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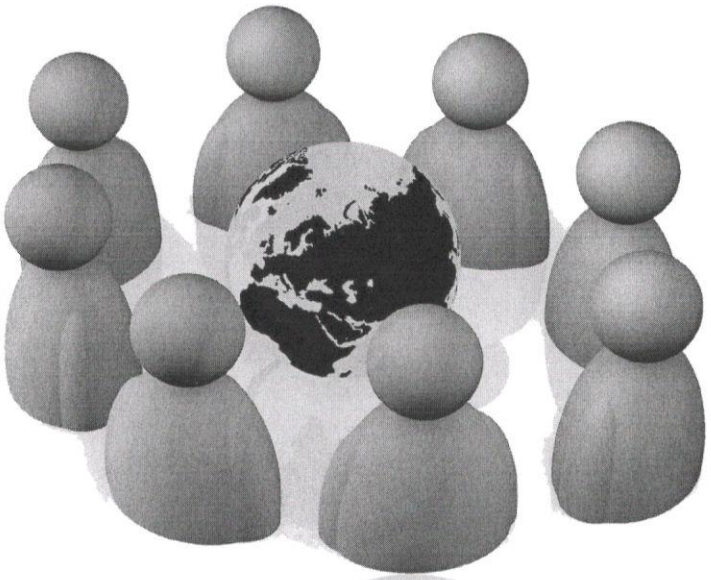

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A New Simple System Identification Example 1696
Zenan Šehić; Zerina Šehić-Galić; Damir Kapidžić

Comparation Study for PID and MPC Controller based on Orthonormal Functions 1700
Zenan Šehić; Zerina Šehić-Galić

New Nonlinear PI Controller applied on SOPDT processes 1705
Zenan Šehić; Zerina Šehić-Galić; Jakub Osmić

Predictive functional controller with the fuzzy process model 1709
Zenan Šehić; Zerina Šehić-Galić

Analysis of electromagnetic intereference generated by household electronic devices 1714
Sergey A. Tsyruk; Sergey A. Yanchenko

SECTION 12. Industrial and Civil Engineering 1720

Effect of subtangential parameter on the stability and dynamic of a cantilever tapered beams subjected to followed forces 1721
N.M. Auciello

Hammerstein and Wiener Models in nonlinear control of servo-speed mechanism AMIRA DR300 1727
Zdeněk Babík; Petr Dostál

Topography image roughess quantification based on phase image information 1735
Bozica Bojovic, Bojan Babic, Lidija Matija, Ivana Mileusnic

The improvement of the quality performance level on the suppliers from the Automotive Industry 1741
Ionela-Oana Bratosin, Gheorghe Solomon

Micrologistic performancies on the example of Central Bussines District of the City of Bitola: A Case Study 1746
Jasmina Bunevska-Talevska, Emina Dimitrova, Riste Ilievski, Nikola Stojanovski

A random algorithm for rural transport scheduling 1749
Omar D Castrillón, Jaime Alberto Giraldo

Agile and gestalt assessment of the project drafts 1753
Viliam Cibulka

River - Groundwater Interaction in a Municipial Area 1758
Rózsa Csoma, Habil. Miklós Gálos

Haptic drive assistant system on motorcycle handlebar grips 1764
Domenico DE FALCO, Giandomenico DI MASSA, Stefano PAGANO

Quality control of compaction of earth structures of traffic engineering 1770
Martin Decký, Katarína Zgútová, Juraj Šrámek, Dominika Ďureková

Are person-specific competencies measurable? 1775
Berend Denkena, Friedrich Charlin, Julia Gillen, Stefan Bode

Design of operational center in central-european reality 1781
Radim Doležal

Selected physical - mechanical properties of specific composite materials with elastomer 1785
DRDÁKOVÁ Jozefína, STRUHARŇANSKÁ Monika, KRMELA Jan

Monitoring of Crankshaft Machining 1789
Jiří FRIES, Stanislav DUBINA, Tomáš HAPLA

Using of Analytical Calculations to Operability Determination 1794
Jiří FRIES, Tomáš HAPLA

Motorways of the sea quality index. Case of Spain 1799
Nicoletta González-Cancelas, Francisco Soler-Flores, Alberto Camarero Orive

A facility location-allocation problem with Bernoulli demand 1806
Hasan Hosseini Nasab, Mino Momeni

FE analysis of automobile tire 1809
Kováč Ivan, Krmela Jan

Micrologistic performancies on the example of Central Bussines District of the City of Bitola: A Case Study

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Abstract—**This paper aims increasing the sustainability and the efficiency of urban delivery of goods by means of an adaptive and integrated mission management and innovative solutions in order to achieve town and environment compatible goods transport development, reduction of goods transports on city roads, enhancement of vehicle capacity utilization, and most of all the improvement of city logistics transport processes. Namely, for the purpose of the future studying in the field of developing and adopting of the VRPModel in the central-historical zone of the town of Bitola, FYROMacedonia, two year analysis has been conducted, (from the middle of May 2010 till the middle of May 2012). State-of-the-Art analysis pointed at the number and average tonnage of commercial vehicles entering the target area, delivery vehicles approach, delivery time window, quality of the load-unload manipulations, and load factor. Here the quantitative and qualitative measures of effectiveness are presented.**

Keywords-urban logistics; micro-logistic system; measures of effectiveness.

