HV INTELLIGENT ACCESS and E-WAYBILLS DEVELOPMENT IN ESTONIA

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Abstract

The research objective is more effective and greener road freight transport with HV's, without damaging aging road infra below. One of the best solutions in 21. century is to use all kinds of digital data (temperature; GNSS; OBW etc.) and maps, to control the logistics in the most optimum way, depending on the used vehicle's load type (IA). It's a very cost-effective system. Since the HVTT15 paper, much work has been done in Estonia in the logistics digitalization area which has been described shortly below. By the end of 2021 will be analysed, if different cloud-based logistic infosystems can be developed together in a small Estonia.

Keywords: Intelligent Access; Estonian VELUB System Development; Estonian Smart Road; OBW Automated Mass Control Integration; Reducing Infra Construction Stresses; More Efficient and Greener Transport; CEDR Road Freight Transport (RFT) workgroup; Estonian eCMR & e-waybill development; EU eFTI regulation.

1. Introduction

Since 2010 Estonian Transport Agency (ETA) has been developing Intelligent Access (IA). In the beginning, it was meant only for the wintertime 52t timber transport, if the pavements were frozen at the min 0,5m depth. For that reason, the digital vertical temperature sensors (max 2,5m deep) were installed over Estonia. /1/
At the same time, the strong infra corridors were analysed and mapped /2/ (in the SmartRoad – the green colour digital road corridors with daily update time at 4 pm). /3/
In the VELUB system, it is possible to apply for the special vehicles permit for up to 1 year. /4/

As the climate change proceeded, the wintertime allowed corridor window decreased quickly, we started in ETA to develop the year around 52t (the violet corridors) IA system /5/ with the legislation. /6/
IA has been used since 2015 by ca350 truck/y, mostly by timber trucks so far, but also increasing others.
The VELUB IA is a good sample, described also in the CEDR 2017 report Conditions for efficient road transport in Europe. /7/ More detailed info is described below and in the HVTT15 paper. /8/ Also, EU Aeroflex's project HVTT16 paper describes ongoing worldwide IA projects.

Since the HVTT15 paper, much work has been done in Estonia in the logistics digitalization area which has been also described below to understand in the better way, the different new, cloud-based logistic systems and their common ground (see also in the HVTT15 paper the VELUB System Dimensions and EU Aeroflex project workshop, Figure 1).
For example, if the (i.e. abnormal) HV is in the wrong road corridor or has a total mass over the limited value etc, the cloud-based eCMR can change the cell red and send the notice to controlling organizations (and also on the Smart Road map can blink as the red dot, etc). It's possible in the future to make automated direct enforcements as well – kind of like the speed cameras do now (based i.e. on the Belgium new legislation). /9/

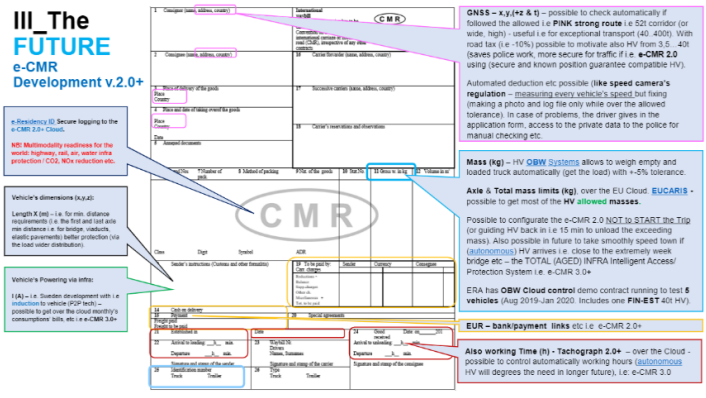

Figure 1 – The EU Aeroflex workshop Estonian schema shows how IA and eCMR/eFTI can be theoretically connected in the digital cloud systems via the same data fields /10/

By the end of 2021 will be analysed if different cloud-based logistic infosystems can be developed together as a Single Cloud System and if the private or public sector is going to develop it, etc.

2. Transport digitalization targets for the efficiency growth and the climate targets

Greener transport vision is in detail described in EU's new Sustainable and Smart Mobility Strategy 2050. It describes how greener transport should look like and how it should be developed in the EU member states etc. /11/
EU and EFTA Ministers of Transport declared also last year in the Passau Declaration that digitalization is the Smart Deal for Mobility and it shapes the mobility of the future – sustainable, safe, secure, and efficient. The Passau Declaration talks about Building Information Modelling (BIM) and eFTI and other digital tools for making the whole transport sector more efficient in coming years. /12/

EU's 2020/1056 Electronic Freight Transport Information (eFTI) regulation demands EU member states to accept the digital transport documents at the level of competent authorities starting from 21. August 2024. /13// Based on that regulation, Estonian Ministry of Economic Affairs and Communications (EMEAC) is piloting eFTI/eCMR together with the neighbour states and ETA.

