University of Pardubice
Faculty of Transport Engineering

IMPLEMENTATION SYSTEM OF TSI FOR THE ROLLING STOCKS

DISSERTATION THESIS PRECIS

2019 **Ing. . Katarína Magdechová**

Graduant

Ing. Katarína Magdechová

Study Programme

P3710 Technique and technology in Transport and Communications

Field of study

3708V024 Technology and management in Transport and Communications

Supervisor

doc. Ing. Jaromír Široký, Ph.D.

Supervisor specialist

Ing. Petr Nachtigall, Ph.D.

Training Center

Department of Transport Technology and Control

Content

1 Current state in the field of doctorate thesis

The main task of the authorisation process of the type of vehicles is to attract wider interest of the public into production and import in the area of transport. It is regarded mainly to safety but also to ensure the quality, reliability and lifecycle of the rolling stocks at a required level. These requirements need to be assured and at the same time they should be a tool to satisfy transport needs. The vehicles should reflect the progress in science and technology and their construction should be in harmony with the development of transport.

Ensuring the aims of interoperation within the spectre of rail system in the European Union should result in setting up the optimal level of technical harmonization and mitigate, improve and further develop services that are offered within the international railway transport. The aim is to create an inner market with facilities and services targeting at building, innovation, modernization and operation of railway system in the Union. Within the fourth railway packet is suggested a new procedure of authorising a new type of rail vehicles and their allowance into operation. The aim is to move the competences of authorising and certifying the types of rail vehicles onto European Union Agency for Railways "EUAR". Individual activities should be carried out on the basis of dividing the competences between EUAR and National Safety Authority "NSA". Objective activities will be carried out on the basis of the legal relation of these two bodies. Fundamental is elimination of national regulations and direct exercisability of TSI as internal regulations for the whole railway network.

Analysis of the current state both home and abroad

Authorising the types of railway vehicles is an integral part of transport process. The main goal should be securing the safety of transport. The aim of every authorising body is to ensure that the authorising process was carried out in accordance with the European legislation and in a non-discriminating way.

Current state of authorising the types of railway vehicles within the conditions in the Slovak republic

Development of authorising the types of railway vehicles has gone through several changes since the establishment of the Slovak republic. Every development stage was aiming to make the process easier and ensure the continuity of particular activities in every area.

Authorising the types of railway vehicles has changed a lot since the Slovak republic was established in 1993. It is possible to divide this process into several development stages that are described in detail in this doctorate thesis. These are:

- authorising the types of railway vehicles in years 1993-1996,
- authorising the types of railway vehicles in years 1996-2009,
- authorising the types of railway vehicles in years 2009- 2014.
- authorising the types of railway vehicles in years after possible shift of competences onto EUAR (after year 2020).

Current state of authorising the types of railway vehicles abroad

Authorising the types of railway vehicles and putting them into operation are carried out in individual countries by the authorising bodies or NSA (National Safety Authority) in accordance with the directive (EU)

2016/797 of the European Parliament and of the Council on the interoperability of the rail system within the European Union and also in accordance with particular related regulations, decisions and recommendations, and upon its transposition into national legislation.

To analyse the current situation in the area of authorising the types of railway vehicles we have used the knowledge acquired at different conferences and also available literature as well as studies from universities and research institute. The analysis was carried out in six countries – Poland, Austria, Hungary, the Czech Republic, Spain and Germany.

Within the analysis we have also analysed the legislature in the area of authorising the types of railway vehicles and competencies of particular bodies. With the help of administrative outputs, we have made an overview of registered vehicles in individual member countries, notified people carried out in member countries and types of vehicles registered in the European Register of Authorised Types of Vehicles (ERATV).

Conclusion of the analysis

Commission Recommendation 2014/897/EU defines particular important parts in the area of authorising structural subsystems and vehicles into operation. It is a broad manual or rectification how to proceed in this area in such way as to follow clauses of directive 2008/57/ES. There is not a graphically shown procedure in the area of authorising the types of railway vehicles that are in accordance with technical specifications of the interperability (TSI) or are not in accordance with TSI and their consequent putting into operation. This will be a part of the suggested methodology.

Individual studies from scientific fields concentrate only on partial activities in the area of authorising the types of railway vehicles. They do not define the authorising process as a complex of activities, they do not say how

to simplify or fasten it as a whole. To shorten the length of time of the authorising process, it was necessary to review and analyse particular problems that could emerge during the process. Because of this, it was inevitable to secure operative solutions of problems that can occur. Not to foresee these problems could lead into extending the length of time necessary for authorising. Creating a convenient methodology for authorising the types of railway vehicles is an appropriate solution of these drawbacks and prevention from extending the authorising process.

2 Defining the aim of the doctorate thesis

The aim of the doctorate thesis was to outline methodology in the area of authorising the types of railway vehicles with the emphasis on applying interoperability, new European regulations, directions and decisions. The methodology was graphically plotted with the help of a developing diagram. We have also created SW model of applying the European legislature aimed at authorising the types of railway vehicles and minimising the administrative difficulties.

The doctorate thesis includes verification of the outlined model on practical examples right at the execution of actions of the authorising body.

Setting up the hypothesis

On the basis of acquired experience we have set up the following hypothesis:

With the use of the outlined methodology the length of time of the authorising process of the types of railway vehicles will be shortened by 30%.

