

DRAGO SPAJIĆ, B. Eng.
E-mail: drago.spajic@post.ba
Croatia Pošta d.o.o. Mostar
KREŠIMIR ŠAPINA, B. Eng.
E-mail: ksapina@net.hr
Slavonijatrans turizam d.o.o.
Primorska bb, 35000 Slavonski Brod

Transport Engineering
Review
Accepted: May 16, 2006
Approved: Mar. 1, 2007

AMQM SYSTEM FOR MEASURING THE QUALITY OF POSTAL SERVICES

ABSTRACT

The work presents the AMQM (Automatic Mail Quality Measurement) system for measuring the quality of postal services. The system has been developed at the request of UPU – the world postal union. AMQM represents an advanced managerial tools whose main task is to obtain objective data on the quality of providing postal services. Based on the obtained data from the AMQM system, the activities may be planned which are necessary for quality improvement of postal services.

KEY WORDS

quality, system, measurement

1. INTRODUCTION

Only when the market became saturated with various products and services and when the user-customer came into position to be able to make choices on the market, has the priority importance been given to the quality of service.

The aim of successful business has been shifted from the factor of production and service provision to the factor of customer “satisfaction” with the service provided.

The postal operator, having as objective a satisfied customer, undertakes all the activities to reach this goal, and *measuring of traffic* is emphasised among these activities. Measuring of traffic means determining the characteristics or properties of the user. The traffic is measured at all the points, nodes and branches. In a wider sense, traffic can be defined as a system or a process which performs the “transport” of people, goods and information by means of a traffic network according to defined rules or protocols.

Every traffic system has quality through:

- performance,
- constancy, and
- efficiency.

The quality of the traffic system should be considered from the aspect provided by the network and required by the customer, and there is quality of service from the viewpoint of the primary user – QoS (Quality of Service) and quality of service from the aspect of the network GoS (Grade of Service). Quality of service can be defined as a group effect of service performance which results in the users’ level of satisfaction.

The measurement results processing is the study of the statistical analysis based on the results of the samples i. e. defining of the conclusions as to how much the sample properties match the properties of the entire population.

Digital network is determined by secondary and tertiary users that come from the source.

Therefore, measurement in digital network is a process of collecting data on secondary and tertiary users with the aim of observing their flow through the network due to the following:

- network load,
- “cargo” design,
- traffic model construction,
- level of occupying the network means, and
- network expansion planning.

The process of presenting the measured data has three levels:

- collecting and statistical analysis of traffic records - trace,
- development of a maximally accurate model, and
- analysis of the proposed traffic system from the aspect of quality measuring instruments.

Measurements in digital network provide a large volume of different data so that during the analysis of the data, the reduction – shrinkage of data / examples needs to be made because of measurements in micro second to measurements in nano second.

The approach to measurement depends on the object of measurement and the digital approach to measurement is based on the fractal random process, i. e. general occurrence. The fractal object is the ability of

keeping a certain property / image, time, order, etc. / within different spatial and temporal measurement instruments.

Fractal characteristic is reflected in the form of self similarity performance.

All traffic measurements, both in case of classic telecommunications system or in the postal system, have their "umbrella organizations", i. e. societies of world level which provide rules for the measurements and quality. For telecommunications systems this is the ITU – International Telecommunications Union and for the postal system it is the UPU – International postal union.

2. MEASURING TRAFFIC IN POSTAL SYSTEM

The International postal union (UPU) has paid special attention to traffic measurements and stimulates the postal operators by various measures to introduce advanced systems of measuring quality in providing postal services. The competition has "made" the postal industry worldwide to speed up postal items through postal flows, because the users' expectations regarding the speed of transport are getting higher, and the number of postal items is increasing daily. Therefore, the basic element of the postal service quality has become the speed of transport and compliance with the defined terms from the receipt to the delivery of the postal item.

Due to the mentioned facts the introduction and application of modern technical solutions, modern sorting of items, high-quality network and transport, good information technology support, etc. have become necessary in order to raise the quality in internal and international postal traffic.

