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Assessment and countermeasures selection for safer roads to schools in the city of Yaoundé: progressive evaluation using surveys and iRAP methodology

Ndingwan Tevoh Lordswill[a], Wounba Jean-Francois[a], Fondzenyuy Stephen Kome[a,b], Steffel Ludivin Feudjio Tezong[a,b]*, Awasiri Rita Ndonue [a], Davide Shingo Usami[b], Luca Persia[b]

[a]*National Advanced School of Public Works, Elig Effa Street, P.O. Box: 510 Yaounde, Cameroon*
[b]*Sapienza Università di Roma,Via Eudossiana, 18, 00184, Roma, Italia*

Abstract

About 500 children die daily in road crashes that occur while the children are going to school or engaging in other activities. This paper outlines a two-phase study to enhance pedestrian children's safety. Phase one included crash data analysis, iRAP assessment of risky road section, and school evaluations. Phase two involved a behavioural school journey survey of 1,100 students and star ratings assessments of 14 schools. The findings indicate that a notable portion of crashes occur during school commuting hours and pedestrians are involved in one out of every ten crashes. Moreover, 59% of students reported feeling safe on their way to school, and 17% demonstrated a high level of road safety knowledge. The iRAP assessment demonstrated that current road conditions were rated at 1 and 2 stars for pedestrians. However, implementing effective countermeasures, such as 30km/h speed limits, enhanced delineation, and road surface treatments, could improve ratings to 4 and 5 stars for pedestrians, leading to an 88% reduction in fatalities and serious injuries. Furthermore, star ratings for school assessments revealed over a two-year period that most school entrances remained unsafe, with ratings of 1 and 2 stars, indicating a lack of road improvements. This study underscores the need for multidisciplinary approaches, including engineering, community engagement, law enforcement, and behaviour changes, to enhance road safety in communities.

Keywords: Road safety; Star Rating for Schools; Safer routes to schools; iRAP; Countermeasure

* Corresponding author. Tel.: +39 351 352 6369.
E-mail address: steffelludivin.feudjiotezong@uniroma1.it

1. Introduction

Road traffic injury is a serious public health problem among adults and children in Cameroon and around the world. According to the global status report on road safety 2023, road crashes are the leading cause of death for people aged 5-29 years (WHO, 2023). On a daily basis, traffic collisions claim the lives of more than 3500 people, 500 children and tens of thousands are injured (Ferguson et al., 2014; iRAP, 2015). Children are victims of road crashes as they carry out various activities or play close to streets. According to UNICEF (2020), hundreds of children are injured in road crashes, and every four minutes a child dies on the road. The most frequent victims of road traffic crashes are young children, with those who walk accounting for 61% of accidents and those who cycle for 13.6% (Aggarwal & Singh, 2010).

A study on student journeys to schools in Tiko (a city in Cameroon), showed that over 70% of students get to school by motorcycle without any protective gear (Nyagwui et al., 2016). It has been shown that the risks of motorcycle injury and death are highest among young people, even in high-income countries. (Baker et al., 1991; Chaudhuri et al., 2019; Oxley et al., 2013; Sayyed Hoseinian et al., 2019). In a pedestrian setting, the relevant information children must attend to are safety cues (e.g., walk signals, pavement markings, visual occlusions, and traffic) (Barton & Morrongiello, 2011). The continuous education of children regarding traffic behaviour has a limited reach, if not combined with other preventive measures. Of these, the design of traffic infrastructure is one of the more important (Ištoka Otković et al., 2021).

There were an estimated 1.19 million road traffic deaths in 2021 – a 5% drop compared with the 1.25 million deaths in 2010 (WHO, 2023). In contrast to this global drop, fatalities in the African region increased by 17%. In the context of Cameroon, there are numerous shortcomings in enforcing road safety policies that allow reckless driving (Gerald et al., 2022).

In recent years, a tool to assess road safety conditions, developed by the International Road Assessment Programme (iRAP), is being implemented globally. In school areas, iRAP developed Star Rating for School (SR4S) which has been used across the world. In the Philippines, Gomintong et al. (2022) found that tools such as SR4S empower researchers to conduct pedestrian safety assessments, identify possible improvements, measure impacts, and, most importantly, effectively communicate these to stakeholders to bring improvements.