To verify the hypothesis, we have used the **Gantt's graph**. With its use is shown the length of particular actions during the process of authorisation with and without the use of SW model. Objective verification was carried out in the following three cases:

1. installing a mobile part ETCS L 1 into a vehicle – essential change of a railway vehicle,
2. authorising a type of railway vehicle – three system electric locomotive class 381 type 109 E2,

3. authorising a type of railway vehicle – diesel unit class 861, type VR – 24 – 2010 - DMJ.

Following the procedure of current authorising system on particular examples, it was possible to rate how much time can be saved when compared with the current authorising system. The aim was to lead to minimise the administration during the authorising or allowing the types of railway vehicles, in accordance with the new regulation of interoperability which should be transposed until June 16th2019, latest until year 2020.

3 Methods and solution way used

In the doctorate thesis is, based on the found differences and problems that could emerge during the process of authorising the types of railway vehicles, outlined methodology of authorising the types of railway vehicles as a supporting tool for setting up the SW model.

3.1 Chosen methods

Apart from the basic methods (analysis, synthesis, brainstorming etc.) we have used also other methods that are necessary for solving the stated problematics.

The theory of system modelling

The theory of modelling deals with particular areas of knowledge. Modelling itself is used within the research of social phenomena, psyche and cognitive phenomena. In relation to modelling is used also term model that could be characterised as an "imitation". It could be carried out with the relation to practical tasks or in relation with the research. And its parts are also working methods such as mathematical and experimental modelling. (55)

Usage: while creating the SW model.

Simulation

Simulation is an experimental method during which a real system is replaced by a computer model. Its basis is that the examined dynamic system is replaced by its simulator and this one is used to gain information about the original system. Simulation is carried out on a created model (simulator) which imitates simulated system and is limited on a physical object created for this particular use. (56)

Usage: verifying the model on particular examples

Visual Basic Application (VBA)

Visual Basic Application Excel macros allow saving time, optimising processes and also lowering the number of mistakes in particular calculations. Excel macro is a program that can take several actions instead of a person, worker. As an appropriate example, we can imagine that a person needs to copy several different tables daily from different Excels into one file and in every table also needs to make particular mathematical calculations, format the table, underline very other line etc. (58)

Usage: SW model as a support of the methodology

Gantt's graph

Gantt's graph is used to display particular actions and their length of time. It is then used for planning the project and displaying its stages. It can be used to display expected time consumption and also sequence of particular parts within the stated project. To manage and control the project it is necessary to have a detailed and realistic planning. Gantt's graph acts as an overview of the observed process only. (59, 60)

Usage: displaying the length of time of particular activities and verifying the hypothesis

3.2 Methodology of authorising the types of railway vehicles and a SW model as a supporting tool of authorising methodology

The aim of the outlined methodology in the area of authorising the types of railway vehicles with the emphasis on using the interoperability,

new European regulations, rules and decisions, was to set up particular possible ways how the authorising itself can be carried out. The methodology is graphically shown with the help of development diagram and is afterwards reflected onto a SW model which is the main tool to minimise the administrative difficulties of the whole process.

SW model can also be called as a tool to minimise the administrative problems of the whole process. It was created by the VBA macros.

When creating the Form, we have used used one of the parts of Microsoft Office package – Microsoft Excel with VBA editor. I have based my decision to use this on several criteria:

1. MS Excel is a part of Microsoft Office package which is currently installed on most computers used in administration.
2. MS Excel includes VBA editor which is actually a programming language for Microsoft Office, and this opens a lot more other options.
3. It is possible to open also other files from MS Excel which allows us to have a database in a separate file.
4. Within the VBA it is possible to create files in program MS Word.
5. Possibility to create pleasant and user-friendly graphical environment.
6. To create keys and sheets in a standard that the user is familiar with from MS Windows.

Programming

Overall creating or generating the Form and final decision about authorising the type of railway vehicle was carried out by VBA macros – by the programming. Used were both global variables and functions.

Form (Exercise book)

The main exercise book that is used by the user was named as “Form”. It contains one page with the same name. The whole Form is named as “The Form about decision of authorising the railway vehicle”. It is pre-programmed and locked and the user can fill it in by the keys used for this purpose. In the first part are keys “Fill in” that are used to fill in information and “Delete” that is used to delete the filled in data. The latter is of course secured by the warning whether the Form should really be deleted. Filling in the Form can be postponed at any stage and particular steps can be filled in separately. For filling in the Form are always used sheets created in VBA. There are programmed functions and automatic filling in to make the work for the user as easy as possible, effective and without mistakes. The Form adapts itself according to filled in data so the original and the final one can look completely different. The outcome of the whole Form is a prescribed decision in MS Word. Another advantage of the Form is also that it is automatically saved into a file and so it is possible to go back to filling it in any time in the future.

VBA

Programming in VBA is divided in the following files:

1. *Modules*

It contains only one module (General) which includes global variables and functions that serve for work with programs Word and Outlook.

2. *Microsoft Excel Objects*

It contains one „Workbook“ which also has a function that starts right after opening the Form. This function should serve to find the way to the file. It is

a key for next steps to make it possible to open the database and prescribed documents in Word.

It also contains one „Worksheet“ which includes:

- function for opening the database,
- function that controls whether the particular cells in the Form have not been changed and on the basis of these changes it saves the Form with a new name or it adapts the Form according to filled in data (shows and hides parts of the Form),
- it also contains serving functions that are invoked by pressing particular keys. Note: these functions open further particular forms and functions according to the key pressed.

Forms

There are 15 forms that are used to fill in the Form. These forms invoke by themselves or after pressing a key.