Since 2020 ETA is piloting e-waybill in the bulk material transport in building contracts with the target to demand it since 2022 in all building contracts. At the beginning of 2021, EMEAC joined our Bulk Material Transport Memorandum and declared the interest to develop also the internal National Access Point (NAP) for e-waybills to ensure seamless access to the data between competent authorities and economic operators – nationally and also internationally, supporting the implementation of the eFTI directive. Also, the Estonian Association of Information Technology and Telecommunications joined as 10. member to the memorandum.

ETA has developed already since 2010 also IA, with the VELUB System which allows controlling on the Smart Road map, 52t abnormal transport vehicles (with GNSS) for more effective and greener transport. More controlled vehicle movements protect road and bridge constructions (avoiding movements on the weaker roads).
Different types of e-waybills and digital information (Figure 2) can be theoretically developed in a single, digital cloud-based system. The data can be sent cross-border and in the multimodal mode, in the future.

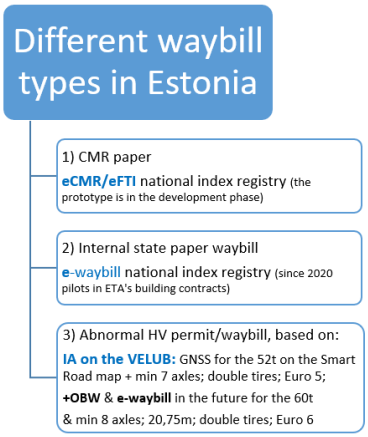

Figure 2 – Different paper & e-waybill types in Estonia

In the following paragraphs, a short overview of Estonian's different e-waybill connected developments and researches will be given.

3. eCMR pilots and ongoing process

Estonia supports the fast adoption of eFTI to achieve the goals of road transport digitalization as early as possible. There are already several eCMR service providers on the market, and there are public authorities capable and interested to receive the data that they are entitled to check. Still, governmental institutions cannot easily accept the eCMR, even if the legal ground for it exists. The missing link is the secure and trustful way to exchange eCMR data between governments and eCMR service providers.

eCMR solution, which meets the market´s expectations and eFTI rules, can only function as an internationally connected digital ecosystem that would allow the data exchange on transport documents along the logistic corridor. Therefore, the pilot project on road transport digitalization was carried out as cross-border service development in cooperation with neighbouring countries.

Under the leadership of EMEAC, the cross-border eCMR prototype between Estonia, Latvia, Lithuania, and Poland (Figure 3) was introduced and tested in September 2020. /14/

The objective of prototyping was to create an e-governance compatible eCMR indexing scheme that allows controlling institutions of the partner countries to check the availability and validity of CMR transport documents on remote in a secure and trustful way. The prototype involved the digital availability of a CMR document (preferred machine-readable) and a mechanism of indexing such documents across the partner countries via an indexing scheme. Every authorized governmental institution was given access to indexing information via a testing environment.

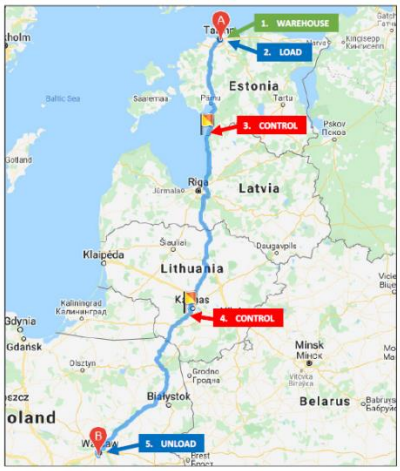

Figure 3 – eCMR prototype piloting scheme.

Cross-border prototype testing was carried out across all participating countries – Estonia, Latvia, Lithuania, Poland - in August and September 2020 in cooperation with governmental institutions (Tax and Customs Board, Police, Road Administration, etc.), private sector eCMR service providers and road carriers.

Selected sample rides with the different scenarios were tested. Testing involved remote eCMR control from offices, roadside checks, and using the road and border cameras. The project

partners could successfully experience in practice how the eCMR issued in one country is visible to the authorities of another country.