Given the high number of lives lost due to road crashes, an examination of crash data is important for improving the safety of children travelling to and from school in Yaoundé. It is important to look at students' travel behavior, as well as iRAP assessments of targeted areas in the city. This study improves on the first phase study that did not include student surveys (Ndingwan et al., 2023). This paper emphasizes roads to school assessment to evaluate the safety of children on their way to school and proposes certain countermeasures that can be implemented to make them safer and reduce the rate of fatalities and serious injuries (FSI). The application of the proposed countermeasures will provide safer travel along roads in Yaoundé and reduce the overall number of road crashes and FSI.

2. Methodology

This progressive study was carried out in 2 phases: a first phase in 2022 (January to July) comprising the crash data analysis, iRAP assessment of a road section and SR4S, and the second phase in 2023 (October to December) and 2024 (January to February) comprising school surveys and second Star Rating for School assessment. The findings of the first phase were presented during the PIARC World Road Congress in 2023 as iRAP assessments and countermeasures selection for safer roads to schools in the city of Yaoundé.

Crash data recorded by the Police (General Delegation of National Security – DGSN) was collected for analysis. The collected crash data was georeferenced to produce a blackspot map of the crashes. Each crash was recorded on the map which corresponds to a crash in the data. Blackspots comprise road sections with clusters or a road section with over 5 crashes. A blackspot map was produced using GIS software (QGIS) once the blackspots had been identified from the crash data. Google Maps was used to identify the type of area and land use data for key points of interest, such as areas with a high student concentration (schools, universities, and the surrounding streets). Field study and previous knowledge on the distribution of schools around Yaoundé were used to complement data on the points of interest where a greater number of schools and a high student population was found. With the analysis of the blackspot

map, a high-risk road section was selected. In addition, schools in high crash areas were selected for iRAP SR4S assessments.

A general reconnaissance of the site was conducted to observe and record traffic flow characteristics of relevant school areas. Through visual examination and counts, data on traffic flow including pedestrian flows, were recorded for travel at peak times. The national speed limit (60km/h) was used for the analysis and it was assumed, for the iRAP assessment, that the operating speed (85th percentile speed) is 5km/h greater than the speed limit as many studies have confirmed operating speeds to always be greater than speed limits (Andrade et al., 2016; Fitzpatrick et al., 2005; HCM, 2010). Speed limit enforcement in Yaoundé is very minimal and this assumption of operating speed is conservative, as 100% of drivers in the city reported travelling above the speed limit(Fondzenyuy, et al., 2024). In the absence of speed data when performing road assessments, a speed prediction model, often as a function of road attributes, can provide more robust estimates of operating speeds (Cigognetti et al., 2024; Gonzàlez-Hemàndez et al., 2020; Singh & Vasantha Kumar, 2022). However, it is important to ensure that the models used are developed within a similar context to the application (e.g., models developed in high-income countries (HICs) may not be feasible for low- and middle-income countries (LMICs) roads). Given that we could not find such locally relevant models, and the available models from other LMIC contexts had several parameters that were not considered in this study, we used the approach explained. Wherever possible, the model based approach should be applied to provide more accurate estimates of operating speeds.

A baseline scenario assessment was carried out that considered the actual (existing) conditions of the road, which was followed by a design scenario that considered selected countermeasures. The data for the attributes used in the iRAP survey was collected in the form of pictures and video recordings. These recordings were collected using digital map platforms: Mapillary and Google Maps. After collection, ViDA (iRAP software for road assessments) was used to assess the school locations and the road section. A comparison was made between the school locations assessed in 2022 and those in 2023.

3. Results and Discussion

The crash data used in the crash analysis was obtained from the crash database of the Cameroonian Police (General Delegation of National Security) comprising crashes for the 7 subdivisions in Yaoundé that occurred from October 2018 to September 2019. The crash data registered 483 crashes in this period. The crashes were grouped and studied by various categories but the areas examined were with many schools.

