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Review of Transport R&I Literature




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HAPPY NEW YEAR

2019

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Italics text : Own edits







Environmental sustainabilty and climate change

COP24: Through the eyes of an observer

(article by the UN Sustainable Development Solutions Network)

Climate change is one of the world's most complicated challenges, and nations are scrambling to organize around a common goal while maintaining their own interests. In 2015, the Paris Agreement was put forth as a unifying doctrine in which 196 countries agreed to work together to fight climate change and move toward a low-carbon future. Since then, country delegations have been working to identify the rules and pathways to implement the Agreement. One of the primary outcomes missing from the original agreement was a "Paris Rulebook" to establish concrete guidelines for all signatories. Between December 2-15, the delegations from 196 countries participating in the 24th annual United Nations Conference of Parties (COP24) met in Katowice, Poland and produced this rulebook to finalize important details of the Agreement and help nations reduce their emissions.

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In-depth analysis in support of the Commission Communication COM(2018) 773. A clean planet for all. A European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy

[…]

<u>4.4.1.1 Low- and zero emission vehicles, vehicle efficiency and infrastructure</u>

A strategic approach to low emissions mobility needs to fully exploit the potential for improving vehicle efficiency, in both conventional and alternative fuels vehicles. Engine efficiency improvements, aerodynamic improvements and drag reduction, engine hybridisation of various forms, as well as plug-in hybridisation and range extension, will continue to play a role.

Important gains can still be made through a radical rethink of vehicle and vessel design, including light-weighting of vehicles, or the use of sails as an auxiliary power source in shipping. Significant gains are also possible in aircraft efficiency.

The uptake of low- and zero-emission vehicles will need to accelerate over the coming years and decades. Battery electric vehicles are themselves a strong enabler of efficiency of energy use for vehicle propulsion, as well as offering novel vehicle design possibilities. Falling battery prices are expected to facilitate the uptake of these vehicles, although as discussed in section 5.6.1.2, the necessary supply of raw materials needs to be secured. Advances on battery and fuel cell developments need to be complemented by strong action to accelerate the roll out of appropriate recharging and refuelling infrastructure in the Union, on the Trans-European Transport Network (TEN-T) and




beyond, to ensure full coverage of all transport networks. Electricity can also be delivered via catenary lines and pantograph systems, such as in rail, tram, and metro systems or possibly through road electrification295. Accelerated emissions reductions in the whole electricity system, including the production of hydrogen, will further amplify the benefits of low- and zero-emission vehicles (see section 4.2).

4.4.1.2 The use of alternative and net-zero carbon fuels

There is no single fuel solution for the future of low-emission mobility - all main alternative fuel options are likely to be required, but to a different extent in each of the transport modes. In addition, the interplay between vehicles powertrains and fuels is expected to become more diverse in the long term. Electricity and hydrogen will be used in dedicated powertrains. Furthermore, for those transport modes where the deployment of zero emission vehicles is unfeasible due to energy density requirements or technology costs, carbon neutral fuels (i.e. advanced biofuels and biomethane, as well as e-fuels) can be deployed for use in conventional vehicle engines. For instance, if, in a transitional phase, were gas to be used as a fuel for shipping, it could be gradually decarbonised.

In the case of advanced biofuels and biomethane, CO2 emissions are offset through the initial growth of biomass in case of sustainable biomass. However, as discussed in section 4.7, land constraints imply that they should be deployed only in those transport modes or means where they are necessary.

E-fuels (e-liquids and e-gas) represent a promising alternative but their lifecycle CO2 emissions will depend on the source of the CO2 used to produce them; in case of biomass or direct air capture of CO2 this can result in carbon-neutral fuels (see also section 4.2.1.4). With e-fuels requiring significant amounts of electricity for their production and the uncertainty regarding the pace of their cost reduction, the transport modes where they would be deployed need to be carefully considered.

An important advantage of both e-fuels and advanced biofuels is their direct use in conventional vehicle engines, relying on the existing refuelling infrastructure.

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link1; link2

The development of renewable energy for electricity, heating and cooling, and transport

(excerpt from European Environment Agency Report: Trends and projections in Europe 2018. Tracking progress towards Europe's climate and energy targets)

[...]

