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EFFICIENCY OF THE INTEGRAL INFORMATION SYSTEM AND VIDEO SURVEILLANCE OVER THE WORK OF STATIONS FOR TECHNICAL INSPECTION OF VEHICLES AND TRAFFIC SAFETY CONTRIBUTION

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ABSTRACT: *This paper will present a short analysis of the past use of the unified information system a|TEST, as well as introduction of video surveillance over the work of stations for technical inspection of vehicles in Federation of Bosnia and Herzegovina in the period of 19 April 2007 – 31 March 2012. This use has caused increased quality of control performance of technical vehicle regularity, which contributes to overall increment of level of traffic safety on the roads in Bosnia and Herzegovina. The quality of information system a|TEST is also confirmed by the implementation of standard ISO/IEC 27001:2005 during year 2009. Only about 5000 companies in Europe have this standard. The aforementioned confirms the quality of work of an overall organization of professional institution and established information system a|TEST in Federation of Bosnia and Herzegovina.*
KEYWORDS: *professional staff, a|TEST, video surveillance, ISO/IEC 27001:2005*

INTRODUCTION

Technical inspection of vehicles is an activity of general social interest. From the standpoint of traffic safety on the roads, the technical inspection is also important from the view of protecting the environment from pollution and global warming, as a global problem (issue). The purpose of technical inspection is to have technical malfunction of the vehicles as less cause of traffic accidents as possible, and to ensure safe traffic with the least undesirable consequences. Employees in the stations for technical inspections are corrective factor which directly affects the traffic safety.

Number of vehicles in the pre-war period reached a figure of around 500,000 for the entire area of B&H. The situation in the area of control of the work of stations for technical inspection and control of technical condition of vehicle in the period of war events 1992-1995 was completely unfavorable. It is assumed that during the war period there was 2/3 of vehicles destroyed, but today in Federation of Bosnia and Herzegovina there are more cars than in the entire B&H before the war, and total number of vehicles is around 850,000. Most of them are the passenger cars 80-91% depending on the development of Canton. [11]

Problems that accompany this area are the following:

1. *vehicle age*
2. *damage to road infrastructure in Bosnia and Herzegovina*
3. *poor traffic culture of the citizens*
4. *poor purchasing situation of the citizens*
5. *poor maintenance of vehicles, which is mostly done in their own arrangements or by unregistered services*
6. *poor and low-quality spare parts which are installed*
7. *inadequate implementation of legal mandatory technical inspections (vehicles do not show at inspection)*

The average vehicle age is over 16 years for passenger cars in Federation of B&H. Number of brand new vehicles in last three years is at the level of 9,000-10,000 vehicles. [2]

All this had the effect that, in year 2006, the Entity Government of Federation of Bosnia and Herzegovina makes the Decision whereas the tasks of professional supervision of the work of stations for technical inspections of vehicles were transferred to the professional institution, which was signed by the Agreement on Mutual Rights and Obligations of the Federal Ministry of Transport and Communications and the Institute for Commercial Engineering Zenica (IPI). Transferred jobs referring to the work of stations for technical inspections of vehicles are the following:

Table 1. Overview of the transferred jobs to the professional institution [15]

No.	Transferred jobs
1.	Monitoring of regulations in the area of control of vehicle condition, taken by neighboring countries, European Union and other international organizations
2.	Professional training of the controllers of roadworthiness of vehicles, managers of technical inspection stations and other persons working in the professional jobs of technical inspection; periodic check of knowledge of controllers of vehicle roadworthiness and other persons working in the professional jobs of technical inspection
3.	Control of conducted calibration of equipment used for the control of technical condition of vehicle
4.	Binding the stations for technical inspections of vehicles and other interested subjects into unified computer system linked to the tasks of technical inspections of vehicles
5.	Cooperation with professional and scientific organizations, institutes, enterprises and other legal subjects from the area of technical inspections of vehicles
6.	Preparation of written instructions and information and publications from the area of technical inspection of vehicles
7.	Data processing and analysis from the area of technical inspection of vehicles

Subsequently, pursuant to new Decision by the Government of Federation of Bosnia and Herzegovina there was made the provisional allocation of funds for expenditure by the delegated authorities in the way that the previous Decision was amended with two new jobs which caused introduction of video surveillance system in Federation of Bosnia and Herzegovina.

