

THE PROJECT FRUIT - A GOAL-ORIENTED APPROACH TO TRAFFIC MANAGEMENT IN FRANKFURT AM MAIN AND THE RHINE-MAIN REGION

Dr.-Ing. Manfred Boltze

AS&P - Albert Speer & Partner GmbH, Hedderichstraße 108-110,
D-60596 Frankfurt am Main

ABSTRACT

In the exploration and feasibility study FRUIT which was conducted for the City of Frankfurt am Main with partly funding by the State of Hessen and the Commission of the European Communities (DRIVE/ATT) extensive information on selected operational measures in traffic management was gathered. This included restrictive measures like access control in Frankfurts inner city as well as the introduction of advanced technologies such as individual driver information systems. Essential part of the study was a comparative assessment of the measures on a strategic level, and their integration in an overall traffic management concept.

1. INTRODUCTION AND METHODOLOGY OF THE STUDY

As many other European regions, Frankfurt am Main and the Rhine-Main region are facing growing traffic problems which endanger the attractiveness and basic functions (i.e. living, working, shopping, recreation) of the city as well as of the region. In order to solve these problems, there are different approaches, which partly exist and already are applied by other big cities and metropolitan areas. Frankfurt am Main, for instance, established a programme for priority treatment of buses and tram ways at traffic lights and for priority lanes for public transportation. Furthermore, the City of Frankfurt installed a traffic actuated control system for traffic lights, defined zones for residential parking and speed reduced areas, set up cycling routes and traffic lights, which give priority to pedestrians, reduced parking-space in the city-centre etc.. However, those measures, which unquestionably are important, are only isolated strategies in order to achieve traffic-relevant goals. Combined (synergetic) effects are rather accidently and not verified.

A more far-going approach is to develop a concept of traffic management, covering both, the management of traffic demand and the management of the entire traffic system (supply). However, before implementation such measures should be carefully investigated. On the highest, strategic decision making level it has to be investigated to what extent these measures contribute to achieve political and planning goals and to what degree they can complement each other within a general concept.

On the base of this requirement the municipal authority of Frankfurt - represented by its Road Traffic Authority - conducted the project FRUIT (FRankfurt Urban Integrating Traffic Management). Within an exploration and feasibility study FRUIT developed approaches for implementing an integrating strategy of traffic management based on a defined goal concept. It was established which measures within traffic management and what new type of advanced transport telematics (ATT) are useful, which measures have to be supplemented, continued and further developed.

FRUIT goes beyond the investigation of technical feasibility. It rather concentrates on management measures and, thereby, techniques are used in a goal-oriented way. Furtheron, measures are not seen in an isolated way only referring to Frankfurt, but in its very complex relations with its vicinity. Therefore, traffic management is developed in close cooperation with the State of Hessen and all the other regional decision-making bodies. FRUIT was not intended only as a study, but with its organisational framework it has also introduced a new and intensive form of cooperation between all decision making bodies in the field of traffic management in the Rhine-Main Region. The contents of the project were roughly structured in advance for the project definition and, in the course of the project, specified in detail through participation of important decision-making bodies. The following steps mainly were necessary in the course of FRUIT:

- Definition of the concept of goals for traffic management;
- Gathering of possible measures and selection of measures to be investigated;
- Impact analysis, investigation of feasibility and comparative evaluation of different technical approaches;
- Evaluation of measures on the base of the concept of goals;
- Grouping of appropriate measures to implement an integrating strategy of traffic management;
- Definition, evaluation and priority ranking of project proposals.

2. INVESTIGATED MEASURES

The first approach to FRUIT could not consider all issues of traffic management. Due to the limited period of examination, hitherto, the contents confine itself to possible operational aspects of traffic management. Issues which go beyond that (e.g. referring to the grading of working and business hours, etc.) are partly dealt with at other institutions or not sufficiently enough. In order to meet the standard of an integrating traffic management, they have to be integrated into an overall organisation subsequently.

Measures concerning the traffic data base were investigated in FRUIT but not considered by the evaluation, because the traffic data base is not an end in itself but rather results from the requirements of other measures.