The potential benefits for authorities include a more effective transport sector and trade supervision. One of the outcomes of the system is reduced time spent on stopping trucks for CMR control, but also minimized the number of offences related to tax avoidance and transport safety. In turn, carriers can experience savings in administrative costs, reduction in inspection times, faster delivery times, and easier communication with authorities.

The prototype development team included governmental organizations (ministries, road administrations, tax and customs, police, statistics, etc.), logistics and road carriers' associations, consulting experts, and leading software developers with an international background. eCMR cross-border prototype technical solution, development and testing process, deliverables, and conclusions are described in the final report, all the results are public. The software developed during the project is distributed under a free software license. /15/

Work on the eCMR prototype 2.0 version continues in 2021, focusing on the development of common datasets, the extension of authorization possibilities, and the enhancement of security. In addition, a roadmap for eCMR concept implementation by 2024 has been agreed in the Baltic Sea Region, a corresponding task force is formed, and cooperation is also taking place at the governmental framework level.

EMEAC will analyse in 2021 (Figure 4) the alternatives for the foundation of Estonian NAP, including functionality, ownership, Cost-Benefits, and different risks related to it, etc. Also, the connectivity with internal e-waybills will be considered. ETA is involved in the development as a road owner, whose interest is to increase construction and traffic safety etc. /16/

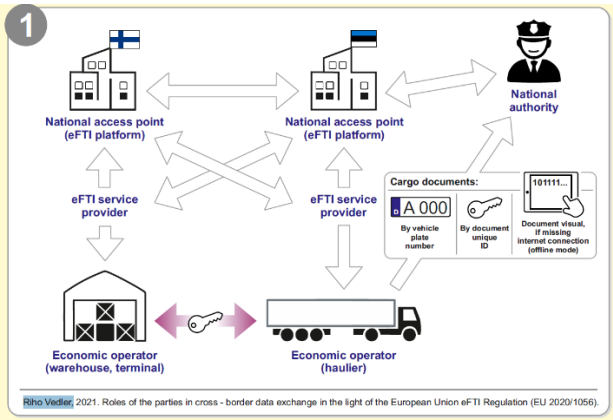

Figure 4 – NAP as part of national and global ecosystem (Estonian possible version)

EMEAC will also introduce to the EU on 3. June 2021, the Joint Position Paper on achieving an interoperable electronic freight information exchange system in Europe. The position paper includes the road owners' vision on handling freight information, road safety, and other data in a single information flow.

The European Commission's vision to digitize G2B, B2G transport information flow across Europe with eFTI regulation is undoubtedly ambitious. However, it addresses only the information related to cargo, but not the vehicle or a driver. At the same time, there is a strong need for public authorities and businesses to handle this information together to achieve greater transparency, safety, and efficiency.

Therefore, the eCMR concept can be expanded using the same data exchange channel and technology in:

- **Reducing risks in road traffic** (automated validity of driving license and health certificate; inspection of compliance with working, driving, and rest time rules; technical inspection of truck and trailer; payment of fines and tolls; insurance of truck and goods, etc.).
- **Improving road construction safety** (truck weight information from OBW systems).
- **Handling of dangerous goods**, special cargo, and contract deliveries (GNSS tracking, automated fee payment control).
- **Increasing the transparency of tax revenues** (payment of customs duties, automatic VAT refunds).
- Other areas (rescue, statistics, insurance, etc.).

Handling this information in a single channel has the potential to significantly improve the efficiency of transport and, therefore, to contribute to the smooth functioning of the EU’s Single Market.

Taking into consideration the quick need for a positive transformation in the electronic freight transport information sector, Estonia together with Finland, Latvia, Lithuania, Poland and Hungary highlight the need to swiftly start discussions by setting up the joint development of the eCMR data exchange model in Europe.

4. Internal state e-waybill using experience

In 2020, ETA carried out three procurements, where it was mandatory to use an e-waybill of lading for the transport of the bulk materials. The special requirements for documenting, the works applied to both: the contractor and the owner's supervision. All consignment notes for the bulk materials and the summary tables, compiled based on them, had to be prepared in an electronic data exchange platform. /17/

The pilot projects assumed the use of either the Waybiller environment developed in Estonia or an analogous electronic data exchange platform. /18/ The procurement required that the digital platform allow the creation of separate objects and GNSS location-based tracking of each load (Figure 5). The vehicle and/or trailer number information had to be generated automatically from the traffic register database and had to reach the electronic environment on the e-waybill. If the truck had a special cargo permit of 48 or 52 tons, its data, permit number, and the validity period had to be included. Supervisors and subscribers needed to have access to the environment so that they could control the information through the cloud.

