THE DISTANCE BETWEEN REAL TIME DATA AND DECISION MAKING IN URBAN ROAD FREIGHT TRANSPORTATION SYSTEMS; THE EXAMPLE OF THE CITY OF THESSALONIKI

Efstathios Bouhouras, PhD Transport Engineer (City Logistics) – Researcher, Faculty of Rural and Surveying Engineering, Department of Transportation and Hydraulic Engineering, School of Technology, Aristotle University of Thessaloniki, 54 124 Thessaloniki, Greece, *E-mail*: stbouh@auth.gr

Abstract

Road freight transport in urban areas (city logistics) is under study worldwide, especially during the last years, mainly due to its negative impacts to the environment and to the efficient operation of the road network. The modern approach to deal with this rising issue includes the deployment of strategies and measures that take into consideration the conditions prevailing in each study area. In order the decision makers to adopt the proper measures and define the strategy, it is vital for them to have full knowledge of the way an Urban Road Freight Transportation (URFT) system is organized and functions in the field. For this to happen, the decision makers must have under their disposal reliable real time data. After all URFT systems evolve through time and space and it is s crucial that the necessary data not only will be collected correctly but also they will be accessible anytime and anywhere. In this paper a new approach is proposed in order to achieve real time monitoring for URFT systems in order to provide the decision makers with all the necessary data for the case of Greece.

Keywords: Urban Road Freight Transportation system, real time monitoring, decision making.

1. INTRODUCTION

The first element of understanding how URFT sector functions, lies in the presentation of the stakeholders and the analysis of their characteristics. In Figure 1[1] these stakeholders are presented along with the "internal links" that constitute the basic elements of an URFT system.

ROMANIAN JOURNAL
OF TRANSPORT INFRASTRUCTURE

Efstathios Bouhouras,
The distance between real time data decision making in urban road freight transportation systems; The example
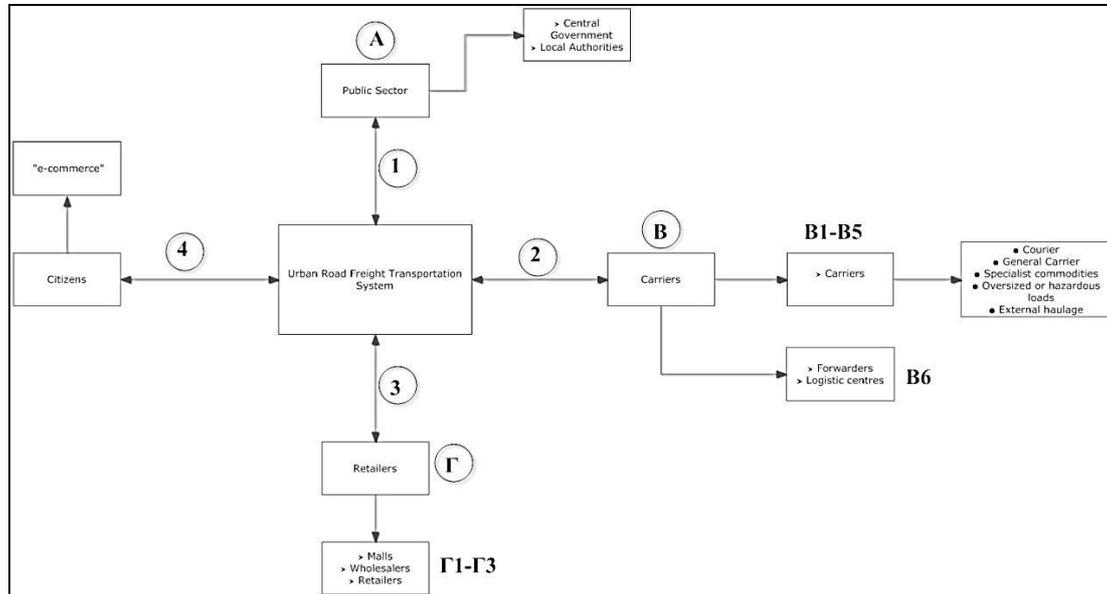of the city of Thessaloniki

Figure 1: Presentation of an URFT system

The stakeholders of an URFT system can be easily identified. However the way their actions interact is difficult to be defined. For this reason an URFT system and its stakeholders should be examined simultaneously, increasing the amount of the necessary data and at the same time forcing the researchers to develop and apply new techniques in real time monitoring.

