LESSONS LEARNED FROM THE PILOT INTELLIGENT ACCESS FOR SPECIAL ROAD FREIGHT TRANSPORT IN THE NETHERLANDS

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Abstract

The concept of Intelligent Access for road freight transport, which originated in Australia, is gaining interest in Europe. From September 2021 to June 2023, the Netherlands conducted an Intelligent Access Special Road Transport Pilot on behalf of the Ministry of Infrastructure and Water Management. The purpose of the pilot was to investigate the feasibility and scalability of Intelligent Access for special road transport in the Netherlands. More specifically, it concerned the EMS1 use case. Two consortia participated in the pilot, each consisting of at least one carrier and one service provider. Together with one of these consortia (V-Tron / HAN University of Applied Sciences) we present the results of the pilot. While the V-TRON/HAN paper focuses on the technical feasibility and scope of HCVs, this paper takes a broader look at lessons learned and recommendations for follow-up.

Keywords: Intelligent Access, Digitization, Road Asset Management

1. Introduction

There is an increasing need for more data and risk-driven management of assets and traffic and the supervision and enforcement of freight transport by road. Where in inland shipping in the Netherlands all information about owner, cargo, origin and destination, etc. becomes available from the Traffic Center by placing the cursor on a passing ship, freight transport by road is largely a black box for the road manager . This while freight traffic is almost entirely responsible for the wear and tear of the road network as a result of the use of the road. (8) The complexity of road management is growing due to factors such as climate change and automation. Traffic jams are back at the same level as before corona and traffic and transport are expected to increase further in the future. The space and budget are lacking for expanding the road network, so that the existing infrastructure (which is partly ageing) must be better utilized. Conditions are imposed on the use of the road by transports with additional safety risks for the road construction, road furniture, road safety and the environment, but supervision and enforcement thereof is very limited. The police and inspectorate must stop trucks on the roadside to determine whether the rules are being followed. Year after year, the enforcement agencies have fewer people at their disposal, because society demands different priorities. There is a great need to operate more data and risk-driven, so that human resources can be deployed more adequately and companies that comply with the rules are not unnecessarily bothered. (5) Risk ceilings for buildings along motorways due to the transport of dangerous goods are determined on the basis of camera counts at a limited number of locations for a period of two weeks per year. This working method must approach the actual use of the road by dangerous goods transports and the associated external safety risks. There is no supervision of dangerous goods transports through tunnels.

The way in which public authorities have to make efforts to obtain information about road use by freight transport is in stark contrast to the data available in the logistics chain. In 2021, this was the reason for the Ministry of Infrastructure and Water Management to set up a small-scale Pilot Intelligent Access for Special Road Transport (PITbw). This is a first tentative exploration of the feasibility and scalability of Intelligent Access.

Special Road Transport refers to all forms of road freight transport that entail additional safety risks due to deviating weights and dimensions or due to the transport of dangerous goods. In the pilot it was decided to start with the EMS1. EMS stands for European Modular System and refers to the standardized weights and dimensions of loading units as used in the cross-border transport of goods by road in Europe. The EMS1 and EMS2 refer to High Capacity Vehicles (HCVs) that are 25.25m/40-60T and 32-34m/70-76T respectively (varies by country). Both freight vehicle combinations are not permitted everywhere in Europe.

The structure (§2), the result (§3) and the conclusions and recommendations (§4) of the PIT*bw* are explained in more detail in the following paragraphs. In this paper the emphasis is on the side of the public authorities (legal basis, roles and responsibilities and the functional specification of Key Performance Indicators). The V-TRON/HAN paper, which also discusses the PIT*bw*, zooms in on the technical feasibility on the part of the private parties.

