THE PROMISING EVOLUTION OF INTELLIGENT ACCESS: FROM AUSTRALIA TO EUROPE

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Abstract

This paper considers the diversity of applications for Intelligent Access, the underlying capability of intelligent regulatory systems as well as the economic and other benefits such applications bring to road network management and the transport task. The examples illustrate the continuing evolution of approaches to Intelligent Access. Drawing on the Australian and European experience the paper considers what lessons might be applied to further progress the implementation of regulatory arrangements to drive greater environmental and productivity efficiencies in the transport sector using Intelligent Access. An important feature of the analysis is identifying the main parties involved in progressing the development and implementation of Intelligent Access systems. Understanding the interests of key actors influences the direction and design of future policy and regulatory reform.

Keywords: Vehicle-infrastructure communications; Efficient transport; Carbon emission reduction; Enforcement strategies; Infrastructure and space planning

1. Introduction

Across Australia and Europe work is being done on how to make better use of digital concepts, facilitating innovations in vehicle configurations and new smart loading units that increase the ease of and use of multi-modal transport across national and international logistics chains, which in turn lifts freight efficiency and reduces transport emissions. An important focus of this work is maximising the efficient use of infrastructure to help ensure *"the right vehicle with the right cargo is on the right road at the right time"*. Achieving this through the digital monitoring of vehicle movements is a relatively straight forward task, however the optimal matching of (new) vehicle and loading units with road infrastructure requires the definition of new standards and the intelligent management of access to infrastructure within the context of a multi modal transport network. The policy and regulatory systems required to achieve efficient and effective controls for Intelligent Access remain institutionally and politically challenging, yet despite this, evidence in different regions demonstrates that the concept continues to evolve and respond to different conditions and constraints imposed by the local policy context.

This paper analyses the Australian experience and various programs and projects across Europe that involve the development and operation of Intelligent Access arrangements. Here we define Intelligent Access as the use of in-vehicle technology including the Global Navigation Satellite System (GNSS), telecommunications and other digital technologies to maximise the efficiency of the road network safely and sustainably by best matching the maximum safe capacity of road infrastructure to heavy-duty vehicles. Intelligent Access represents a natural evolution from static 'historic' access decision-making to more dynamic, evidence-based access decisions using digital solutions to match vehicle configuration, load and infrastructure capacity more effectively. Importantly, this supports improved risk management by simplifying the detection of noncompliance, particularly those risks associated with nonstandard heavy-duty vehicles. Intelligent Access also helps shift the burden and the use of digital data to demonstrate compliance back to transport operators.

2. Intelligent Access in Australia

The Australian Intelligent Access Program (IAP) has been well documented and presented at previous HVTT events (Koniditsiotis and Sjögren 2012, Wandel, Sternberg and Hill 2014, Wandel and Asp 2018, Walker 2018, 2016) and hence the following provides a brief overview of the program's purpose and operational framework. The IAP involves the electronic monitoring of vehicle movements 24/7 and this may include compliance to speed, time of travel, vehicle weight and route travelled (Transport Certification Australia 2016). The program has been designed to assist road agencies in responding to the diversity of challenges that emerge from growing freight demand, increasing road infrastructure constraints and the fact that innovative vehicles that respond to demand growth are likely to be larger, heavier and pose greater safety or infrastructure protection risks. The IAP helps supplement traditional on road enforcement methods that are generally poorly placed to manage these additional risks. The scheme is voluntary and provides an avenue for innovation allowing for productivity and efficiency gains beyond standard regulatory limits that control road access and use (Transport Certification Australia 2016). The IAP transforms the way road access can be managed by making greater use of telematics and data.

In Australia, the IAP is underpinned by a national legislative framework that defines the roles and responsibilities for transport operators, regulators, and technology providers. It operates under national functional and technical standards and involves a national certifier and auditor established by Australia's road authorities: Transport Certification Australia (TCA). TCA sustains the participation of parties. Central to the program are road authorities. These agencies determine access rights and limits for heavy vehicles. Operators may also apply to have innovative and nonconventional vehicles (and loads) approved by road authorities who assesses and determine appropriate routes, speed and other restrictions that may be applied. Specific access information and operator requirements are applied by technology providers to monitor vehicles through the IAP. The technical operation of the program relies on telematics providers who provide data, tracking and telematics services to a standard certified by TCA. Certified firms are permitted to offer IAP monitoring services to truck and transport operators. Road transport operators apply to road authorities for specific conditions and concessions on regulatory limits, engage with telematics providers to purchase IAP monitoring services and run services within the specified conditions of their IAP approvals. As the diagram below illustrates, TCA plays a coordinating role. Facilitating the participation of key actors to sustain the Intelligent Access system and the agency's certification function is critical for ensuring an open technology market, that serves the needs of the program (government, industry and end-users).