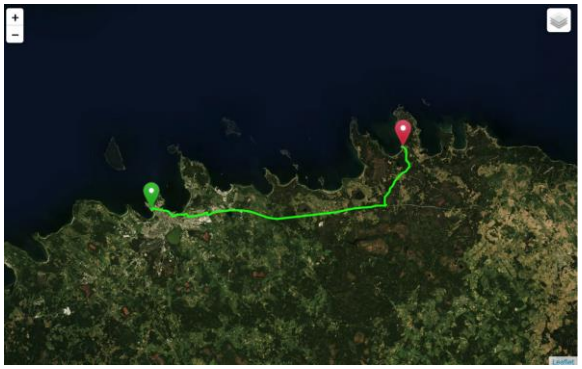

Figure 5 – GNSS makes material transport more transparent in road building (from the right quarry, along the strong road corridor).

The e-waybill had to contain at least the number of the truck and/or trailer, the number of axles, the permissible weight/load capacity of the truck; the mass and name of the material, the name of the driver, the haulier, the owner of the load and the quarry. If the transport was on public roads, an e-waybill had to be created for the transport from the intermediate warehouses to the site (except for the intermediate warehouses immediately adjacent to the site). An indication had to be made on the e-waybill, whether the material came from a quarry or an intermediate warehouse.

As mentioned, the owner supervision was also obliged to use the electronic environment of the e-waybill. For example, he had to check the e-waybills for bulk materials provided by the contractor and confirm receipt of the load in the digital environment. Also, during the asphalting works, the engineer used a data exchange platform to validate the e-waybill of asphalt loads arriving at the site. In total, more than 5000 paper waybills were avoided by using e-waybills in the 3 smaller pilot building contracts.

This year, the ETA is already planning several times more (14) pilot procurements to prepare for the full transition to e-waybills in 2022, for the transport of bulk materials. One procurement in the Pärnu area will require the use of a weighing station, loader, or OBW interfaced with the service provider - to protect the weaker road constructions and bridges (Figure 6).

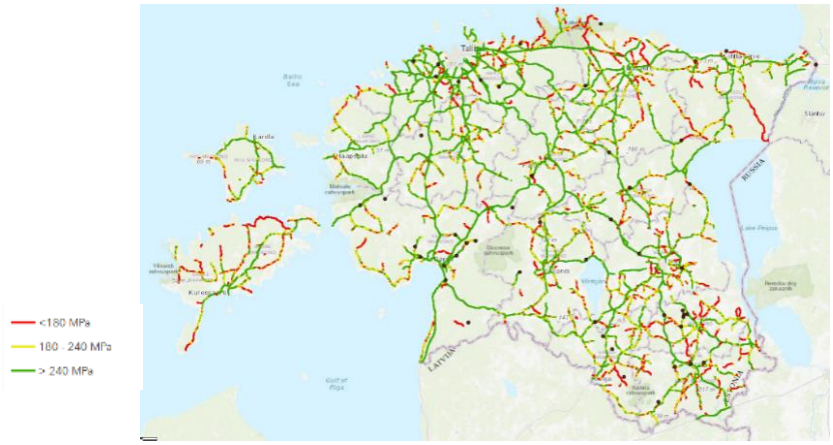

Figure 6 - Strength of the Estonian state roads in 2019 (black dots, weaker bridges).

For 2021, a separate contract annex (2 pages) has been prepared for contractors, which contains detailed minimum technical requirements for the e-waybill. This will make it easier for the new service providers to bring data exchange platforms to market and will be better traceable to all parties. /19/

5. VELUB Intelligent Access

ETA has since 2010y developed digital Intelligent Access solutions in the VELUB platform for the abnormal 52t transport monitoring (Figure 7). This system can be used in the future for controlling also heavier trucks, adding more controlling criteriums, etc. At the moment, 60t and EMS longer and heavier vehicles CBA is ongoing in ETA.

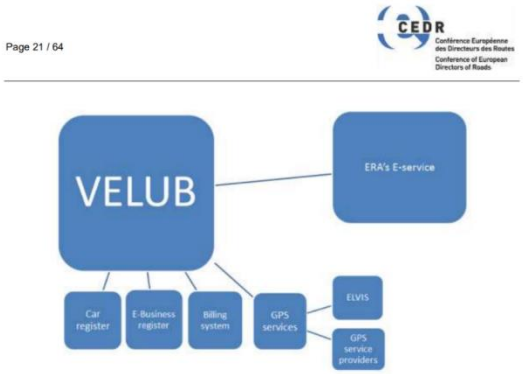

Figure 7 – The VELUB special permit application system in ETA; ELVIS – State Forest Management's electronic cargo list information system. /7/