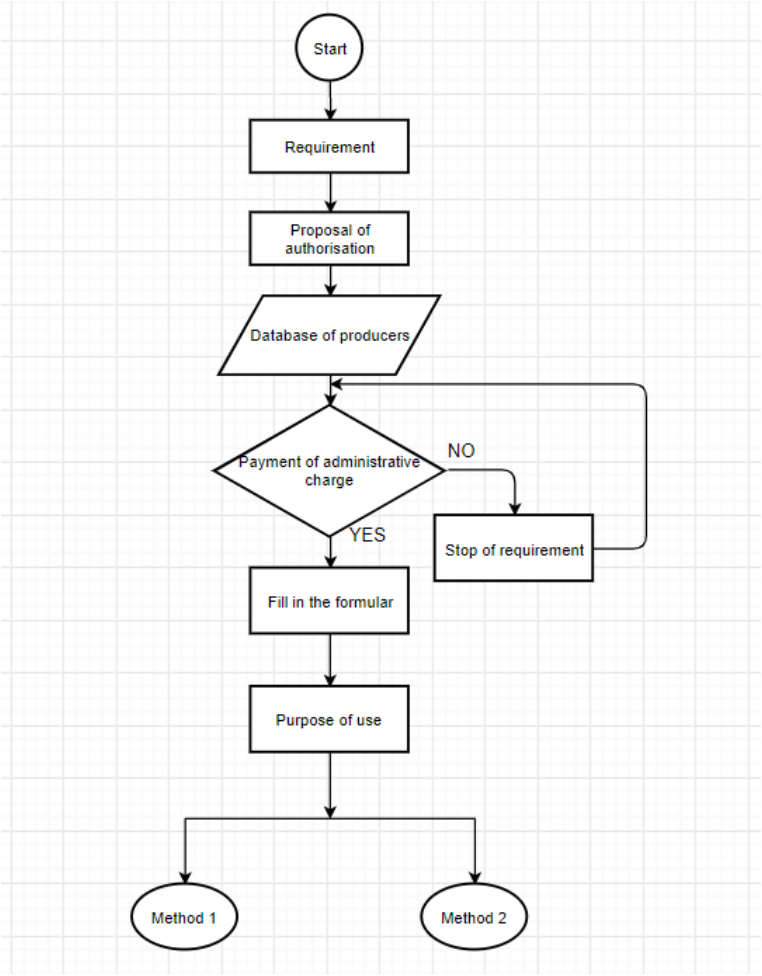
Every form consists of two parts:

- „Object“ which is its graphic draft,
- „Code“ which includes source code for particular „Object “. „Code“ contains functions that invoke themselves when opening particular form (it serves for initial initialisation and filling in the form based on the data already stated in the form). It also includes functions that are opened while filling in particular cells (these serve mainly as an assurance that the data have been filled correctly or to make sure that data have been filled automatically). Functions that are shown after pushing a button serve mainly to open other forms or to close the form.

Parts in a graphic interface for Form have been set up with the help of „Properties“ for particular elements. All the functions and methods used when programming are described in the Help Excel – VBA (option to display after pressing key F1 when the cursor is on this command).

The whole filling in the Form leads to generating a complete decision that is filled in with the data from the database too.

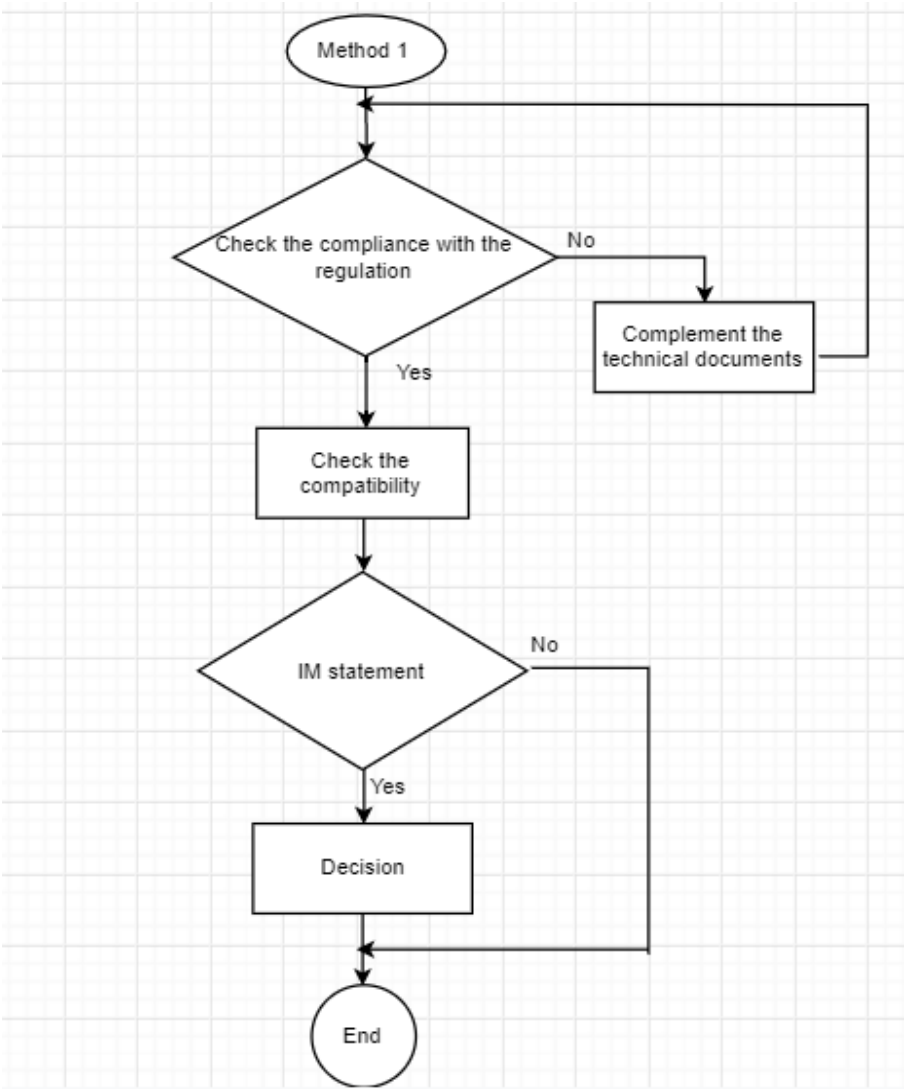
As is shown below in pictures 1 -3, the basis is to submit a request for authorising the type of railway vehicle. At first it is necessary to state or decide whether it will be authorising of the type of railway vehicle, its modernisation or innovation. Sending the request in an electronic form will enable its faster submitting and authorising body can start the process of its evaluation sooner. Afterwards, the authorising body can find an applicant in a database of producers, or it can generate it for the next use. The database is or will be constantly updated according to the needs of the authorising body which will speed up the process of making the decision, where the date will be automatically reflected.