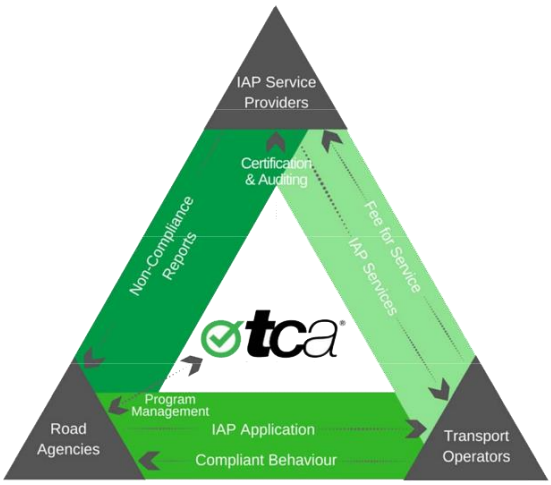

Figure 1 – Roles and tasks within the IAP

The technical operating standards of the IAP have been recognised by the International Standards Organization (ISO), under ISO 15638 – Framework for Collaborative Telematics Applications for Regulated Commercial Freight Vehicles and this further supports the development of an open and competitive market in the intelligent monitoring of road vehicles.

The IAP formally commenced operating across Australia 13 years ago, and was preceded by numerous pilots and trials dating back to 1999. The number of vehicles enrolled in the scheme has progressively increased recently from around 4,000 in 2017 to 7,500 in mid-2021. The various vehicle types and applications monitored under the IAP include oversized passenger

buses, standard heavy vehicles which carry heavier loads, heavy vehicles which meet performance-based standards (and may exceed length, weight or width regulations), and unusual combination freight vehicles such as A-Doubles and triple-trailer combinations. An example of the IAP being used to monitor vehicle route compliance involves a number of transport operators commissioning new AB-triple and BA-triple combinations and realising payload gains in excess of 35 per cent. Some firms hauling containers are using super B-double configurations, which allow them to move two 40-foot or two 20-foot containers per trip – resulting in 100 and 33 per cent productivity increases, respectively.

In May 2018 Australian Transport Ministers requested that TCA look at ways to improve Intelligent Access to further expand its use across a wider range of vehicle types and uses. The outcomes of this work, which were endorsed by Australian Transport Ministers in November 2018, resulted in new variants of Intelligent Access being introduced – known as Road Infrastructure Management (RIM) and the Telematics Monitoring Application (TMA). These new variants of Intelligent Access are now widely applied by road authorities as access conditions across a wider range of vehicle types. They enable TCA to certify telematics systems already in use by transport operators (for example, fleet management, driver safety and vehicle efficiency) and smartphone technologies for Intelligent Access purposes. These innovations in IAP development are discussed in more detail in the HVTT paper to be presented by Hill and Greenow titled *Applying a Risk-Based Approach to Road Access Using Telematics.*

2.1 Projected and observed outcomes from Intelligent Access in Australia

The operational data demonstrates that the Australian Intelligent Access program is dominated by innovative vehicles progressing productivity and safety improvements. The anticipated benefits were originally assessed in 2005 through a formal regulatory impact statement (RIS) (NTC 2005). This work noted safety gains, reductions in crash costs and fewer kilometres travelled from more efficient vehicles resulting in a reduction in emission impacts. Productivity gains were seen to contribute the largest proportion of benefits and with an estimated take-up of 8,400 vehicles this was calculated at approximately AUS$264 million over seven years, with a projected benefit cost ratio of 5.4. With the current level of vehicle enrolment in IAP, these economic benefits are now being realised in Australia.

Intelligent Access is not a standalone reform and is integral to maximising the benefits from other associated trucking and transport reforms such as Performance Based Standards (PBS), increasing vehicle mass limits and expanding network access for restricted vehicles such as B-doubles. In 2011 an assessment was made of the value of road transport reform in Australia. This RIS estimated AUS$12 billion of value over 20 years. This included AUS$9 billion in productivity value attributed to improved heavy vehicle access and of this AUS$1.2 billion was directly attributable to the Intelligent Access Program (Productivity Commission 2020) (see table below).