In a given day, the highest number of crashes were observed at hours when children are on their way to or back from school. As represented in Figure 1, a steady increase in crashes occurs from 7 to 9 am (07:00 to 09:00) when students are usually on their way to school and two peaks, at 3 pm (15:00) and at 7 pm (19:00). Schools close for the day in the afternoon and most students begin their journeys home at 3pm (15:00).

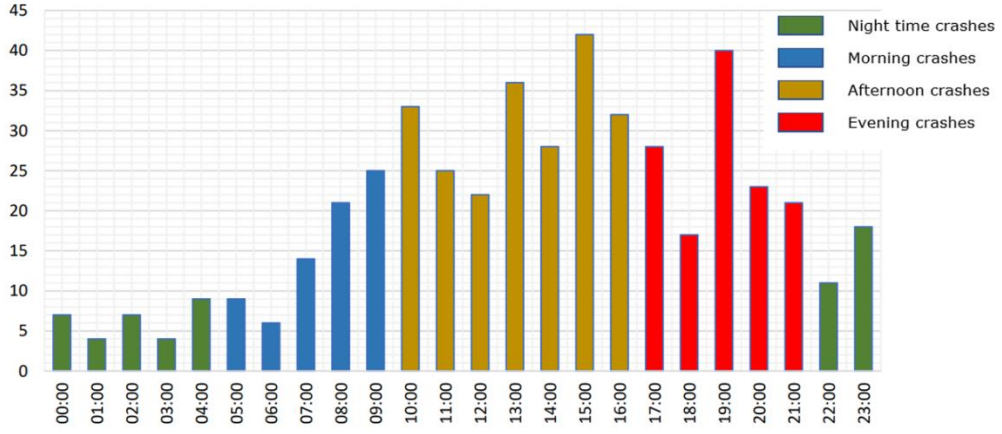

Figure. 1. Crashes recorded by hour

The recorded crashes occurred in several ways. Out of the 483 crashes, 11.18% involved at least one pedestrian. Crash casualties by age group show that people aged 1 to 24 made up 7% of the casualties. In addition, the majority of these crashes involved material damage while injuries (bodily damage) and fatalities (deadly) are about equal. The material damage collisions correspond to *Object damage collisions* according to the KABCO scale (NHTSA, 2024). Questionnaires were used to study students' knowledge of road safety and their behaviour. Students who participated in this study were from 5 schools in Yaoundé, which were selected by convenience. 1100 students participated in completing these questionnaires.

Questionnaires were completed by students from 5 schools (Oxford Secondary School, Seed of Grace school, Franky Academic Complex, Mada International College and PNEU School) which produced about 2000 samples. Among the 2000 samples collected, the questionnaires were fully completed by 1100 students of both genders of whom a large majority had aged between 10-20 years. In addition, the students were from primary to secondary levels.

The survey included participants of whom 50% were taking part in road safety education in their schools at the time of the survey. From this survey, 39% of participants walk to school, while public transport (taxi and bus) and motorcycle passengers account for 16 % each as depicted in Figure 2a.

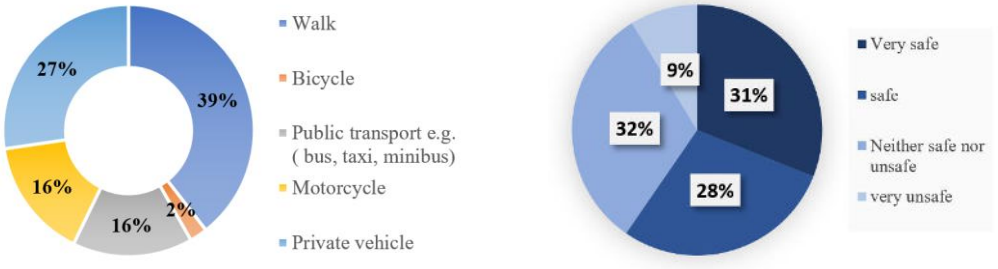

Figure 2. (a) mode of travel to school (b) How safe students feel on their way to school

The survey showed that students had good road safety knowledge. 80% of students understood the importance of pedestrian crossings, with 42% understanding this very well. 69% were familiar with the traffic rules and 52% recognized the dangers of speeding. 18% rated their knowledge of road safety as high and 23% understood the importance of frequently wearing helmets. 83% of students believed that road safety education should be included in schools. In their school journeys, a significant 41% of students do not feel safe as depicted in Figure 2b.