Many postal authorities – operators have undertaken significant steps to increase the percentage of postal item delivery within a defined period of time, to reduce the terminal costs and to respond to the increasing users' requirements. These authorities were the first to introduce the quality measurement system – AMQM - Automatic Mail Quality Measurement.

This system appeared on the market, and the postal authorities – operators use it to measure, analyse and improve the quality of their services. This system allows tracking of postal items "from start to end", i. e. from sender to receiver, and provide the postal authorities with the necessary activity with the aim of identifying and then also of eliminating bottlenecks in the phases of transfer and processing.

AMQM - Automatic Mail Quality Measurement system for automatic measurement of the postal services quality was developed at the request of the World postal union (UPU). The main task of the sys-

tem is to obtain objective data on the quality of postal services.

Automatic Mail Quality Measurement - AMQM system has been installed at the Izmjenična pošta (post office for international traffic) 11003 Belgrade with the objective of tracking the postal flow on the territory of the former state. The basic reason lies in the fact that the international flows of postal items recognize only the volume of postal traffic and the best price and the type of transport. UPU has recommended international calculation of "terminal" costs according to unique methods and with validity for all postal operators in the world.

3. DEVELOPMENT OF PROJECT BY UPU

With the aim of directing the entire world postal development, the Beijing Postal Strategy - the strategic plan for the development in the period from 2000 to 2004 was adopted at the 1999 UPU Congress in Beijing. This strategy represents a professional program, for the national governments, postal operators and bodies – UPU committees which contains six following objectives:

1. to insure the provision of Universal postal service, which allows the users to send and receive messages or goods in any part of the world;
2. to improve the quality of international postal network, providing the users with reliable, safe and efficient postal service;
3. to improve cost efficiency of international postal network, insuring their users price-affordable postal services;
4. through better knowledge of the market and development of services to efficiently satisfy the needs and expectations of postal customers;
5. to provide postal users, through reform and development of post, to feel the advantages from technological and economic changes in the environment, and
6. reinforce and expand cooperation and interaction among stakeholders of the postal industry.

At the Bucharest UPU Congress in 2004 the decision was adopted to perform all the future calculations of terminal and transit costs in accordance with the time of postal item transfer in the destination country. This certainly influences all the UPU member states, in the sense that they have to maximally improve the quality of postal items transfer on their territories. UPU is required to insure independent, objective and reliable method of collecting and processing data on time necessary for the delivery of postal items, on the basis of which the diagnostic monitoring of quality would be performed.

The International Post Corporation – IPC, consisting of a larger number of national postal operators, has started the UNEX project - Unipost External monitoring of quality in international postal system. The UNEX project was started with the aim of performing measurement of the time of transfer of international postal items from the sender to the receiver, with special emphasis on time necessary from the incoming IP - (post office for international traffic) to receiver.

Various researches were done and various systems studied, that would facilitate high-quality monitoring of the flow of the postal item from the sender to the receiver and identify the bottlenecks in distribution.

Postal authorities have tested various technologies, out of which the most successful ones proved to be those based on **transponders** which were huge and heavy in the beginning. This concept showed success and served in the approach to the development of a new AMQM system which is based on sophisticated hardware and software, as well as on the technology of radio-frequency identification. In order to provide assistance to poorly developed postal systems, UPU established a quality fund, collecting the means from the developed countries of the world. By August 2002 the AMQM system was installed in 27 countries of the world: Australia, Belgium, Brazil, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Island, Ireland, Italy, Luxembourg, Malta, the Netherlands, Norwegian, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Tanzania, England and the USA.

The measurement of quality for the so-called Balkan routes has been determined by IP 11003 Aerodrome, Belgrade for monitoring the quality of international postal traffic in the former state. The AMQM system was installed on 17 July 2003.

4. PRODUCERS OF QUALITY MEASUREMENT SYSTEMS

The maker and producer of the AMQM system is the Dutch company Lyngsoe Systems that specializes in the control of automatic processes and generating of report data. Lyngsoe Systems developed its projects primarily for the postal industry, aerodromes, retail networks and distributive centres. These are the systems with high speed sorting, systems for diagnostic measurement of the quality of postal items AMQM, world-spread systems for radio-frequency identification (RFID), etc.