The last decade the development of Telematics applications provided the researchers with the necessary tools to monitor in real time the sub sectors of an URFT system, such as the fleet of the commercial vehicles, the needs of the retailers, etc. The next logical step would be the combination of these techniques in one tool that would monitor an URFT system in real time. The collected data would then be saved in a data base in which the decision makers should always have access.

As decision makers in an URFT system are recognized the central government and local authorities. These two levels of governance, central and local, have the political legitimacy to investigate, analyze and take decisions in the name of the greater good. Also, they are those with the power to legislate all the necessary laws in order their decisions to be implemented. The central government is responsible to formulate the strategies to be followed and the local authorities are responsible to implement these strategies by adjusting them to their local communities.

ROMANIAN JOURNAL
OF TRANSPORT INFRASTRUCTURE

Efstathios Bouhouras,
The distance between real time data decision making in urban road freight transportation systems; The example
of the city of Thessaloniki

2. MATERIALS AND METHODOLOGY [1]

The participation of the public sector in the proposed system for real time monitoring requires the cooperation of several public agencies and ministries. Each ministry is responsible for the collection of different types of data concerning URFT systems. However, these data are nothing more than a piece in the greater picture, just a piece of a puzzle.

For Greece, the ministries (regardless of how are named by each government) involved in the proposed system are the following:

- ➢ Ministry responsible for transportation, public infrastructure and the environment.
- ➢ Ministry responsible for the development.
- ➢ Ministry responsible for the economy of the country.
- ➢ Ministry responsible for public safety.

For the local authorities the entities responsible for real time monitoring of the URFT system are the Technical Department and the Legal Service.

It has to be mentioned that the ministries listed above responsible for monitoring the URFT systems, are part of the proposal real time monitoring system. In other words, these are the ministries that should be responsible and not that they truly are.

The Ministry responsible for transportation, public infrastructure and the environment in Greece should have under constantly revision the following topics:

1. The total control of the goods transportation. That means that the ministry is responsible to guarantee the free operation of the market of freight transportation in the country by carving national strategies and promoting the cooperation between the public sector and the private sector.
2. Maintaining data bases, concerning records for the commercial vehicles, traffic volumes in rural and urban road network and O-D matrices for the commercial flows.
3. Carrying out surveys for traffic volumes constantly and calculating the environmental impacts, checking the commercial vehicles in order to investigate if the fulfill the minimum standards that Greek Highway Code demands.

The Ministry responsible for the development in Greece should have under constantly revision the following topics:

1. The control of the market in order to insure that the market functions for the benefit of the consumers.

ROMANIAN JOURNAL
OF TRANSPORT INFRASTRUCTURE

Efstathios Bouhouras,
The distance between real time data decision making in urban road freight transportation systems; The example of the city of Thessaloniki

2. The promotion of the projects and programs by introducing the new technologies in the enterprises.
3. Maintaining data bases concerning the characteristics of the logistics centres, the demand and supply for goods and services and finally records for the retail sector.

The Ministry responsible for the economy in Greece should have under constantly revision the following topics:

1. The audit of the enterprises not only in the road freight transportation sector but also in the retail sector.
2. To insure the implementation of a fair and sustainable tax system, to fight tax evasion and in general to insure government income.

The Ministry responsible for the public safety in Greece should have under constantly revision the following topics:

1. Checking the commercial vehicles for traffic violations such as over speeding, overloads or the transporting goods without the necessary papers.
2. For the urban areas, the ministries' services in case of high environmental pollution are responsible to implement emergency plans in order to calm down the traffic or to remove the traffic from the central area of the cities.

The real time monitoring of an URFT system provides the decision makers with the necessary inputs in order to make decisions for the optimization of the system. The proposal real time monitoring system set as prerequisite that the first level of the data collection is the local authorities. This is due to the fact that local authorities have better knowledge of how the URFT system in their town or metropolitan area is organized and functions that the central government.

