IMPROVEMENT OF VEHICLE INSPECTION TECHNOLOGY BY INTRODUCING INTEGRATED INFORMATION SYSTEM

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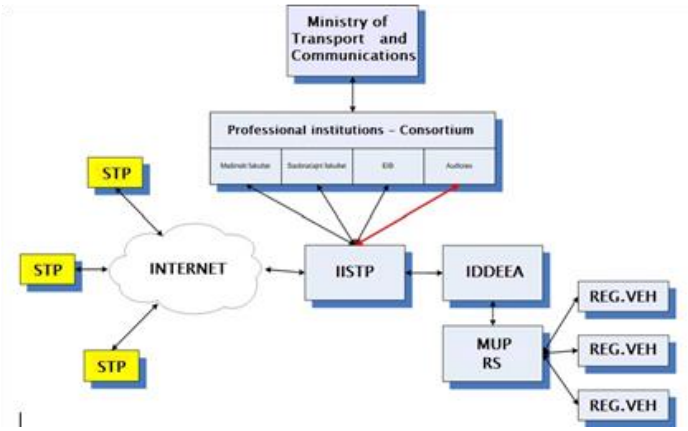
1. INTRODUCTION

Legal regulations governing vehicle inspection in Bosnia and Herzegovina and in the Republic of Srpska are as follows: the Law on the Basic Principles of Road Safety in Bosnia and Herzegovina (Official Gazette of the Republic of Srpska, no. 96/06, 57/07, 97/09, 62/10 and 22/13), the Rulebook on Vehicle Inspection (Official Gazette of the Republic of Srpska, no. 19/07, 95/07, 87/08 and 90/09) [1, 2]. In 2009, the Republic of Srpska introduced a new concept for the operation of vehicle inspection stations. This new concept involved the introduction of the Vehicle Inspection Expert Institution operating under the Republic of Srpska Ministry of Transport and Communications. Organizational chart pertaining to vehicle inspections in the Republic of Srpska is given in Figure 1.



Sending electronic TP-1 FORM will result in immediate delivery to vehicle registration location IDDEEA - Agency for Identification Documents, Registers and Data Exchange of Bosnia and Herzegovina

Figure 1 Organizational chart for vehicle inspection in the Republic of Srpska

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In the Republic of Srpska, the RS Ministry of Transport and Communications issues licences and supervises the operation of vehicle inspection stations, and the RS Traffic Inspection is responsible for the inspection of the stations. The Vehicle Inspection Expert Institution of the RS Ministry of Transport and Communications is a consortium comprising the following institutions: the University of Banja Luka, the Doboj Faculty of Transport and Traffic Engineering, EIB Centar za motorna vozila doo Banja Luka, and Audioteks doo Banja Luka. The Expert Institution is primarily responsible for keeping track of vehicle inspection regulations passed in neighbouring countries, in the European Union, and by international organizations, as well as for the modernization of vehicle inspection technology, the education and licensing of vehicle inspection station staff (supervisors and controllers).

Since 2009, all the vehicle inspection stations, the Agency for Identification Documents, Registers and Data Exchange of BiH (IDDEEA), and the RS Ministry of Transport and Communications have been connected to the integrated information system. This system allows the RS Ministry of Transport and Communications to monitor the operation of vehicle inspection stations in real time, to obtain data on the number and type of vehicle inspections, on the procedure and duration of vehicle inspections, on staff performance, etc. The integrated information system provides information about vehicle characteristics and malfunctions. It is used for the analysis of data relevant for road safety, and also for other analyses (environmental effect of exhaust gas emissions, collection of the public road usage charge that is paid upon vehicle registration, etc.).Since 2009, all the vehicle inspection stations, the Agency for Identification Documents, Registers and Data Exchange of BiH (IDDEEA), and the RS Ministry of Transport and Communications have been connected to the integrated information system. This system allows the RS Ministry of Transport and Communications to monitor the operation of vehicle inspection stations in real time, to obtain data on the number and type of vehicle inspections, on the procedure and duration of vehicle inspections, on staff performance, etc.

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2. STRUCTURE OF INTEGRATED INFORMATION SYSTEM FOR VEHICLE INSPECTION (IISVI)

The following features ensure the functioning of the information system:

- Modern Data Centre with optical link to the Internet
- Robust three-tier software architecture
- Software Micro Strategy BI / ORACLE Warehouse Builder
- Software/hardware encryption.