Table 2. Overview of the transferred jobs to the professional institution upon amended Decision [15]

No.	Transferred jobs
1.	Financing the implementation of video surveillance system at the stations for technical inspections in FB&H
2.	Financing the printing of forms necessary to conduct technical inspections in FB&H (for preventive conditions, for technical-exploitation conditions, etc.) and their distribution by stations for technical inspection

Using the information system a|TEST much greater ability to control and supervision over the work of technical inspection stations was enabled to professional personnel of Professional institution of IPI Zenica. The result of the measures of control and supervision over the authorized users of information system on technical inspection stations is permanently pointing to mistakes and shortcomings in the work as soon as they have been noticed.

The importance of this project was recognized by the State Ministry of Communications and Transport of B&H, so the Regulations on the technical inspections of vehicles (Official Gazette B&H, No. 13/07, 72/07, 74/08, 3/09, 76/09) published on 28 September 2009 was amended by the definition of a unified information system on the State level [1]. According to the Regulations it states: "Information system is a complete unit which is used for measuring individual prescribed sizes for vehicle that testify on technical condition of vehicle and which enables graphical display of results including the graphical review and input of those values and measurements that cannot be automatically downloaded to the Information system. The system is IT connected to the computer support for automatic processing of measured values, their archiving into a single database, and includes equipment, software and internet connection for delivering, distribution and usage of data in the procedure of registration of vehicles and other tasks performed in authorized stations for technical inspection of vehicles, authorized entity ministries or the service of Brčko District of Bosnia and Herzegovina, professional institution or the Agency for identification documents and electronic data exchange (IDDEEA)." [1, 7, 16]

Unified information system a|TEST is a web based application for entering data on conducted technical inspections into a central database. It is designed to be located together with the data in one place, and that technical inspection stations approach to it via internet connection (web), Figure 2. Printing of all reports is done from a central server. In this way everything is recorded into a unique information system, as well as who and when it did and from which stations for technical inspection of vehicles.

INTEGRAL INFORMATION SYSTEM a|TEST

The Decision of the entity Government of Federation of B&H, dated 1 April 2008 states that the input of all data on conducted technical inspections into a unified information system a|TEST has become mandatory in the area of Federation of Bosnia and Herzegovina.

By the beginning of 2008 there were seminars held regarding the issue of these authorizations which all employees from 156 stations for technical inspections had to attend, in the regional principle at the entire area of B&H. After this compulsory training prescribed by the Regulations we had approached to the first accreditation-inspection which resulted the issuance of licenses and stamps for the persons who passed the exam. By the end of 2009 the same training took place for all professional personnel in both Federation of B&H and all 12 stations for technical inspections in Brčko District of Bosnia and Herzegovina (BD B6H), which continued in years 2010 and 2011. [14, 15]

Professional staff on all stations for technical inspections of vehicles in FB&H (controllers of roadworthiness of vehicles and station managers) was introduced with the work of a unique information system a|TEST in written form and by video instructions.

The introduction of a unified information system into the work of stations for technical inspection of vehicles has changed the public opinion in the entire area of FB&H and BD B&H (as well as in the entity of Republika Srpska) because the common practice was to conduct technical inspection irregular. The insurance companies and agencies for vehicle registration dictated the work of technical inspection stations in the way that they "increased" their trade and introduced fictional conduction of technical inspection of vehicles.

Constant monitoring and analyzing the work of stations for technical inspection of vehicles led to the situation that they (stations) started entering data on conducted inspections with minor defects. The biggest problem in this initial period was not entering data on conducted preventive inspections. All stations for technical inspections of vehicle which, from their own reasons, did not enter data on conducted inspections into a unified information system and in proper way were sanctioned.

