UPSKILLING AND RESKILLING THE TRANSPORT INDUSTRY FOR CURRENT AND FUTURE CHALLENGES

SS NYOMBI

Department of Civil Engineering, Stellenbosch University, MEng Civil Engineering
Tel: 066 179 5010; +25 6778956691; Email: 27422259@sun.ac.za

ABSTRACT

Most low- and middle-income countries do not have sufficient systems for gathering and analysing data of traffic crashes. This shortfall hampers their ability to monitor, advocate for, oversee, and enhance road safety effectively. In most African countries crash data is still in physical paper forms at police records, but digitising it would make it more accessible to carry out necessary activities and implementations towards the Road Safety Vision.

Digitisation of road safety data, when carried out in a controlled pattern, would help bring all countries in Africa and the globe at large to a similar platform to comply with the same standards and assessment procedures to achieve the road safety goal as stated by the Sustainable Development Goal (SDG) 3.6. Hence, implementing the digital technologies described in this essay in conjunction with equipping personnel who manage road safety data with the requisite expertise to operate them at the various stages from collection at the crash scene to the end users is crucial in bringing the Road Safety Vision of halving the global road fatalities every succeeding decade to a reality.

1. INTRODUCTION

The Global Status Report on Road Safety 2023 noted that the number of road traffic fatalities in 2021 was 1.19 million, which falls far short of what is needed to meet the target of the United Nations Decade of Action for Road Safety 2021-2030 to halve deaths by 2030. In 66 countries, there was an increase, out of these, 28 are located in the African Region and have experienced a 17% growth in the number of fatalities since 2010.

Road safety data is crucial for identifying hazardous locations, diagnosing safety issues, understanding crash patterns, evaluating intervention effectiveness, and prioritizing prevention efforts. It serves as the foundation for reducing injuries and fatalities on the roads (FHWA, 2017). According to PIARC (2019), lack of accurate and reliable data hinders the progress towards safer road and transportation systems in any nation. Digitisation of such data would be a step closer to bringing it much closer to reality. According to the AfDB (2013), research work on road safety on the continent is scarce. This is partly due to the absence of reliable road safety data to carry out the research.

This essay identifies digital technologies that have been implemented in other parts of the world at the various stages, from when the crash scene to the end users which the African continent should also implement together with training personnel who are responsible for managing road safety data at all stages from data collection to access to the end users.

2. CRASH DATA

Crash data plays a crucial role in analysing road safety and is universally recognized as the most unbiased and dependable form of safety information. Nevertheless, obstacles persist, such as inaccuracies in human reporting, incidents that go unreported, and delays in entering data into databases (FHWA, 2016).

Police play a crucial role in collecting crash information, as they are present at the scene or receipt of post-event reports. Detailed crash data, identifying causes and solutions, is typically gathered through crash report forms, traditionally on paper or more recently using computer-based systems in developed countries. These forms include essential details like crash location (including coordinates), time, information about involved parties, road and environmental conditions, crash circumstances (e.g. vehicle movements, objects struck, contributory factors), and vehicle types (PIARC, 2019).Hospital data serves as a supplement to police data, offering insights into injuries when police reports are deficient, thus addressing underreporting. In cases of restricted crash data, hospital data emerges as the second most valuable source for crash statistics (PIARC, 2019).

When crash data from the police is in hard copy, extensive data cleaning and adjustments become a mandatory requirement to conduct a thorough analysis and identify patterns. The original form of such crash data from the police records is too broad to be useful for transportation planning and designing road safety measures, necessitating comprehensive data cleansing (Osano et al., 2020).A survey by the African Development Bank in 2013 indicated that the road crash recording system is not computerized in most African countries. (AFDB, 2013).

Digitising such road safety data in a controlled pattern would help bring all countries in Africa and around the globe to a common platform to comply with the same standards and assessment procedures in order to achieve the road safety goal as a whole, as stated by SDG 3.6.

Digitisation can be a crucial tool to ensuring accessible, quality crash data to all the above stakeholders and especially when it is put in a format understandable by all. According to SSATP (2021), in crash data, there is a need for uniform definitions for:

- Traffic engineers – for identification, analysis and treatment of existing risks, as well as the prevention of future risks.
- Policy-makers – at national, regional and local levels in setting crash reduction targets, developing road safety action plans, and monitoring performance.
- Police – To identify problem locations and times for enforcement.
- Research community – in preventative studies, and in testing and improving the effectiveness of road safety treatments.

3. COMPONENTS OF THE DATA DIGITALIZATION FRAMEWORK

This section explains the various digitisation reforms that the road safety data chain should undergo from when the crash scene to when it has been processed and received by the end users for effective road safety interventions to be carried out.

3.1 Data Collection

Crash data collection starts at the crash site, where a traffic officer documents key information in a crash report. Basic data include location, time, crash type, and involved parties. Original crash reports typically feature narratives and diagrams, but these may not transfer to the crash database (FHWA, 2017).

Crucial digital data in form of road environment details at crash scenes can be collected using technology such as the Garmin Oregon 600 handheld GPS to gather spatial data.