RES are used in power generation, for heating and cooling, and in the transport sector. In addition to the overall 20 % target for renewable energy use in all sectors by 2020, the RED sets a 10 % target in the transport sector at EU and Member State level. With the new regulation having been agreed, EU Member States should ensure via obligations on fuel suppliers that between 2021 and 2030, at least 14 % of transport fuels stem from renewable sources. The contribution from conventional biofuels is capped at a maximum share of 7 %. Generally, progress in the transport sector is much slower compared with overall RES growth rates for all sectors.

Between 2005 and 2016, the share of electricity from renewable sources consumed in the EU grew at an average of 1.3 percentage points per year. In 2016, about 30 % of the electricity consumed in the EU was generated from renewables, with the most important sources being hydropower (36 %), wind (32 %), solar photovoltaic (PV) energy (12 %) and solid biomass (10 %). About 44 % of renewable electricity came from variable sources such as wind and solar power. For 2017, the EEA's approximated estimates indicate that about 31 % of total electricity consumed was derived from RES, with more than 45 % of this share from wind (34 %) and solar power (12 %).

In the EU heating and cooling sector, the RES share grew by 0.7 percentage points per year, on average, between 2005 and 2016. The greatest sources for renewable heating and cooling throughout the EU are solid biomass, heat pumps and biogas, followed by solar thermal collectors. The share of energy from renewable sources used in this sector amounted to 19.1 % in 2016 and was estimated to increase in 2017 (19.4 %). Heating from renewable sources is increasingly being used as a cost-efficient and secure alternative to fossil fuels (mainly natural gas) in Member States for district heating and at local levels.

In 2016, renewable energy represented only 7.1 % of energy consumption in the transport sector (see Figure 4.3). According to preliminary estimates from the EEA, this proportion was 7.2 % in 2017. After rapid growth between 2005 and 2010, the proportion of RES in transport (RES-T) dropped in 2011 and has been increasing at a slower pace since 2012. This can be explained by several factors, including:

- Some Member States were late in transposing and implementing the legal provisions meant to ensure biofuel sustainability under the RED.
- The debate concerning the future of biofuel policy, in the light of the indirect displacement effects of conventional crop-based biofuels on other land uses. Studies showed that there is a risk of high GHG emissions caused by indirect land use change induced by biofuels. To avoid further risks, a political agreement led to a cap on the use of these fuels in 2015. Accordingly, such fuels should account for a maximum of 7 % of gross final energy consumption in transport by 2020. The Indirect Land Use Change (ILUC) Directive also sets an indicative target of 0.5 % use for advanced biofuels by 2020 (e.g. fuels made from waste or algae). The recast of the RED requires Member States to promote targets for advanced biofuels post-2020 (0.2 % of transport fuels by 2021, rising to 3.5 % by 2030). It requires them to cap conventional crop-based biofuels at the level consumed in each Member State in 2020, with an additional 1 percentage point allowed over present consumption but with a maximum up to the overall cap of 7 %. After 2019, criteria for riskiness of crop-based biofuels are to be reviewed and crop-based biofuels with high ILUC risk will need to be decreased to 0 % by the end of 2030.
- The use of biofuels to reduce GHG emissions remains a relatively high-cost climate mitigation option. For example, it is estimated that the mitigation costs of biodiesel (not considering the indirect emissions related to land use change) would be in the range of EUR 100 to EUR 330 per tonne of CO_2 avoided; for bioethanol fuels from sugars and straw, costs would range from EUR 100 to EUR 200 per tonne of CO_2

avoided. These estimates depend to a large extent on the cost differentials between fossil fuels and biofuels. Nonetheless, biofuels and other renewable liquid fuels may have to be used in emission-intensive sectors such as aviation and shipping to substitute fossil fuels.

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Figure 4.3 Shares of energy use from renewable sources by sector in the EU

Notes: Percentages indicate the share of energy from renewable sources in gross final energy consumption of the corresponding sector. Values for 2017 are approximated.

Sources: EEA, 2018d; EU, 2009b; Eurostat, 2018b.




Air transport emissions are steadily increasing

(excerpt from the Global Observatory on Non-State Climate Action (Climate Chance) 2018 report)

When calculating emissions from the air transport sector, international transport emissions (530 million tonnes of CO2 equivalent in 2015, i.e. approximately 60% of the total) and those from domestic transport (345 million tonnes of CO2 equivalent or 40%) are always differentiated. The temporal dynamics of these emissions are the result of the growth of air transport and the improvement of its energy efficiency.