As part of this world system of measuring the quality of postal services the same system has been developed, that is used for one postal authority under the name of QSMTM system.

The development of the AMQM system started on the request of UPU in 1994. Already in 1996, the Lyngsoe Systems technology offered a version of the AMQM system that was approved by the UPU in 1999. The first installations of this system occurred in the most developed postal authorities such as Deutsche Post, TPG Post, Post Denmark and Posten Norway. These postal authorities used the AMQM system only for measuring the quality of postal items in internal postal traffic.

Also, a big and well-known company from the Siemens system, Siemens ElكتروCom from Berlin developed the system for testing – measuring of quality QTS - Quality Test System. This system represents the type of letter service i. e. “electronic letter” designed so as to identify weak points in the logistics of the postal network. QTS - Quality Test System allows easy and efficient analysis of critical journeys, on which later the causes of standstills are elim-

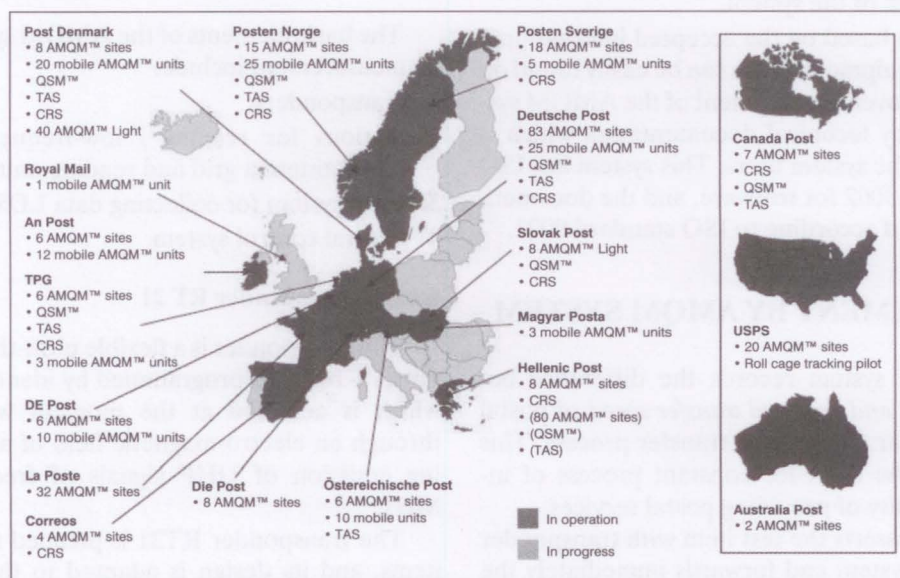


Figure 1 - Postal authorities that introduced the AMQM system

inated, i. e. the quality of providing postal services is reduced

However, the AMQM system has found greater application in the measurement of the quality of postal flows and Figure 1 presents postal authorities that had already introduced this system for monitoring, i. e. measuring of the quality of postal services in internal and international traffic.

5. AMQM SYSTEM

The AMQM – Automatic Mail Quality Measurement is a system for automatic measurement of the quality of transferring mail items that can collect, analyze and present total and objective data, as well as the data from huge organizational systems and it enables:

1. a completely new system of objective measurement of postal system efficiency,
2. well documented basis for making business decisions, and
3. safe manner of objective measurement of specific postal technological operations in internal and international traffic.

AMQM system offers also many technical advantages in everyday work of postal employees and they use part of the program for current processes because this system covers the segment of measuring traffic from the sender to the receiver.

The system allows also the following:

- greater level of reading the data in the measurement process,
- reading of data in circular cages in movement,
- easy mounting of the system,
- precise and reliable measuring of the quality,
- specially designed for postal systems, and
- open structure of the system.

The system is based on the accepted international standards and equipment which can be easily found on the market. The overall equipment of the AMQM system is covered by technical documentation which is delivered to all the system users. This system has ISO standard quality 9002 for software, and the documentation is delivered according to ISO standard 9001.