A study of the HV impact on the bridges showed that less than 7% of the total bridges are not OK for 52t in Estonian state roads /20/ Those weaker bridges are not marked inside the Smart Road (Figure 8) strong corridor's digital map. /5/

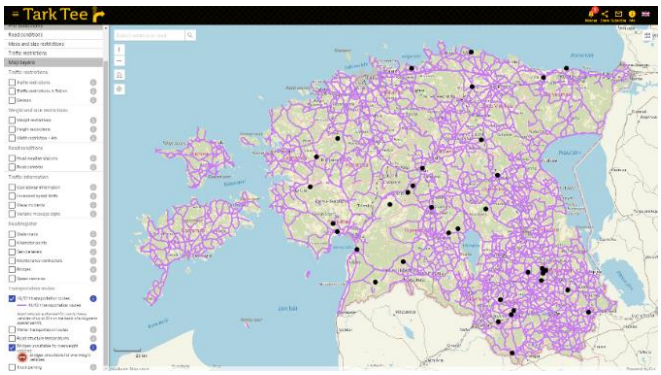

Figure 8 – Smart Road (ETA, Tark Tee) strong corridors marked with the purple lines (dots - weaker bridges) 28.02.21

Detail overview of the VELUB development and its digital possibilities was given in the HVTT15 Symposium. /8/

Overview of Stakeholders in the VELUB and different waybill developments in Estonia was given in Aeroflex/i4DF workgroup. /10/

In 2020, OBW telemetry tests were completed, with 5 different HV. Good results were achieved for continuing in the coming years. OBW test report showed (Figure 9) HV's total mass error is only ca 1%, despite the single axle masses vary quite a lot. /21/

The study with OBW tests with HV's was carried out to determine the possibility of using OBW equipment to monitor weights of HV's reliably and accurately.

Sõiduk	Andmeallikas	Teljekoormus, t Axle 1 Telg 1	Telg 2	Telg 3	Telg 4	Telg 5	Telg 6	Telg 7	Sõiduki tegelik mass koormus-kaalud, t	OBW Sõiduki tegelik mass pardakaal, t	Tolerants, % Viga, %
	Koormuskaalud	8.75	8.10	7.75	6.15	8.35	6.70	6.75	52.55		
Scania 04	Pardakaal OBW	7.80	7.70	7.60	7.30	7.50	7.17	7.53		52.60	0.10
	Koormuskaalud	7.60	9.15	9.30	7.40	8.15	7.35	7.40	56.35		
Volvo 02	Pardakaal	7.50	8.70	8.50	8.00	8.60	7.30	7.40		56.00	-0.62
	Koormuskaalud	7.80	9.05	8.85	6.80	8.25	7.20	7.25	55.20		
Volvo 04	Pardakaal	7.40	8.90	9.20	6.40	8.20	7.30	7.20		54.60	-1.09
	Koormuskaalud	7.70	9.30	9.05	6.85	5.55	8.05	8.00	54.50		
Scania 05	Pardakaal	6.80	8.60	8.90	7.60	7.40	7.27	7.37		53.93	-1.04
	Koormuskaalud	8.25	9.55	8.60	7.35	9.00	6.75	6.85	56.35		
Volvo 02	Pardakaal	7.80	10.10	8.80	7.40	9.10	6.70	6.80		56.70	0.62

Figure 9 – The results of the vehicles control weightings

For this test purpose, five trucks were selected, connected /22/, and monitored through the fleet management platform provided by FleetComplete. Necessary additional hardware and software developments were done to allow to read the weighting data by telematics devices from vehicles CAN bus using FMS interface and display the data through web interface (Figure 10& 11). For verification purposes, weighing of fully loaded HGV vehicles was carried out with portable scales.