LiDAR (a term that combines “light” and “radar”) technology swiftly collects highly detailed data of roadway assets, enabling the creation of comprehensive 3D models and precise topographic maps. A vehicle equipped with LiDAR sensors and other necessary gear collects data swiftly in a single pass at highway speeds. This method reduces data collection time and lane closures, improving safety analyses based on roadway attributes and crash data (UDOT, 2014). Such digital means of data collection would eliminate possible sources of errors right from the start.

3.2 Data Integration

The integration of safety data with other datasets is highly important for transportation departments. Essential types of data to merge with safety data include road features and traffic volume information. When road characteristics are combined with crash data, safety experts can identify factors that lead to more frequent or severe crashes, enabling a systematic approach to reducing risks at locations affected by these factors. By taking into account traffic volume, organizations can determine crash rates (e.g. crashes per vehicle), which helps in identifying areas that need safety improvements (FHWA, 2017). A separate IT team possibly in a nation’s lead Road Safety agency should be set up for this role.

3.3 Data Processing

The essential steps for creating a comprehensive database which include: importing new data sources or updating existing ones, cleaning to remove errors and outliers, assessing data quality, processing to gain insights from the imported and cleaned data, converting raw data into processed form for further analysis in software like ESRI Arc GIS.

3.4 Data Analysis

Often as the most critical stage to achieve the desired outcomes, data analysis can be achieved through the following digitized means described below.

Global variations exist in data analysis and reporting capabilities. Geographic Information System (GIS) offers a valuable visual dimension to users' daily workflows by facilitating the visualization of trends that are not easily discernible in tabular form, allowing for flexible information queries based on geography (SSATP, 2021).

Additionally, GIS provides tools for creating macro programs to extract crash database information, conduct spatial analyses, and present findings through thematic maps. It is particularly useful for mapping crashes; visually identifying crash patterns; exposing high-incident locations; as well as predicting safety trends as road conditions evolve through recent advancements in crash modelling. Finally, GIS also offers various types of analyses valuable for assessing crashes such as: Intersection/Spot Analysis, Segment/Strip

Analysis for identifying high-crash segments with adjustable lengths, and Collision Density Analysis for mapping crash density by area or length. (Sando, 2005).

Hotspot analysis methods can be utilized to identify and rank road crash hotspots. Examples include: network Kernel Density Estimation (KDE+), Getis-Ord GI* method, as well as Spatial Traffic Accident Analysis method proposed recently which accounts for the road crash frequency severity and socioeconomic costs (Zahran El-Said et al., 2019).

One platform that achieves most of the prerequisites described before is the 'DRIVER' system, developed by the World Bank, which is a free and open-source web-based platform designed to enhance the gathering, organization, analysis, and presentation of road crash information. It allows various agencies including law enforcement, healthcare providers, and local/national government bodies to record road incidents in real time within a shared database with geospatial referencing capabilities (GRSF, 2018). This tool offers open-source licensing for low-cost implementation, adaptable to various locations via Open Street Map. It includes essential tools for managing road safety data and provides a public-facing website for anonymized data download (Holly et.al, 2018).

3.5 Data Presentation and Access

A database eventually should be formed that gets updated weekly, biweekly, or at most monthly. Australia has a good example of one where the collection and combination of information on road transport crash fatalities from each state and territory road safety authorities gets updated every two weeks and is made available for use by the public for purposes such as research and advocacy.

A final digital platform should be made available to the public and necessary stakeholders in form of a website with links to various countries, and regions within nations. Such a digital platform should be able to achieve accessibility through a centralized web application, one-stop portal for all information and all information live-linked (SSATP, 2021). On such a website, there should also be an accessible guide on notes and definitions, how to use the data, comprehend it, possible analysis of the data, methodology information and supporting technical documents. One good already existing of such a database is for the United Kingdom. The website should also have interactive mapping tools able to make displays in form of location since location is the most critical aspect in crash data. This can be used improve transportation planning by analysing crash data, and segmenting roadway networks for risk assessment (FHWA, 2016). A final database that combines the data at national and continental level should be made available and accessible via the website where a user can download data from general to more classified data that has been filtered.

4. IMPLEMENTATION AND TRAINING

The following two potential established organizations can lead the transformation of digital road safety data at a continental level by collaborating with leading Road Safety agencies of individual nations or with the Ministries of Transport to ensure the necessary training and infrastructure takes place.

The Africa Road Safety Observatory (ARSO) which serves as the Regional Road Safety Observatories was established to aid countries in gathering and overseeing road safety data to track safety targets. This practice has expanded to encompass not only data but

also policy discussions and development, supporting evidence-based approaches for successful road safety policies.

The World Health Organisation leads the action towards achieving SDG-3.6 of halving annual world road traffic fatalities by 2030. It can play a critical role in funding, training, and coordinating a road safety data digitisation project on the continent is essential due to escalating total road fatalities in low-income countries. Without necessary measures, population growth and motor vehicle usage may hinder SDG achievement.

Upon acquiring the required hardware and software technology, it is essential to conduct training programs and workshops for existing staff, particularly traffic officers and the leading Road Safety Agencies across the continent. A prime illustration of this approach is the Global Road Safety Partnership's current initiative to train traffic police officers to improve road traffic policies.