6. MEASUREMENT BY AMQM SYSTEM

The AMQM system records the difference between the *actual and expected transfer speed* of postal items in particular parts of the transfer process. This information is the basis for constant process of increasing the quality of providing postal services.

The sender, inserts the test item with transponder into the postal system and forwards immediately the information on time and date of sending to the Cen-

tral system for quality measurement at CMS in Brussels. The item passes through the postal system and at every point of AMQM system the *time and date of passage are registered*. Upon having received the test item, the receiver also forwards the data directly to the SMS – Central measuring system in Brussels.

The AMQM system is set at the measurement “points” in the postal system such as:

- postal centres for concentration and diffusion of postal items,
- post offices for international traffic – organizational units of the system for international postal traffic,
- at all transloading locations of integral and multi-modal transport, and as micro-location the AMQM system is installed:
 - on the entrance to the premises where measurement is performed,
 - on the scales for measuring the volume of items,
 - on trolleys, etc.

In fact, the point for measuring the transfer speed can be located at places where it is necessary to perform the measuring of quality. It is essential that the measuring stations for the identification of test letter are set at a distance of 3 metres. The system can identify 10 – ten or more “scattered” letters – test letters that are not complex, and passing at the same time through the quality measurement system. The CMS system receives data on measurement from different measurement stations and processes the data and then gives them in the form of charts and graphs to detailed statistical analysis which is delivered to postal operators or objective “third” party – technical committee of UPU.

6.1 Basic elements of AMQM system

The basic elements of the AMQM system for quality measurement include:

1. transponders,
2. stations for reading / low-frequency antennas, UHF antenna grid and reading unit,
3. local system for collecting data LDSC, and
4. central control system.

6.1.1 Transponder RT 21

The transponder is a flexible ultra-thin radio transmitter – receiver programmed by identification code, which is actuated at the moment when it passes through an electro-magnetic field of antennas, causing emission of UHF signals of frequency 433.92 MHz.

The transponder RT21 is planned to track postal items, and its design is adapted to that purpose. It weighs 12 grams and the dimensions are of standard-

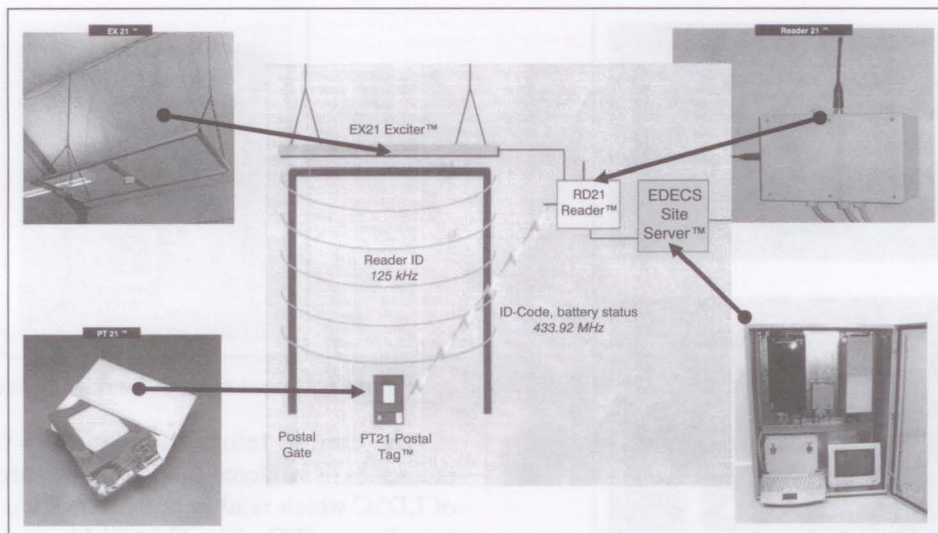


Figure 2 - AMQM system scheme with elements

ized letter, i. e. 140x90mm; it is resistant to impacts and machine processing of items, temperature differences, etc. The instrument is foreseen for being packed into a letter becoming the test letter for providing quality data in the measurement process. It is also resistant to other electronic interferences which may occur on the path of quality recording.