Flexible access to the information system: cable or wireless, Figure 2. The following programs for vehicle inspection have been developed and tested:

- Regular vehicle inspection: first registration (eVI), roadworthiness certificate (eVI), semi-annual inspection
- Extraordinary vehicle inspection: change of technical data (eVI), roadworthiness test
- Vehicle licencing inspection: for road passenger transport, for road goods transport.

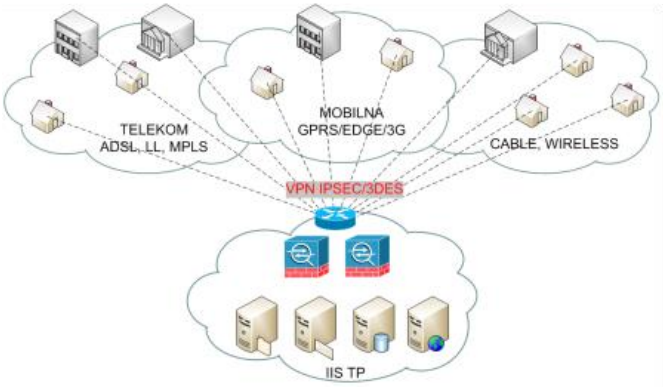


Figure 2 Access to the information system [3,4]

Figure 3 shows the procedure and phases of a regular vehicle inspection that served as the basis for program development.

If a vehicle is registered for the first time in the Republic of Srpska (first registration), vehicle inspection data are saved in the information system (72 different check data from the application form are entered in eVI). The RS Expert Institution checks data accuracy, [3].

In case of a vehicle undergoing other than its first vehicle inspection in the Republic of Srpska (roadworthiness certificate, semi-annual inspection, extraordinary inspection or vehicle licencing inspection), the integrated information system for vehicle inspection (IISVI) will automatically generate technical data on the vehicle based on its VIN. Vehicle inspection station (hereinafter: VIS) supervisor will then check whether vehicle data are correctly entered in the information system, add missing data, or correct the incorrectly entered data during vehicle inspection, if he/she has proper authorization for it.

If the supervisor is not authorized to modify vehicle data, the vehicle will be sent to certification, to identification of vehicle technical data. After certification, the vehicle will be returned to the same VIS to complete the inspection, i.e. to close the item. An extraordinary inspection – change of technical data – will be recorded in the application. The item remains open for 10 workdays, during which period vehicle inspection can be done at some other VIS. If vehicle inspection does not continue within 10 workdays, the vehicle is declared un roadworthy, and the item is closed (eVI electronic vehicle inspection form gets cancelled).