Creating and documenting webinars to showcase the tools can serve as an effective method for educating stakeholders in situations where resources are constrained due to their numerous tasks and busy schedules (MassDOT, 2021). Recordings like these can serve as introductory learning materials for new users and lay the groundwork for future training endeavours nationwide. It is also essential to provide training on effectively presenting analysis results and insights to decision makers throughout the community. The success of digitizing data depends significantly on comprehensive training and ongoing knowledge sharing with both system administrators and end users.

5. CONCLUSION

Data plays a crucial role in the improving the of road safety sector by enabling the identification of areas for concern and focus for different agencies. Safety data, such as information on collisions, traffic volume, and road features, are all important for analysing safety issues. It is essential to uphold high standards in the gathered data regardless of its nature. Organizations collecting safety-related data should strive to achieve timeliness, accuracy, completeness, uniformity, integration accessibility to enhance their capacity for making well-informed decisions which is only achievable with digitisation and equipping personnel who handle such data with the skills to achieve those objectives.

Most nations gather information on road safety regularly, but this information only proves useful for guiding road safety initiatives if it is effectively encoded, processed, and analysed within a computerized database system.

Digitising the Road Safety Data of the African continent along with training and upskilling of personnel across the continent that handle road safety data in operating the digital platforms outlined at each stage in the right way is crucial and needs to be implemented if the annual road fatality rate on the continent is to be reduced by half by 2030 as outlined in the Decade of Action of 2021-2030 and to less than 10% by 2050 or else the Decade of Action of 2021-2030 will remain in writing given the fact that the population and motorisation rate on the continent are ever growing.

6. REFERENCES

African Development Bank Group. (AFDB). Transport and ICT Department. 2013. Road Safety in Africa, Assessment of Progresses and Challenges in Road Safety Management System. Available at: https://www.afdb.org/fileadmin/uploads/afdb/Documents/Events/ATFforum/Road_Safety_in_Africa_-_Assesement_of_Progresses_and_Challenges_in_Road_Safety_-_AfDB.pdf.

Federal Highway Administration. FHWA. 2016. Utah's and Kentucky's Innovative Use Of GIS-Based Tools, Strategies for Using GIS To Advance Highway Safety. September 2016. Available at: https://safety.fhwa.dot.gov/rsdp/downloads/fhwasa16028.pdf.

Federal Highway Administration. FHWA. 2017. Fundamentals of road safety. Available at: https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-08/rspcb_Road_Safety_Fundamentals.pdf.

Global Road Safety Facility. Spring 2018. DRIVER – The Bank's Sustainable Solution for Road Crash Data Management. Available at: https://pubdocs.worldbank.org/en/383191522246101256/GRSF-Newsletter-Spring-032618-rev3.pdf.

Holly, K, Soames, J & Sara, S. 2018. Better Crash Data Can Improve Road Safety. Available at: https://thedocs.worldbank.org/en/doc/749961538428052242-0190022018/original/TransportGlobalPracticeNoteSeptemberweb.pdf.

Massachusetts Department of Transportation, Safety Data Visualization, MassDOT's IMPACT Tool and Promoting Safety Planning in Massachusetts. 2021. Available at: https://safety.fhwa.dot.gov/rsdp/downloads/MassDOT%20IMPACT_Case%20Study_508.pdf.

Osano, SN, Amollo, KO & Ouko, RO. 2020. Data-Driven High Collision Location Identification and Corrective Countermeasures on Roads in Kenya. *International Journal of Scientific and Research Publications*, 10(10). October 2020. Available at: https://www.ijsrp.org/research-paper-1020/ijsrp-p10607.pdf.

PIARC. 2019. Road Safety Manual, Effective Management and Use of Safety Data. A Manual for Practitioners and Decision Makers on Implementing Safe System Infrastructure. Available at: https://roadsafety.piarc.org/en.

Sando, T. 2005. Modelling highway crashes using Bayesian belief networks technique and GIS. Available at: https://www.proquest.com/docview/304997350?pq-origsite=gscholar&fromopenview=true.

SSATP (Africa Transport Policy Program). 2021. Road safety data in Africa: A proposed minimum set of road safety indicators for data collection, analysis, and reporting. Available at: https://www.ssatp.org/sites/ssatp/files/publication/SSATP%20Road%20Safety%20Data%20in%20Africa.pdf.

Utah Department of Transport. August 2014. Collection and use of roadway asset data in Utah. UDOT. Available at: https://safety.fhwa.dot.gov/rsdp/downloads/utahiidarcasestudy.pdf.

World Health Organisation. 2023. Global status report on road safety 2023. Available at: https://iris.who.int/bitstream/handle/10665/375016/9789240086517-eng.pdf?sequence=1

ZahranEl-Said, MM, Soon, J, Tan, Asri P, Nurul, A, Tan, Hie A, Yap, Yok, H, Rahman, Ena Kartina Abdul, Pessiki, S, Jonkers, H, Siswosukarto, S, Fajar SA., Awaludin, A, Matsumoto, T, Nur, RP, K. MATEC Web of Conferences, 2019, Vol. 258, p.3008