Table 1 – Expected benefit of the IAP over 20 years (Based on, Productivity Commission 2020, *National Transport Regulatory Reform, Report no. 94*, Canberra. P.179).

Reform	*Expected Benefit (AU$ billion) over 20 years*
Access for restricted access vehicles	7.0
Access for Higher Mass Limits vehicles	1.8
Intelligent Access Program	1.2
Fatigue – Chain of Responsibility	1.0
Other	1.4
Total	**12.4**

A key lesson from the Australian experience is that Intelligent Access is an important enabler for other, associated transport reforms. Through the use of data generated from telematics technology and data, it helps maximise the economic gains while managing risks drawing on sophisticated systems of monitoring and compliance. Intelligent Access is recognised as an important compliance reform that assists with balancing productivity gains with infrastructure protection, safety, and environmental outcomes.

2.2 Intelligent Access: A network of actors

The success of the IAP is dependent on a collaborative framework of stakeholder engagement. The freight sector, transport operators and road agencies work to identify opportunities where benefits outweigh costs. Here there exists a shared interest in transport innovation, efficiency and safety. Further collaborative effort is also required between road agencies, regulators and the technology sector to align their interests in sustaining a competitive market for the deployment of innovative technology solutions as well as the identification of future opportunities for Intelligent Access. Creating and sustaining this policy environment requires a level of facilitation and leadership by significant actors such as Transport Certification Australia (TCA). The role of a facilitator for Intelligent Access was considered by Australian policy makers in the early 2000's, leading to the establishment of TCA (by mutual agreement of all Australia road agencies) in 2005. Alternative delivery options were considered, but it was recognised that a body with a combination of facilitation and operational functions had advantages over other models (National Transport Commission 2005)[1]. A 'no oversight' model was initially considered, but was discarded because it had the potential to constrain the development of an IAP 'network' with its attendant potential for economies of scope and scale. The potential development for ad hoc applications and rules would also undermine trust and collaboration amongst stakeholder and weaken the reliability of Intelligent Access arrangements.

Recent work to be presented at HVTT16 examines the relationships and network of connections amongst actors within the IAP policy sector (Moulis and Walker 2021). This analysis provides insight into what might help sustain and extend Intelligent Access arrangements both within Australia and into other international locations noting that it is the

legislative and policy framework that is essential to the establishment and maintenance of the program. For example, Australia and Sweden exchanged information around implementing Intelligent Access in Sweden. TCA played a critical role in these discussions. The paper finds that where road authorities do not take on the full suite of policy and technical responsibilities that are central to Intelligent Access, then a coordinating actor (or agency) is needed to bring contributing parties together and provide rigorous structure (contractual and certified) to the organisation and design of their relationships.

This has been further evidenced by the role TCA played in introducing new variants of Intelligent Access following the request of Australian Transport Ministers back in 2018. The rapid development and implementation of new variants of Intelligent Access arrangements could not have occurred without the coordination and facilitation role performed by TCA across road authorities, regulators, technology providers and transport operators.

3. Intelligent Access: the European Experience

The Australian experience with Intelligent Access has long attracted the attention of a small number of experts in Europe dealing with high-capacity vehicles. For example, Sweden and the Netherlands currently have plans to set up pilots that draw on relevant aspects of the Australian experience. Italy, Estonia and Spain are also experimenting with Intelligent Access. These examples will be explored in more detailed shortly.

In these countries the focus of Intelligent Access is the need to be able to gear mobility to the capacity of road infrastructure faster, more precisely and with more flexibly. It is the logical next step in making traffic and asset management, traffic enforcement and logistics planning more data-driven. This shift is necessary to manage ageing infrastructure, congestion, impacts of climate change and to achieve greater transport efficiency, reduce CO^2 emissions and improve the quality of life and air quality in urban areas.

The idea of Intelligent Vehicle Access, especially in urban areas, is now widely supported by the European Parliament through recent preparatory action known as the UVAR (Urban Vehicle Access Regulation) pilot. Even though the UVAR framework is not primarily intended for heavy goods vehicles, there are some fundamental similarities with the Australian Intelligent Access framework which involves better matching of the vehicle with infrastructure capacity. The emphasis of this project is to establish a traffic management system that regulates access to specific urban areas and locations. Access is conditioned by vehicle type, age, or emission category for a specific time of the day or day in the week, as practiced in similar EU funded research projects on transport such as NORDICWAY [1] or ReVeAL [2]. These innovative and highly responsive systems regulate traffic access providing improvements in the quality of the urban living environment (emissions, noise, vibration, and congestion).