I. INTRODUCTION

By treating urban freight transport in an integral way, important relations between transport demand, traffic, economic, social and environmental variables are uncovered, and scoped as measures of effectiveness. The main objective of this paper is interesting for local policy-makers and researchers in the field, by improving their understanding about urban freight transport and its specific research requirements.

Namely, a large part of Bitola's inner city traffic problems are attributable to goods transports, just like in many FYROMacedonian cities. In the town centre of Bitola this situation is most of all the result of the high business concentration. In addition to this, the historic old town is characterized by a system of narrow, widening lanes and streets. These not only serve as transport routes for delivery traffic, but are simultaneously also filled with shoppers, tourists and residents. The result being that a very diverse range of mobility interests converges in an extremely constricted space.

According to the new territorial distribution, study area, known as Central Bussines District of Bitola - CBDB has 32,4644 ha surface [1]. The land assignment is a complex mix of a large number of activities. The traffic network is quite specific and formed as a result of the inherited town structure in the central part. It is characterized with non-regular, winding form and geometric profile which is not dimensioned for the modern necessities in the town. For detailed analysis, six zones are defined (*z=1,....,6*), *"Fig. 1"*, where z=zone, [1].

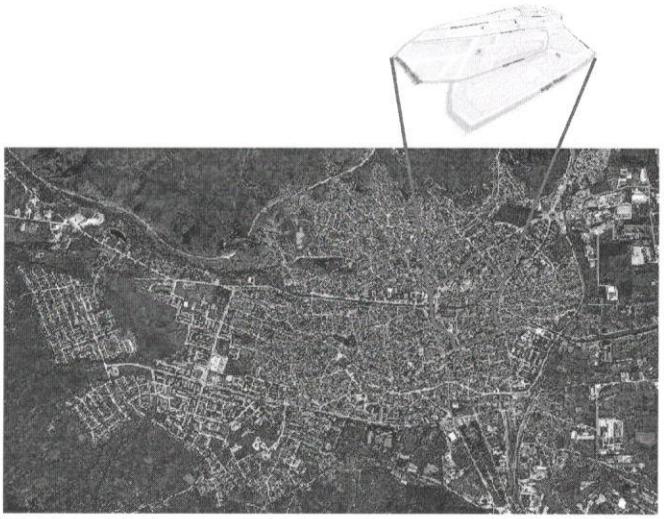

Figure 1. CBDB zoning

II. CBDB QUANTITATIVE MEASURE OF EFFECTIVENESS ANALYSIS

Quantitative Measure Of Effectiveness are important in order to ensure cost savings due to more efficient transport trips, better loading rates and the optimization of the delivery processes. Data squishing was realized through 1000 questionnaires, successfully realized during past two years. The data provided us with large number of information, but for the

needs of this work we will present only those that relate to the type, the quantity of daily delivered goods and the number of deliveries, *"Fig. 2 – Fig.3"*, taken as input parameters in the mathematical model for calculating the overall quantity of goods that daily and yearly has been loaded to the CBDB.

The questionnaire involved several segments that included data for:

- Study of the current movements of goods, the number and average tonnage of commercial vehicles entering the target area,
- The number of deliveries per trip as well as increased number of direct small deliveries,
- Analysis of the needs and habits of businesses, shops and goods carriers, especially of small and medium-sized enterprises (SME),
- Infrastructure for loading and unloading.

Figure 2. Quantity of daily delivered goods by type in tones

Figure 3. Daily number of deliveries, by type of goods

III. CBDB Qualitativ Measure Of Effectiveness Analysis

Qualitative Measure Of Effectiveness are performances that improve time savings due to less congested roads, lower inconvenience for residents due to reduced noise caused by loading and unloading freight, more accessible shops, e.g. for pedestrians, est. *"Fig.4"* presents daily delivery time window.