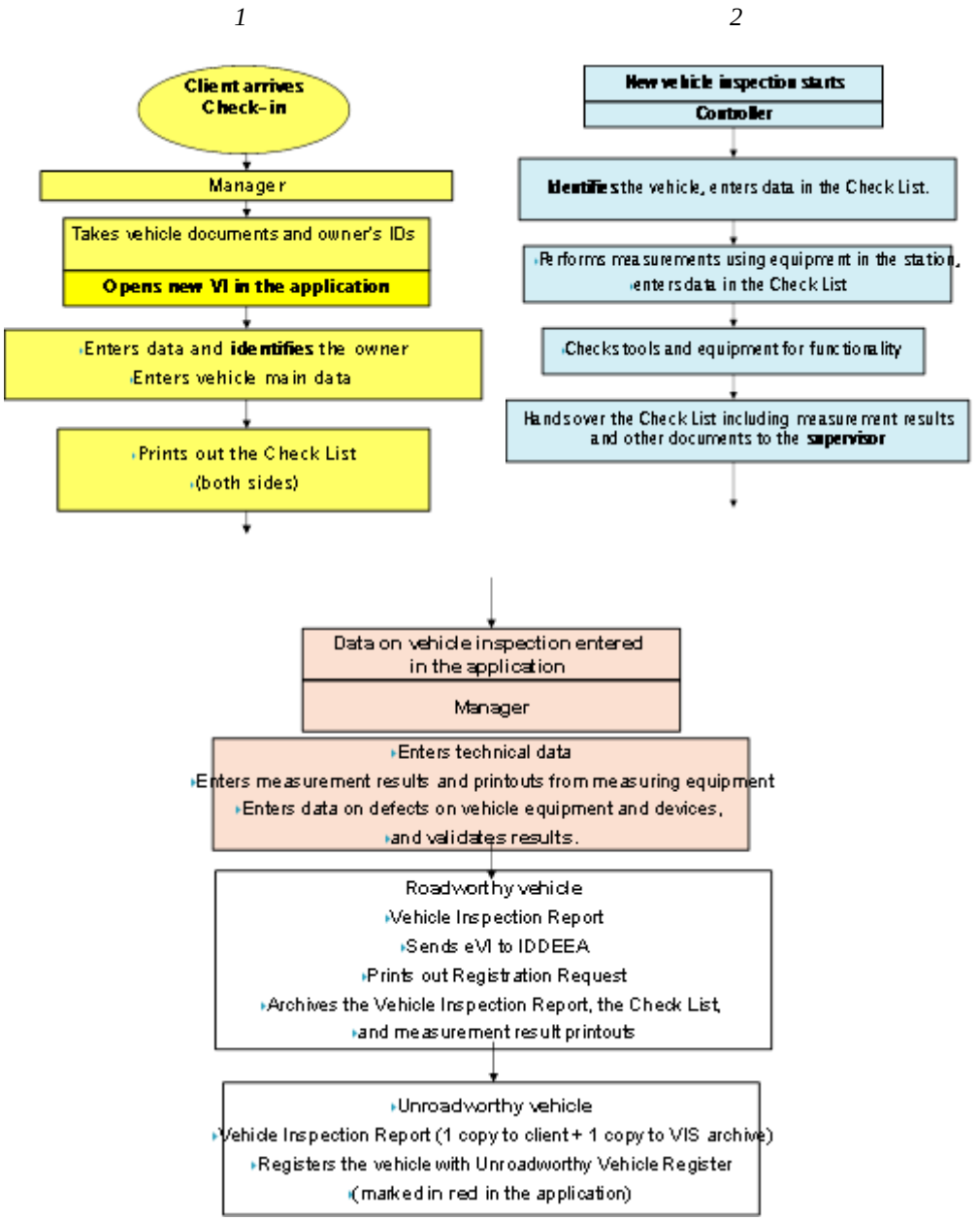


Figure 3 Regular vehicle inspection procedure and phases

Figure 4 shows the data entry application form for each new VI. The same procedure will be followed after detecting vehicle system malfunctions. Within 10 workdays, the vehicle owner must have malfunction repaired and vehicle inspection completed (close the item) at the same VIS (vehicle malfunction application). In that case, the vehicle system with detected malfunction will undergo vehicle inspection phases that

were not included previously. The application will display a warning message that the vehicle was inspected at the same VIS and recorded as un roadworthy, or that it was inspected at another VIS after the expiry of the 10 workdays deadline. Figure 5 shows the warning message that appears on screen for a vehicle inspected at another VIS, and recorded as un roadworthy.

(72 data from the application form introduced into eVI)

Figure 4 eVI implementation (regular vehicle inspection – roadworthiness certificate)

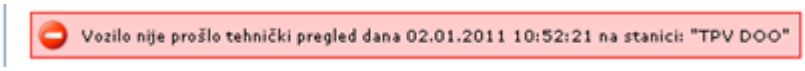


Figure 5 Warning message for vehicle inspected at another VIS and recorded as unroadworthy

Some of 72 vehicle data that are entered in the IISVI application represent obligatory data required during vehicle registration. The data are taken over from eVI form (electronic form compiled during vehicle inspection) to IDDEEA's information system, and further sent from there to relevant vehicle registration point within the Ministry of the Interior of the Republic of Srpska or the Federation of BiH or the Brcko District. IDDEEA's information system has codebooks for most of the data. If some of the data that are identified during vehicle inspection – first registration at VIS - are not in IDDEEA's codebooks (e.g. new vehicle type or brand), the Expert Institution will enter the data in IDDEEA's information system. Upon entry, the data remain inactive until confirmed by counterpart institutions from the Federation of BiH and the Brcko District (electronic authorisation), which makes it active.