Picture 1 Basis for VBA I.

Source: author

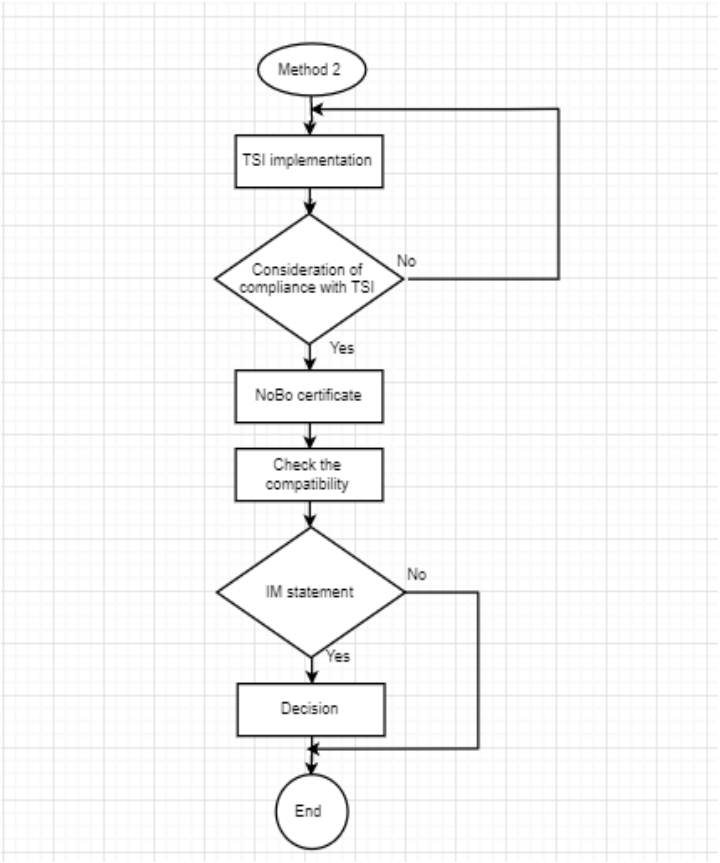
After setting the purpose of use it is possible to state which way the authorisation will go, or which method will be used.



Picture 2 Basis for VBA II.

Source: author

In method 1 we count with the authorisation according to specifications of regulative, mainly with the intestate legislature. That is the reason why we have already accounted in this methodology with the fact that the user will have an updated version of the regulation. After accomplishing the requirements, it is possible to proceed to generating the decision itself.



Picture 3 Basis for VBA III.

Source: author

Second version of authorising is verifying the compliance with TSI. Here it is necessary to get a reviewing from Notified Body (NoBo). That is the reason why we have already accounted with the option of connecting to NoBo. The system also takes into account a possibility of submitting the information about the type of vehicle, range of vehicle, power etc.

4 Achieved results

Methodology of authorising the railway vehicles and its usage was verified by the use of simulation directly in MS Excel with the use of macros VBA (Visual Basic Application). The aim was to state an estimation or the length of time of the authorising process of the railway vehicles or different cases within this process. To show the length of particular activities we have used the Gantt's graph.

4.1 Installing a mobile part ETCS L1 into an electrical multiple unit class 671 type 214

Overall time of the process allowing the essential change dwelling in installing ETCS L1 into EPJ class 671 type 214 was 213 working days.

Overall time of the process allowing the essential change dwelling in installing EPJ class 671 type 214 into ETCS L1 into a vehicle with the use of SW was 164 working days.

Process of authorisation with the use of the system was shortened as followed:

213 – 164 = 49 working days

Process without the use of SW..... 213 working days

Process with the use of SW ..... 164 working days

Save (U) ..... 49 working days

$$U = \frac{49}{213} \times 100$$

$$U = \mathbf{23}\ \%$$

Percentual savings..... 23%

Hypothesis:

With the use of the outlined methodology the time of authorising process of the railway vehicles will be shorter by 30 %.