International aviation is a driver of emission growth. Between 1990 and 2015, its emissions increased by 104.6% worldwide, 88.1% in the European Union and 88.8% in France (AIE, 2017, p.109). At the global level, emissions from domestic aviation are growing three times slower than international aviation emissions (+ 15% between 2000–2017) (Enerdata) In Europe, these emissions remained stagnant and even decreased in France by 13% between 2000 and 2016 (source Enerdata), probably because of the increased use of the high-speed rail. The European Union accounts for 26% of international aviation emissions and 5.5% of domestic aviation emissions, which is easily explained by the small size of the member countries. France accounts for 13% of European emissions from international aviation and 19% from domestic aviation, which reflects both the lower propensity to travel abroad (tourist trips) compared to the countries of Northern Europe and the size of the country (1,000 km of diagonal distances across the "Hexagone"), favouring certain domestic links by plane.

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	2015
international aviation	
World	529.69
Europe	136.08
France	17.78
National aviation	
World	345.44
Europe	18.98
France	3.64

TABLE 1. DOMESTIC AND INTERNATIONAL AVIATION EMISSIONS IN 2015 (MTCO2E)

Source: International Energy Agency (IEA), Enerdata

	Unit	2015	2016	2017
European Union		**$MtCO_2$**	**18,9757**	**19,8323**
North America	$MtCO_2$	172.8483	179.9023	188.1661
Latin America	$MtCO_2$	15.5112	14.6124	14.5108
Asia	$MtCO_2$	94.0161	101.2096	103.9358
Pacific		**$MtCO_2$**	**10.1798**	**10.9321**
Africa	$MtCO_2$	8.4273	8.1547	8.3436
Middle-East	$MtCO_2$	4.0618	4.117	4.0657
World	$MtCO_2$	345.4379	359.9141	371.7467

TABLE 2. DOMESTIC AVIATION GREENHOUSE GAS EMISSIONS BY REGION

(Source: Enerdata)

Performance of the transport system and mobility services

[SP-FP7/H2020]: European roadmaps, programs, and projects for innovation in connected and automated road transport

(chapter in Meyer G., Beiker S. (eds.) (2019) Road Vehicle Automation 5, Lecture Notes in Mobility, Springer)

This chapter is summarizing the current initiatives in support of connected and automated driving taken by public authorities, academia and industrial stakeholders in Europe. It is covering the actions by the European Commission, such as the GEAR 2030 strategy, the C-ITS platform, the cooperation of automotive and telecom industries for connectivity, and the strategic transport research and innovation agenda (STRIA). At the same time, the roadmaps of European technology platforms and public private partnerships such as EPoSS, ERTRAC, ECSEL and EATA are explained. Also, an analysis of funding calls and projects for the Automated Road Transport (ART) topic of Horizon 2020 is given, and additional programs such as ICT, ECSEL, PENTA, and the Urban Innovative Actions are introduced. The results of a worldwide benchmark study are reported as well. Finally, the two Coordination and Support Actions forming the connectedautomateddriving.eu initiative, SCOUT and CARTRE are presented and their efforts to establish a comprehensive roadmap to accelerate innovation of connected and automated driving in Europe are summarized.

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Measuring progress towards transport sustainability through indicators: Analysis and metrics of the main indicator initiatives

(paper published in Transportation Research Part D 67 (2019) 316–333)

Transport is widely considered as a sector with significant positive and negative externalities affecting society, environment and economy. The fact of incorporating the main principles of sustainable development into transport planning is of prime importance. However, moving towards transport sustainability is a challenging task; it requires a paradigm shift as well as the constant monitoring and intensive evaluation of the current conditions through broadly accepted methodological tools such as indicators. In this context, the scope of the current research is to provide a complete picture of the approaches which aim at measuring progress towards transport sustainability as well as facilitating the development of new initiatives by highlighting the major trends. Consequently, a considerable number (78) of sustainable transport indicator initiatives were selected through an extensive literature review. Accordingly, descriptive statistics was used regarding the main features of the examined initiatives, while an analysis focused on the 2644 included indicators was subsequently implemented. The current research illustrates the linkages among the sustainability pillars and the selected objectives/ themes. It also points out the great variability regarding the hierarchical structure, categorizes the considerable number of themes found in the literature into smaller groups, presents the most commonly used themes and indicators, and finally proposes an alternative categorization of weighting schemes concerning indexes. An attempt has been made so that this study can become a meaningful operational tool for researchers aiming at promoting the relevant research by contributing to the selection of the most suitable yet compatible and scientifically valid methods for each case.

