

## Congestion Forecast Strategies

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*Abstract: For the successful deployment of congestion forecast systems several preconditions have to be fulfilled. Information technological, economical, financial, legal and institutional aspects influence the system setup. First, Several solutions for the individual problem areas are developed and evaluated. Then, alternatives for congestion forecast systems are defined as coherent solution sets of the depicted problem areas. The information technological key issue is data quality. Successful introduction of such a system in terms of economy and finances deeply depends on the technological service provided. Legal and institutional solutions target in the first line data privacy requirements. Finally, the most attractive solution is outlined.*

*Keywords: traffic, congestion, forecast, dissemination*

## **1 Overview**

The psychological and economical benefits of congestion forecast systems seem to be obvious. The basic goal of a congestion forecast system is to help users to avoid congestions. Individual and societal benefits can be achieved if this goal is reached. Individual benefits include decreased travelling time and savings on fuel

consumption. Societal benefits would be reduced emission of motor vehicles and reduced traffic. By reducing traffic and stress a positive effect on the number of accidents can be expected. Overall, quality of life could be improved particularly in bigger cities.

## 2 Technological Background

Congestion forecast systems can be sorted into three groups based on the source of data. These are person-dependent, automated and – as a combination of the two – hybrid systems.

A person-dependent system treats congestions as unexpected events by the cooperative data management of different institutions (ÚTINFORM, FÖVINFORM, police, fire department, dispatcher centres, etc.). The major problem of these type of systems is that congestion spots are reached with significant delays and the institutions can provide data only if it has been reported to them. Due to lack of real-time and redundant information data cannot be synchronized and filtered easily which results in poor data quality. Further disadvantages are the costs related the acquisition of input data. The only advantage is that start-up investments are relatively low.

Automated systems provide road load information by the use of telematic systems that can be built into passenger cars or other vehicles. Automated systems that provide confident congestion data would be based on GPS systems. During a congestion event vehicles equipped with GPS would provide slow motion data. When congestion is cleared the vehicles speed up, this is detected by the data management system and forwarded to the contracted service providers. In case several vehicles provide motion data congestion situation can be identified more accurately. Also, the number of the data providers has to be large enough to cover representatively the important segments of the road system. Automated systems that provide distortion-free data for a large road network may only be realized with a large number of individuals who provide data. Drawbacks are high investment costs as wide-spread deployment of telematic systems is needed. On the other hand, multifunctional usage that goes beyond congestion forecast could justify these costs.

Of course, hybrid systems can be established as well. These systems could extend data provided by automated systems, e.g. road maintenance data, traffic weather data would be valuable. Road users could avoid critical road sections, thus avoiding the development of congestions. Another option is the usage of mobile phones that are much wider spread than telematic units.

Beyond information technological aspects it is important to integrate supply and demand on a system level and to manage this connection appropriately.

### 3 Shareholders

The process of data transmission aiming congestion avoidance can be divided into two phases that is connected by the agreements about the forwarding of information. First, microscopic traffic data has to be supplied to a central data management facility. Second, macroscopic traffic data is transmitted to mobile devices of individual participants of the transportation system.

The information for congestion avoidance is or may be provided – via different technologies – by the participant of the vehicular traffic themselves directly to the data management centre. Thus, the congestion database may be built up based on live real-time data of a small organized group of traffic participants or even of a larger group. It is even possible to make data supply obligatory.

The prerequisite for sales of the service - depending on the state of technical developments – is the creation, management and exploitation of relevant data records, which includes the following tasks: data collection, implementation and management of the databank, data processing and use of information obtained from the databank. These activities can be assigned to data management and data processing organizations. The data management centre is responsible for lawful execution of data processing operations. The transmission of congestion forecast information can be accomplished by the data management centre, or an intermediary service.

The primary end-users are the drivers who receive road traffic information. The users may be individuals or legal persons and owners or employees of unincorporated companies.

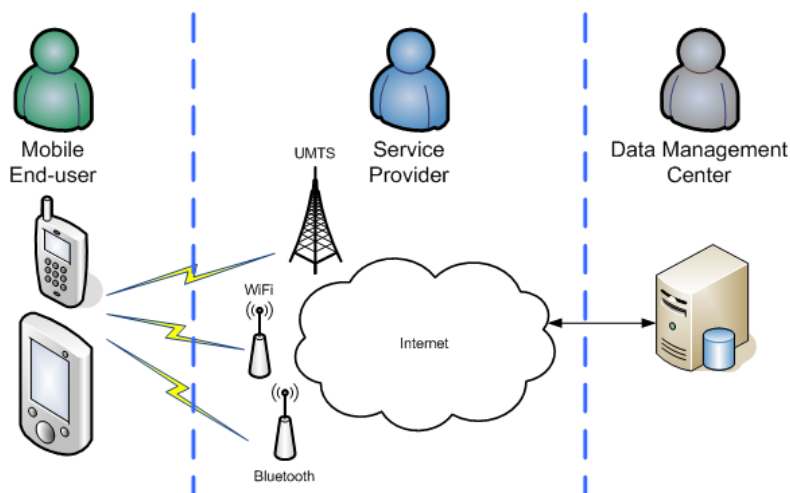


Figure 1  
Congestion forecast shareholders

## 4 Economic Context

In addition to the information technological aspects the economical view on the systemic link between supply and demand and the way it is managed is a strategic key element.

