and consequently increases the problems that have to be faced. This situation argues, as noted earlier, for a mechanism that involves politicians in the planning process. Although clearly the value of politician decisions is limited, at a maximum, to the current period of office.

23.3. Another aspect of the question of incorporating pricing policy within the scope of planning relates to the usage made of infrastructure provided as a result of the implementation of plans. To develop a system of evaluation for various network possibilities, assumptions have to be made in relation to prices and a consequent demand. The criteria of the state in relation to new infrastructure (which can range from profit maximisation to covering only direct costs) must be sought but there can be no guarantee that the balance of factors, political and otherwise, will not have changed by the time the schemes come to fruition. In this situation, it is impractical for planners to plead for their optimum system. A more practical course might be to demonstrate in terms of a sensitivity test, the results on the project ranking of various possible changes in the pricing system. This course has the advantage of showing the "costs" of the various choices that are open.

24. Budgeting

24.1. A frequent occurrence for planners at the end of the first round of the planning process is to come against a budgetary constraint. This was noted in the Netherlands and Norway. In connection with these problems, the position taken in the United Kingdom was particularly noted. In the United Kingdom prior discussions take place on budgetary limits and what is feasible for planning within these limits. With this type of procedure, the situation is avoided where planners recommend a network many times larger than the available budget permits. This situation can result in considerable loss of both time and money and hold back the development of planning.

24.2. Certain participants were not certain of how far models were capable of fitting into a budgetary allocation system. The link between econometrics and behavioural system was not sufficiently clear. If the "reduction" system of network testing was used, this does not allow one to consider scope for unfulfilled wants. However, the alternative of building-up a network by testing hypothetical links was a time-consuming and expensive process.

24.3. In connection with budgetary problems, it was noted that price elasticity for transport is high. Experience in many studies had indicated what changing prices can produce considerable revenue. However, at the present it is very difficult to estimate rates of return in the transport sector.

25. Co-ordination of Planning Processes

25.1. Is co-ordination of planning between various sectors of the economy feasible? Certain participants felt that we were not yet sufficiently advanced to be able to co-ordinate planning on an overall level. According to this view, the best that could be achieved was to take note of certain main indicators in other planning areas and attempt to integrate these into the planning process under consideration.

25.2. Other participants held a more optimistic view on the feasibility of the planning process notably with regard to the possibility of achieving plans built up from certain key indicators that were agreed on a national level - G.N.P. population estimates etc. However, a further view expressed on this subject was that co-ordination could be dangerous in that it creates a sort of planning élite, over-centralised, and remote from actual life and practical problems. This view held that discussion, even disagreement, between planning bodies could result in a healthy process of reassessment of ideas that would produce useful benefits.

25.3. Attempting to summarise the divers views expressed on this subject presents difficulties. On the one side were supports of planning as followed in Germany and Switzerland, on the other, less convinced participants who believed the experience so far realised in countries like Norway and the United Kingdom indicated the need for caution before placing too much reliance on co-ordinated planning.

26. International Co-ordination of Planning

26.1. The problems of border regions posed special difficulties for planning if this was carried out on a solely national scale. Co-ordination in these regions was especially to be supported in the light of increasing European co-operation on many levels. The type of co-operation will depend on the nature of the problems being studied hence there can be no hard and fast rules laid down to govern the formation of a planning process.

27. Planning for International Links

27.1. How can the benefits of international links be assessed in economic terms? To be able to answer this point requires that estimates can be made of regional development benefits arise from wider markets and freer exchange. This problem has yet to be satisfactorily solved although international trade indicates theoretical guidelines. Scope exists to develop the theoretical ideas given in international trade theory and hopefully to provide firm information on this subject.

28. The Incorporation of New Technological Developments in the Planning Process

28.1. The rate of technological progress is now very rapid but even admitting this, the incremental benefits of new technologies are seldom great enough to justify their early introduction when compared with continuing operation at current costs (i.e. excluding "sunk" costs) of existing equipment. In these circumstances it is clear that planning at least with a medium term horizon of 20 years (the high rates of discount make longer time horizons difficult to justify for practical purposes) must be heavily concerned with planning the use and replacement of existing technologies. The problem area occurs with the preparatory work in the medium term of other systems to replace existing links on or expand connections. An answer in these circumstances is to plan on the hypothesis of service characteristics that should be achieved irrespective of by what technique. These outline characteristics will allow progress in planning new developments of differing technical nature but which compete in the same market.

29. Conclusions on the Value of Integrated Transport Studies

29.1. The discussion of the current position that has been reached with integrated transport studies resulted in a lively exchange of views between participants. The various arguments can be summarised as follows. The first argument held that:

(a) Studies had been looked at too optimistically and had hence not been able to fulfil all that had been expected of them;

(b) The costs of the studies were greater than had been forecast;

(c) The methods were experimental - especially as related to inter-city transport over long distances where particular forecasting problems existed - notably in relation to land users and zonal populations.

According to the basis of this view, the planning process could help to illuminate planning alternatives but was not yet in a position to solve all problems associated with planning.

29.2. On the other side, it was noted that in Germany techniques of planning for inter-city transport had passed the experimental stage and were capable of practical application. The techniques maybe far from perfect but this was true of all scientific activities which were constantly being improved and developed to provide better guidance on problems. Transport is influenced by many factors outside the direct influence of transport planners hence overall transport planning was most useful as a process that threw light on various future courses.

29.3. On a detailed level, a number of important conclusions emerged from the discussions.

29.4. Integrated as opposed to sector planning implies increased practical difficulties for data collection and handling and subsequent model building and evaluation. In this situation, careful consideration of the priorities for integrated planning is called for. In certain situations, as shown in the Norwegian roads plan mentioned earlier, sector planning can be justifiable. Notably where cross-elasticity is not important and there is an urgent need for some form of overall planning sector planning can rightly take priority over the necessary, more difficult attempts at integrated planning.

29.5. Where sector plans are already in existence or where sector planning for some areas is thought correct, a problem of co-ordination to form an integrated plan emerges. In this situation, it is necessary to commence integration by agreeing:

(a) A common line scale for planning;

(b) Common assumptions on basic economic parameters (rate of G.N.P. growth, etc.);

(c) Common criteria for evaluation or, at least, agreement on how evaluation is to be carried out.

29.6. All planning, not least that on an integrated level, requires that clear objectives are established. The process of arriving at workable objectives for planning is complex and calls for a close liaison between decision-makers (possibly politicians) and planners. Some form of dialogue is necessary to maintain a feedback process between the two bodies that produce objectives suitable for planning.

29.7. Much discussion centred around the problems of data collection. The main conclusions were:

(a) Data collection should be subject to normal economic tests to ensure that its marginal cost is at least equal to its marginal benefit.

(b) Data currently collected should be examined jointly by planners and economists to ensure that it is really useful in practice.

(c) Data should be stored in a manner that facilitates its retrieval and should only be subject to restrictions on access in cases of proven necessity.

(d) The possibility of establishing National Databanks should be considered as offering a most useful form of classifying data and ensuring ready distribution to planners.

(e) The use of a grid-system to collect and classify data had been shown to be successful in Switzerland. It appeared that the costs of a grid-system in Switzerland had been satisfactory in relation to its benefits; the successful implementation of this system justifies attention in other countries, with further consideration of the possibility to establish common systems between neighbouring countries.