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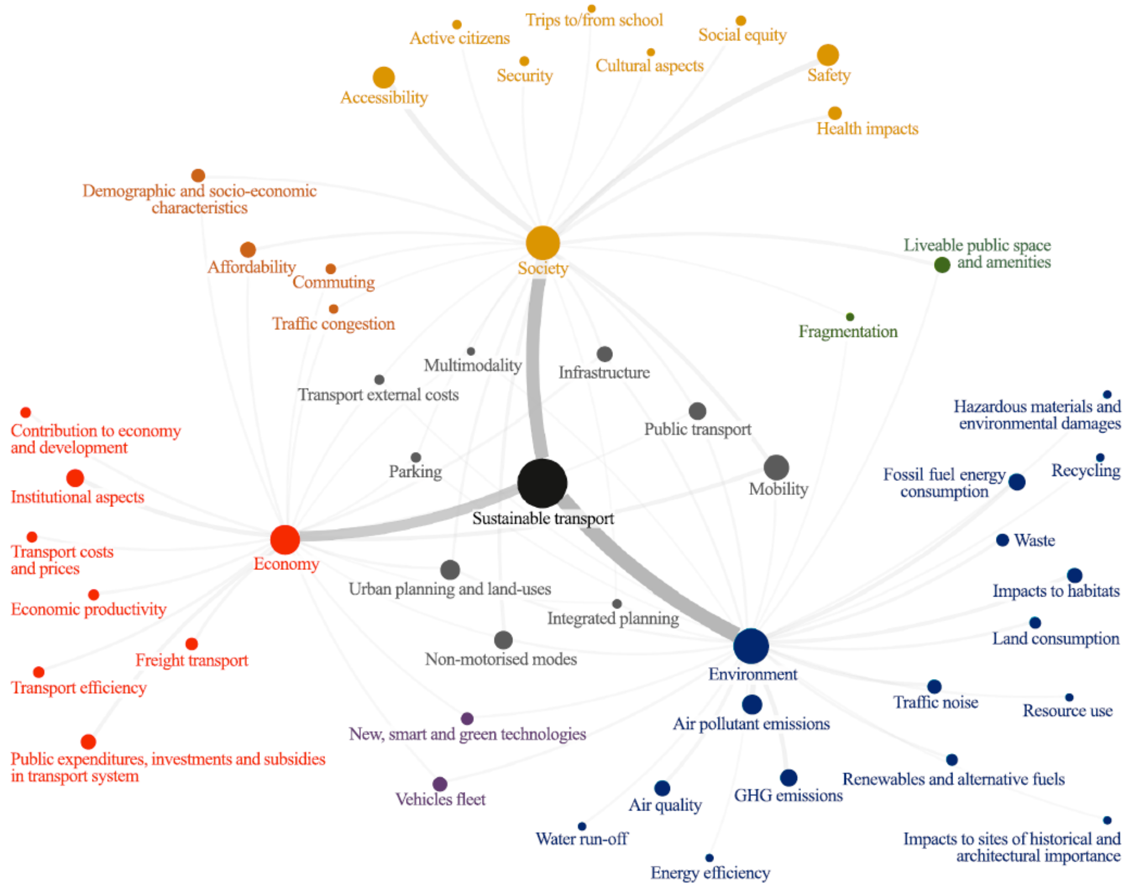

Fig. 6. Overall structure of the examined sustainable transport indicator initiatives.