2. Opzet van de Pilot Intelligente Toegang Bijzonder Wegtransport

From 2021 to June 2023, the pilot PIT*bw* ran in the Netherlands on behalf of the Ministry of Infrastructure and Water Management. The project management was in the hands of Rijkswaterstaat, the manager of the main road and waterway network in the Netherlands, which is an executive organizational unit of the Ministry of Infrastructure and Water

Management. The aim of the pilot was to determine the feasibility and scalability of Intelligent Access. The three learning objectives of the pilot were:

1. Technical / functional operation: Learning in the field of formulation and compliance with requirements (functional and/or technical) about data, services, systems and reports from private parties to account for performance and risks for public requirements and end goals. Learn how to deal with the privacy rules. Investigate the extent to which Intelligent Access contributes to insight, integration, supervision, enforcement and efficiency of special road transport.
2. Organizational side: Learning about the organization of the collaboration between private parties and public-private. Think of the description and division of roles, tasks, responsibilities, in particular about how the availability and quality of data or information are guaranteed and how opportunities and risks are dealt with.
3. Knowledge exchange and support: Learning about knowledge exchange, communication and support with regard to Intelligent Access for road freight transport in this pilot project and more broadly at domestic and abroad. Such as by explaining how things are going, processing feedback and matching opportunities, making proposals for regulation and standardization, dealing with privacy rules, etc.

Two consortia participated in the pilot led by:

- **Collect + Go** (service provider specialized in the digital consignment note (eCMR) in cooperation with the transport company KLG, the manufacturer of potato products Lamb Weston and the ZF / Transics, provider of Fleet Management Solutions)

- **V-Tron** (specializing in traffic and transportation connectivity solutions, in cooperation with MapTM, mobility service provider, HAN Applied Science University – Automotive Research and the container carrier and terminal owner Bolk Transport)

Both consortia have set up and validated a system for the exchange of data. After performing a Data Protection Impact Analysis (DPIA), they worked on the creation of a dashboard with the visualization of the desired information for the benefit of the public authorities.

The figure 1 below shows the essence of the Dutch Intelligent Access Pilot. The desired data comes from FMS and TMS systems and, and in the case of the first consortium, also from the eCMR. The starting point is that the data remains as close as possible to the source. Service providers receive the source data and process it via predetermined Key Performance Indicators (KPIs) in monthly reports. These monthly reports are sent to the road and enforcement authorities. Neither the road manager nor the enforcement authorities have access to the source data. Enforcement authorities use Intelligent Access for pre-selection and can only issue fines based on their own observations or information.

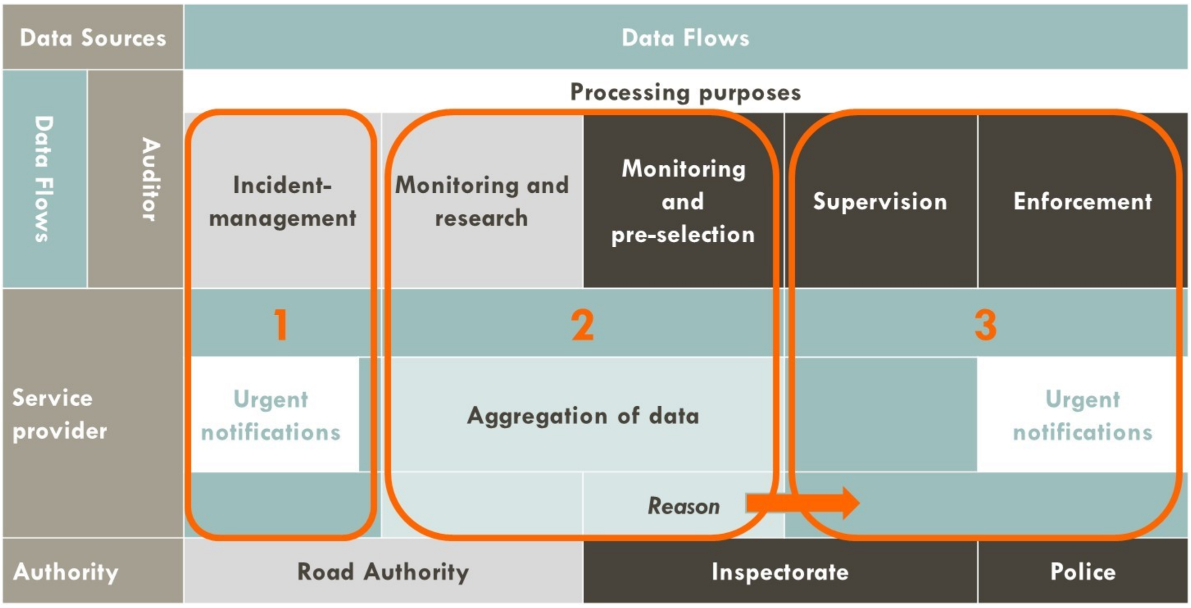

Figure 1 Flowchart of the data flows (divided into source data and aggregated data) between the private and public stakeholders involved

