

## **Exploring the development of an open data platform for road safety KPIs**

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### **Abstract**

The European Commission (EC) has adopted the EU Road Safety Policy Framework 2021-2030, in which emphasis has placed on monitoring the road safety progress at EU level. In view of that, it has been suggested to measure a set of eight road safety Key Performance Indicators (KPIs). The EC has been trying in parallel to develop the European Open Science Cloud (EOSC) ever since 2016, which is an open environment for hosting and processing research data. The objective of this paper is to explore the development of a road safety KPIs data ecosystem that could be integrated in the Transport Research Cloud as a subset of the EOSC platform. The paper describes the necessary steps to be taken in order to make the KPIs data open, as well as the concept and the governance plan of an open platform for road safety KPIs (OPEN RSPI). This has been done with the aim to make the platform exploitable by both the EC and the EU countries. From the practical point of view, there has been conducted a review of the available road safety KPIs in the EU, duly respecting the EOSC principles and requirements applicable to open data. The emphasis is placed on the data management plan requirements, as a component of a findable, accessible, interoperable, and reusable (FAIR) ecosystem, which allows collecting, storing and reusing the KPIs data across all EU countries. Finally, the focus has been on the opportunities and barriers for data sharing, which arise from opening up the KPIs data that should be taken into consideration when developing a platform. The development of an open platform provides researchers, practitioners, and road safety stakeholders at all levels to more promptly identify those critical factors that are contributing to road accidents and strengthen the proactive road safety management.

**Keywords:** Road Safety; Key Performance Indicators; Open Data Platform; EOSC

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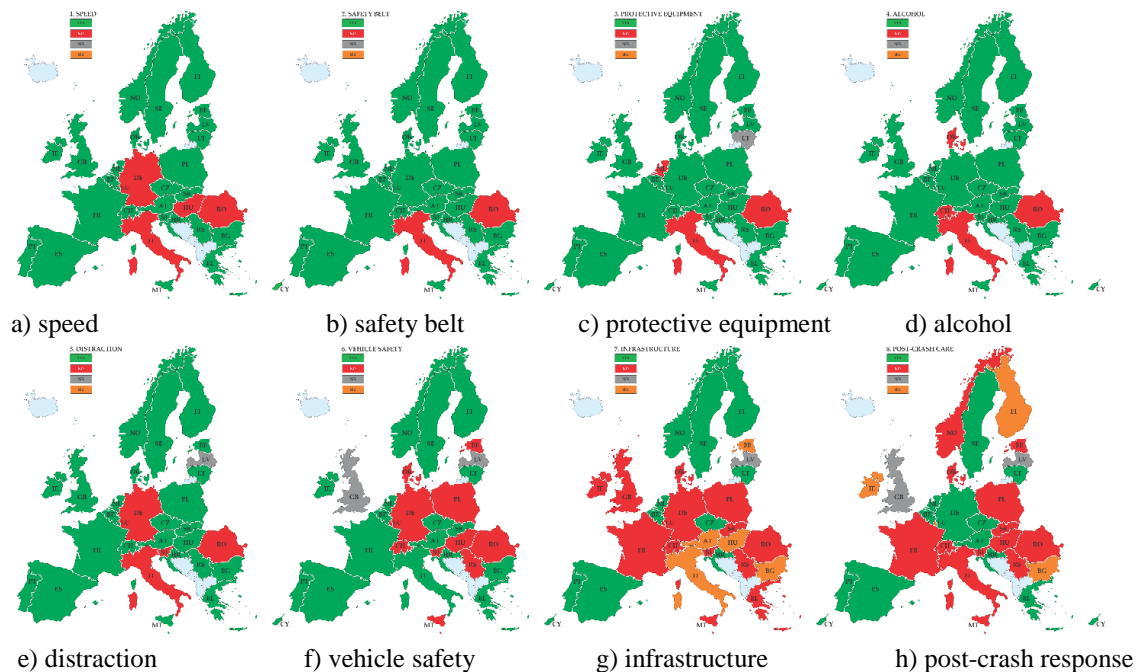
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## 1. Introduction