In this case the stated hypothesis was not fulfilled. Percentual saving is 23%. We have not accounted with creating a prototype board. Even with this, we can see a large percentage of shortening the length of the process. The time of the authorisation is therefore individual, case to case.

4.2 Authorising the three-system electrical locomotive class 381 type 109 E2

Overall time of the authorising process of the locomotive class 381 type 109 E2 was 122 working days.

Overall nett time of the authorising process with the use of SW system was 64 working days. To make this time even more effective, there was established a prototype commission which allowed solving several possible inconsistencies even before submitting the application for authorisation.

The process of authorisation with the use of the system was shortened as follows:

122 – 64 = 58 working days

Process without the use of SW..... 122 working days

Process with the use of SW (without the commission)..... 64 working days

Process with the use of SW (with the commission) ..... 85 working days

Savings (U1) ..... 58 working days

Savings (U2) ..... 37 working days

$$U_1 = \frac{58}{122} \times 100$$

$$U_1 = \mathbf{47}\ \%$$

$$U_2 = \frac{37}{122} \times 100$$

$$U_2 = \mathbf{30,33}\ \%$$

Percentual savings without the commission..... 47 %

Percentual savings with the commission..... 30, 33 %

Hypothesis:

With the use of outlined methodology, the authorisation process of the types of railways vehicles can be shortened by 30 %.

In this case the stated hypothesis was approved. Percentual saving of the authorisation process means, including the length of time of the prototype commission, 30, 33 %. The prototype commission markedly influences the nett time of the authorisation process. As we have already mentioned, the saving of time is very individual. To improve or shorten this can be secured by establishing the prototype commission.

4.3 Authorising the diesel unit class 861 type VR – 24 – 2010 – DMJ

Overall time of the authorisation process of DMJ class 861 type VR – 24 – 2010 - DMJ was 153 working days.

Overall nett time of the authorisation process with the use SW was 40 working days. To make this time even more effective, there was established the prototype commission which enabled to solve some of the inconsistencies even before submitting the application for authorisation.

The process of authorising with the use of the system was shortened as follows:

153 – 40 = 113 working days

153 – 96 = 54 working days

Process without the use of SW..... 153 working days

Process with the use of SW (without the commission).....40 working days

Process with the use of SW (with the commission).....96 working days

Savings (U1) ..... 113 working days

Savings (U2) ..... 54 working days

$$U_1 = \frac{113}{153} \times 100$$

$$U_1 = \mathbf{73}\ \%$$

$$U_2 = \frac{54}{153} \times 100$$

$$U_2 = \mathbf{35,29}\ \%$$

Percentual savings without the commission..... 73 %

Percentual savings with the commission..... 35, 29 %

Hypothesis:

With the use of the outlined methodology the time of the authorisation process of the railway vehicles will be shortened by 35, 29 %.

In this case the hypothesis was approved. Percentual savings of the authorisation process is, including the length of time of the prototype commission, 35,29%. As we have mentioned before, the savings of time are very individual and change with each case. To improve or shorten the time is also possible by establishing the prototype commission which can influence the length of the authorisation process.

4.4 Concluding the acquired results

On the basis of the verification of the outlined methodology of the authorising the types of the railway vehicles with the use of SW system, we can conclude that the time of the authorisation process is very individual and changes with each case.

When verifying the stated hypothesis in practice in the first case – Implementing a mobile part ETCS L1 into an electric multiple unit class 671 type 214, the hypothesis was not approved. The saving of the authorisation time was by 23%. However, even this result is a significant shortening.

In the second case – authorising the three-system of an electric locomotive class 381 type 109 E2, there was a significant shortening of the authorisation time. It is very important to remark that there was established a prototype commission which can directly influence the nett time of the authorisation process. Because there was a 30,33% shortening of time, the hypothesis was approved.

The third case – approving the diesel unit class 861 type VR – 24 – 2010 – DMJ – have also approved the stated hypothesis. There was also established a prototype commission which influenced the overall authorisation time into such extent, that the shortening was by 35, 29 %

In the table 1 is shown comparison of the verified results in particular cases.

Table 1 Conclusion of verifications

Case	Without SW	Savings days with SW (without commission)	Saving %
C1	213	49	23
C2	122	64	47
C3	153	113	73

Source: author

During the verification of the particular cases, we have used simulation, stated estimation of the length of particular stages (mostly when using the SW system), and also the method of brainstorming. The lengths of time were estimated on the basis of discussions with the representatives of the authorising bodies or related subjects.

5 Contributions of the graduant

The doctorate thesis contains complex mapping and summarising of the current situation in authorisation process of the types of railways vehicles both home and abroad. It gives information of the real legislature related to train railway vehicles. It also offers an overview of the stated problematics to both wide public and academic field.

Methodology, which is based on SW model, significantly makes the authorisation process easier and faster. It secures clear evidence and more effective cooperation. It also sets up a possibility of using new modern SW tools in the authorisation process. Most of the communication happens online, including the issuing the particular documents which are a basis for the decision of the authorisation. Therefore, it creates savings of postage costs as well as office material.

The outlined methodology can be used also internationally. It is possible to change it according to one's needs. After supplementing further functions, it can be adjusted for the needs of EUAR and can speed up the communication and exchanging of the information between the EUAR and interstate authorisation bodies. This can be secured by the contact treaty between the EUAR and NSA. The aim is to use the SW model in accordance with the European legislature. It will result in saving the time of the authorisation process, as well as saving the costs related to it.