The technical feasibility of the desired data determines the scope of the application of Intelligent Access, but the legal feasibility in the field of privacy determines whether Intelligent Access gets off the ground at all. It is important to include the protection of personal data in the design of the concept from the start. The set-up of the Dutch Intelligent Access pilot differs from the form of Intelligent Access as implemented in Italy for abnormal loads transports. There, the road and enforcement authorities can track abnormal loads transports in real time. The legal basis for this is the notification obligation that carriers of abnormal loads have before they start their trip. (2) The design of the Dutch pilot is more comparable to RIM (Road Infrastructure Management) in Australia. There, RIM is a further development of the Intelligent Access concept. Australia is the birthplace of the Intelligent Access concept, which initially had to serve to organize trust between the road manager and transport operator in transport with HCVs.

About RIM:

“Where data are available for heavy vehicle road use and loading, conventional methods of collecting data typically only provide ‘point-based’ data samples (i.e. road-based systems which count vehicle passes, axle groups and or loads). Compared with other economic utilities (such as electricity, water or communications infrastructure), there is a comparative shortfall in data collected from road assets to inform the level of asset utilization and consumption.

Shortfalls in ex post data can lead to assumptions that over-compensate for infrastructure and safety risks that cannot be adequately quantified. Over time, this can lead to sub-optimal outcomes for heavy vehicle access policies, and limit the potential for innovative, higher productivity vehicles to be introduced on the road network.” (1)

The risks of unauthorized use of personal data have been mitigated in the RIM by the position of TCA (Transport Certification Australia) as third trusted party.

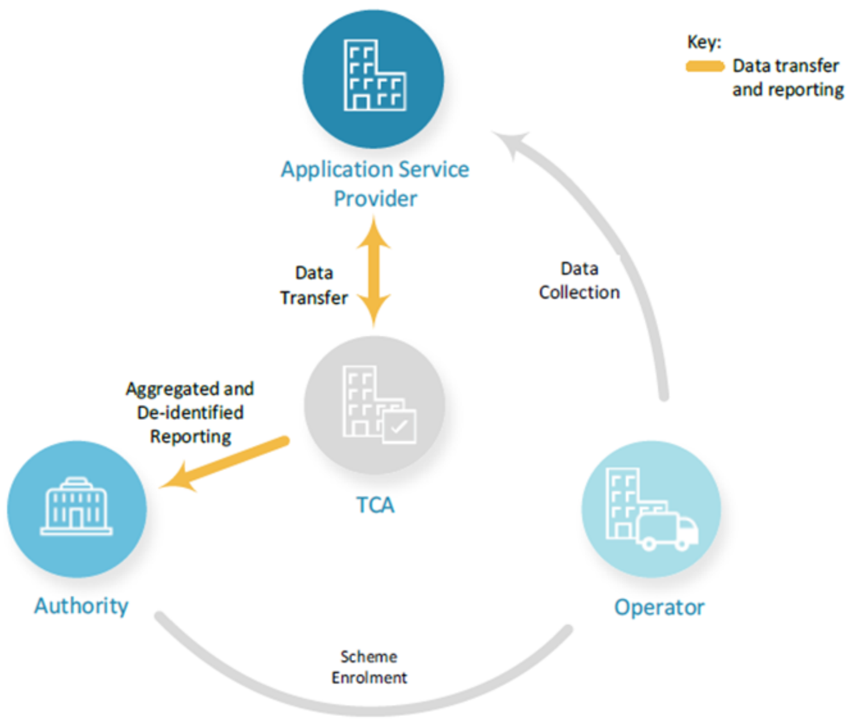

Figure 2 Flowchart of the data flows between the involved private and public stakeholders as applied in Australia.