With careful analysis of the blackspot map and points of interest, the road segment stretching from Carrefour EMIA to Monument de la Reunification (1.6 km) was identified as significant. This particular road, identified and highlighted in Figure 3, connects five schools directly and three indirectly, and it has a history of ten crashes, resulting in two fatalities. Figure 3 shows crash spots in red circles and selected road segment in black line. As a result, this road segment was chosen for further analysis and intervention.

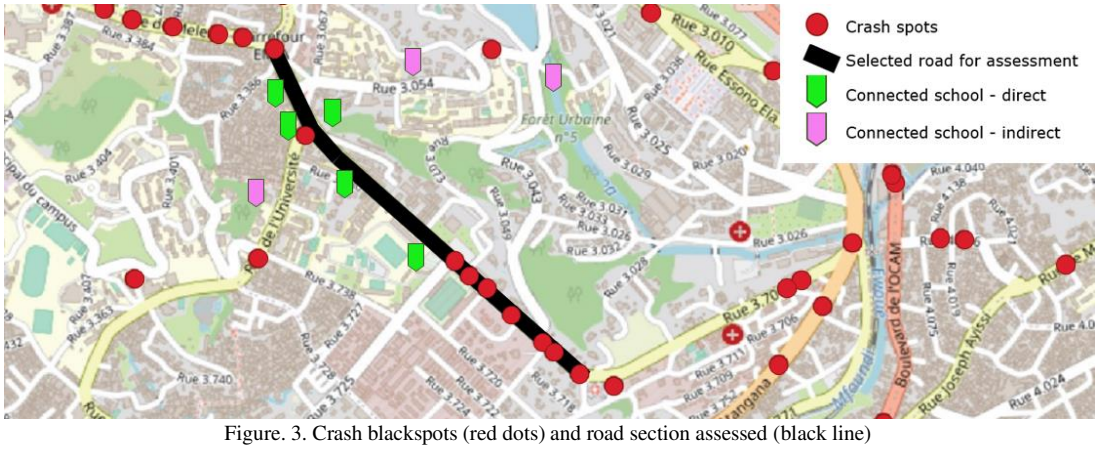

Figure. 3. Crash blackspots (red dots) and road section assessed (black line)

The iRAP survey of the existing road network shows that 0.1 km out of the 1.6 km has no functional footpath. Additionally, the entire road section has no bicycle or motorcycle facilities. Of the six intersections where traffic flows at 60 km/h or more, four have no roundabout, protected turn lane, or interchange.

The assessment shows that this road section is predominantly 1 star for all users, Table 1 shows the current star ratings for the road section.

Table 1. Star ratings for baseline (existing road section) for all road users

	Vehicle Occupant		**Motorcyclist**		**Pedestrian**		**Bicyclist**	
Star Ratings	Length (km)	Per cent	Length (km)	Percent	Length (km)	Percent	Length (km)	Percent
5 Stars	0	0.00%	0	0.00%	0	0.00%	0	0.00%
4 Stars	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3 Stars	0.2	12.50%	0	0.00%	0	0.00%	0	0.00%
2 Stars	0.4	25.00%	0.6	37.50%	0.2	12.50%	1.2	75.00%
1 Star	1	62.50%	1	62.50%	1.4	87.50%	0.4	25.00%
Not applicable	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Totals	1.6	100.00%	1.6	100.00%	1.6	100.00%	1.6	100.00%

From the Table 1, 100% of roads have less than 3 stars for pedestrians, bicyclists and motorcyclists (vulnerable road users) and only 12.5% of the section has 3-star ratings for vehicle occupants. This, therefore, suggests that vulnerable road users are at a greater risk on the road and interventions to elevate star ratings should be targeted to vulnerable road users, especially pedestrians. Given the study focuses on providing solutions for Safer Routes to school, the pedestrian risk map for the baseline assessment is shown in Figure 4. The figure shows the distribution of star ratings along different sections of the road network with black and red lines representing 1 and 2 stars. It is worth noting that star ratings range from 1 to 5 with 1-star having the most risk for road users and 5-stars being the safest.