At the beginning of the Second Decade of Action for Road Safety, the fact is that the world has not reached the target set in the previous road safety decade of action. In order to better handle the road safety problem in the EU Member States (MS), the EC adopted the EU Road Safety Policy Framework 2021-2030, in which special emphasis has been placed on monitoring the road safety progress, at both national and EU level. To that end, a set of eight road safety Key Performance Indicators (KPIs) has been suggested to be collected under a common methodology by the EU MS, in order to better grasp different road safety issues and define the earlier goal-oriented actions. In parallel, over the last years, digital technologies have been transforming the economy and society, affecting all sectors of activity, especially those of transport and mobility. With an aspiration to become a global “digital data hub”, the EC adopted the European strategy for data in February 2020. A few months later, the EC adopted also the Sustainable and Smart Mobility Strategy, in which special emphasis has been placed on developing the green, smart, and affordable mobility at EU level. This strategy lays the foundation for the EU transport system and how its green and digital transformation could be achieved. Thus, based on the growing needs to facilitate data-sharing/reuse, the EC has initiated the development of the European Open Science Cloud (EOSC) since 2016 [2], with the aim to link the existing infrastructures from research sectors and Member States in order to ensure sharing of research data [3]. The EOSC is the basis for a science, research and innovation data space that will bring together data resulting from research and deployment programmes. Within this context, the need for establishing a Transport Research Cloud (TRC) as a subset of the EOSC platform has already been declared [2], which will provide researchers in the transport and logistics domain with access to open data sets relative to their research interests in a consistent manner. The objective of the current paper is to explore the development of a road safety KPIs data ecosystem that could be integrated in the TRC as a subset of the EOSC platform. The paper describes the necessary steps to be taken in order to make the KPI data open, as well as the concept and the governance plan of an open platform for road safety KPIs (OPEN RSPIs).

## 2. Road safety performance indicators in the EU

The Staff Working Document titled EU Road Safety Policy Framework 2021-2030 – Next steps towards “Vision Zero” recommended the establishment of a range of road safety KPIs, at the European level. For all of these KPIs, the EC has defined a general methodological consideration applicable to all the indicators. The EC funded project Baseline (see <https://baseline.vias.be/>) has further developed a set of common methodological guidelines for the data collection and estimation of the KPIs in the EU countries [8], including minimum data requirements, measurement procedure and data analysis requirements. The so far progress towards collecting KPIs in the European countries is presented in Figure 1, based on information gathered from 32 PIN countries [1] and *IRTAD Road Safety Annual Report 2020* [9].



**Figure 1: Availability maps of KPIs in the European countries**

However, most countries apply different data collection methodologies, while the level of detail for each KPI and the frequency of data collection vary among the countries. Despite the fact that a road safety assessment level obtained on the basis of a narrower comprehensive set of KPIs can offer an adequate and efficient way of road safety monitoring [6], the road safety assessment performed on the basis of a broader set of KPIs will provide a more accurate identification of good and poor road safety performances, which is in line with the recommendations by [5].