The methodology is an asset also to producers and owners of the railway vehicles as well as wide public. Thanks to this methodology there will be a faster exchange of the information, time and cost saving and a possibility of operative solution of the possible problems.

References

(1) MAGDECHOVÁ, K. Analýza vývoja schvaľovania typov dráhových vozidiel v podmienkach Slovenskej republiky, In: *Zborník z medzinárodnej konferencie Horizonty železničnej dopravy 2014*, str. 140 - 149, ISBN 978 – 80 – 554 – 0918 - 4

(2) *Zákon č. 51/1964 Zb. o dráhach vrátane jeho neskorších zmien*

(3) *Zákon č. 104/1974, ktorým sa mení a dopĺňa zákon č. 51/1964 o dráhach*

(4) *Vyhláška Ministerstva dopravy č. 52/1964 Zb., ktorou sa vykonáva zákon o dráhach*

(5) *Vyhláška Federálneho ministerstva dopravy č. 18/1981 Zb. o schvaľovaní dráhových vozidiel a osobitných dráhových mechanizačných zariadení úloha*

(6) TOMČALA, I. Niektoré problémy uplatňovania vyhlášky MDPT SR č . 250/1997 Z . z . pri schvaľovaní typu dráhového vozidla, In: *Zborník zo XIV. medzinárodnej konferencie- Súčasné problémy v koľajových vozidlách,* PRORAIL 99, Žilinská univerzita v Žiline 1999, ISBN 978 – 80 – 7100 – 645 - 9

(7) *Zákon NR SR č. 164/1996 Z. z. o dráhach a o zmene zákona č. 455/1991 Zb. o živnostenskom podnikaní (živnostenský zákon) v znení neskorších predpisov*

(8) Vyhláška MDPT SR č. 250/1997 Z. z., ktorou sa vydáva dopravný poriadok dráh

(9) *Zákon NR SR č. 513/2009 Z. z. o dráhach a o zmene a doplnení niektorých zákonov (vrátane konsolidovaného znenia)*

(10) SMERNICA EP a RADY č. 2008/57/ES *o interoperabilite systému železníc v Spoločenstve (vrátane konsolidovaného znenia)*

(11) SMERNICA EP a RADY č. 2004/49/ES *o bezpečnosti železníc spoločenstva a o zmene a doplnení smernice Rady č. 95/18/ES*

o udeľovaní licencií železničným podnikom a smernici č. *2001/14/ES o prideľovaní kapacity železničnej infraštruktúry, vyberaní poplatkov za používanie železničnej infraštruktúry a bezpečnostnej certifikácii*

(12) *Vyhláška MDPT SR č. 351/2010 Z. z. o dopravnom poriadku dráh (vrátane konsolidovaného znenia)*

(13) MAGDECHOVÁ, K., NACHTIGALL, P. Zmeny v schvaľovaní typov dráhových vozidiel, In: *Zborník z medzinárodnej konferencie Horizonty železničnej dopravy 2013*, str. 242 - 248, ISBN 978 – 80 – 554 – 0764 - 7

(14) ROZHODNUTIE KOMISIE č. 2011/314/EÚ *o technickej špecifikácii interoperability týkajúcej sa subsystému „prevádzka a riadenie dopravy" (vrátane konsolidovaného znenia)*

(15) ROZHODNUTIE KOMISIE č. 2012/757/EÚ *o technickej špecifikácii interoperability týkajúcej sa subsystému „ prevádzka a riadenie dopravy" systému železníc v Európskej únii a o zmene a doplnení rozhodnutia Komisie č. 2007/756/ES s* účinnosťou od 1. 1. 2014 *(vrátane konsolidovaného znenia)*

(16) ROZHODNUTIE KOMISIE č. 2007/756/ES, *ktorým sa prijíma spoločná špecifikácia národného registra vozidiel* uvedená v čl. 14 ods. 4 a 5 smerníc 96/48/ES a 2001/16/ES *(vrátane konsolidovaného znenia)*

(17) ROZHODNUTIE KOMISIE č. 2011/665/EÚ *o Európskom registry povolených typov železničných vozidiel (vrátane konsolidovaného znenia)*

(18) LAVOGIEZ, H., DECHAMPS, J - M., ARDIACA, F. Type of Vehicle*, ERA Workshop on Vehicle Authorisation*, Lille 08. February 2012

(19) ERA: Informácie o krížovej akceptácii, dostupné z: http://www.era.europa.eu/Core-Activities/Cross-Acceptance/Pages/home.aspx

(20) ROZHODNUTIE KOMISIE č. 2009/965/ES z 30. novembra 2009

o referenčnom dokumente uvedenom v článku 27 ods. 4 smernice Európskeho parlamentu a Rady 2008/57/ES o interoperabilite systému železníc v Spoločenstve *(vrátane konsolidovaného znenia)*

(21) Dopravný úrad SR: *Informácie o krížovej akceptácii a referenčnom dokumente* [online], dostupné z: http://drahy.nsat.sk/interoperabilita-zeleznicnych-drah/referencny-dokument-a-krizova-akceptacia/

(22) ERA, SK NSA: National Reference Document: Slovak Republic*;* 31. May 2011, ERA/TD/2009-01/XA

(23) Ministerio de Fomento Espaňa: *Case Study: APIS for SW upgrade*, november 2012

(24) UTK: *Informácie o poľských dopravných predpisoch a postupoch schvaľovania* [online], dostupné z: http://www.utk.gov.pl/