Unified information system in addition to the indicators on the number of inspections, offers many other data, as well as the data on noticed defects on the vehicles during conduction of technical inspection of vehicles. The mandatory use of a unified information system a|TEST in the area of Federation of Bosnia and Herzegovina caused assumptions for further development and improvement of this system, for which there was a strong support by authorized Federal Ministry for Transport and Communications.

Considering as necessary the IPI – Institute for Commercial Engineering from Zenica has successfully implemented the standard ISO/IEC 27001:2005, related to information security management (Figure 1.), because the personal data of citizens go through this information system. So, this standard was implemented in order to comply with the standards and requirements asked by the Law on protection of personal data. [14]

Figure 1. Certificate of standard ISO/IEC 27001:2005

THE USE OF VIDEO SURVEILLANCE OVER THE STATIONS FOR TECHNICAL INSPECTION OF VEHICLES

Performing the professional supervision over the work of stations for technical inspection of vehicles in the period after official commissioning of the unified information system a|TEST there were certain anomalies noticed in terms of safety procedures for performing the technical inspection of vehicles on the territory of FB&H and BD B&H. This refers, above all, to the absence of vehicles at the station for technical inspection of vehicles and issuing the certificate on technical condition of vehicle on this fictional inspection in the way that allegedly all legal working procedures were complied.

In the mid of 2008, in coordination with the Federal Ministry for Transport and Communication the feasibility study was done on introducing video surveillance over the work of stations for technical inspection of vehicles [15]. The goal was to eliminate irregularities in the work of stations for technical inspection of vehicles in FB&H, that is the absence of vehicles at the inspection (this was usually the problem in all countries from ex-Yugoslavia). The study was officially approved by the Government of Federation of B&H on 1 May 2009 after which it has been applied in real time. The video surveillance with OCR recognition of registry plates represents an additional link in unified information system a|TEST, so without vehicles it is not possible to enter data on conducted technical inspection (Figure 3), nor printing some of certificate on conducted technical inspection of vehicle. On the basis of working experience of all stations for technical inspection of vehicles in Federation of Bosnia and Herzegovina, the video surveillance was also introduced in the area of Brčko District of B&H and existed for one year, but without official support from the authorized institutions in Brčko District of B&H.

Amendments to two regulations: Regulations on preventive technical inspections of motor vehicles and trailers and Regulations on technical-exploitation conditions for the vehicles which perform certain types of transport. New Certificates have been also introduced, and put into force along with the beginning of use of video surveillance over the technical inspection stations. The serial number for each certificate individually, and every station is charged with certain series of numbers registered through the unified information system a|TEST. Herewith, we cancelled the practice that technical inspections

are conducted without registering on the occasion of delivering reports to professional institution and to the Federal Ministry for Transport and Communication and without possibility of supervision (surveillance).

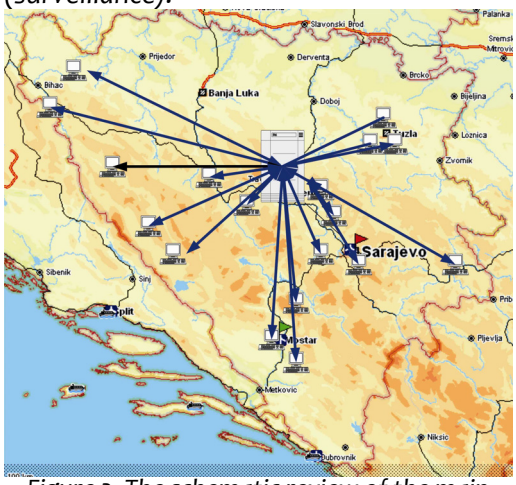

Figure 2. The schematic review of the main server at IPI Institute in Zenica and authorised stations for technical inspection of vehicles in Federation of Bosnia and Herzegovina [2]