2.1 Driver Information Systems

Investigations in this work area focused on three driver information systems: RDS/TMC for transmitting traffic news over the radio, EURO-SCOUT as a route guidance and driver information system using beacons for communication, and SOCRATES, which is a comparable system using the GSM mobile telephone networks as a mean of communication. From a transportation and urban planning point of view a general problem of these guidance and information techniques is,

that they make the use of cars even more attractive. This generally counteracts the intention to shift traffic to environmentally and urban more compatible modes of transportation. This argument certainly is correct when other basic conditions do not change. But when, for example, restrictive measures for motorised road traffic are implemented (reducing the width of streets, introducing separate bus lanes, access control etc.) driver information systems can compensate the loss of quality for those road-users. Therefore, it should be generally considered, that traffic management measures such as the introduction of driver information systems should not be evaluated individually; but rather as part of a group of measures.

2.2 Access Control and Road Pricing

In this work area, first, different opportunities of application for access control and road pricing in Frankfurt am Main were discussed and their effects and feasibility were examined. Finally, one concrete option of access control for cars in the inner city of Frankfurt remained feasible, which would affect an area with a total population of 13,000 people and 100,000 jobs. The operation of essential traffic would be guaranteed by keeping free the access to car parks, free delivering of goods from the morning until early noon time and by maintaining allowances for certain users and situations. The regulations assumed would particularly restrict access to people travelling to work or to school (approximately 40% shift to other modes of transportation). Journeys for shopping and recreational purposes would be restricted only to a certain extent (approximately 10% shift).

2.3 Public Transportation

Currently, in Frankfurt am Main and the Rhine-Main Region numerous measures for the public transportation sector are driven forward by different authorities. Examples are the planning of extending the rail infrastructure in general, considerations for an integral schedule and, of course, the foundation of the new regional transportation authority RMV (Rhein-Main-Verkehrsverbund). FRUIT investigated and evaluated following supplementary measures on the operational level:

- Priority treatment of the entire transportation system above ground and introduction of a COCS¹ within the city limits;
- Priority treatment of regional bus lines coming from the vicinity into the area of Frankfurt am Main;
- Dynamic schedule information in socially secure areas at stations underground;
- Schedule information via videotext;
- Schedule information via personal computer (PC);
- Electronic pocket time table;
- EURO-SCOUT as passenger information system;
- Mobility centre for complete information and services on all transport modes;
- Cards for paying tickets by money transfer.

2.4 Parking Management

Parking management in Frankfurt and the Rhine-Main Region is already relatively well developed. There are detailed parking management concepts, which include both complete management of parking space in the inner city and residential parking in residential areas. A concept for the P+R system in the Rhine-Main Region is in progress, and the dynamic parking guidance system was put into

operation. In FRUIT, supplementing measures were investigated and evaluated:

- Integrating Park+Ride facilities into the parking guidance system;
- Pre-trip parking information (via videotext, RDS/TMC at home etc.);
- Parking information at selected locations (information posts at highway inns, gas stations etc.);
- On-trip parking information (via driver information systems);
- On-street parking managed as parking in public car parks (separation of street segments and operation as car park).

2.5 Freight and Fleet Management

For this work area a very comprehensive analysis of possible measures was conducted. In order to come to results in the near future and due to the pressing need for action, the issues fleet management of emergency services and monitoring the transport of hazardous and heavy goods were dealt with in a first approach:

- Planning of emergency services including infrastructure information, dynamic traffic information and automatic vehicle localisation;
- Signal control for prioritisation of emergency vehicles;
- Computer-based weigh-in-motion and speed control systems;
- Route planning for transport of hazardous and heavy goods.

3. EVALUATION

FRUIT had to evaluate comparatively 22 operational measures, which appeared to be feasible. For this purpose, the method of an utility value analysis was selected. Benefits were defined in a strongly formalised procedure by an expert panel according to their subjective assessment and based on their individual expertise.

In a first step on a seminar on April 1, 1993, the weighting of seven different goals for traffic management was carried out by a group of experts. In a second step on this seminar the 22 measures were subjected to a strategic evaluation by the experts. Therefore, one representative of each public authority and operator participating in FRUIT, one representative of each participating industrial company, as well as the six working group leaders in FRUIT were invited; altogether 21 experts. The evaluation took place anonymously within the seminar. The experts should not evaluate from the perspective of their institutions, but rather from a personal point of view as an expert participating in FRUIT.