The object of measurement may also be bundles of letters, transloading units/bags, palettes, containers, etc. so that the producer Lyngsoe Systems has already made different models of transponders shown in Figure 4.

6.1.2 Readers

The readers consist of low-frequency antenna EH 21 Exciter (Figure 5) and the reading unit with UHF antenna RD 21 Reader.

At the point determined for AMQM system in the technological process of measurement it is possible to set one or several reading units. Most often a rectangular antenna is used in the form of a frame, which is usually attached at the entry by metal chains. The length of the chain should be set so that the antenna hangs at an altitude of 2.70 metres above ground. If the entry is wider, several such antennas are set in a series. The system functions so that the low-frequency antennas EH 21 constantly generate the pulsing electro-magnetic field of frequency of 125Hz, which activate the transponder at the moment when it passes by

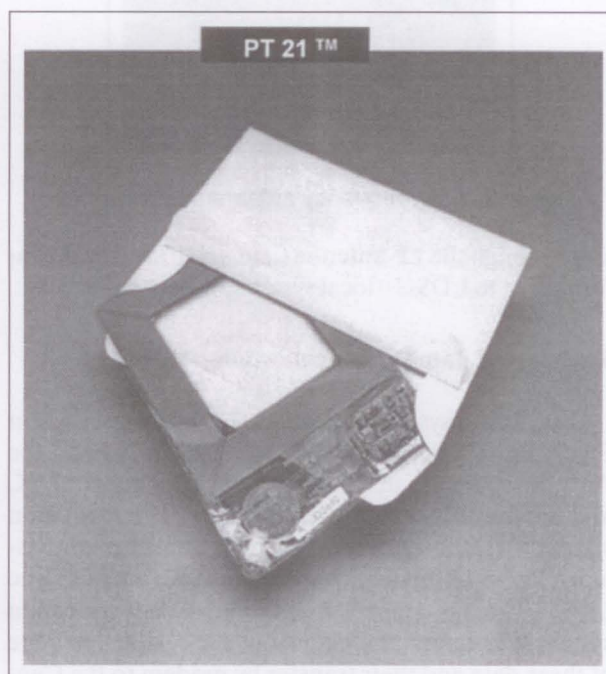


Figure 3 - Transponder RT21

or below the antennas and then it starts to emit the UHF signal of frequency 433.92 MHz which is the identification code.

The reader unit with UHF antenna-RD 21 Reader receives the signal from the transponder, registers the identification code, assigns the time and date of pas-



Figure 4 - Different models of transponders



Figure 5 - Low-frequency antennas EH21 Exciter

sage through the LF antenna field and forwards the information to LDSC – local system for data collection.

6.1.3 Local data system collection – LDSC

Local data system collection (LDSC) presented in Figure 6 is located in the premises in which the AMQM system is installed as well. It consists of PC and modem connected with the Central information system – GEIS – General Electric Information Systems. Up to 15 readers – units may be attached to one LDSC. The basic function of the local data collection system is to collect the data from the readers, storage of these data and their transfer by modem to the Central Monitoring System (CMS) in Brussels.

6.1.4 Central monitoring system - CMS

The Central Monitoring System (CMS) is located in Brussels – Belgium. It collects and distributes the data according to the users' orders, controls the accuracy of the system and reacts to every identified problem.

The Central Information System GEIS - General Electric Information Systems connects all the reading points to the central monitoring system, which is located in IPC, as well as with the centre for the system maintenance. In principle, for the success of the project it is most important to insure adequate software, capable of satisfying all the set requirements.