### 3. Open data platform for road safety KPIs

#### 3.1. Concept

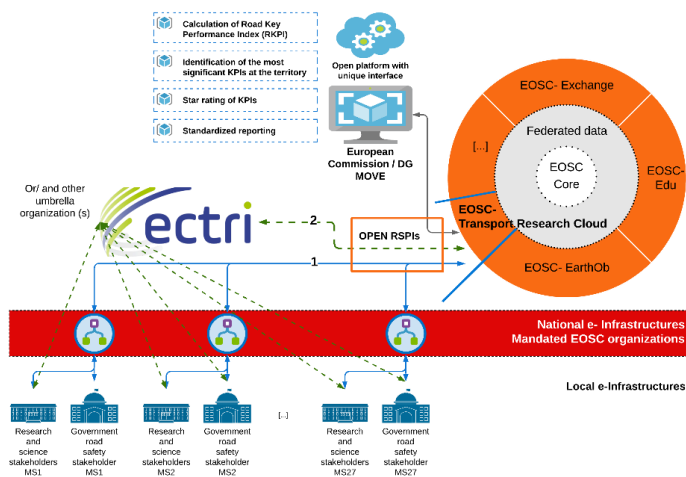
Over the recent years, the need for open data, unified standards and flexible infrastructures in the transport research area has been more relevant than ever, due to the great amount of different types of data collected by researchers, transport stakeholders, private companies and public authorities associated with the movement of freight/persons, as well as the increasing real-time data collection from vehicles, infrastructure and various applications. The current open science-based initiatives supported by the EC and their embedded services in transport research area have been summarized by [2]. One of the biggest initiatives to promote Open Science in transport research is the H2020 project BE OPEN, funded by the EC (<https://beopen-project.eu/the-project>). Within this context, the importance of collecting performance indicators has been also emphasized in [10], including them in the structure of the road safety management, as part of the platform for global road safety data analysis. In accordance with the EC's efforts to ensure collecting and monitoring of KPIs at the EU level, as useful tools for monitoring road safety progress, the need to define an open data platform for road safety KPIs (OPEN RSPIs) has been widely recognized.

Establishing the OPEN RSPIs as part of the TRC meets three strategic objectives relating to people, knowledge, and infrastructures, as defined in the Strategic Research and Innovation Agenda (SRIA) of the EOSC [11]. Despite the fact that the platform provides a “new normal” related to the open science practices and data stewardship, the greatest contribution is expected in developing a web of FAIR data and related services that are underpinning the in-depth research addressing major road safety challenges. Further on, the platform is compatible with the EOSC principles [11], as it includes a wide range of stakeholders (Principle (P) 1. Multi-stakeholderism). They are interested in the OPEN RSPIs data and are able to generate the value by using this platform. By defining the EU Road Safety Policy Framework 2021-2030, the EC stressed the importance of sharing KPIs data (P.2.Openness), in order to ensure transparency and inclusiveness of the joint work and to benefit from the widest possible input in its decision-making. Research, science, and governmental road safety stakeholders need to embrace the new approach, where knowledge is shared at all stages of the research lifecycle of KPIs (esp. raw/ study data), as opposed to the old way, where results are shared primarily through publications made available when the work has achieved a sufficient maturity level. Challenges related to the openness and P.3.FAIR principles have been overcome by the standardized methodology for collecting and monitoring KPIs, which improves the trust in and culture of sharing data. Based on that and with due respect to all the components of the FAIR ecosystem, the interconnectedness of people, services and content can be at a high level, and the emphasis placed on the data management plan. From the practical point of view, a federation of the existing and planned research data infrastructures (P.4. Federation of infrastructures), is quite sufficient for the functioning of the entire KPIs monitoring system. The challenge is to define the national road safety KPIs hub/ leading road safety stakeholder that will conduct the research and enter the (meta) data through the national e-infrastructure. By monitoring the KPIs data at the EU level, activities have grown in volume and complexity in many ways (reading, analysis, comparison, reporting, etc.) and (meta) data must be catalogues based on machine-readable metadata (P.5. machine-actionable).

In accordance with the EOSC structure, an open data platform for road safety KPIs engagement of the wider public/ government sector and private sectors in the EOSC has been proposed (Figure 2). As shown in Figure 2, the platform proposed can be exploited by both the EC/DG Move and the MS in order to monitor road safety progress, identify and exchange best practices through cross-country comparisons, as well as to identify major road safety problems. The governance plan implies a proxy at the national level (Route 1) between the EOSC-TRC and the leading government road safety stakeholder, which is responsible for KPIs measurement, collecting and monitoring at national level, as well as for national research and science stakeholders or private sector. In addition, the leading government road safety stakeholder and research stakeholders may engage in the EOSC via one or more umbrella organizations (Route 2), (i.e., ECTRI, FEHRL, etc.), addressing different layers of the EOSC, primarily the providers of the EOSC-Core and those enabling the EOSC-Exchange. Initially, both routes are acceptable since umbrella organizations are expected to bring their members closer to the EOSC and align their needs with EOSC principles. But in the long-term and within a context of established open science culture, Route 1 is indeed the most appropriate. No matter which route is used for communication with the EOSC, all Member States need to define comprehensive methodology for collecting and monitoring KPIs at national level, which is