The increasing focus on Intelligent Access is also a result of the efforts of various multilateral partnerships. In this paper, three European initiatives are specifically highlighted. These are: the FALCON project (part of the CEDR Call Multimodality), the EC Horizon 2020 research project AEROFLEX, and more recently the CEDR Road Freight Transport Working Group.

CEDR is the umbrella organisation of all national road authorities in Europe. Various national initiatives and the mentioned multilateral partnerships are explained in more detail below.

3.1 National initiatives

Estonia

Initially, the Intelligent Access system, titled VELUB, was intended for timber transport with a maximum weight of 52T in winter. Due to climate change there are rapid temperature changes that can make corridors impassable overnight, as the subsurface of the pavements thawed to less than 0.5m deep. The time window within which it is allowed to drive heavy trucks has become smaller and subject to constant change. For this reason, digital vertical temperature sensors (max. 2.5m deep) were installed across Estonia. At the same time, commonly used road corridors were analysed and mapped (Smart Road) with a daily update at 4 p.m. 52T Timber Trucks can be exempted if they are connected to the VELUB system.

Estonia is currently investigating the possibilities of making this system applicable for higher vehicle weights of 60T for all types of loads and for a national real-time monitoring system for waste management. Estonia is also investigating whether a National Point of Access can be set up: one single platform for all areas of application.

Italy

Through an integrated telematics monitoring system Ulisse (Unified Logistic Infrastructure for Safety and Security) allows for the tracking of vehicles carrying dangerous goods and waste in the Campania Region. The satellite tracking of vehicles on the road and their labelling (which makes it possible to trace all the information relating to the vehicle) helps to mitigate the impacts of any transport accidents and to manage them consciously, knowing the position of the vehicle at the time of the accident and the type of goods transported. The information recorded by the system facilitates an organised and rational management of flows through the planning of itineraries or the "booking" of spaces at the nodes (such as ports and inland freight hubs). In this way it is possible to plan the activities of loading/unloading and boarding of vehicles and goods. This results in a significant reduction in operating times and costs and speeds up the bureaucratic activities and the movement of goods in the ports.

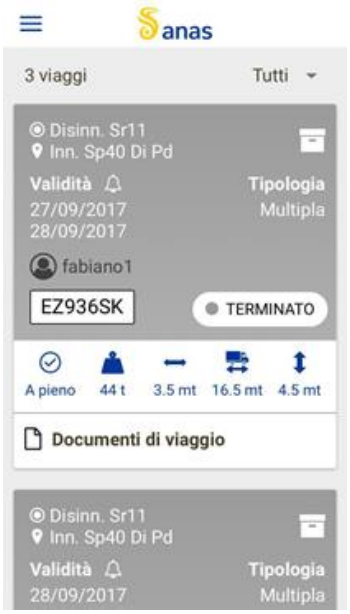

Figure 3 – Teweb APP: Entering journey data in the mobile phone app such as point of departure and destination, type of exemption, dimensions, date of the journey, etc.

The Teweb APP is similar to Ulisse but is designed to monitor abnormal loads.

Sweden

In Sweden an Intelligent Access System has been developed but has not yet been implemented. It uses already installed fleet management systems. The on-board computer registers GPS position, axel loads and the ID of the prime mover and all vehicle modules. This data is saved in the cloud or directly reported to a telematics service provider.

Data must be stored for one year and available for inspections by the police in a similar way to how tacho-graph data is checked. Data is also available for the driver, operator, transport buyer and road owner. FMS standard interfaces developed by ACEA are employed. As the telematics systems are already in place in all new vehicles the extra cost is less than € 20 per month. Older vehicles can be retrofitted with a “dong”. Sweden has also implemented a system for road owners where anonymised data is kept for analysis and statistical purposes. This data can be used for more efficient planning of the maintenance of roads and bridges.

The Netherlands

A pilot on Intelligent Access will commence in the Netherlands from September 2021. This involves two consortia providing monthly reports to road authorities that will provide insights into the performance of heavy-duty vehicles. The pilot will run for nine months, ending in May 2022. The aim of this pilot is to learn by doing and so not all aspects of engagement and operation have been clarified. This pilot is part of a larger project investigating the feasibility and scalability of Intelligent Access.