(25) NKH: *Informácie o maďarských dopravných predpisoch a postupoch schvaľovania* [online], dostupné z: http://www.nkh.gov.hu/a-hatosagrol

(26) OBB: *Informácie o rakúskych dopravných predpisoch a postupoch schvaľovania* [online], dostupné z: http://www.ts.oebb.at/de/

(27) OBB Infra: *Informácie postupoch schvaľovania v Rakúsku* [online], dostupné z: http://www.oebb.at/infrastruktur/de/

(28) TOURNIER, NT., DRILLER, J. The National Legal Framework (DE), Technical Document (Reference Document Part 3)

(29) EBA: *Informácie o nemeckých dopravných predpisoch a postupoch schvaľovania* [online], dostupné z: http://www.eba.bund.de/DE/Home/home_node.html

(30) EBA, Schweizerische Eidgenossenschaft, ANSF, BMVIT, HETI: Cross Acceptance and Corridor Guideline, *Control Command and Railway Communication Conference 2012*, Lille, 6 - 7 November 2012

(31) ERA. Progress with Railway Interoperability in the European Union, *Biennial Report*, 2013

(32) ERA: *Informácie o registri povolených typov vozidiel* [online], dostupné z: https://eratv.era.europa.eu/eratv

(33) IHNÁT, P. Interoperabilita železníc Spoločenstva, In: *Železničná doprava a logistika*, Žilinská univerzita v Žiline 2006, str. 103 - 109, ISSN 1336 - 7493

(34) MAGDECHOVÁ, K. Telematické aplikácie v nákladnej a osobnej železničnej doprave, In: *Zborník z medzinárodnej konferencie LOGI 2012*, str. 252 - 256, ISBN 978 - 80 – 263 - 0336 - 7

(35) MDVRR SR: *Informácie o technických špecifikáciách interoperability* [online], http://www.telecom.gov.sk/index/index.php?ids=60401

(36) EUROPEAN COMMISSION, DG MOVE. Report on the work performed by the task force on railway vehicles authorisation, Brussel 09. July 2012

(37) ERA, EK. Progress on the Vehicle Authorisation Task Force Recommendations, *EC ERA Workshop on Vehicle Authorisation*, Lille 08. February 2013

(38) ODPORÚČANIE KOMISIE č . 2014/897/EÚ z 05. decembra 2014 *o záležitostiach súvisiacich s uvedením do prevádzky a používaním štrukturálnych subsystémov a vozidiel* podľa smerníc Európskeho parlamentu a Rady 2008/57/ES a 2004/49/ES *(vrátane konsolidovaného znenia)*

(39) EK: *Informácie o dopravnej legislatíve EÚ* [online], dostupné z: http://ec.europa.eu/index_en.htm

(40) ARDIACA, F. DV 29bis, *Workshop DV 29 bis*, Lille 14. November 2013

(41) LOCKETT, R. The Vehicle Authorisation Process, *ERTMS Conference*, Lille 6. - 7. November 2012

(42) ARDIACA, F., LO YACONO, L. Authorisation Type of Vehicles, *Final Report*, 30. April 2013

(43) VÚD Žilina. Implementácia interoperability konvenčných železníc SR, *Záverečná správa 2005*

(44) BAČIŠIN, M., FUSATÝ, M., PALUCH, J. *Výpočtový nástroj obrysu koľajových vozidiel s dôrazom na interoperabilitu*, Žilinská univerzita v Žiline 2012, str. 10 - 15, ISSN 1336 - 7943

(45) REMING Consult, a. s., SUDOP Praha, a. s., AM Sudop spol. s. r. o.: *Technicko- ekonomická štúdia pre prípravu a implementácia ERTMS na koridore E* , jún 2010

(46) GUIDO, P. Specifications for Interoperability, *ERTMS Conference*, Lille 6. -7. November 2012

(47) ČECH, R.: *Analýza nákladů a přínosů implementace TSI*, disertační práce DFJP, 2012

(48) JINDRA, P. *Systémová implementace provozní interoperability železniční nákladní přepravy*, disertační práce DFJP, 2010

(49) Frid, A., Leth, S., Högström, C., Färm, J.: Noise control design of railway vehicles- Impact of new legislation, *Journal of Sound and Vibration, 2006*, Vol. 293 (3), pp. 910 - 920, ISSN 0022 - 460X

(50) ROZHODNUTIE KOMISIE č. 2012/88/EÚ *o technickej špecifikácii interoperability týkajúcej sa subsystémov riadenia- zabezpečenia a návestenia transeurópskeho železničného systému* z 25. januára 2012 *(vrátane konsolidovaného znenia)*

(51) MYDIA, S., THOTTAPPILLIL, R.: An overview of electromagnetic compatibility challenges in European Rail Traffic Management Systém, In: *Transportation research Part C*, 2008, Vol. 16(5), pp. 515 - 534, ISSN 0968 - 090X

(52) GHAZEL, M. Formalizing a subset of ERTMS/ETCS specifications for verifications purposes, In: *Transportation Research Part C*, 2014, Vol. 42, pp. 60 - 75, ISSN 0968 - 090X

(53) GUIDO, P. ERTMS Baselines*, UIC ERTMS World Conference*, Istanbul 2. Apríl 2014

(54) BIERLEIN, H. Certification and placing in service, *ERTMS Conference*, Lille 6. - 7. November 2012

