TRAFFIC DATA PROCESSING AND MODELLING FOR THE DRESDEN OPERATIONAL TRAFFIC MANAGEMENT SYSTEM

Matthias Körner

TU Dresden, Institute for Traffic Information Systems,
Chair of Traffic and Process Automation

Abstract: Traffic telematics are these days one of the most common instruments to stabilise traffic conditions and optimise traffic flow in dense urban areas. Impacts on behaviours of road users are effect by targeted optimised and coordinated operational traffic management measures and traffic information. Base for that is a data modelling and processing in adaption to these special conditions. Innovative approaches - decoupling detection and control devices, hierarchic network modelling and hierarchic data supplementing - will be posed in this article.

Keywords: operational traffic management, traffic control, traffic information, modelling, data merging, traffic conditions

1. INTRODUCTION

Traffic telematics are these days one of the most common instruments to stabilise traffic conditions and optimise traffic flow in dense urban areas. Their automatic operations opened the possibility to influence traffic flow in cases of recurring, intended as well as casual occurrences contemporarily and efficiently. (Steierwald, 2003; Zackor, 2003)

This approach was pursued in Dresden agglomeration with their about 500.000 inhabitants by the operational traffic management system VAMOS (derived from the German description of its tasks: traffic analysis, traffic management and optimisation, see Fig. 1).

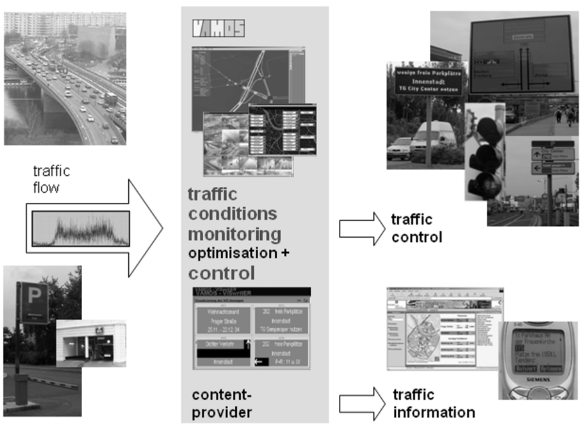

Fig. 1 Plan of operative traffic management

Ambition is to save necessary mobility sustainably. Quality of life and habitat of Dresden agglomeration shell be consolidated, increased and guaranteed long dated with protection of resources and environment as well with regard to economic and social criteria. (Strobel, 2002; Krimmling and Franke, 2004)

Impacts on behaviours of road users are effect by targeted optimised and coordinated traffic management measures and traffic information. Base for that is a data modelling and processing in adaption to these special conditions. Designed and used innovative approaches will be posed in this article.

2. SYSTEMS CONCEPTION

The knowledge about

- present infrastructure,
- current and predicted traffic situation,
- events influencing traffic,
- possibilities for exertion of influence on traffic flow and
- expected effects by the traffic management

is base for traffic influencing measures.

Data describing that information as well as underlying raw data are modelled and recorded in a data pool. So they are ideal prepared for access of bottom up applications.

The data management system includes the

- raw data base recording of current, historic and predicted dynamical traffic data and the
- dynamical traffic model, a locations referenced data base, which contains the network image and serves as combining part between infrastructure and traffic data.

Data preparation as well as transmission of data between data bases is done by clients and other supporting and rehashing services like identification of traffic conditions, data supplementing or data prediction (see Fig. 2). (Franke, *et al*., 1997)

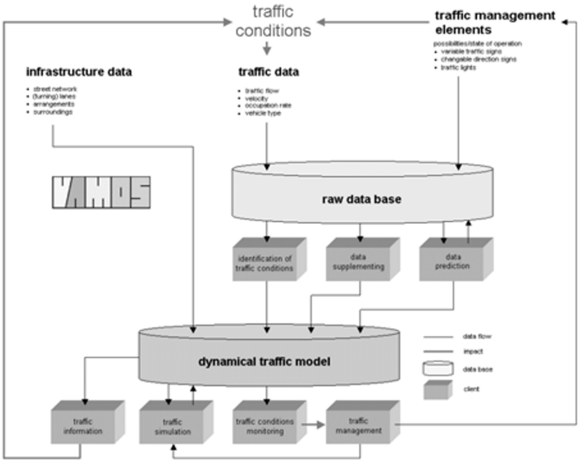

Fig. 2 Systems conception

3. DATA PREPARATION

3.1 Identification of traffic conditions

A wide range of different detectors is available in VAMOS for identification of traffic conditions. VAMOS figures the role of an integrating traffic data base for the management zone because of recording and blending data from different sources. Data links connecting numerous detection systems by different administrative bodies (federal highway department, municipal office for traffic organisation etc.) were constructed using different modes (two-wire, optical transmission).

There are data based on cross section detection, e.g.

- stats detectors (double induction loops),
- strategy detectors (double induction loops),
- Traffic Eyes (infrared detectors) and
- traffic light detectors (single induction loops).

Further data of a section based detection method are used. It is about a fleet based floating car system built in collaboration with Dresden taxi cooperation. Additional data for VAMOS are weather and road conditions as well as information of traffic message channel.

There are different data types, detection intervals and also differences in spatial allocation due to different source systems with specific targets and adapted detection methods. Therefore minimum requirements were postulated as base for data unification for further use (see Tab. 1).

Definition is that there has to be ascertained level of service LOS and travel time T_F respectively time loss T_V if traffic flow on an element of road network is recorded by a detector. If a cross section method is used there is the additional requirement to make a conclusion about traffic volume B.

Table 1 Detected and derived data types

detector type	*data type*	
	detected	*derived*
Traffic Eyes	**B**, V, T, **LOS**	**T_F/T_V**
stat detectors, strategy detectors	**B**, V	**LOS**, **T_F/T_V**
traffic signal induction loops	**B**, T	**LOS**, **T_F/T_V**
floating car system	**T_F/T_V**	**LOS** (associating with cross section detected data, relating to a road network component)

Current smoothed values for traffic parameters of all detectors are always hold in dynamical traffic model as answer to different detection intervals. Thereby definition is made to update values of parameters at least if traffic conditions have changed definitive. This strategy allows the connection of data detected in unvarying intervals and such detect data depending on events (e. g. heavy changes in traffic flow).

Statements about traffic conditions (level of service) are directly available from Traffic Eyes because the determination is realised on board the detector. The traffic volume and velocity are directly retrievable as well. Travel time for used links respectively loss time for crossing intersections is estimated using detected velocity and length of network element known from network modelling.

Strategy and stat detectors provide specifications about traffic volume and velocity. Identification of traffic conditions using fundamental diagram (Schnabel, 1997) is possible by that. A linear relation between traffic volume and velocity representing good conditions of traffic flow (dot line) and a cluster representing congested traffic marked by an ellipse are pictured in Figure 3.

Level of service is derived from. Travel times respectively loss times are determined in the same way like solved by Traffic Eyes.

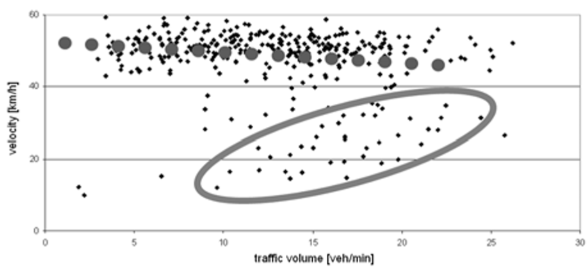

Fig. 3 Velocity-traffic volume-diagram

More traffic volume detections are available from induction loops of traffic lights. Velocities can not be detected because the traffic lights are equipped with single loops only.