The real-time source data goes via certified service providers to TCA, which, as an independent party between the stakeholders, aggregates and anonymizes the data and makes it available to the road authorities via reports. (3) An intermediary such as TCA is something for the future for the scale of the Dutch pilot. However, the auditor Mazars has been appointed to monitor and analyze the protection of privacy and data reliability within the design of PIT*bw*.

<u>Urgent notifications</u>
An exception to the protection of access to the source data for monitoring, supervision and enforcement by public authorities are urgent reports. Two data streams can be distinguished within the urgent notifications. The first is the urgent notification of excessive violations of the legal rules. Within the pilot, limit values have been set for two types of violations: exceeding the maximum permitted vehicle weights by 25% and driving longer than 5 minutes on a route that has not been released for the relevant transport. In these cases there is a safety risk of such an order that immediate intervention is necessary. The enforcement authorities must still stop the transport themselves in order to establish the violation on the spot on the basis of their own observations. Only the enforcement authorities that already have more extensive powers within the privacy legislation are given access to the data of these urgent notifications. The duration of the pilot was too short and the familiarity with the Intelligent Access concept was still too limited, that an access points could be set up at the enforcement authorities where urgent notifications can be received and followed up.

A second stream of urgent notifications concerns source data that becomes available in the event of an incident or accident involving special road transport. For adequate incident management, the availability of data on relevant deviations from regular transports and on the cargo would be welcome. In contrast to the legal powers of enforcement authorities, road authorities lack a direct legal power to receive this source data. The pilot has shown that data can be generated in a technical design, but a legal basis has not yet been found.

3. The challenge of arriving at the right KPIs

Although the consortia involved had estimated in advance that the list of desired data could be retrieved from the systems relatively easily, this turned out to be less the case when they start working. For example, it appears to be difficult to make the total weight of a vehicle combination and the axle loads of the trailer(s) available, because there are different systems on the trailers and the tractor that do not communicate (properly) with each other. During the execution of the DPIA, data that was considered too privacy-sensitive, such as the qualifications of the driver to check whether he has the correct papers, was also lost. The initial long list of desired data was reduced to a shortlist of 5 data types: commodity types, route, weights, safety events and traffic and emissions performance.

After both consortia were able to produce data, it soon became clear that further iteration was needed for the 5 data types. Collecting the data led to large untargeted flows of data. More clarification was needed as to which data should be presented in the monthly reports and how, so that the intended goals would be achieved.

How difficult it is to convert data into KPIs can hardly be underestimated. Within PIT*bw*, this was partly due to the following aspects:

- The data that is generated can be visualized and combined in countless ways. Many variables are possible just for the scale level to be chosen (local, regional, corridor, national, etc.) and the time unit (hour, day, month, season, etc.). For example, wanting to be able to determine the general scope of a problem precludes the KPI from being applicable for interpreting specific situations at a local level. It requires government parties to define very precisely what goal or application they are pursuing and what data and in what form is required for this.
- In the case of the PIT*bw*, several government parties are involved and sometimes different organizational units within these parties. Each party or organizational unit has its own goals and interests. Even a small difference in the formulation or a difference in scale level can mean that the KPI is useful for one party and not for the other party.
- In order to benefit from the system of Intelligent Access for self-interest, it is necessary for all parties involved to look beyond the boundaries of their own organization. Apart from the fact that employees (often specialists) must have the competence for this, they must also be explicitly instructed to do so - by management.
- Goals and interests of government parties shift over time. The detailed KPIs in the monthly reports are therefore not static, but must be revised from time to time.

Three examples are given below of the search for an interpretation of the KPIs in such a way that it produces information on the basis of which action can be taken in order to achieve the intended goal.

<u>Commodity types</u>
With an increase in scale in road transport (EMS1 and EMS2), various stakeholders involved in freight transport are fearful of a reverse modal shift. The reasoning is: more can be transported in fewer journeys, which makes road freight transport cheaper and therefore more attractive. If there were indeed a reverse modal shift, the measure, intended to reduce traffic

volume and CO², would have the opposite effect. The question was whether Intelligent Access can be used to check whether transport with an HCV replaces regular freight transport by road or whether there is a reverse modal shift from rail or inland waterways.