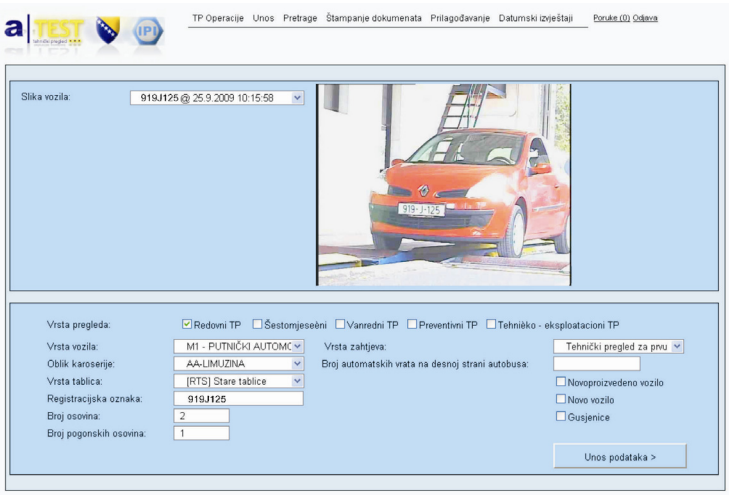

Figure 3. Review of the form of technical inspection of vehicles into the integral information system a|TEST (with installed OCR system – recognition of license plates) [2]

Application of the new Regulations on the registration of vehicles (Official Gazette B&H, number 69/09) has started on 28 September 2009 with official use of eTP form (data on conducted technical inspection have been sent electronically to the Ministries of Interior). In addition to the electronic application form which replaced the paper forms (certificate on completed technical inspection of vehicle) the vehicle classification was also changed and it is coordinated according to the ECE vehicle classification.

INDICATORS OF CONDUCTED TECHNICAL INSPECTIONS UPON INTRODUCTION OF VIDEO SURVEILLANCE SYSTEM

Unfortunately, we have to critically look at past statistics on the causes of traffic accidents which in Bosnia and Herzegovina show that the share of technical defectiveness of vehicles in traffic accidents was only 0,97% (in the entity of Republika Srpska) and 1,97% (in the entity of Federation of B&H). This is impossible if we consider the average age only for passenger cars of over 16,9 years [9]. In European countries, where the average vehicle age is 6-8 years the share of technical defectiveness in traffic accidents is 10-20%. This proves that all our system failed, starting from the police doing the first insight inspection, to the traffic experts because they are the only ones authorized for reconstruction of the traffic accident. [3]

Table 3 presents data on conducted inspections per types of inspections and total number of conducted inspections. From a year to year we constantly get to the growth in the number of inspections, which is above all the result of measures taken in the control of the work of technical inspection stations.

Table 3. Total number and number of conducted inspections per types of inspections in Federation of Bosnia and Herzegovina [3, 5, 6, 13]

YEAR	Technical-exploitation inspections	Regular inspections	Regular six-month inspections	Preventive inspections	Special inspections	TOTAL
19 Apr – 31 Dec 2007	15.713	339.667	0	36.007	0	**391.387**
2008	39.333	477.992	0	55.258	0	**572.583**
2009	49.311	461.210	5.549	54.065	9.513	**579.648**
2010	54.096	468.625	34.064	25.898	14.464	597.147
2011	**50.642**	**480.467**	**40.035**	**19.392**	**8.396**	**598.932**

Besides the standard changes of ownerships or lease of stations for technical inspections by other legal parties, there is a significant change that several stations have received a decision on the temporary interruption of work. In the end of year 2009 there were 154 active stations for technical inspections and the total number of stations did not change. In year 2010, approval for work was given to two stations for technical inspection, so there were 157 active ones, and by the end of year 2011 there were 161 authorized stations for technical inspection of vehicles. [3, 5, 6, 13]

On the basis of obtained information on conducted inspections in year 2011, the Table 5 and Chart 4 present an overview of average vehicle age per vehicle type and age structure of vehicles in Federation of Bosnia and Herzegovina in time intervals of five years.

