A METHODOLOGY FOR TRAFFIC FORECASTING

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1. Introduction

Traffic managers today have no reliable tool for forecasting traffic 24 or 48 hours in advance, which would allow them to prepare and implement the appropriate local or general operation measures, in case of foreseeable events such as transport strikes, demonstration on public thoroughfares, official visits, big shows or important expositions, sports events and weather conditions. Our objective is to suggest indicators for traffic in urban and suburban areas (express roads) and to design models which can forecast these indicators one or two days in advance. These forecasts must take account of exogenous events such as the weather, working sites, demonstrations, strikes etc. The indicators which are developed should allow traffic management measures to be prepared in advance and evaluated, particularly in the case of planned or foreseeable disturbances to traffic caused by road restrictions, demonstrations, disturbances on the public transport system and the weather.

2. Methodological approach

We adopted a four stage method, as follows:
Stage 1 : measuring the interaction between supply and demand. To measure this interaction we have specified five consistent indicators, indicator of mean flow, indicator of time spent, indicator of fluidity and indicator of delay.

Stage 2 : forecasting traffic conditions in recurring situations. After studying the hourly variation in traffic on the test network we specified annual and daily periods. A forecasting model was developed for each. The only exogenous variable here was the calendar. A multiple regression equation with the form given below was then established for each period of the day for each period of the year:
\[ \tilde{q}_{j+1}^p (th) = a + b \cdot q_{j-1}^p (th) + c \cdot q_{s-1}^p + d \cdot S + e \cdot D + f \cdot L + g \cdot PH + h \cdot BPH \]

where: \( p \) is period of year (3 periods), \( th \) daily period (5 periods), \( \tilde{q}_{j+1}^p (th) \) flow estimated on day \( D+1 \) for annual period \( p \) and daily period \( th \), \( q_{j-1}^p (th) \) actual flow on the previous day for annual period \( p \) and daily period \( th \), \( q_{s-1}^p \) actual daily flow during the previous week for annual period \( p \), \( a \) constant in the equation, \( S \) binary variable for Saturday, \( D \) binary variable for Sunday, \( L \) binary variable for Monday, \( PH \) binary variable for all public holidays, \( BPH \) binary variable for the day before and the day after all public holidays.

**Stage 3: studying exogenous variables.** Exogenous events were classified according to type. A standard day was selected for each type. As far as we are concerned, exogenous variables are events which although not directly linked with traffic can modify traffic conditions. We are only able to consider events whose effects can be **forecast** at \( D+1 \) and \( D+2 \). Two situations must be considered in the event of a disturbance: a predictable reduction in road transport supply, and a predictable modification in travel demand. The capacity of the road system can be reduced by demonstrations, roadwork or the weather. These lead to the closure of one or more traffic lanes (demonstrations), the closure of a section of road for a short period (demonstration, accident), or a general reduction in capacity (adverse weather conditions). One of our objectives was to quantify and predict this change in capacity. Demand changes either as a result of an event in the calendar (public holiday, holiday departures and returns) or a trip generation event or a transfer from one mode of transport to another (from public transport to cars). We are not able to take account of traffic accidents, demonstrations for which no prior warning is given, persons who throw themselves onto the underground railway tracks and bomb scares. Although these disturb traffic they are not foreseeable. We can also distinguish between two types of disturbance: general disturbances and localised disturbances. General disturbances affect all traffic to the same degree. Examples are black ice or more generally rain, but also a general transport strike or a public holiday. Localised disturbances on the other hand are confined to a specific geographical zone. The most obvious example is a working site, but another example is demonstrations (which in addition move) or a strike at a bus depot after an assault on a driver.

**Stage 4: studying the impact of exogenous events in forecasting.** By making use of our indicator forecasting example (for all days in 1995), we have juxtaposed the results and the known exogenous events. Following this for each type of event we have suggested ways in which these forecasts could be improved.

**REFERENCES**

Mohammadi R. - Journey time variability in the London area, Traffic Engineering+Control, 1997..
Saporta G. - Probabilités, Analyse des données et statistique, Ed Technip, 1990
Smith B and Demetsky M. - Multiple-Interval Freeway Traffic Flow Forecasting, Transportation research record 1994.
Scemama G.- Spécification des chaînes saturées 1996

**FRENCH RESUME**

La prévision du trafic routier est un outil indispensable à exploitation de la route. L’objectif est de proposer des indicateurs des conditions de circulation en milieu urbain et périurbain et de concevoir des modèles capables de prévoir ces indicateurs à l’horizon de 1 ou 2 jours. Ces prédictions doivent tenir compte des événements exogènes (chantiers, grèves, manifestations…) connus à l’avance.