To arrive at an indicator for this, reference was made to studies into the impact of the EMS1 on the modal split that were carried out in 2008 (0-measurement) (6) and 2011 (1-measurement) (7). Based on the methodology used for this research, three assumptions have been made:

- The risk of a reverse modal shift occurs mainly with containers and bulk goods. The national Central Bureau of Statistics (CBS) also uses the appearance of road freight transport for modal shift analyses.
- A possible reverse modal shift should be visible in a decrease in transported volumes at terminals and ports.
- Journeys with containers or bulk goods to and from a multimodal terminal are regarded as pre- and post-transport.

KPI Managing the risk of a reverse modal shift for EMS1 and EMS2

1.1 Per month percentage of journeys on the total number of journeys in which containers or bulk goods were transported compared to the number of journeys with other forms.
1.2 Of the total number of journeys used for the transport of containers and bulk,
    a. the number of journeys with Origin and Destination a port or an inland terminal
    b. the number of journeys with Origin or Destination a port or an inland terminal
    c. the number of journeys where both the Origin and the Destination were not a port or an inland terminal

Use the following list to locate the inland terminals: https://rotterdamtransport.com/nl/chapter/4b-inland-terminals-netherlands/. If a picture of the whole of the Netherlands is not feasible, make a relevant geographical section.

Figure 3 KPI developed in the PITbw for types of commodities for the monthly reports

If the developed KPI already leads to an outcome on the basis of which it can be unequivocally established that there is a reverse modal shift, there turned out to be a major bottleneck in establishing this KPI at all. Transport companies are free in how they define types of commodities. There is neither a national nor an international general standard for the classification of types of commodities. This means that types of commodities cannot be unequivocally assigned to a category of container or bulk goods. ADR goods (dangerous goods) are fully standardized within a UN coding system. That makes ADR transport an interesting use case for Intelligent Access.

<u>Routes</u>
Special road transport is permitted for safety reasons on a limited part of the road network. The Basic Network applies to the transport of dangerous goods, the EMS1-network applies to the EMS1 and the route per transport for abnormal loads is geared to the extra risks due to deviating sizes and weights. The EMS1 is central to this pilot. For safety reasons and to strive for a level playing field, it is important to check whether EMS1 truck combinations adhere to the prescribed routes. Frequent deviations from the route at a certain location due to multiple transports can also indicate a need or necessity to change the EMS1-network, or to intensify supervision and enforcement at that location. The route indicator has been developed within the pilot for these goals.