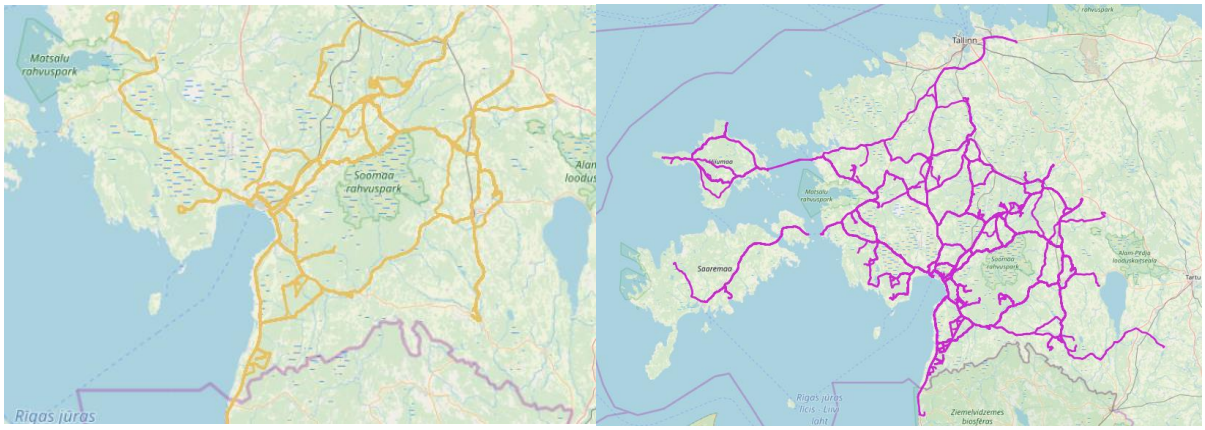

Figure 10 – HV „Volvo 02 timber truck 4+" moving paths 10.09.2019 – 21.10.2019 (left) & 21.10.2019 – 15.01.2020.

Besides enforcement capabilities, OBW systems provide logistics managers with a robust way of optimizing the usage of trucks. As our analysis showed, fuel usage per kilometre does not increase significantly at higher loads. Therefore, loading trucks to the maximum safe limit for roads allow saving fuel and thus reduces carbon dioxide emissions.

To determine safe limits, all data must be integrated with the road database. In this study, only pavement and IRI were used, providing insight that pavement type does affect the measured values, but road roughness does not affect it. In future studies, other road parameters can be used with a similar methodology. Also, the current road networks for heavy vehicles („green roads“ for wintertime and „purple roads“ for a whole year) can be linked to weight data providing even more insight for better logistics management and when necessary, also enforcement. In terms of pavement management, more detailed information about actual weights on the road will yield more accurate predictions than current methods using standardized axles and vehicles.

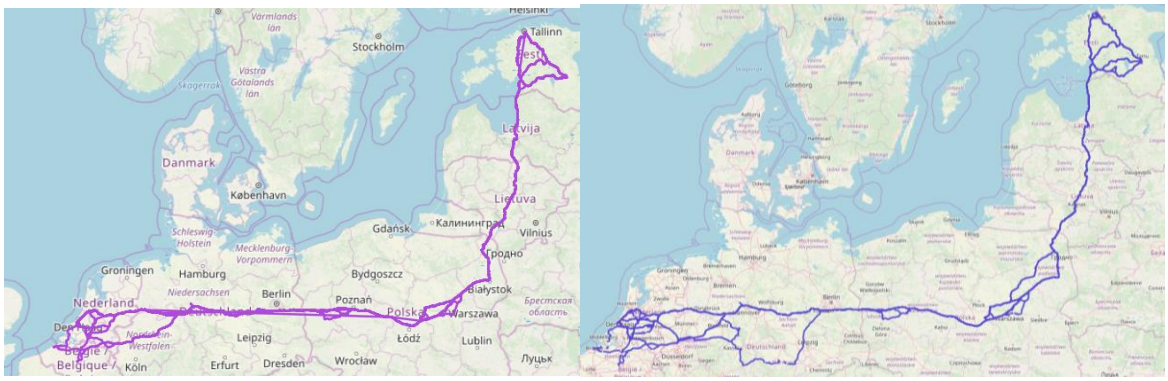

Figure 11 – HV „Scania 02 saddle 2+“ moving paths 02.09.2019 – 21.10.2019 (left) & 21.10.2019 – 15.01.2020

Integration with the road tolling system provides road administrators with an opportunity to promote logistics solutions better for road structures and the environment. This is also valuable information for procurement of logistics services allowing to choose the most effective provider with the smallest carbon footprint. To achieve this, a follow-up study with more vehicles included is needed to better understand the relations between fuel usage, road deterioration, and load weight.

OBW data gives the traffic control a good overview of where are the most likely overloaded HV. With that data traffic control points can be decided much quicker - where to go to do the static weighing with the traffic control van (helps like the echo sounder does for the fisherman’s).

We consider this year more in detail if the Belgium legislation draft principles are good to use for the OBW dynamic weighing and direct enforcement as well etc.

CEDR's new RFT (Road Freight Transport) workgroup has also started the IA subgroup, to study further possibilities of a new system that allows: road construction protection (aging infra); higher traffic safety, and at the same time greener transport, etc.