Figure. 4. Risk map of actual star ratings for pedestrians

In the design scenario, the design aspects (countermeasures) considered include: adding sidewalks (Non-physical separation 0m to <1.0m) on both sides of the road, upgrading pedestrian crossings to marked crossings with refuge, provision of school static signs, a 98school zone supervisor and implementing a 30km/h speed Zone. The chosen interventions are based on recommendations from several authors (Greene & Lewis, 2020; Hoong et al., 2021). The design scenario shows improvements in the pedestrian (students on their way to/from school) star ratings. The results of the star ratings for each road user are shown in Figure 5 and Table 2.

Table 2. Star ratings for design (road section with countermeasures and improvements) for all road users

	Vehicle Occupant		Motorcyclist		Pedestrian		Bicyclist	
Star Ratings	Length (km)	Percent	Length (km)	Percent	Length (km)	Percent	Length (km)	Percent
5 Stars	1.2	75.00%	0.6	37.50%	1.2	75.00%	1.5	93.75%
4 Stars	0.4	25.00%	0.9	56.25%	0.4	25.00%	0.1	6.25%
3 Stars	0	0.00%	0.1	6.25%	0	0.00%	0	0.00%
2 Stars	0	0.00%	0	0.00%	0	0.00%	0	0.00%
1 Star	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Not applicable	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Totals	1.6	100.00%	1.6	100.00%	1.6	100.00%	1.6	100.00%

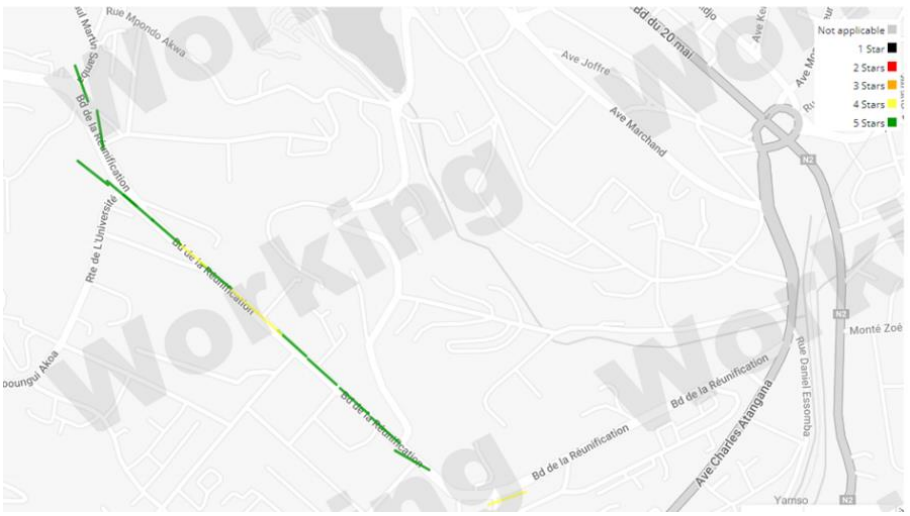

Figure. 5. Risk map of actual star ratings for pedestrians

Figure 5 shows the pedestrian star ratings risk map with 4-star and 5-star sections in yellow and green respectively. Considering the fatality rates only for pedestrians and all road users for the baseline (2.7 and 11 respectively) and the design (0.1 and 1.3 respectively) scenarios, this improvement in safety has the potential to reduce FSI for all road users by 88% and only pedestrians by 96%. It can therefore be concluded that the implementation of the countermeasures is important to reduce the risk of pedestrian crashes.

Star rating for school (SR4S) assessments were carried out in 2022 and later in 2023 for the purpose of evaluating school entrances and students crossing areas. Table 3 lists the schools, their locations in Yaoundé and the results for their respective star ratings for both years.