3.1 Goals and Criteria

The formal procedure in FRUIT and the project goal of a comparative strategic assessment of different traffic management related measures required a structured goal concept, based on politically formulated goals. The basic idea of the FRUIT goal concept (**figure 1**) is to operate traffic compatibly with social and environmental conditions, and to guarantee people's mobility at the same time. In the case of the goal concept illustrated it is important not to view individual goals separately. Individual goals are not decisive. Rather it is the degree of their achievement, which always depends on the conflicts with other goals. The synergetic effects of goals in the system are regulated by their individually different weighting.

Criteria which were employed for classification of the respective goal contribution were as travel time, annual traffic volume, traffic safety, etc.. The verbal descrip-

¹ Computerised Operation Control System for the public transportation system

tion, estimation or quantification of the goal contributions was conducted for each individual measure within the work areas of FRUIT. Afterwards, this was presented to the experts in formalised evaluation sheets for the individual measures. There was no arithmetic procedure with quantified weights for different criteria.

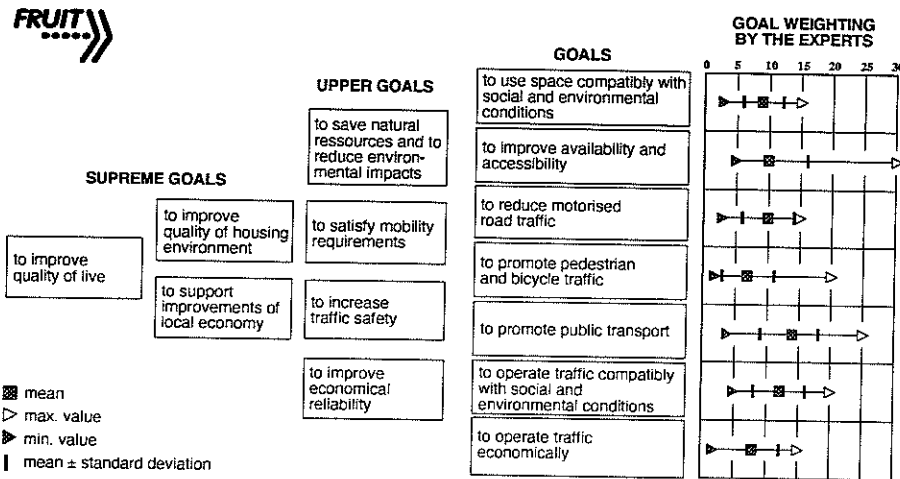


Figure 1 Concept of Goals and Goal Weighting

3.2 Results

For the goal weighting, the individual experts had the opportunity to weight the seven goals by distributing 70 points in accordance with their personal assessment. **Figure 1** presents the experts' results of the goal weighting. The mean values of the seven goal weights are distributed in a range between 7 and 14 points. Thereby, the weightings of the goals "Improvement of availability and accessibility", "Promotion of pedestrian and bicycle traffic" and "Promotion of public transport" have the largest span. "Promotion of public transport" is the most weighted goal (14 points), whereas "Promoting pedestrian and bicycle traffic" represents the least weighted goal (7 points). The arithmetic mean of the goal weight for "Promotion of public transport" is almost twice the value of that for "Promoting pedestrian and bicycle traffic".

For estimating the goal contributions, the experts had to evaluate for every measure how much it contributes to each of the seven defined goals. Therefore, a scale from -3 (to be assessed very negative) to +3 (to be assessed very positive) had to be used. Base for this assessment were the individual knowledge of the experts and the formalised evaluation sheet for each measure. As an example **figure 2** shows the estimated contributions of all individual measures to the goal "Reduction of motorised road traffic". Of course, results for other goals are different. Measures which have an estimated negative impact on modal choice, like driver information systems, can contribute significantly to other goals - for example to the goal "Improvement of availability and accessibility".