(55) ŽU v Žiline – Fakulta špeciálneho inžinierstva: *Úvod – všeobecné základy modelovania* [online], dostupné z: http://www.fsi.uniza.sk/ktvi/leitner/2predmety/OA/00Vseobecne%20o%20modelovani.pdf

(56) Strojnícka fakulta TU v Košiciach: *Simulácia technologických procesov* [online], dostupné z: http://www.sjf.tuke.sk/mmnv/UPLOAD/studentom/PS/2.pdf

(57) Paholok, I.: *Simulácia ako vedecká metóda*, In: E – LOGOS (Electronic Journal for Philosophy/2008) [online], ISSN 1211 – 0442, dostupné z: http://nb.vse.cz/kfil/ elogos/student/paholok08.pdf

(58) LMCTn: *Informácie o práci s VBA makrami* [online], dostupné z: http://www.lmctn.sk/makra_excel

(59) Lorenc, M.: *Ganttův diagram v Excelu* [online], dostupné z: http://lorenc.info/3MA381/graf-ganttuv-diagram.htm

(60) Ott, V.: *Co je to Ganttův diagram a k čemu vám může být dobrý*, In: Denník neziskovky [online], dostupné z: http://deniknеziskovky.cz/co-je-to-ganttuv-diagram-a-k-cemu-vam-muze-byt-dobry/

Author´s publikations

Publikačná činnosť

1. Magdechová. K.: Telematické aplikácie v nákladnej a osobnej železničnej doprave; Logi 2012; Pardubice 22. 11. 2012; zborník str. 252-256, ISBN 978-80-263-0336-7

2. Magdechová, K., Široký, J.: Telematic applications for freight and passengers in railway transport; Horizons of Railway Transport; str. 84 - 86; Vol.3 ; 2012

3. Magdechová, K.: Analýza vytvárania spoločného podniku Shift^{2}Rail; Železničná doprava a logistika, str.61, X ., 2014, ISSN 1336 - 7943

4. Magdechová, K.: Analýza železničních priecestí v podmienkach Slovenskej republiky; Aktuální trendy v dopravě a ekonomice 2013 (virtuálna konferencia), Pardubice 2014, zborník str. 22 - 30, ISBN 978 – 80 – 86530 – 90 - 1

5. Magdechová, K., „Analýza technických špecifikácií interoperability železničného systému v Európskej únii“, poster na 12. fóre koľajovej dopravy, Bratislava 15. – 16. 03. 2016

Active participation at conferencies and publications in collections

1. Magdechová, K., Nachtigall, P.: Zmeny v schvaľovaní typov dráhových vozidiel; Horizonty železničnej dopravy 2013, 26.-27. september 2013, zborník str. 242 - 248, ISBN 978 – 80 – 554 – 0764 - 7
2. Magdechová, K.: Analýza vývoja schvaľovania typov dráhových vozidiel v podmienkach Slovenskej republiky, Horizonty železničnej dopravy

2014, 18.-19. September 2014, zborník str. 140 - 149, ISBN 978 – 80 – 554 – 0918 - 4

3. Výberová prednáška na zasadnutí TSI PRM poradného orgánu: „National Implementation Plan of the Slovak Republic“ (Brusel 05th November 2015)
4. Magdechová, K., ***Aktuálny stav implementácie interoperability konvečného systému železníc v SR,*** presentation at conference Horizonty železničnej dopravy 2016, Strečno 29. – 30. september 2016
5. Magdechová, K., ***Národné kontaktné miesto pre telematické aplikácie v osobnej a nákladnej doprave (TAF/TAP TSI),*** presentation at 5th regional meeting on telematics application for freight (TAF TSI), Bratislava 4th october 2016
6. Magdechová, K., ***5th TAF TSI Workshop in Bratislava – solutions of the problems,*** presentation at TAF TSI working group, Lille 22nd March 2017
7. Magdechová, K., ***Slovak National Implementation Plan for TSI PRM,*** presentation at TSI PRM Advisory Committee, Brusel 5th apríl 2017
8. Magdechová, K., ***WAGON SERVICE travel – Special trains***, prezentácia na konferencii Horizonty železničnej dopravy 2017, 21. -22. september 2017
9. Siroky, J., Sramek, P., Magdechova, K., Tischer, E., Siroka, P.: *Capacity range calculation, Electronical technical journal of technology, engineering, and logistic in transport „Perner´s Contacts“*, University of Pardubice, Jan Perner Transport faculty, Pardubice, Number IV, Volume XIX, December 2019, in print, ISSN 1801-674X, avaible: <http://pernerscontacts.upce.cz/>

10. Siroky, J., Sramek, P., Magdechova, K., Tischer, E., Hlavsova, P.: *Timetable performance evaluation*, Proceedings of 23rd International Scientific Conference. Transport Means 2019. Pp. 1427-1432. ,ISSN 1822-296X

Abstract

A dissertation thesis deals with the analysis of existing situation on authorisation type of vehicles in Slovak Republic and foreign countries. It is concerned with the Commission Recommedation 2014/897/EU of 5th December 2014 on matters related to the placing in service and use of structural subsystems and vehicles under Directives 2008/57/EC and 2004/49/EC of the European Parliament and of Council which should be application guide for this area. A main goal of dissertation thesis is to ensure the interoperability (new directives, regulations, decisions, recommendations) and to create the methodology of authorisation type of vehicles especially SW model as a tool with using the EU legislation for speeding up the whole process. It contains the analysis of scientific methods which were used for the assurance of the main goals.