This pilot is driven by the need to better understand the use of the road network by heavy-duty vehicles. Aging infrastructure and budget shortages mean it is increasingly important to exercise effective control over the freight load on the road network. This can be done by

better spreading heavy commercial vehicles over the network according to route and time. The management of network assets can also be smarter if there is more data (intelligence) on the actual use of the road by heavy vehicles and freight traffic. Another important motivation for conducting an Intelligent Access pilot is that there is currently no insight into how load exemptions are used. After granting an annual exemption for abnormal loads, it is unknown whether the transport operator adheres to the prescribed routes and the agreed maximum weight requirements. The pilot will help track the routes of these approved abnormal loads.

The pilot consortia consist of an Application Service Provider, one or more transport companies and a firm that can analyse and aggregate the data into monthly reports. Public sector agencies include vehicle inspections, police, the vehicle registration authority and the national road authority. In time, efforts will be made to create a separate authority that can act as a trusted third party (similar to TCA in the Australian Intelligent Access system). In this pilot it is especially important to show policymakers and the market how Intelligent Access can work and what possibilities it offers.

3.2 Initiatives from multilateral partnerships

FALCON

The FALCON project ("Freight and Logistics in a Multimodal Context") was a collaborative effort funded by the Conference of European Directors of Roads (CEDR). A primary goal of the project was to define a potential Performance-Based Standards (PBS) for cross-border road freight transport in Europe. The results can be found here [3]. One of the ways to enable controlled admission of High Capacity Vehicles is the application of Intelligent Access.

AEROFLEX

The AEROFLEX project [4] has built its philosophy on the vision of the physical internet, applied results from several research projects and re-thought the transport of freight and goods whilst promoting multi-modal transport at national and global levels. In doing so it has maximised efficiency [5] and increased global environmental benefits, reducing emissions and connecting the last mile of distribution. In the context of road freight transport, legislation is one of the main identified obstacles for the implementation and deployment of novel road vehicle technologies and concepts developed in the AEROFLEX project (see Figure 4.).

Figure 4 – Example of Aerodynamic and Flexible Vehicle combinations developed in the AEROFLEX project which improve the efficiency in road freight transport up to 33%.

On this basis, over the past two years bilateral interviews, workshops and mini symposia have resulted in a vast gathering of expertise and knowledge regarding the IAP.

As a part of the AEROFLEX project extensive research was performed. More than 30 interviews with actors affiliated with an identified stakeholder cluster involved in Intelligent Access (i.e. users, providers, facilitators, policymakers, planners and owners) were carried out. The goal of the interviews was to understand the needs of each cluster, to identify what the barriers and success factors are for the implementation of the IAP, and/or what can be used as an opportunity to deploy the IAP in Europe.

CEDR Working Group Road Freight Transport

CEDR is the umbrella organisation of all national road authorities in Europe. The idea behind the organisation is that resources can be saved at the national level by investing in research and development in collaboration. Research and development is necessary for road authorities to be able to continue to offer high quality innovations and to be prepared for future developments. One of the areas that is developing strongly is freight transport by road. In addition to accommodating the expected increase, there are other issues such as meeting climate objectives, combating overloading, scaling up, outdated infrastructure, automation and digitisation. This scenario brings challenges as well as opportunities. One option to address these issues is Intelligent Access. In 2021, the permanent CEDR Road Freight Transport Working Group will focus on mapping the opportunities and barriers for the implementation of Intelligent Access. This group will work together with the World Road Organization PIARC, the worldwide equivalent of CEDR. Results are expected at the end of 2021.

4. Conclusions and recommendations

Based on the knowledge and experiences of Australia and the research of Aeroflex, a number of recommendations can be made for the implementation or further development of Intelligent Access. These recommendations are organised according to the following topics: 1. Application areas; 2. Policy support; 3. Harmonization and standardization; 4. Stakeholders; and 5. Privacy and security.

1. Application areas

   In Europe:

   - The IAP may benefit from already existing UVAR (Urban Vehicle Access Regulations) pilots, making use of specific vehicles having access to infrastructure whilst using certain performance criteria.
   - IAP can be a great enabler to considerably reduce CO2 footprint from road freight transport and thus should be linked to the action plan of the EU Green Deal (which endeavours to reduce CO2 emissions of road transport by 30% by 2030).