The overall evaluation of the measures (**figure 2**) results from the assessment of the seven goal contributions and from the goal weighting by the experts. The assessment of the goal contributions through the experts can be regarded as

objective and relatively independent from the evaluating persons. However, other persons, lobbies, political pressure groups etc. could weight the various goals differently according to their own individual opinion. Therefore, within FRUIT a sensitivity analysis for weighting the goals was conducted, in which, altogether, great stability of the results was detected against changes in weighting the goals.

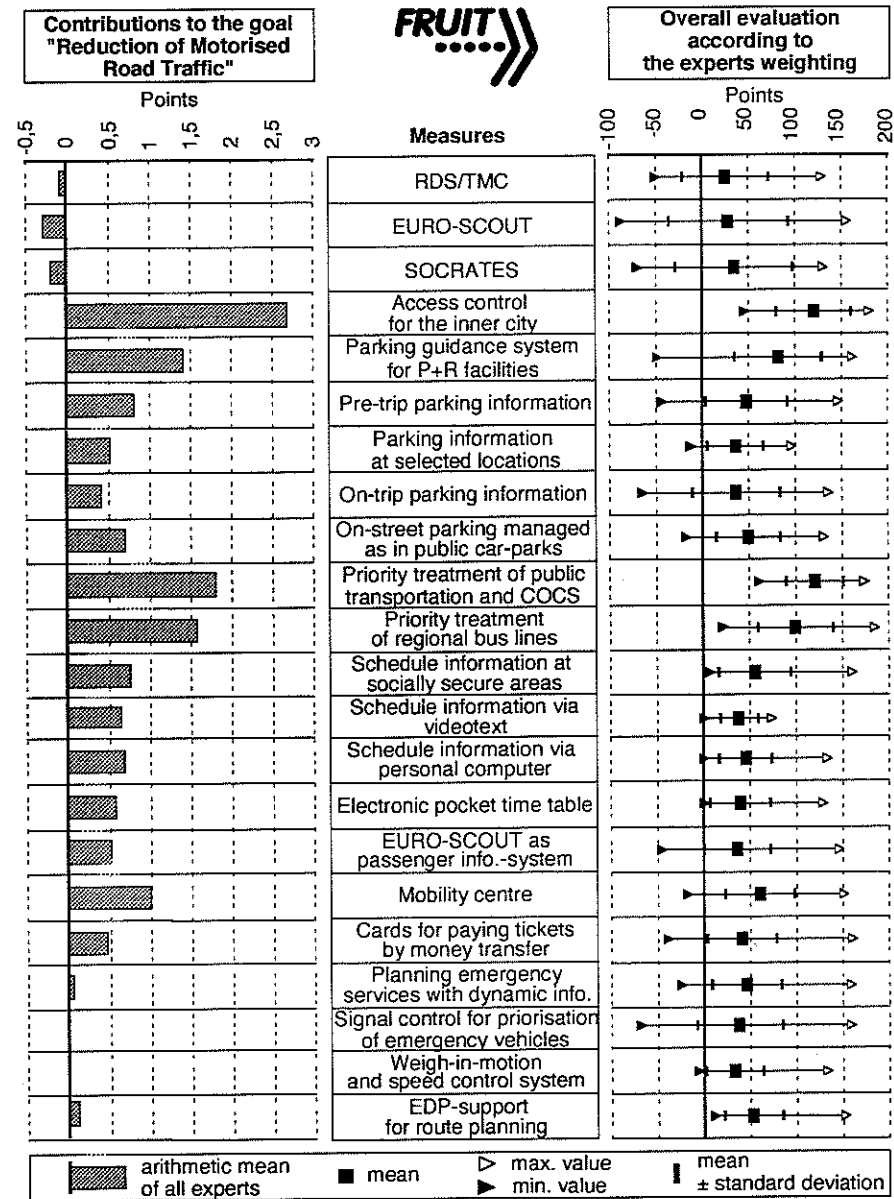


Figure 2 Evaluation results

Based on the sum of the goal contributions, all measures were evaluated positively (mean values), although there are significant differences in the extent of contribution to the goal concept. The span between the most positive evaluation of a single expert and the most negative evaluation is also quite different. This indicates how "safe" a decision would be to implement a measure.