In the future, we plan to implement a 60t weight limit for all kinds of transport - as it is in the existing 52t (not only for the timber, as it was in the starting years). At the moment, the 60t CBA report expertise is ongoing by Tallinn University of Applied Sciences.

In the 60t CBA report, there are planned to implement 2 kinds of abnormal HV's:

- EMS 60t; 25,25m with the min 8 axles; e-waybill (for the main stronger road corridors);
- 60t; 20,75m; min 8 axles; double tires; GNSS; OBW and e-waybill.

Both options will have then in the Smart Road different digital map (different layers with different colours, IA).

Estonia is also planning IA in the national real-time waste management monitoring system. 23/

6. Lessons learned

- From the road engineering point of view, we have learned that it is possible to develop a system that allows, based on digital data, to control logistics so that it helps to protect the aging roads infra.
- OBW data can be accurate enough on the paved roads, so it can be considered to be used for direct enforcement (i.e. for abnormal permit HV vehicles, etc.).
- It is very cost-effective to allow more loads with the IA, without damaging the infra below.
- This IA VELUB and eCMR technology are compliant with the self-driving trucks as well, as there will be everything digitally controlled, over the cloud-based systems, in the coming decades.
- The most difficult task to be tackled in Estonia, and in many other countries, is not technological, but an emotional barrier (Figure 12), to implement new CO_2-friendly technologies. It may take time but one day the new technologies will come, as road freight transport grows a lot - every decade, all over the globe.

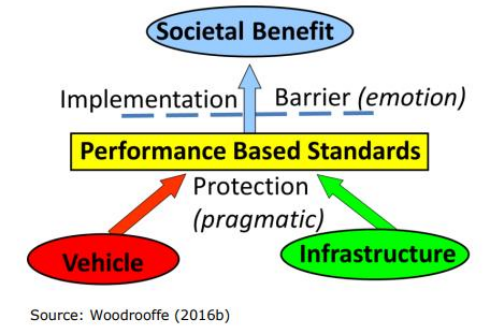

Figure 12 – HV Pictorial model showing a barrier to progressive policy /24/

See the EU Aeroflex project's HVTT16 paper for more about IA worldwide.

7. Conclusions

E-waybill development in Estonian state road building, abnormal transport IA, and other areas has given us already a lot of savings in CO2 emissions, making transport more efficient at the same time - with the single data entry to the cloud, etc. Defiantly there is still a lot to do and develop in coming years, to achieve EU's climate targets in the transport sector, using digitalization as a tool for helping it.

Estonia together with neighboring countries, and other EU states, are working together to achieve the EU digitalization goals and to make the freight transport between the states, and inside the state, more efficient.

ETA's bulk material e-waybill piloting and usage is just a small part of internal transport (ca 5%), but it is a huge step to digitize all internal waybills (over 2mln/y) together with EMEAC, and together with international eCMR, based on the eFTI regulation. In 2022y ETA is planning to demand e-waybills in all building contracts. There are already now many interested ITS companies with big interest to develop e-waybills in Estonia, as it's not so complicated in 21. century anymore.

Digitized cloud-based transport and road information systems are allowing much further IA development - to protect road constructions and increase traffic safety. At the same time, transport transparency increases, and ca20mln EUR/y socio-economic benefit is produced in a small Estonia, in 60t case.

By the end of 2021 will be analyzed, if different cloud-based logistic infosystems (Figure 2) can be developed together in Estonia. Also, 60t abnormal transport IA-based regulation will be hopefully worked out in coming years. After that, we'll get a lot of new experiences in IA and the e-waybill area to share.

8. References

1. Muldkehade läbikülmumise ilmastikutingimuste ja erinevate teede kandevõime seose uuring I etapp 2010, AS Teede Tehnokeskus https://www.mnt.ee/sites/default/files/survey/percostation2010_aruanne.pdf
2. Ülekaaluliste (52 tonni) veoste võimalike marsruutide kaardistamine riigimaanteedel, Maanteeamet 2010 https://www.mnt.ee/sites/default/files/survey/ylekaaluliste_veoste_v6imalike_marsruutide_kaardistamine_ma_2010.pdf
3. Estonian ETA's SmartRoad digital winter time max 52t map (goes green, if frozen min 0,5m) https://tarktee.mnt.ee/#/en/link/MhlCUFt1wlly
4. E-service of the Estonian Transport Administration for applying the special permits (VELUB) https://eteenindus.mnt.ee/main.jsf?lang=en
5. Estonian ETA's SmartRoad digital year-round max 52t map (the violet corridors) https://tarktee.mnt.ee/#/en/link/ZoE5c6OJw1iB
6. Estonian abnormal transport valid legislation https://www.riigiteataja.ee/akt/109092015002?leiaKehtiv
7. Conditions for efficient road transport in Europe, CEDR 2017 https://www.cedr.eu/download/Publications/2017/2017-5-Conditions-for-efficient-road-transport-report.pdf