Table 3. Star ratings for schools for selected schools

No	Name of School	Location	Star Ratings in 2022	Star Ratings in 2023
1	Biyemessi Lycee	Descend Scalom	N/A	★
2	Cetic Ngoa Ekelle	Ngoa Ekelle	★	N/A
3	College St Benoit	Mvole	★★	N/A
4	College Tsimi	Nkolbisson	N/A	★
5	Ecole Excellence Plus	Nkolbisson	N/A	★
6	Ecole Prive Laïc LES BAMBIS	Biyem-Assi (Descend Scalom)	★	N/A
7	English High School	Monte Chapelle Obili	★	★

8	Faith comprehensive high school	Carrefour Obili	N/A	★☆☆☆☆
9	Franky	Obili Biscuterie	N/A	★☆☆☆☆
10	Holy infant	Melen Mvog beti	★☆☆☆☆	★☆☆☆☆
11	Lycée Bilingue Yaoundé	Essos	★★☆☆☆	N/A
12	Lycee Leclerc	Ngoa ekele	N/A	★☆☆☆☆
13	Mada International	Obili	★☆☆☆☆	★☆☆☆☆
14	Mount Zion	Nkolbisson	N/A	★☆☆☆☆
15	National Advanced school of public works	Elig effa	★☆☆☆☆	★☆☆☆☆
16	Oxford	Obili	N/A	★☆☆☆☆
17	PNEU school	Etoug ebe	N/A	★☆☆☆☆
18	The Genius Trilingual School	Nkolbisson	N/A	★☆☆☆☆

The star ratings for the majority of the schools are 1 and 2 stars. Where star ratings show N/A, the SR4S assessments were not carried out that year for the corresponding school. These star ratings contradict the impressions of the students who feel safe on their way to school, as compared to the evidence-based iRAP methodology.

4. Conclusion

While the number of fatalities and serious injuries (FSI) on roads is being reduced around the world, the reverse is true in many low- and middle-income countries (LMICs). Unfortunately, the lives of young people are lost while trying to get an education. This study was aimed at analysing the existing road safety infrastructure, road user behaviour and crashes in Yaoundé, using low-cost methods for data collection and the application of iRAP methodologies and tools (ViDA and SR4S). As a result, methods have been shown whereby the risk of these daily commuters can be reduced. In the general analysis of the crash data, it is noticeable that Yaoundé is a very risky town for pedestrians because about 1 in 10 of all crashes involve a pedestrian, and 12.6% of all crashes include a fatality.

Evaluating students' school journeys shows that 39% of students walk to school and a significant 37% of students do not feel safe while commuting to school. The application of iRAP methodology shows significant improvement in road user safety when countermeasures are implemented with an improvement of 96% in pedestrian safety and 88% for all users.

In order to improve safety and take meaningful actions, targeted efforts should be multidisciplinary and not limited to engineering measures. Multidisciplinary actions should comprise engineering methods, complemented with implementing the safe system approach. They should also include engagement of community stakeholders, such as educators, and enforcement who have an extensive knowledge of local road user behaviour. Considering the current state of road safety management in Cameroon, further research could be carried out on the behaviour of other road user groups and transferability of proposed solutions to Cameroonian cities.

This study addresses a critical issue using low-cost methods and providing practical solutions from a multi-disciplinary approach. The study provides guidance for policy makers to develop comprehensive strategies that prioritize pedestrian safety, implement innovative solutions, strengthen enforcement, engage the community and invest in research. Policy makers can utilize the findings to inform the development and implementation of targeted interventions.

References

Aggarwal, A. D., & Singh, H. (2010). Fatal road traffic accidents among young children. *J Indian Acad Forensic Med*, *32*(4).

Andrade, G. R. De, Pitombo, C., Cunha, A. L. N., & Setti, J. R. (2016). A Model for Estimating Free-Flow Speed on Brazilian Expressways. *Transportation Research Procedia*, *15*, 378–388. https://doi.org/10.1016/j.trpro.2016.06.032

Baker, S. P., O'Neill, B., Ginsburg, M. J., & Li, G. (1991). *The Injury Fact Book*. Oxford University PressNew York, NY.