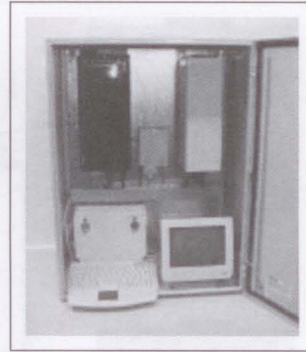


Figure 6 - Local system for data collection LDS

The Central Information System – GEIS consists of a series of modems and PCs, which are components of LDSC which read in pre-determined intervals and transfers to IPCs. The Central Monitoring System – CMS receives data and gives reports on the status in defined intervals. Automatic self-testing is performed for local hardware and the report on the status is produced. The Central Monitoring System manager is responsible for the cooperation with the Centre for maintenance and national coordinators, in order to insure maximum efficiency in the system operation. The manufacturer of the AMQM system - Lyngsoe Systems automatically receives a copy of all reports on the operation as well as IPS, so that the elimination of identified deficiencies is solved within a very short period of time. In case of a problem, the Central Monitoring System is automatically contacted and it receives details on the identified problem. The system manager solves these in a “remote” manner and really rare are the cases when it is necessary to come to the identified problem. The collected data are stored by means of a large capacity secondary memory.

7. MOBILE AMQM SYSTEM

The AMQM system – producer aims to continue to develop and improve the system so that it would be capable of satisfying the future requirements of postal operators. The operators want to keep and increase the quality of service provision which is the pledge of positive business operation in the future.

By introducing mobile units for data collection, the postal operator can perform measurements at any point of their organization and postal items flow. Mobile system consists of the following parts:

- unit located in the “flying box” which contains the local unit for data collection,
- antenna, and
- reader.

The mobile AMQM unit is easily installed and activated. It allows collection of data also from the places at which there are no installed fixed AMQM

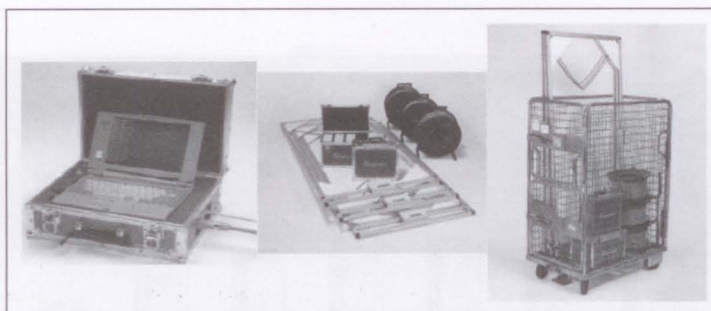


Figure 7 - Mobile AMQM unit

system, and certain postal flows exist. Communication from the local unit for data collection to central monitoring system is performed by means of GSM network. One of the possible additions to the AMQM system can also be the software module for national network, whose aim is to monitor and measure the quality for internal postal traffic.

Responding to the needs of postal authorities worldwide, the solution of the AMQM system is concentrated on the monitoring of letters of the first weight rate in internal and international traffic. Other types of postal items such as packages, postal bags, containers and items of higher value are included in the development program of AMQM system for the next period.

8. MEASUREMENT OF POSTAL SERVICES QUALITY IN EUROPE

In order to illustrate the success of the AMQM system, the fact should be mentioned that the number of delivered postal items within a guaranteed period of time, in the first several months of implementation in percentage increased from 80% to 90%. Postal opera-

tors of the European Union member countries started in 1994 the UNEX project - Unipost External Monitoring System, with the aim of improving the quality in the area of Europe. This system measures two basic performances: the percentage of postal items delivered in pre-defined period of time and the average time of delivery in days. The validity of such data is certified by the independent English organization for issuing certificates ISO Research International.

During 2001 the measurement included over a million test letters of all types and sizes in 36 countries on 600 regional transport lines that cover urban and rural areas. Measurement was performed also among 430 nodes between North America and Europe.

In the first half of 2001, the measuring results indicated that 93.1% postal items in the territory of Europe, were transferred from the sender to the receiver in the time period D+3.

Comparing the data with 1994 measurement one can note the increase in the quality of on time delivery by 23.6%. On the average, the average time of delivery of postal items from the sender to receiver took 2.2 days.