Table 4. Number of conducted technical inspections and ECO TESTs in Federation of Bosnia and Herzegovina in year 2011 [13]

Vehicle Cat.	Preventive inspections		Regular inspections		Regular six-month inspections		Technical-exploitation inspections		Special inspections	
	No of inspect.	No of ECO TESTs	No of inspect.	No of ECO TESTs	No of inspect.	No of ECO TESTs	No of inspect.	No of ECO TESTs	No of inspect.	No of ECO TESTs
WORK. MACH.	9	0	877	6	7	0	5	0	41	0
L1	0	0	2.487	59	0	0	0	0	71	5
L2	0	0	339	5	0	0	0	0	6	0
L3	1	0	4.718	3.479	1	0	0	0	95	2
L4	0	0	8	7	0	0	0	0	0	0
L5	0	0	24	20	0	0	0	0	0	0
L6	0	0	11	0	0	0	0	0	0	0
L7	0	0	146	112	0	0	0	0	4	0
M1	677	5	452.568	452.096	1.876	21	2.724	2.721	6.909	906
M2	111	0	100	100	302	0	381	377	10	5
M3	1102	0	499	499	1.794	4	1.959	1.902	58	18
N1	7038	13	6.811	6.802	17.500	88	22.777	22.657	465	126
N2	4122	8	1.565	1.491	5.635	34	7.414	7.212	174	61
N3	4175	5	2.554	2.512	8.088	15	9.378	9.180	265	83
O1	3	0	2.320	0	4	0	10	0	44	0
O2	139	0	904	0	337	0	894	0	28	0
O3	100	0	595	0	160	0	287	0	24	0
O4	1915	0	1.683	0	4.328	0	4.813	0	152	0
T1	0	0	1.194	6	2	0	0	0	19	0
T2	0	0	706	9	0	0	0	0	5	0
T3	0	0	210	3	0	0	0	0	17	0
T4	0	0	134	2	1	0	0	0	9	0
T5	0	0	14	0	0	0	0	0	0	0
	19.392	31	480.467	467.208	40.035	162	50.642	44.049	8.396	1.206
TOTAL INSPEC.	**598.932**				**TOTAL ECO TESTS**		**512.656**			

On the basis of analysis we have got the data that the average age of passenger cars in year 2009 was 16,43 years, and in year 2011, as it can be seen from the table, the age of passenger cars was 16,93 years. [3, 5, 6, 13]

In development of integral information system there was a problem with the input of incorrect data on vehicle age by individuals - owners of vehicles, which was in the end corrected upon constant monitoring and control of data by authorized staff of the Institute as well as by placing restrictions in the system a|TEST.

Table 5. Average age per vehicle type in year 2011 [13]

VEHICLE TYPE	AVERAGE AGE	VEHICLE TYPE	AVERAGE AGE
L1 - MOPED	7,04	O1 - TRAILER	11,37
L2 - MOPED	5,63	O2 - TRAILER	15,65
L3 - MOTORCYCLE	11,39	O3 - TRAILER	21,6
L4 – MOTORCYCLE	23,5	O4 - TRAILER	14,12
L5 – MOTOR TRICYCLE	12,46	WORKING MACHINE	14,34
L6 - LIGHT QUADRICYCLE	5,27	T1 - TRACTOR	24,43
L7 - QUADRICYCLE	4,67	T2 - TRACTOR	25,26
M1 – Passenger CAR	16,93	T3 - TRACTOR	23,14
M2 - BUS	14,56	T4 - TRACTOR	22,07
M3 - BUS	18,39	T5 - TRACTOR	15,36
N1 - TRUCK	12,85		
N2 - TRUCK	19,34		
N3 - TRUCK	15,8		

Here we should note that correct data on average vehicle age was obtained on the basis of data on all conducted inspections. Due to the small number of conducted periodic and regular six-month inspections that are conducted several times during the year for certain types of vehicles, we could have minimum possible deviations from presented data, which can be tolerated (buses and trucks).