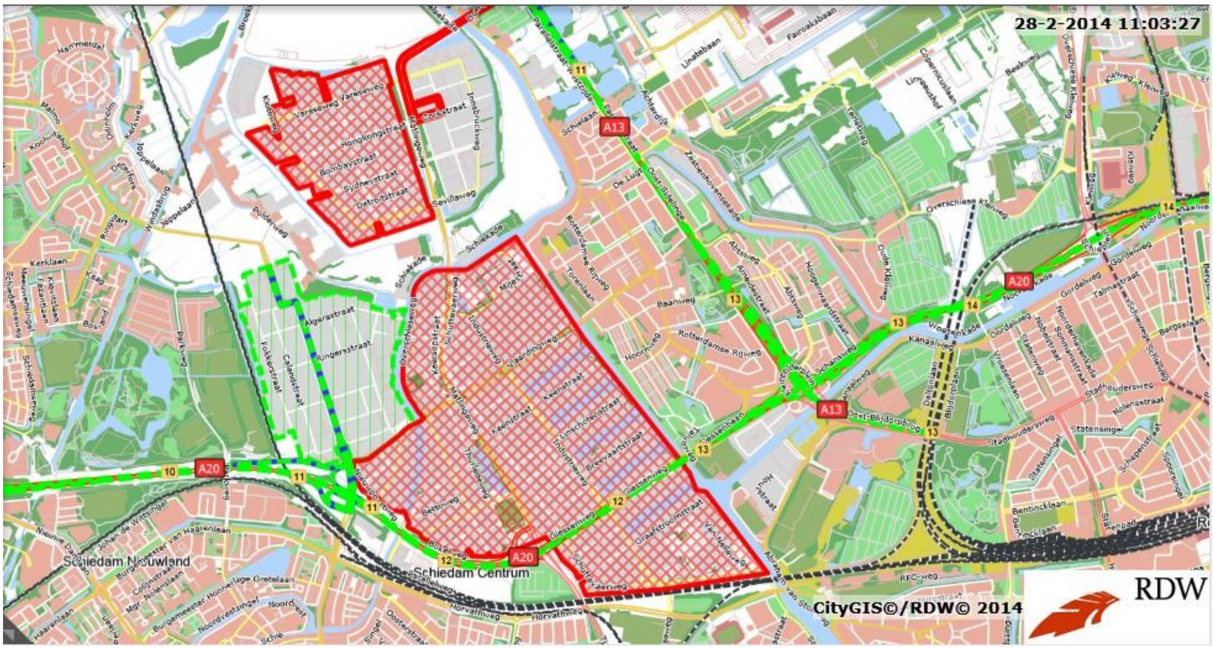

Figure 4 Screenshot DWO map on which green indicates the routes that belong to the EMS1 network and red indicates the routes and areas that are not accessible for EMS1 truck combinations. (4)

The RDW (national vehicle authority) has developed a viewer, the Digital Road Map Exemptions (DWO map). With the help of the viewer, a transport company can read which roads are available for the planned special transport. The DWO map is based on an underlying database in which road authorities keep the road file under their management, including roadworks, up to date.

KPI Monitoring compliance with the restrictions in permitted routes for EMS1 truck combinations
2.1 Per month, percentage of journeys on the total number of journeys that deviated from the planned route (regardless of the reason).

2.2 Make a geographical section of the area you want to provide insight into. Within this, select the routes on the basis of the DWO map where EMS1-vehicles may and may not be driven. Choose a geographical cut-out where at least two roads / areas are colored red (where you are not allowed to drive).

a. Indicate per month the percentage of the number of journeys within the geographical area that deviated from the permitted EMS1 routes (probably 0)

b. Show or simulate how real-time insight can be provided if an EMS1 deviates from the permitted route

c. Show or simulate how an urgent notification works if you are on a route that is not permitted for EMS1-vehicles for longer than 5 minutes.

Figure 5 KPI developed in the PIT*bw* for routes for the monthly reports

Within the duration of the pilot, the RDW was unable to make the DWO file digitally available. If this data file were available digitally, it could be processed in TMS systems and deviations from the route could be signaled automatically. The consequence of the unavailability of the DWO file is that a situation had to be simulated within the pilot.

Safety events

Every day, 26 heavy duty vehicles come to a stop on or along the side of motorways in the Netherlands as a result of an accident, breakdown or for another reason. (9) Stationary heavy duty vehicles on the emergency lane quickly pose a risk to road safety. If there are traffic signals, the right lane is crossed off and there is temporarily less road capacity available. A stationary heavy duty vehicle is only registered when a road inspector or recovery vehicle arrives on site. The number of 26 heavy duty vehicles therefore only concerns the number of registered incidents. In the figure below, a KPI has been worked out in 4.1 to gain a better insight into the scope of the problem of stationary heavy duty vehicles, and in this case specifically about special road transport. In 4.2 an attempt was made to establish a relationship with the cause of the stoppage. Insight into the causes of the stoppage can contribute to the police investigation in the event of an accident or provide information about the extent to which tires play a role in the stopping of heavy duty vehicles.