The European Union had the task to deliver 85% letters within the given time period i. e. D+3. The

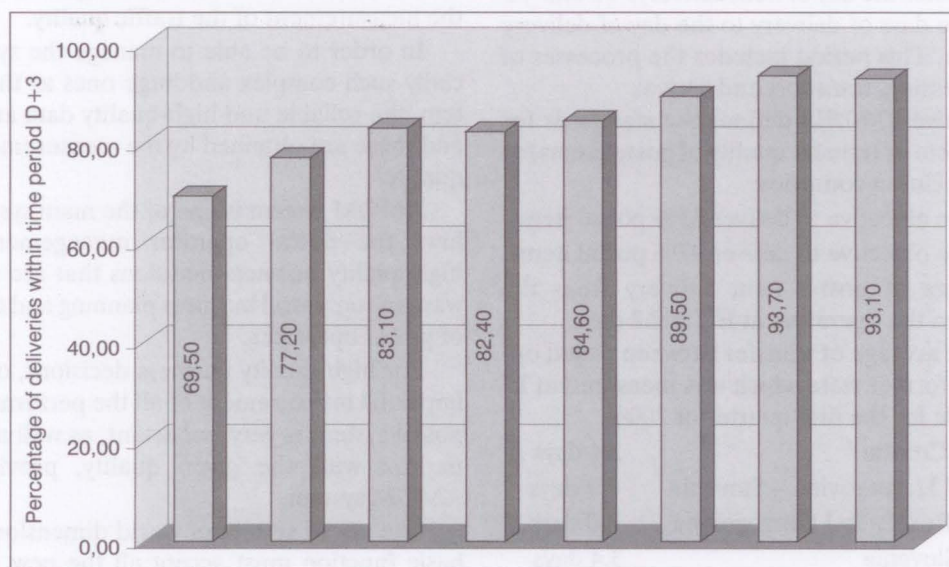


Figure 8 - Percentage of postal items delivered within time period D+3

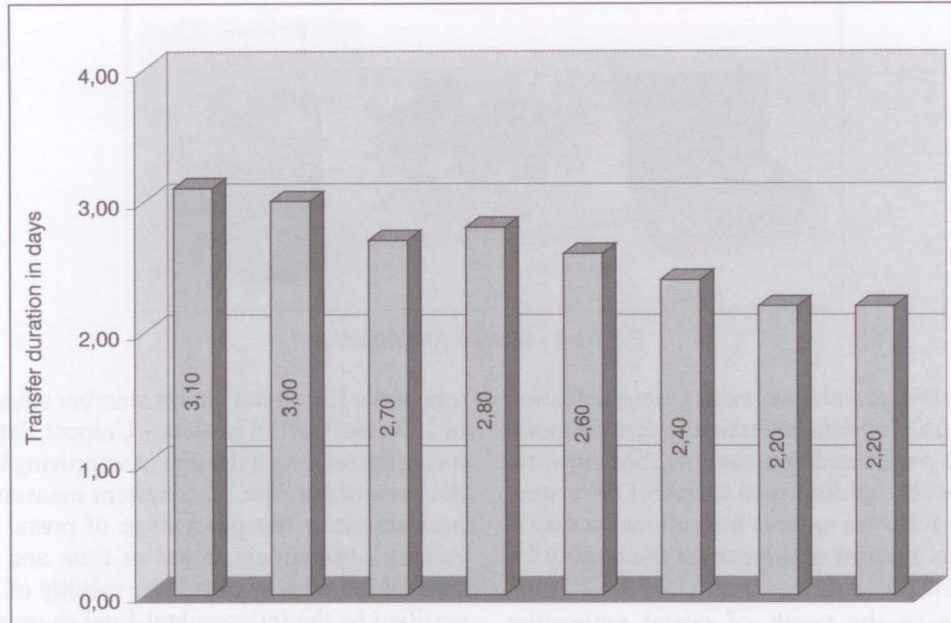


Figure 9 - Average transfer duration in days

measurements showed that the task was exceeded and that the postal operators of the European Union achieved better quality than the given one, realizing 93.1% of deliveries from the sender to the receiver within the time period D+3.

Similarly, the given percentage of 97% of items to be delivered within the time period D+% was exceeded and the realization was 98.6%.

Measurement showed that the introduction of new technologies has no alternative in raising the quality of providing postal services which allows equal fight for the market with other competitors in postal industry. The IPS members publish the results of UNEX project twice a year. Also the standards for speed J+3 and for the reliability of transfer J+5 have been determined. J – denotes the day of item delivery, +3 and +5 – represent the days of delivery to the day of delivery to the receiver. This period includes the processes of delivery, processing, transport and arrival.