- IAP can speed-up implementation of new technology such as electric/hybrid vehicles or teleoperation which may impose specific requirements on the infrastructure.

2. Policy support

In Australia:

- Create a marketplace and generate 'demand' for Intelligent Access (telematics services) by having road agencies assign specific compliance conditions.
- Continual evolution of policy around Intelligent Access – the requirements of decision makers continue to change, but the core principles of Intelligent Access remain largely consistent.

In Europe:

- Policymakers need to act as front runners who should support small local (national based) pilots.
- From the outset, Intelligent Access should be seen primarily as a service-providing system and not purely as an enforcement tool.
- The awareness of IAP on a pan-European level needs to be created through webinars, knowledge and technological platforms and European research and innovation projects.

3. Harmonisation and standardisation

In Australia:

- Use of embedded technologies within contemporary vehicles which can be used for Intelligent Access arrangements.

In Europe:

- Harmonisation of policies and infrastructure design codes among all 27 EU jurisdictions represents an enormous challenge for global implementation. Hence the preferred approach in Europe should be bottom-up.
- The local, national-based pilot projects dedicated to rolling out/testing various concepts of the IAP need to be scalable for further expansion.

4. Stakeholders

In Australia:

- Consideration of where benefits and costs are attributed to (create a positive value proposition for road agencies, regulators, transport operators, service providers).
- Providing certainty and consistency to the telematics sector may be achieved through standardising performance requirements for technology, data standards and business rules providing clarity to telematics providers and minimising business risks.

In Europe:

- The role of the facilitator is seen as crucial for gaining the trust of all involved stakeholders. Therefore, it is important that the facilitator will be independent, yet with a solid mandate which is supported by policymakers and government.

- Integrity in monitoring and exchanging the data is essential for the trust of logistic operators in the User cluster. Moreover, the data accessibility must be managed well (perhaps even partially anonymised) without compromising the security or competitiveness of all involved stakeholders.
- Establish a solid governance structure for the national-based facilitators as they will be primarily in charge of running the IAP schemes.
- The IAP must be cost effective otherwise a risk exists that users will reject the scheme.
- Telematics providers should work together to develop linkages/Application Programming Interface between the various systems so the right data can be disclosed. Also in this case, the work needs to be motivated by a clearly defined business case to develop IAP platforms and services.

5. Privacy and security

In Europe:

- Privacy by design: Make sure that the privacy of the stakeholders involved is guaranteed in the design of the Intelligent Access system. By including it in the design, fear of cold feet in the transport sector can be removed.
- To successfully deploy the IAP framework a data exchange between the users and the road planners and owners is essential to ensure the compliance of the specific vehicle with specific road sections. At the same time users (represented mainly by logistics service providers and vehicle OEM's), may be hesitant to share this information as it is sensitive. Hence, data protection and secure data sharing is essential.

The evolution of Intelligent Access is taking place in Australia in a different way than in Europe. In Australia, the need to improve productivity through the deployment of High Capacity Vehicles (HCVs) was the initial driver for the development of the Intelligent Access Program (IAP). It was recognised early on that Intelligent Access was a logical next step in relation to the possibilities offered by telematics. The IAP was greeted with enthusiasm in Europe through contacts at the International Forum for Heavy Vehicle Transport & Technology (HVTT). These actors initially also approached IAP with the aim of enabling the authorisation of HCVs. However, the main motivation behind the introduction of HCVs in Europe is CO2 reduction. While there was an extensive and lively transfer of knowledge and experiences from Australia to Sweden about the IAP, in the Netherlands and in the Aeroflex project similar concepts started to develop. As outlined above, experiments with Intelligent Access also took place in Estonia, Italy and the UVAR project. The experiences of Intelligent Access in Australia and Europe provide insights and lessons that may benefit the continuing implementation of regulatory arrangements aiming to drive greater environmental and productivity efficiencies in the transport sector. This paper has made clear that the evolution of Intelligent Access offers many possibilities.

5. Footnotes

[1] https://www.nordicway.net/ (Trafikverket 2021).
[2] https://civitas-reveal.eu/ (Civitas 2021).
[3](https://www.cedr.eu/download/Publications/2019/CEDR-Contractor-Report-2019-03-Call-2015-Freight-and-Logistics.pdf) (Saxe et. al. (2019)).

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