Telematics applications can also be used in order to collect the necessary data or even to monitor in real time the position, the route, the speed and other data of the vehicles fleet operating in urban environment. There are six basic categories of Telematics application available for use providing real time monitoring information [2]:

➢ Positioning systems: These systems are used in order to specify the position of the vehicle in real time. The most used and famous system is Global Positioning System – GPS. Alternative systems and not yet fully operational are GALILEO positioning system launched by the European Union and GLONASS which is the Russian positioning system.
➢ Two-way communication systems: In this category the systems are used in order to achieve communication between the vehicle and the base.

ROMANIAN JOURNAL
OF TRANSPORT INFRASTRUCTURE

Efstathios Bouhouras,
The distance between real time data decision making in urban road freight transportation systems; The example
of the city of Thessaloniki

However all the protocols developed for the systems of this category can be considered as old mainly because of the cellular networks established in all over the world.

➢ Systems for monitoring the functionality of the vehicles: These systems are the state-of the-art for the commercial vehicles. There are systems-devices that can be installed in the commercial vehicles in order to provide in real time information to the driver of the vehicle and at the same time the data are sent to the base. The data are also recorded (stored) in a hard disk installed in the vehicle as well. The data that can be monitored with these devices consider the transmission, the fuel consumption, the brake system, the speed of the vehicle, the pressure in the tires and the weight of the vehicle, the number of stops and their duration for loading and unloading, etc.

➢ Navigators: These devices are used in order to provide the vehicle's driver the optimized route that he can follow in order to minimize the duration of the route and maximize the utilization of the vehicle. In case the navigator can receive and analyze real time data regarding the traffic condition (this of course requires the proper infrastructure) can re-route the vehicle based on the real conditions in the road network.

➢ System for the safety of the vehicle: These systems are used in order to ensure that the vehicle is safe before it begins its route and that the goods are loaded with the correct way.

➢ Systems increasing road safety: The systems are developed in order to minimize the possibility of a commercial vehicle to involve in a car accident. For this, cameras, thermal cameras and sensors are used in the commercial vehicles increasing not only the safety level for the driver but also for the pedestrians and the other users of the road network.

3. RESULTS

In Figure 2 is presented the proposed real time monitoring system. The data are collected in a local level (town or metropolitan area) by:
1. Highly trained personnel that substantiate surveys in the field.
2. Special equipment established in the field.
3. Universities and institutes that carry out research projects regarding logistics, transportation and the environment.

ROMANIAN JOURNAL
OF TRANSPORT INFRASTRUCTURE

Efstathios Bouhouras,
The distance between real time data decision making in urban road freight transportation systems; The example
of the city of Thessaloniki

The data collected are transferred through secured communication channels to servers using intranet. The servers can be established in the local authorities or in the ministries.

Other European countries (such as France, Germany and U.K.) have permanent monitoring systems for URFT systems. An exemplary three-part survey was performed in Munich in 1995 as part of an extensive analysis of the regional commercial transport. The survey consisted of three parts [3]:
1. Written postal behavior survey
2. Questioning of singular transport generators
3. Questioning of drivers on the roads

Similar surveys were performed before and afterwards in Berlin, Hamburg, Dresden, Madrid, Rome and in other regions. All of these studies work with the definition of commercial transport as the trips which are generated by drivers during their jobs. The Munich survey is the most extensive of all and is the survey which is best included in the analysis of the entire transport system. The gross random sample of the written postal behavior survey included 3,881 businesses. By making frequent telephone contact with a named contact person at the firms selected for the survey, high participation was achieved, which could be clearly shown in a reply rate of 58%. The survey was based on a key date concept and was performed in waves [3].

The results of the analysis of the collected data provide the decision makers with the necessary inputs in order to plan the next steps to the optimization of URFT sector. The European Statistical Agency (EUROSTAT) each year publishes the data for the member states concerning road freight transportation among others. It is crucial to be understood the importance and the necessity for a real time monitoring system for URFT systems in Greece, at least for the two major cities, the capital Athens and the co-capital Thessaloniki.