completely in line with the EC minimum methodological requirements. Nevertheless, this methodology should define a leading road safety stakeholder for collecting KPIs (e.g. ministry of transport or leading traffic safety agency), the list of KPIs (in line with EC recommendations) and a list of additional safety performance indicators (e.g. related to vulnerable road users), a sustainable funding source for periodic, long-term monitoring of indicators, as well as mechanisms for reporting to the parliament, citizens, etc.

Being able to recognize the importance and generate the proposed platform value, as part of the EOSC- TRC, the governance plan implies direct involvement of the EC/DG Move, as a focal point for KPIs management at EU level. This concept encloses a strong collaboration with national road safety stakeholders, a comprehensive road safety management plan and the exchange of best practices at EU level. For this purpose, the following should be enabled as a minimum by the OPEN RSPIs platform: 1) Entering (meta) data of KPIs according to the EOSC-TRC requirements- EU level and EU MS level; 2) Data management that provides monitoring/ cross- country comparisons for each KPI individually- EU level; 3) Calculation of the key performance index and cross- country comparison- EU level; 4) Identification of the most significant KPIs in a territory- EU level; 5) Star rating of KPIs (incl. a larger number of indicators) and star rating of road user's behaviour- EU level; 6) Generation of results and reports according to the selection criteria of the EC/DG Move and leading road safety stakeholder- EU level and EU MS level; 7) Generation of results and reports according to the selection criteria of the academic and research stakeholders, and 8) Other attributes that can contribute to improving road safety.



**Figure 2: Concept of the open data platform for road safety KPIs (OPEN RSPIs), based on [4]**

The collection of KPI data is mainly conducted under contracts paid by taxpayer funds or under a publicly funded initiative/project, constituting them a public good, which should be open, easily accessible and reusable. Thus, the establishment of the open data platform for road safety KPIs will contribute to building a research road safety environment that will promote the Open Science and increase the trust and reproducibility of research outcomes.

### 3.2. FAIRness of road safety KPIs data

The implementation of the FAIR principles relies on the following essential components: policies, data management plans, identifiers, standards, and repositories [12]. In the context of an open KPI data ecosystem, data policies could be issued by the EC/DG Move, leading road safety stakeholders at EU MS level, as well as by research and other related stakeholders. Additionally, Data Management Plans (DMP), which will articulate all relevant information concerning the generation or collection of publicly funded research data [12], will hold valuable information on the data and related outputs, should also be ensured and structured in a machine actionable way.

Interoperability frameworks that define community practices for data sharing, metadata standards, tools and infrastructure play a fundamental role [3]. With the development of the proposed OPEN RSPIs platform, having a unique interface and enabling a triangle knowledge exchange such as: 1) the EOSC/TRC and the EC/DG MOVE; 2) the EOSC/TRC and leading road safety stakeholders at EU Member State level, and 3) the EOSC/TRC and academic stakeholders, it will be possible to ensure the interconnectedness of people, services, and content. The challenges can occur in the semantic layer, when it comes to differences in the definitions of certain indicators (e.g. applicable legal provisions relating to the maximum permitted BAC, definition of KPIs related to vehicle safety and infrastructure, etc.). In open science, data must also be shared in such a way that both humans and machines are able to access, understand, and reuse them [13]. A key issue of the reusability of KPIs dataset is the