4. GROUPING OF MEASURES AND PROJECT PROPOSALS

The evaluation showed, that all feasible measures investigated within FRUIT can make a positive contribution to the goals formulated for Frankfurt am Main. However, this does not mean that every measure should or can be implemented individually and separately, nor that all these measures should be promoted by the City of Frankfurt itself with the same engagement. In any case, it has to be guaranteed that the measures selected have synergetic effects in a goal oriented way. The grouping of measures depends on many impacts and as a rule is not to be derived objectively from the basic conditions given. In FRUIT, the grouping of measures is based on the following criteria:

- effectiveness (goal achievement),
- functional criteria,
- planning criteria,
- compensating negative goal contributions,
- homogenous effects, and
- responsibilities for the implementation.

Since all measures mentioned above are feasible and their goal contributions were generally evaluated positively, the recommendations basically include all grouped measures to be implemented in Frankfurt am Main. However, implementation of all mentioned measures will not take place simultaneously. Nevertheless, the dependencies in functional and planning terms have to be considered when measures are implemented time after time. This also can be applied to dependencies in order to compensate for negative goal contributions of individual measures. Therefore, the temporally differentiated implementation of measures also has to take place in subgroups with different priorities.

The subgroup of measures with top priority consists of four measures which were evaluated excellently positive:

- Access control for Frankfurts inner city,
- Priority treatment of the entire public transportation system above ground and introduction of a COCS within the city limits,
- Priority treatment of regional bus lines coming from the vicinity into the area of Frankfurt am Main, and
- Integrating Park+Ride facilities into the parking guidance system.

Negative goal contributions of the measure "Access control for the inner city" to the goal "Improvement of availability and accessibility" are compensated by the positive goal contribution of "Priority treatment of the entire public transportation system above ground and introduction of COCS within the city limits".

Main element of the subgroup of measures with secondary priority is the mobility centre as a starting point for the data network, which is to be assessed very important. In connection with the COCS this can be developed to a traffic data base at least for the public transportation system. This subgroup consists of the measures

- Mobility centre,
- Dynamic schedule information in socially secure areas at stations underground,
- Parking information at locations selected,
- Pre-trip parking information,
- Schedule information via videotext,
- Schedule information via personal computer,
- Electronic pocket time table, and
- Priority treatment of the entire public transportation system above ground and introduction of a COCS within the city limits.

The subgroup of measures with tertiary priority consists of the investigated measures referring to freight and fleet management, which should be supplemented further in order to develop urban compatibly commercial traffic.

Following the assessment on a strategic level, 35 project proposals for those measures were developed, which appeared to be worthwhile to pursue. These proposals show detailed next steps for a period of one or two years. They include the implementation of some measures, and - if measures cannot be realised immediately - further investigations and/or field trials. Furthermore, recommendations were made for institutions to be included, and for preconditions to be created in the future. Project proposals were grouped in accordance with the assigned measures and ranked according to their degree of priority.

5. OUTLOOK

FRUIT is not finished after this study. Rather, traffic management is a process, which will bring up the following main tasks:

- implementation of measures,
- continuing cooperation,
- elaboration of a regional traffic management concept,
- integration of operational considerations for traffic management with planning and other measures, and
- investigation of further operational measures.

Traffic management is essential for shaping future urban life. The authors of the FRUIT study hope that Frankfurt am Main continues its strategy of handling traffic management issues on the base of an integrating overall concept despite heavy financial restraints. Finally, only this approach can guarantee that measures act in combination in a goal-oriented and efficient way - to achieve compatibility of traffic with urban live for the benefit of all citizens.

6. REFERENCES

Additional results of FRUIT are described in following publications:

- [1] City of Frankfurt am Main, *FRUIT - Final Report of the Overall Project*, prepared by AS&P - Albert Speer & Partner GmbH in cooperation with Heusch/Boesefeldt GmbH and Planungsbüro Transport und Verkehr GmbH, Frankfurt am Main, 1993
- [2] Boltze, M. et al., "The Project FRUIT - A Goal-Oriented Approach to Traffic Management in Frankfurt am Main and the Rhine-Main-Region", *Traffic Engineering + Control*, July/August 1994, pp.437-444