Besides the collection of the data, it is extremely important these data to be reliable and accessible not only by the decision makers but by all the stakeholders of the URFT sector. The data must be saved in a simple format so that researches that want to have access to them in order to use them, would be able to do it easily. For these researchers and other stakeholders outside URFT sector the data could be available at low cost. The money could be used for the maintenance of the hardware of the system (PCs, servers, etc.). In the U.S.A. private companies carry out surveys in order to collect data with the official permission of the federation government and the collected data are sold to those that are interested [5].

**ROMANIAN JOURNAL
OF TRANSPORT INFRASTRUCTURE**

Efstathios Bouhouras,
The distance between real time data decision making in urban road freight transportation systems; The example
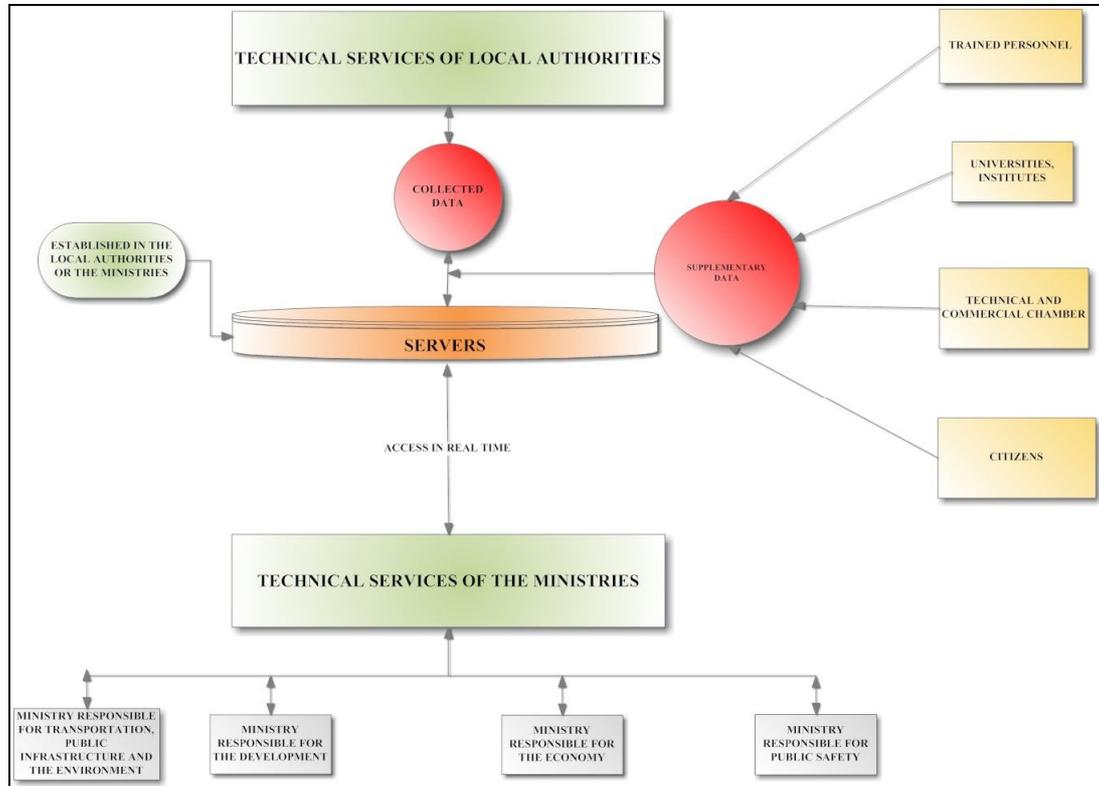of the city of Thessaloniki

Figure 2: The proposed real time monitoring system for Greece

4. DISCUSSION

The proposed real time monitoring system can be simplified by the implementation of Telematics application not only in the commercial vehicles but in all stages of the supply chain.

The data could be collected and saved without external interferences, increasing with this way the reliability and insuring the objectivity of the collecting method.