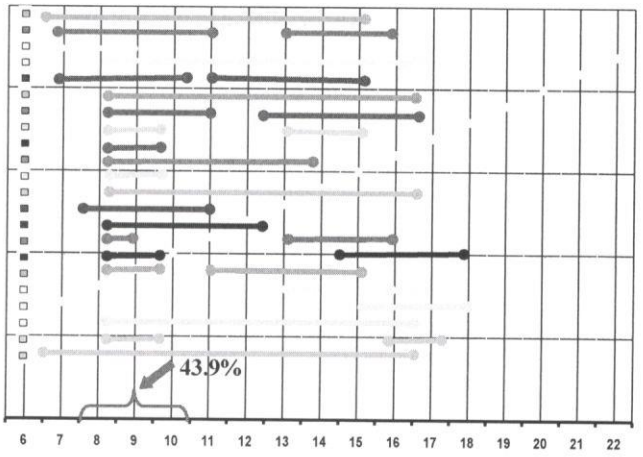

Figure 4. Daily delivery time window by type of goods

As it's shown 43.9% from the total number of the deliveries are realized among $8^{00} - 10^{00}$ a.m.

A sample of the delivery vehicles access, parking, and the quality of loading and unloading operations shows:

- Limited access because of the illegally parked TAXI vehicles;
- Limited access because of the inappropriate road geometry;
- Manually handled loading and unloading operations;
- Deficiency of loading ramps;
- Conflicts between delivery vehicles;
- Conflicts among delivery vehicles and other traffic consumers; About 60% of all deliveries are made double-parked while another 22% are either made on the sidewalk, bus stops or at pedestrian crossings. Deliveries made by double parking are particularly disruptive since they bloc a street lane in high density areas, seriously impairing circulation.
- Only 8% of deliveries are made using an available sidewalk parking space, implying that parking space availability at the moment of the delivery is in short supply.
- Another 7% of deliveries takes place in pedestrian-only streets where deliveries are permitted at certain time of the day.
- The remaining deliveries are done in designated street delivery areas (3%).

IV. Concludions and Recomendations

Optimizing micro-urban goods delivery can be achieved through several types of measures, concluded and recommended based on the detailed two years case study analysis:

1) Creating logistics platforms, which integrate trade, commerce, logistics, services, and freight companies, such as within urban distribution centres, offering city logistic terminals or room for storage.

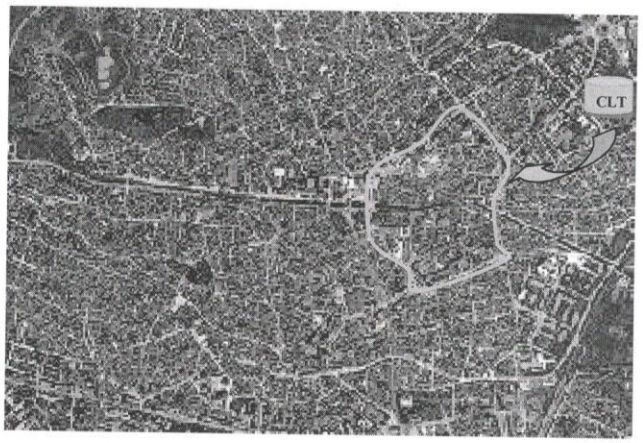

Figure 5. City Logistic Terminal, proposed location

2) Creating legal frameworks and regulations to oblige carriers to cooperate.

3) Defining regulations for access to urban areas for commercial vehicles delivering freight (e.g. only during fixed times or permitting access only to vehicles meeting specific standards, "Fig.6"*).*

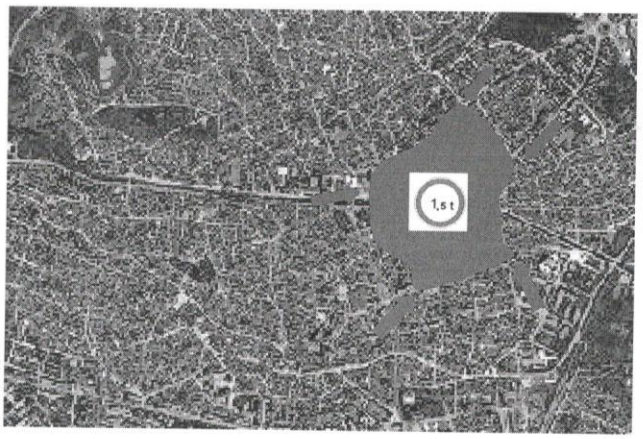

Figure 6. Proposed CBD Access regulations

4) Creating freight maps and signage to show the most suitable freight routes to CBD and highlighting obstacles as well as areas that should be avoided, such as narrow streets, residential areas, pedestrian areas, etc.

5) Managing the parking spaces for loading and unloading goods in an area.

6) Introducing Intelligent Transport Systems (ITS) technologies and or web-based logistics coordination systems enabling more efficient transport planning and an increased load factor.

7) Implementation of measures to enhance citizens safety and security (e.g. by introducing speed limits for heavy vehicles in an area).

References

[1] General Urban Plan of Bitola, Public Enterprise for Spatial and Urban Planning, Bitola, 1998. (references)

[2] Traffic study of the city of Bitola, Municipality of Bitola, 2011. (references)