### 4.1 The Product

The product is data on road traffic congestion. An essential condition for the marketing of the product is that the information distortion-free. The database is relatively undistorted, if the verification process works on a large amount of data, and targeted traffic segment is covered continuously.

The product – examined in space and time dimensions – can form different sets of products. The information may cover the entire public and local road network, only the road network, only the larger cities or the network of small and medium-sized cities. Fees can be charged on yearly, monthly, daily base.

### 4.2 Market Forecast and Price Sensitivity – the Supply Side

For marketing purposes supply and demand has to be evaluated. The problems of supply are lack of trust, vulnerability of personal data, low number of vehicles equipped with on-board GPS, low connection willingness, therefore, the low reliability of the product information, and hence its relatively high cost.

The biggest initial problem is product quality. The relatively distortion-free product would require large number of vehicles with GPS installed. Reliable and complete traffic input data is only possible with the intervention of the public sector. If data management is done by the private sector than data management will comply with their interests and therefore data loss may occur.

The key solution lies in the multi-purpose use of GPS, which serves public and private interest at the same time. The payment of taxes imposed on motor vehicles can be combined with the use, i.e. additional road toll is paid over a certain amount of usage. If the idea was supported by the government longer-term, the necessary technical conditions must be created with on-board GPS systems.

In addition, the cooperation between insurance companies dealing with motor vehicle and the government to support the purchasing of congestion-warning systems may have positive impacts. GPS-based vehicle tracking could significantly reduce insurance payment due to theft and there may be a discount on insurance fees for vehicles equipped with GPS-based tracking systems. Cumulative advantage could be obtained by many small and medium-sized enterprises through maintenance works and sales of replacement parts. This in turn

would extend the options of the banking sector. Additional advantages would be an alternative EU-wide usage-proportional road toll payment option for the passenger cars.

On this basis, the security of the vehicle fleet could be improved, toll payment would depend on the actual road usage, and the acquisition of automated, objective, undistorted congestion data would become possible.

Optimized fuel consumption would reduce the environmental pollution. The additional tasks of the mobile network operators would lead to revenue increase that would result in tax increase that leads to consolidated macroeconomic revenue. The participation of SMEs would increase employment.

### **4.3 Price Structure of the Product – the Demand Side**

Demand analysts say Hungarian population is very price- and cost-conscious. Most important task is to create consumer confidence. First, potential buyers are going to test the product. The majority would buy congestion forecast information for a smaller area. It is not likely that annual subscriptions will be purchased for the whole national area. At national level, there will be demand for occasional connections only.

The mobile network operators have to carry out very serious business-psychological demand analyzes to find out how to contract with the data manager in order to compensate for the development costs and the operational services fees.

The data service in the major cities is not required continuously by road users, usage is mostly related to get to the workplace and back home. Thus, congestion information is claimed just in a fraction of the day. The majority of congestion areas are already well known as they appear periodically. Most drivers are less interactive and use the usual route and do not change. Country-wide demand covering the whole year and all time of day shall not be a real demand due to relatively high costs.

## **5 Legal and Institutional Aspects**

The service provider may be the mobile network operator company which has a contract to the data management centre and to the final user. The contract requires that the mobile network operator license permits this type of service, and that the available network covers user demand areas. Theoretically, the service provider could be the data manager as well, but the mobile network operator may attain

competitive advantage as data provided to other mobile network operators could be analyzed.

The reliability of the information has to be guaranteed by the data transmission contract between service provider and data manager. The key object of the end-users contract is the congestion information, and therefore the alternative routes suggested. The data processing methods and the spread of automated information acquisition systems will minimize the distortion of information.

The traffic data is a very sensitive area of the implementation of the congestion-warning service. Data protection is the responsibility both of the service provider and the data manager. According to the statutory provisions on the protection of personal data, the individual user must declare that the service provider is empowered to use personal data for temporary service records and for the temporary transfer to the central database. Regarding the new service it is worth mentioning that the mobile network operator companies have to inform the affected customers about all details of handling of personal data.

The data management centre can be established by private organizations and the public sector. However, public interest may arise indirectly. As information related to public interest is concerned there are multiple reasons to establish a state authority. In the present case, it is proposed to put the focus on the data management centre. Because of data privacy problems and trust reasons, the system cannot be spread widely without the assistance of state interaction.

### **Conclusion**

Gradual introduction of congestion-warning information systems shall generate important macro-economic benefits and savings. The congestion forecast project's basic problem is related to the handling of personal data. The solution is to create confidence in users that depends on fair and credible data handling of the data manager and the mobile network operator.

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