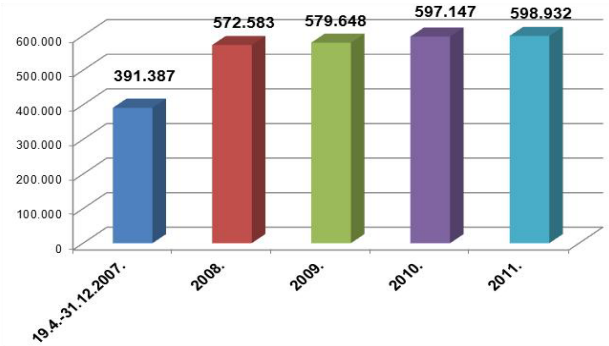

Figure 4. Total number of conducted inspections per years in Federation of Bosnia & Herzegovina [3, 5, 6, 13]

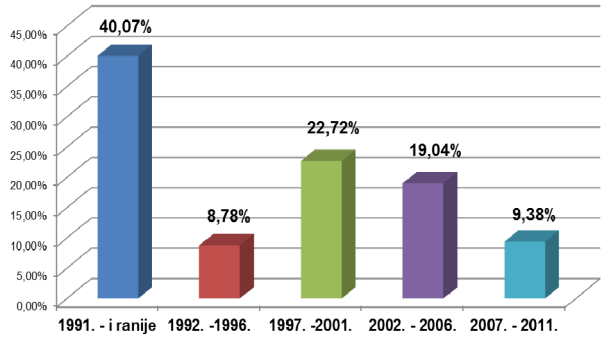

Figure 5. The age structure of entire fleet in Federation of Bosnia and Herzegovina in year 2011 depending on the production year of vehicle [3, 5, 6, 13]

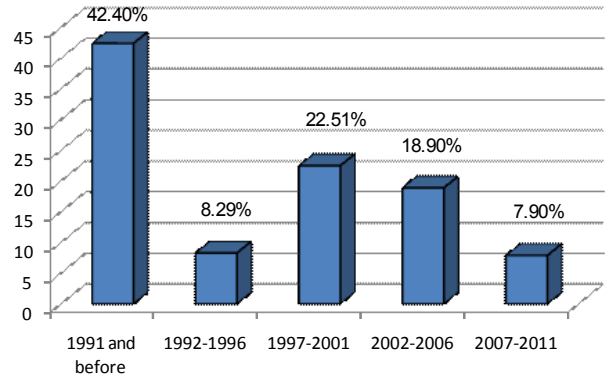

Figure 6. The age structure of M1 vehicles – passenger car in Federation of Bosnia and Herzegovina in year 2011 depending on the production year of vehicle [3, 5, 6, 13]

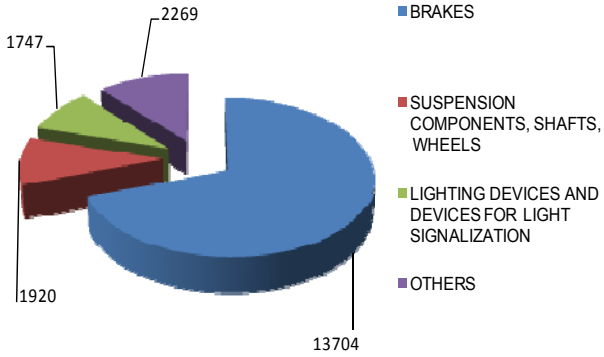

Figure 7. Number of defectiveness per malfunction systems in year 2011 [13]

NUMBER OF REGISTERED DEFECTIVENESS OF DEVICES AND NUMBER OF DEFECTIVE VEHICLES AT THE FIRST AND REPEATED INSPECTION IN YEARS 2009, 2010 AND 2011

In year 2011 we can see that the largest number of defects was noticed in the brake system – 13,704 errors, then in the systems of suspension elements, shafts, wheels – 1,920 identified failures, and lighting devices and devices for light signalization – 1,747 recorded defects. This data on the number of errors in the brake systems was obtained on the basis of a sum of errors in the brake systems and errors identified automatically by the system on the occasion of entering measurable values, and which are related to the brake system.