availability of high-quality metadata, which will provide precise information on data collection procedure and methodology, data process, data owners, access to data, etc. From the point of view of data, the biggest challenge can be the preparation of raw data due to the size and complexity of the KPIs datasets. By using the proposed platform, it is possible to overcome this problem by providing the unique interface and strong data entry instructions for the leading road safety stakeholder at the EU MS level. Through this interface, raw data will be entered in a unique way, which will enable easier data processing (and even data aggregation, if necessary). Finally, the most common type of reporting KPIs data is the publication of reports, journal articles, conference papers, dissertations, proceedings, databases (study data), etc. To provide a higher level of interoperability and reuse, the OPEN RSPIs platform should enable exporting or generating standardized reports which will be published by the EC/DG Move or the leading road safety stakeholders of the EU MS.

#### **4. Opportunities and barriers to road safety KPIs data collecting and sharing**

The use of to- date scientific and technological achievements in the field of information and communication technologies, cloud computing, artificial intelligence (AI) and Internet of Things (IoT) can improve significantly road safety across Europe for all road users. Under this assumption, it is possible to generate large amounts of KPIs data, obtained from various projects, naturalistic driving studies, field operational tests, smart cameras, advanced smart solutions in urban area, smart in-car solutions, etc. During the transition period, from traditional to connected and automated mobility, when both human drivers and self-driving cars will co-exist on the roads, the number of accidents may not change or may actually increase [14]. Automated process of KPIs data collection by using the AI, communication between the vehicle, infrastructure, and driver (i.e., V2X) and the IoT system, will enable the management of the road safety performance generally, management of driver's behaviour and identification of the most common risky behaviour, which can lead to a reduction of harmful impacts of traffic in the said transition period.

However, the numerous challenges that can hinder the reuse of KPI data are listed in [3], among which the following ones stand out: data storage, fragmentation of data ownership, a lack of interoperability between datasets and platforms, etc. In addition to these challenges, the following challenges have emerged onto the surface, relating directly to the KPI data: funding and sustainability of collecting KPIs data, data quality, diversity of definitions of a wider list of road safety indicators and several ethical issues arising from opening up the raw/ survey KPIs data, such as: personal or privacy sensitivity and intellectual property rights. In the near future, automated process of KPIs data collection, accompanied by advanced smart solutions in urban areas, smart in-car solutions, etc. can significantly improve data quality, by taking into account that data providers may be unwilling to use cloud services for fear of data breaches or unauthorized access. Eventually, the ethical issues can be overcome by means of the proposed unique interface within the OPEN RSPIs platform, which requires the entry of aggregate data for each KPI individually.

#### **5. Conclusions**

The development of a TRC as a subset of an EOSC platform, provides the conditions for comprehensive management of the KPIs data. Through the paper, guidelines are given for development of an open data platform for road safety KPIs that could be integrated in the TRC. More precisely, the paper describes the necessary steps to be taken in order to make the KPIs data open, as well as the concept and the governance plan of an open platform for road safety KPIs (OPEN RSPIs). This has been done with the aim to make the platform exploitable by both the EC and the EU countries. Within this context, the FAIRness of road safety KPIs data are highlighted, and emphasis is placed on the requirements for a proper data management plan, which allows to collect, store, and reuse available KPIs data from all EU countries. The development of the OPEN RSPIs platform enables comprehensive and periodic monitoring and management of the KPIs at the EU level, sets ambitious national KPI targets, a more accurate identification of good and poor road safety points, identification of the critical factors leading to road accidents, as well as strengthening the proactive road safety management. In order to make the transition period (from traditional to connected and automated mobility) as safe and efficient as possible, the development of the star rating for assessing road safety performance of a territory should be a possible game-changer for systematic management of road user's behaviour, especially in case of automated process of KPIs data collection by using the AI, V2X communication and the IoT system. By using to-date scientific achievements in road safety management, as well as technological achievements in the field of information and communication technologies, the development of the OPEN RSPIs platform does not require large resources (architecture, infrastructure, services, and other requirements) and could be a very useful tool in the hands of the EC/DG Move and national road safety stakeholders.

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