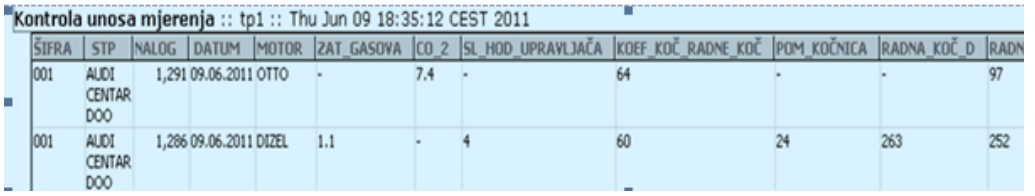
3. SUPERVISION AND CONTROL OF VIS OPERATION

The integrated information system for vehicle inspection (IISVI) enables the supervision of all VIS by using search options within VIS modules: ART program for system configuration and maintenance, BI (business intelligence) program within the

statistics and reporting module. ART is a web based program that practically processes SQL requests and returns results in real time (instantly or within several minutes).

For the needs of users within the RS Ministry of Transport and Communications, and IISVI administrators, 30 reports have been prepared, necessary for the tracking of activities within VIS (supervision of VIS operation, control of measurements performed at VIS, finances, VIS staff, VIS tools and equipment, aggregate reports).

Fake vehicle inspections used to be frequent before the introduction of the information system. For that reason, the RS Ministry of Transport and Communications, together with the Expert Institution, tried to find a system solution to the issue by introducing time standards for different types of vehicle inspections. The system is designed to disallow the beginning of a new vehicle inspection before the time set within the time standard has expired. Unfortunately, this has not fully eliminated fake vehicle inspections but they have significantly reduced in number. Progress has been achieved in facilitating the work of the Ministry of Transport and Communications and inspection authorities, pertaining to supervision and control. In addition to being able to monitor time standards, there is an option for monitoring the recording of measured values of physical quantities. Figure 6 shows an example of measurement recording control.



Kontrola unosa mjerenja :: tp1 :: Thu Jun 09 18:35:12 CEST 2011

ŠIFRA	STP	NALOG	DATUM	MOTOR	ZAT_GASOVA	CO_2	SL_HOD_UPRAVLJAČA	KOEF_KOČ_RADNE_KOČ	POM_KOČNICA	RADNA_KOČ_D	RADN
001	AUDI CENTAR DOO	1,291	09.06.2011	OTTO	-	7.4	-	64	-	-	97
001	AUDI CENTAR DOO	1,286	09.06.2011	DIZEL	1.1	-	4	60	24	263	252

Figure 6 Monitoring of measurement recording

During scheduled visits to VIS, the Expert Institution controls the possession and quality of measuring equipment. Data on executed controls and control results relating to VIS measuring equipment are saved in the information system. Figure 7 shows a report on the condition of examined measuring equipment, generated by the information system.

Uređaji koji se baždare :: tp1 :: Thu Jun 09 18:42:58 CEST 2011

STP	ŠIFRA	VRSTA_UREĐAJA	PROIZVOĐAČ_TIP	SERIJSKI_BROJ	GOD_PROIZ	MJERNI_OPSEG
AUDI CENTAR DOO	001	KOČNI VALJCI	MAHA, NJEMAČKA-EURO SYSTEM LKW	B102-060405	2003	0-40 kN
AUDI CENTAR DOO	001	DINAMOMETAR	MAHA, NJEMAČKA-PK-100-MA02	0303100788	2003	0-1000 N
AUDI CENTAR DOO	001	MJERAČ USPORENJA	MAHA, NJEMAČKA-VZM 100	B90-010759	2003	0-10 m/s2
AUDI CENTAR DOO	001	REGLOSKOP SA LUXMETROM	MAHA, NJEMAČKA-LITE 1.1	B95-002320	2003	0-64 lx

Figure 7 IISVI report on status of examined measuring equipment

ART reports in real time open up excellent possibilities for creating aggregate reports by selected time periods (report on the number of executed vehicle inspections by VIS, list of un roadworthy vehicles by VIS and by controller, report on registered malfunctions, average age of vehicles by vehicle type, list of pass rates for vehicle license inspection, etc.).