The total number of registered defects in year 2011 is 19,640.

There is an evident increase in the number of defects detected in year 2010 (19.606) compared to year 2009 (17.852), that is year 2008 as well as number of inspections.

In relation to the total number of conducted inspections there are only 1,55% returned vehicles at the first and repeated inspection.

Table 6. Number of defective vehicles at the first and repeated inspection and number of registered defectiveness of devices in years 2009, 2010 and 2011 [5, 6, 13]

YEAR	Number of defective vehicles at the first inspection	Number of defective vehicles at repeated inspection	Total number of defectiveness
2009.	9.027	256	17.852
2010.	10.711	349	19.606
2011.	9.324	186	19.640

The data on detected malfunctions during inspections of vehicles for year 2008 we did not compare with the data from years 2009 and 2010 because these are the data for the period from 1 April 2008.

Average number of conducted inspections in Federation of Bosnia and Herzegovina per one station for technical inspection in year 2009 was 3,739 inspections.

In year 2010 this number was increased to 3,803 inspections per one station for technical inspection. In the end of year 2011 there were 161 active stations for technical inspection, and therefore we obtained the data that 3,720 inspections were conducted in average per one station for technical inspection.

On the basis of data on results of conducted inspections in year 2011 (TEU and RED), for the vehicle type M1 – passenger car, we have obtained the data that there were almost 40% of vehicle running on gasoline, while approximately 60% of vehicles were with diesel fuel.

In year 2010 this data for motor vehicles was: 36% vehicles on gasoline, and 64% vehicles on diesel fuel.

Based on the data on number of conducted technical-exploitation and/or regular inspections for the vehicle category M1 – passenger car in year 2011, we obtained the data that the most conducted inspections for vehicles were conducted for Volkswagen type.

CONCLUSIONS

In coordination with the Federal Ministry of Transport and Communications the major step which was done by a system of professional institutions and contractors (IPI – Institute for Commercial Engineering Zenica) represents a significant contribution to bringing order to the neglected area of roadworthiness as an important factor in traffic safety, and thus an incentive to other support activities puts under control through this IT solution. These activities are various collection fees on vehicle registration, payments for the budgets, etc.

This work presents the results of data collected at the technical inspection stations in Federation of Bosnia and Herzegovina for years 2008, 2009, 2010 and 2011. As it can be seen, the system of data monitoring was improved during years 2009, 2010, and 2011, as well as the quality review. A significant number of returned vehicles during inspections presented in the work indicate to the fact that inspections are conducted in more detail than in previous period.

Although, in period of years 2009 – 2011, the substantial increase of number of defective vehicles was recorded, yet we are still far from the average of detected faulty vehicles in relation to the standards of European countries.

The results of the introduction of video surveillance systems have made an immeasurable contribution to advancing the area of traffic safety from all aspects. It was also proved that regardless all its specificity this area may and must follow new trends in science. All this can only help to a better understanding of roadworthiness issues everyday life as well as in reconstructions of traffic accidents.

With an intention to conduct technical inspections with no "shorten procedure" and in order to record all defective vehicles, the plan is networking all IT equipment on technical inspection stations. Following the order of the Government of Federation of Bosnia and Herzegovina the test solution was made in the Institute and IT company aNET with a coordination of Federal Ministry of Transport and Communication.

The professional institution of Institute for Commercial Engineering has intensified cooperation with all relevant government bodies and other professional organizations and individuals, which would allow data to be collected directly from measuring devices.

In this way the problem will be solved, which was pointed to in past, which is that the authorized staff at technical inspection stations occasionally entered invalid data into the integrated information system a\|TEST. For these reasons, a number of reports that are created from the integrated information system a\|TEST are not used to the purpose and we cannot do the proper analysis. Thus, the influence of human factor would be brought to a minimum.

All this is a step forward in which implementation all relevant authorities will be involved and will have an impact on the establishment of road traffic safer.

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