Predict or prophesy? Issues and trade-offs in modelling long-term transport infrastructure demand and capacity *(paper published in Transport policy journal, vol. 74, 2019, 165-173)*

Effective planning and investment for transport infrastructure systems is seen as key for economic development in both advanced and developing economies. However, planning for such strategic transport investments is fraught with difficulties, due to their high costs and public profile, long asset life, and uncertainty over future transport demand patterns and technologies. Given that only a finite quantity of funding is available for transport investment, it is important that this funding is spent in the right places and on the right schemes in order to ensure that the best return

   

is obtained from limited public resources. There is therefore a need for a model which is capable of assessing network demand and performance in a wide range of possible futures, in order that robust decisions can be taken with regard to which schemes are given the go ahead. This paper discusses a range of issues associated with the development of a strategic national transport model for Great Britain as part of a wider interdependent infrastructure systems modelling framework (NISMOD). It considers the compromises which have to be made in order to develop a model which can examine a wide range of potential futures in a reasonable timescale, outlines how such futures can be captured in the model, and finally assesses the continued role of planners and policy-makers in determining both how the model is applied and how the future of transport systems might play out in reality. While the paper is based on a case study example from Great Britain, most of the general issues discussed are of relevance to transport and infrastructure policy making in almost any national or international context.

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Economic and industrial competitiveness

Innovation policies in the digital age *(excerpt from the OECD Science, Technology and Industry Policy Papers, 2018, 59)*

Most innovations today are new products and processes, enabled by digital technologies or embodied in data and software. These digital innovations are both an outcome and a component of digital technologies, which make it possible to collect, process, manipulate, store and diffuse data (digitalised information and knowledge) automatically, using machines. Those tasks have been performed by humans over time, with increasing but limited support from "technologies" (books, abacus, etc.). The mechanisation of information processing has allowed the performance of these tasks to enter a new era, where it can benefit from technical change. Progress in electronics (Moore's law) and in data science has allowed for a new way of using technologies: information of all types is put in digital form ("0" and "1", embodied in electrons), and can be processed, stored and circulated automatically. Advances in artificial intelligence (AI) promise a further acceleration in these processes, facilitating the manipulation of information and knowledge.

These changes driven by the advancement of science and innovation are also themselves drivers of science and innovation. Today digital technologies are essential to the innovation process; most if not all innovations are at least partially digital. This transformation took place first in digital sectors (e.g. software) and has now spread to all sectors, including many tangible sectors, such as the agro-food and automotive sectors (Paunov and Planes-Satorra, forthcoming). The Internet of Things (IoT) represents the vision that every object and location in the physical world will have network connectivity, allowing them to send and receive data and, consequently, becomes part of the digital world. Innovation processes and outcomes are being transformed precisely because the digital world differs in many dimensions from the physical, tangible world. Changes in innovation are particularly deep because digitalisation changes how knowledge –innovation's key ingredient – is produced and disseminated.

With such broad and deep transformations in innovation under way, it is important to evaluate whether policy support to innovation should adapt, and in what directions. This study focuses on that question. Building on an assessment of the economic mechanisms transformed by digitalisation, the paper presents a framework that characterises the impacts of the digital transformation on innovation processes and outcomes, and the effects of those impacts on business dynamics, market structure, and the distribution of income. Based on this assessment, lessons are drawn for the design of innovation policies. The framework, outlined in, builds on existing evidence of the effects of the digital transformation and specific policy cases.

Several conclusions emerge. Digital technologies have drastically reduced the costs of searching, sharing and analysing data. They have also increased the fluidity of knowledge and data. Once available, digitised knowledge (knowledge put in the form of digital data) and digitised data can be shared instantaneously among any number of actors, no matter the geographic distance or other barriers, and each of those actors have full access to the whole package.

These changes have affected innovation processes and outcomes in the following ways:

1. New possibilities for handling data have made them core inputs for innovation in all sectors of the economy. The ways data feed into innovations range from using information on consumer behaviour to enabling entirely new services (such as transportation services as illustrated by Uber that relies on instantaneous information about demand and supply for transportation services).
2. Innovation has become more collaborative, due to the reduced costs of collaborating and the greater need for interdisciplinary research.
3. Opportunities for launching new products and processes at lower cost using the Internet and relevant platforms facilitate versioning and experimentation of products for differentiated customers. Innovation can also be more frequent: in the automotive industry, while new car models are launched once a year, software updates (which are innovations and modify the models concerned) are issued at a high frequency, e.g. by Tesla Motors. These shorter cycles, however, do not necessarily imply progress at greater speed, as these innovations are also more incremental than before. Frequent, sometimes even daily, software updates are an example.
4. The digital transformation creates opportunities for innovation in services, as digital technologies allow for reduced costs and greater fluidity in reaching and interacting with consumers and in tracking their behaviour. It also moves manufacturing towards mixed models for providing goods and services.
5. Digital technologies are also relatively young, general purpose technologies (GPTs) that offer new opportunities for innovation. They are both far ranging and fast evolving, hence generating much uncertainty as regards their current and future development. This is particularly true of artificial intelligence (AI), a set of technologies that can emulate functions normally accomplished by human intelligence based on pattern recognition and prediction. Not only is AI expected to transform economic activity, but it also raises complex societal and ethical issues.