If these data could be combined with a methodological framework developed by Aristotle University of Thessaloniki in order to optimize URFT systems, it could provide the decision makers with a supporting tool. The methodological framework is developed in order to be used mainly by a user from the public sector and secondly by a user from the private sector.

The proposed methodological framework, aims to link the problems of the Urban Road Freight Transport sector with the necessary policies and measures so that to achieve the optimization of his/her organization and the optimization of the way it operates. The methodology for the development of the framework apart from the analysis of the international literature also included:

ROMANIAN JOURNAL
OF TRANSPORT INFRASTRUCTURE

Efstathios Bouhouras,
The distance between real time data decision making in urban road freight transportation systems; The example
of the city of Thessaloniki

> ➢ Data collection surveys in the field and questionnaire based surveys in the city of Thessaloniki, Greece.
> ➢ Implementation of the proposed methodological framework in two Greek cities.

The real challenges for the researchers concerning real time data monitoring are the following [4]:

> ➢ To build "win-win-win" scenarios to benefit government, urban road freight industry and universities and other institutes.
> ➢ To continues to build trust among the stakeholders of URFT sector through communication.
> ➢ To ensure that a significant part of research is meaningful and usable in practice in the near term.

In Northern America researchers have realized the importance of sharing and open data. Sharing transportation data with as many people as possible is the key to maximize innovation, because society as a whole can spend more resources transforming raw data into useful information that governments alone can [6].

In Europe, the Commission through the research programs came to the conclusion that there has been a lack of standards regarding the attributes to be used for recording traffic regulations and traffic circulation plans or recommended routes for heavy goods vehicles [7].

5. CONCLUSIONS

It is clear that delivering goods in the center of the city of Thessaloniki is a challenging issue, just like other urban area. Especially today, the economic situation of Greece requires measures and policies to be implemented in order to maximize the efficiency of all productive sectors and at the same time to minimize the cost.

The main idea of this proposal is to optimize the way that URFT sector is organized and functions and at the same time to achieve minimization of the cost and maximization of the efficiency of the sector. Real time monitoring as a policy will provide not only the decision makers with interesting data but the scientific community of Greece with data necessary to their work.

The proposed system can be easily installed with a low budget, mainly because of the development of Telematics applications. Innovation is necessary more than ever in Greece, if the Greek society wants to overcome the economic crisis and funding slump. Most of all the improvement of the goods distribution

ROMANIAN JOURNAL
OF TRANSPORT INFRASTRUCTURE

Efstathios Bouhouras,
The distance between real time data decision making in urban road freight transportation systems; The example
of the city of Thessaloniki

system in the study area of the city of Thessaloniki requires that all parts involved, must begin a sincere and fruitful dialogue under the supervision of the state.

REFERENCES

[1].   Bouhouras, E., "*Development of a methodological framework for the optimization of urban road freight transport systems based on their qualitative characteristics*", PhD Thesis, Department of Transportation & Hydraulic Engineering, Faculty of Rural & Surveying Engineering, School of Technology, Aristotle University of Thessaloniki, **2011.**

[2].   Bouhouras, E., Kyritsis C., Basbas S., "*New Technologies in Road Freight Transportation*", International Conference "Roads of the Future", Ministry of Transportation and Telecommunication, Athens, **2007.**

[3].   Friedrich, M., Haupt, T. & Nokel, K, "*Freight Modelling: Data Issues, Survey Methods, Demand and Network Model*", 10th International Conference on Travel Behavior Research, Lucerne, **2003.**

[4].   Roorda, M., "*Centre for Urban Freight Analysis at UTRAC*", Department of Civil Engineering, University of Toronto, **2003.**

[5].   "*A concept for a National Freight Data Program*", Transportation Research Board, Committee on Freight Transportation Data: A framework for Development, **2003.**

[6].   Spencer, S., "*Improving Urban Freight Transportation: Data's Critical Role*", CRTF & Transport Canada Roundtable on Innovation in Urban Freight, Canada, **2012.**

[7].   "*Intelligent Transport Systems in action*", Action Plan and Legal Framework for the Deployment of Intelligent Transport Systems (ITS) in Europe, Directorate – General for Mobility and Transport, **2011.**