Micro Strategy program is used for statistical data processing. Micro Strategy is a collection of applications, procedures, and methodologies for data management – collection, storage, analysis, and presentation. Such a system allows users to execute advanced data analysis from the integrated information system for vehicle inspection, as well as to have better control of VIS operation.

4. ADDITIONAL USE OF IISVI

The information system for vehicle inspection is used by many other RS institutions. The Hydro Meteorological Institute of the Republic of Srpska makes estimates on air pollution in urban areas by means of COPERT program. Vehicle data that they require are taken from IISVI, [5].

Data from IISVI facilitate the work of the RS institutions responsible for supervision and inspection, as well as the process of forensic expertize.

VIS can issue the "Odometer Reading Report" through IISVI. Data on odometer readings during all regular vehicle inspections (first registration, roadworthiness certificate, semi-annual inspections) are taken from IISVI. Nevertheless, one has to be aware that with some vehicles, odometer readings do not correspond to their actual mileage due to various manipulations, [6].

IISVI may also significantly facilitate the work of traffic police, pertaining to extraordinary vehicle inspections, [7]. It is the reason why the program has been upgraded to match the needs of traffic police. At present, traffic police send vehicles to specified VIS to be able to collect the Vehicle Inspection Report the following day. Due to such complicated procedure, along with the issue of payment for extraordinary VI if the vehicle is declared roadworthy, traffic police end up having a very small number of vehicles undergoing extraordinary VI. Sixty traffic teams send, on average, less than one vehicle per week to extraordinary VI. An advanced information system for the police would allow the use of tablet computers, which would make traffic police work more efficient and more professional. The system would enable access to all relevant data from the IDDEEA's database and the RS Ministry of Transport and Communication's database on vehicle inspections. Such a solution would greatly simplify traffic police work relating to vehicle roadworthiness control. It would create conditions for a larger number of extraordinary vehicle inspections to check vehicle roadworthiness, which would directly result in improved road safety. The advantages of such a system are as follows:

- Extraordinary vehicle inspection can be conducted at any VIS
- Traffic police can conduct on-the-spot check of previous extraordinary vehicle inspections
- Extraordinary VI Report on Unroadworthy Vehicle is printed in the police station, and sent for further processing
- Administrator within the Ministry of the Interior can supervise all traffic teams,
- Real time monitoring
- Reports can be generated for any specified period (day, week, month, etc.) from when IISVI was activated.

Figure 8 shows an option for the implementation of the integrated information system for the police (IISP).

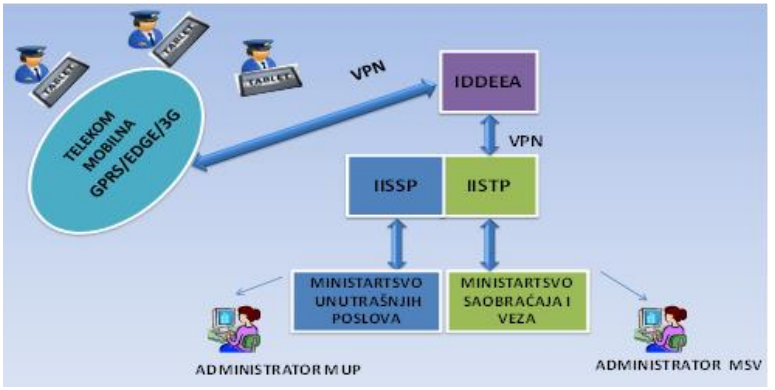


Figure 8 Schematic diagram of police information system implementation

5. CONCLUSIONS

The introduction of the new work system, Expert Institution, and integrated information system for vehicle inspection is important for the following reasons:

- Supervision and control of VIS operation is simplified, thus greatly reducing possibilities for any manipulation during vehicle inspection
- VIS staff ongoing education
- Large amount of data collected during vehicle inspection can be statistically analysed, and they are important for different parts of society: environmental pollution calculations, toll road revenue forecast, fuel consumption forecast, road safety analysis, court proceedings requiring efficient and accurate vehicle data, etc.
- Upgrading of IISVI can facilitate traffic police work and increase efficacy in terms of extraordinary vehicle inspections.
- Special contribution to improving overall road safety.

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