Transformations in innovation processes and their outcomes in turn affect business dynamics and market structure, and consequently have implications for the distribution of performance and rewards among businesses, individuals and regions.

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European vehicle market statistics, 2018/2019

(report by the International Council on Clean Transportation)

The European vehicle market statistics pocketbook offers a statistical portrait of passenger car and light commercial vehicle fleets in the European Union, updated annually. The emphasis is on vehicle technologies and emissions of greenhouse gases and other air pollutants. Brief introductions to each chapter note important trends and provide selected comparisons to other large vehicle markets.




[…]

Selected highlights of the 2018/2019 edition

- In 2017, new car registrations in the EU increased to 15.2 million, the highest level since 2007.
- The SUV market segment showed the strongest growth in sales. About 4.3 million new cars in 2017 were SUVs, which is more than 6 times as many as 15 years before. Sales of small diesel, small gasoline, and medium-sized diesel vehicles – all with comparatively low CO2 emission values – lost more than 9 percentage points from 2015 to 2017.
- The vast majority of Europe's new cars remain powered by gasoline or diesel motors. The market share of hybrid-electric vehicles in the EU was 2.7 % of all new car sales in 2017.
- The share of diesel cars dropped notably in 2017; from 49 % in 2016 to 44 % in 2017. This is significantly less than in 2011–2012, when 55 % of new cars were still powered by diesel.
- In 2017, plug-in hybrid and battery electric vehicles made up about 1.4 % of vehicle registrations in the EU, a slight increase compared to the previous year.
- Average CO2 emissions from new passenger cars, as measured via the type-approval test procedure, increased to 119 g/km in 2017, which is 1 g/km higher than in the previous year.
- On average, a new car in 2017 emitted about 42 % more CO2 under everyday driving conditions than advertised by vehicle manufacturers, up from a gap of 9% in 2001.

link1; link2

People-centred approach

Global status report on road safety *(excerpt of the World Health Organisation Report)*

[…]

The number of road traffic deaths continues to climb, reaching 1.35 million in 2016. However, the rates of death relative to the size of the world's population has stabilized in recent years. The data presented in this report show that progress has been achieved in important areas such as legislation, vehicle standards and improving access to post-crash care. This progress has not, however, occurred at a pace fast enough to compensate for the rising population and rapid motorization of transport taking place in many parts of the world. At this rate, the Sustainable Development Goals (SDG) target 3.6 to halve road traffic deaths by 2020 will not be met.

[…]

Some progress is also evident in the planning, design and operation of roads and roadsides, and in the take-up of a range of tools, notably the International Road Assessment Program (iRAP), which is a star rating tool for road networks. One hundred and fourteen countries are currently carrying out systematic assessments or star ratings of existing roads. These assessments and the implementation of appropriate road standards are particularly important as the majority of travel by road users such as pedestrians, cyclists and motorcyclists, occur on roads that are inherently unsafe for them.

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Safer City Streets. Global benchmarking for urban road safety *(International Transport Forum working document)*

The International Transport Forum collected mobility and road safety data from 31 cities, the majority of which in Europe, 10 in the Americas and 2 in Oceania. Indicators were developed to evaluate, monitor and benchmark road safety outcomes.

A network of road safety experts was developed in parallel to support data collection and to exchange experiences with road safety analysis and policy making.

[…]

Together, the global city-level road safety database and the network of road safety experts make up the Safer City Streets initiative. It is delivered by the International Transport Forum in partnership with the International Automobile Federation (FIA), and with support from the International Traffic Safety Data and Analysis group (IRTAD).

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- Springer
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- Various Transport Journals and Periodicals

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