The Directive 97/67/ES defines the standards for the measurement of transfer quality of postal items for the European Union countries:

J+3 has the objective to deliver 85% postal items,
J+5 has the objective to deliver 97% postal items.

The average of postal item delivery from the sender between the operators in EU is 2.2 days.

Here is the average of transfer between postal operators of the former state which was measured at IP 11003 Belgrade for the first quarter of 2004:

Slovenia – Croatia	2.4 days
Bosnia and Herzegovina – Slovenia	2.7 days
Slovenia - Bosnia and Herzegovina	3.0 days
Croatia – Slovenia	3.4 days
Bosnia and Herzegovina – Croatia	4.0 days

Slovenia - Serbia and Montenegro	4.2 days
Slovenia – Macedonia	4.2 days
Croatia - Bosnia and Herzegovina	4.8 days
Macedonia – Slovenia	5.0 days
Serbia and Montenegro – Slovenia	5.4 days
Croatia - Serbia and Montenegro	5.6 days
Serbia and Montenegro – Croatia	5.6 days

9. CONCLUSION

Measurement of traffic in the postal system is an everyday phenomenon, measuring the services per types, quantity, performance time, performance method, etc. One of the most important measures is the measurement of the traffic quality.

In order to be able to manage the systems, especially such complex and huge ones as the postal system, the reliable and high-quality data are necessary, and these are obtained by the measurement of traffic quality.

AMQM system is one of the main systems that allows the postal operator management to make high-quality business decisions that are the basis towards a successful business planning and development of postal operators.

For high-quality business decisions, objective and impartial measurement of all the performances of the postal system is very important, as well as their comparison with the given quality, provided by the AMQM system.

The postal system of world dimensions, due to its basic function must accept all the new technologies that increase the quality of providing postal services,

since every delay causes loss in customers – services. International accounting – common realized income on the international market is divided exclusively on the basis of high-quality performed service within the given time of transfer and delivery.

The first results of recording by AMQM system of our region leads to the conclusion that we are “far” from the average of the European Union, towards which we have oriented all our efforts. The first task is to solve in a high-quality manner the transfer of postal items in internal traffic. This can be achieved by setting adequate organizational structure, technological reorganization, postal process automation, more intensive introduction of information technology, introduction of intern AMQM system, introduction of new control method, etc.

Postal system of our region, based on the “findings” obtained by the measurement of the quality using AMQM system, tells us that we need to make “big changes” in achievements and equal competition with other European postal operators for the provision of postal services.

DRAGO SPAJIĆ, B. Eng.
E-mail: drago.spajic@post.ba
Croatia Pošta d.o.o. Mostar
KREŠIMIR ŠAPINA, B. Eng.
E-mail: ksapina@net.hr
Slavonijatrans turizam d.o.o.
Primorska bb, 35000 Slavonski Brod

SAŽETAK

AMQM SUSTAV ZA MJERENJE KVALITETE POŠTANSKIH USLUGA

U radu je prikazan AMQM (Automatic Mail Quality Measurement) sustav za mjerenje kvalitete poštanskih usluga. Sustav je razvijen na zahtjev UPU-a (Svjetske poštanske udruge). AMQM predstavlja suvremeni menadžerski alat čiji je glavni zadatak dobivanje objektivnih podataka o kvaliteti pružanja poštanskih usluga. Temeljem dobivenih podataka iz AMQM sustava, mogu se planirati aktivnosti koje su neophodne za podizanje kvaliteta poštanskih usluga.

KLJUČNE RIJEČI

kvaliteta, sustav, mjerenje

LITERATURE AND SOURCES

- [1] **M. Begović**: *Lectures from post-graduate study* – April 2006
- [2] Stručni informativni časopis *Suvremena pošta*, No. 4, 2005
- [3] <http://www.ipc.be>
- [4] <http://www.lyngsoessystems.com>
- [5] <http://siemens.com>