KPI Generate an overall picture of incidents involving special road transport (breakdowns and accidents) and insight into road safety risks in relation to road design

4.1 Per month the number of the total number of heavy duty vehicles that were stationary for more than 15 minutes (speed 0 km/h) on the motorway

4.2 Map image per month with the locations where there was a standstill for more than 15 minutes (speed 0 km/h) on the motorway.

a. Of that: the number of vehicles that stood still for more than 15 minutes on the motorway where the tire pressure was much too low (choose a limit value in such a way that it must be a blowout or flat tire)
b. Of that: the number of vehicles for which a warning from the ADAS system preceded the standstill
c. Of that: the number of vehicles in which the airbags are deployed

4.3 Top 10 per month per type of alert of the locations at which an alert has been triggered. Is there anything to say about the cause?

Figure 6 KPI developed in the PIT*bw* for safety events for the monthly reports

If a certain type of alert is triggered more often at a certain location, it can be investigated whether there is a relationship with the road design at that location. For example, if multiple trucks often brake hard in a bend in a driveway. With the help of this information, it can be decided to reduce the recommended speed in that corner.

In 4.3 a KPI has been worked out in which a relationship is established between location, type of alert and frequency.

Both consortia have demonstrated that linking safety events, time and location is possible. However, the accuracy of the location determination is insufficient to be able to make a statement about the exact position on the roadway in the case of stationary heavy duty vehicles. It cannot be said with certainty whether this concerns the right lane or the emergency lane.

Image 7 Experience Day on November 29, 2022 on the Maasvlakte of the Port of Rotterdam where a demonstration of the EMS2 took place and the Minister of Infrastructure and Water Management was invited to join the ride.

A rough indication of the location is sufficient when identifying location-related safety risks due to the traffic situation or road design. In 2024, a small-scale pilot will probably take place in The Netherlands on public roads with the EMS2. In order to gain a better insight into the possible safety risks within the context of Dutch road design and the Dutch traffic situation, the EMS2 pilot is a nice testing ground for further developing Intelligent Access for safety events. Using the data from the vehicle, supplemented with camera images that observe any reactions from other traffic, analyzes can be made of, for example, locations where a relatively large number of braking actions take place.

4. Conclusions and Recommendations for scaling up

Many lessons have been learned and questions answered for all learning objectives, especially in relation to the limited time and resources for the project organization. A number of lessons learned have already been discussed in this paper. It goes too far to list all the lessons learned here. It can be said, however, that a foundation has been laid for further upscaling. A first experience has been gained with the Intelligent Access concept and parts of the concept that need to be solved have been exposed. The actively involved parties see promising follow-up actions. It is encouraging that the European Commission, in its proposal for the revision of the Weights and Dimensions Directive EC/96/53 (July 2023), explicitly mentions the concept of Intelligent Access as part of a package of measures to achieve greening and harmonization in the cross-border transport goods by road (10). In addition, the European organization for Directors of National Road Authorities (CEDR) will issue a Research Call at the end of 2023 with the aim of making recommendations for the implementation of a harmonized system of Intelligent Access in the cross-border transport of goods in Europe.

A number of technical conditions turned out to be unsolvable within this pilot project, but are considered feasible with further research, provided there is sufficient support and perspective for scaling up. The transport of dangerous goods seems to be the most promising for scaling up, because the necessary basic data about cargo and routes are available and the usefulness and necessity for better monitoring and rapid follow-up in urgent unsafe situations are evident.

Improvements can also be achieved for the current EMS1 and possible special transports with annual exemptions, through a mandatory specification by companies of the type of load and weights in eCMR and rFMS and automated data sharing about applicable route/road restrictions by road authorities and/or RDW. There are strong opportunities for generic monitoring with the already automated data dump that carriers must make available to national Central Bureau of Statistics (CBS) a number of times a year. There are also matching opportunities for urgent notifications. Finally, there are opportunities for controlled admission of practical tests for innovations, such as the EMS2.

The companies and governmental organizations involved see Intelligent Access as a logical follow-up to the ongoing digitization of road freight transport and the increasing need for data- and risk-driven management of infrastructure, traffic and enforcement. A condition is that there is clarity about: the legal basis; the distribution of roles and responsibilities in the data chain; data standards and guarantees for confidence in the quality and security of data/info (e.g. with system authority and actual checks). The human effort may also not increase and the concept may not lead to direct enforcement. Finally, there is only fair competition if the evading transporters are caught, for example with smart camera surveillance.

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