8. Estonian VELUB system for more efficient and greener transport VELUB System is a small part of the much bigger, theoretical, MVMC System (E^n dimensional movement controlling system), T.Tonts, 2018, HVTT15, https://hvttforum.org/wp-content/uploads/2019/11/Taavi-Tonts-ESTONIAN-VELUB-SYSTEM-FOR-MORE-EFFICIENT-AND-GREENER-TRANSPORT.pdf
9. Draft Decree pertaining to the approval, verification and installation of measuring instruments for the weighing of high-speed vehicles in motion, Belgium, 2021 https://ec.europa.eu/growth/tools-databases/tris/en/index.cfm/search/?trisaction=search.detail&year=2021&num=203&mLang=EN
10. Experiences with the stakeholder process from Estonia, T.Tonts (2019), Aeroflex/i4DF, Special Focus Workshop, Intelligent Access Part II, Paris.
11. EUROPEAN COMMISSION, Brussels, 9.12.2020, *Sustainable and Smart Mobility Strategy – putting European transport on track for the future*. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2020:789:FIN
12. PASSAU DECLARATION on the occasion of the virtual Informal Meeting of EU and EFTA Ministers of Transport under the auspices of the German EU Council Presidency on 29th October 2020 https://www.bmvi.de/SharedDocs/EN/Documents/K/passau-declaration.pdf
13. Regulation (EU) 2020/1056 of the European Parliament and of the Council of 15 July 2020 on electronic freight transport information https://eur-lex.europa.eu/eli/reg/2020/1056/oj
14. Final Report eCMR index registry prototype, 2020y, Estonian Ministry of Economic Affairs and Communications https://www.diginnobsr.eu/ecmr-testing-results
15. eCMR index registry prototype code https://koodivaramu.eesti.ee/majandus-ja-kommunikatsiooniministeerium/ecmr-prototype-testing
16. E-waybill future possibilities in road owners point of view (E-veoselehe väljavaated taristuomaniku pilgu läbi), Roadpaper (Teeleht), pg 32-33 nr 100, 2020y, Taavi Tõnts, ETA https://www.mnt.ee/sites/default/files/road_paper_pdf/mnt_teeleht_suvi2020_nr100_veeb_1_1.pdf
17. EU sees "YES" for eCMR (Euroopa ütles e-veoselehele „jah"), Roadpaper (Teeleht), pg 19-21 nr 102, 2021y, Taavi Tõnts, ETA https://www.mnt.ee/sites/default/files/road_paper_pdf/teeleht_nr_102_veeb.pdf
18. The pilot project's sample e-waybill environment, developed in Estonia https://waybiller.com/en/
19. Maanteeveod ja e-andmestik presentation, Taavi Tõnts, 2021 https://prolog.ee/wp-content/uploads/2021/02/04_Single-Windows_TA_e-veoselehest_TT_170221.pdf.pdf
20. HV Impact to the bridges, 2020, ETA (Raskeveokite mõju sildadele. Nende koormuste valideerimine reaalsetel koormustel ning mõju analüüs) https://www.mnt.ee/sites/default/files/survey/raskeveokite_moju_sildadele_lopparuanne_2020-03-23.pdf
21. OBW tests with HV's (Tänapäeva ja tuleviku rakendused sõidukite kaalumisel, sõidukite masside jälgimissüsteemi loomine ja jälgimine reaalajas), Maanteeamet, ETA, AS Teede Tehnokeskus, Fleet Complete Eesti OÜ, Tallinn 2020y. https://www.mnt.ee/sites/default/files/survey/pohiaruanne_06_02_2020.pdf
22. Commission Implementing Regulation (EU) 2019/1213, Laying down detailed provisions ensuring uniform conditions for the implementation of interoperability and compatibility of on-board weighing equipment pursuant to Council Directive 96/53/EC https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R1213
23. Estonia planning national real-time waste management monitoring system, ERR news, 2021 https://news.err.ee/1608207373/estonia-planning-national-real-time-waste-management-monitoring-system
24. High Capacity Transport, Towards Efficient, Safe and Sustainable Road Freight, OECD, 2019 https://www.itf-oecd.org/sites/default/files/docs/high-capacity-transport.pdf