https://doi.org/10.1093/oso/9780195061949.001.0001
Barton, B. K., & Morrongiello, B. A. (2011). Examining the impact of traffic environment and executive functioning on children's pedestrian behaviors. *Developmental Psychology*, *47*(1), 182–191. https://doi.org/10.1037/a0021308
Chaudhuri, U., Ratnapradipa, K. L., Shen, S., Rice, T. M., Smith, G. A., & Zhu, M. (2019). Trends and patterns in fatal US motorcycle crashes, 2000–2016. *Traffic Injury Prevention*, *20*(6), 641–647. https://doi.org/10.1080/15389588.2019.1628224
Cigognetti, T., Carra, M., Ghirardi, A., Assefa, N. G., Ferretto, L., Ventura, R., Maternini, G., & Barabino, B. (2024). Mega-Events: Assessing Road Safety through an Operating Framework. An Application for the Milano–Cortina 2026 Winter Olympic Games. *Infrastructures*, *9*(3), 51. https://doi.org/10.3390/infrastructures9030051
Ferguson, R. W., Yang, M., Walker, L., Isaac, M., & Carr, K. (2014). *Safe Roads Safe Kids: Global Road Safety for Children*. https://www.safekids.org/sites/default/files/documents/ResearchReports/safe_roads-safe_kids_study_revised_version2.pdf
Fitzpatrick, K., Miaou, S. P., Brewer, M., Carlson, P., & Wooldridge, M. D. (2005). Exploration of the relationship between operating speed and roadway features on tangent sections. *Journal of Transportation Engineering*, *131*(4), 261–269. https://doi.org/10.1061/(ASCE)0733-947X(2005)131:4(261)
Fondzenyuy, S. K., Fowo Fotso, C. S., Feudjio, S. L. T., Usami, D. S., & Persia, L. (2024). Self-Reported Speed Compliance and Drivers Speeding Behaviour in Cameroon. *Future Transportation*, *4*(2), 659–680. https://doi.org/10.3390/futuretransp4020031
Gerald, A., Mbue, I. N., Merlin, A. Z., & Achiri, A. T. (2022). A Systematic Review of Excessive Speed Monitoring and Control System for Accident Prevention on Cameroon Highways. *World Journal of Engineering and Technology*, *10*(01), 28–39. https://doi.org/10.4236/wjet.2022.101002
GOMINTONG, C. L., & Jose, R. F. R. (2022). *Pedestrian safety assessment within public elementary school zones in quezon city using star rating for schools*. Eastern Asia Society for Transportation Studies. https://doi.org/10.11175/easts.14.2057
Gonzàlez-Hemàndez, B., Llopis-Castelló, D., & García, A. (2020). Operating speed models for heavy vehicles on tangents of two-lane rural roads. *Advances in Transportation Studies*, *50*, 5–18.
Greene, D., & Lewis, K. (2020). *Guide to traffic management: part 6: intersections, interchanges and crossings management* (4th. ed.). Sydney Austroads 2020.
HCM. (2010). HCM2010 Highway Capacity Manual. In *Transportation Research Board of The National Academies* (Vol. 1). http://hcm.trb.org/?qr=1%0Ahttp://dx.doi.org/10.1016/j.ssci.2016.03.011
Hoong, A. P. W., Mohamad Khaidir, N., Syed Tajul Arif, S. T. M., Sim, H. J., Mohd Yunin, N. A., Mohd Zulkiffli, N. S., Megat Johari, N., Ismail, M. F., Ishak, S. Z., Voon, W. S., & Abu Kassim, K. A. (2021). Evaluating Road Safety Risks at Schools in Selangor: An iRAP Approach. In *Malaysian Institute of Road Safety Research (MIROS)*.
iRAP. (2015). *Vaccines for roads: Third edition (English)* (Issue 3). https://irap.org/2015/12/vaccines-for-roads-precis-english/
Ištoka Otković, I., Deluka-Tibljaš, A., Šurdonja, S., & Campisi, T. (2021). Development of Models for Children—Pedestrian Crossing Speed at Signalized Crosswalks. *Sustainability*, *13*(2), 777. https://doi.org/10.3390/su13020777
Ndingwan, T. L., Wounba, J.-F., & Fondzenyuy, S. K. (2023, October). iRAP assessment and countermeasures selection for safer roads to schools in the city of Yaounde. *PIARC World Road Congress*.
NHTSA, National Highway Traffic Safety Administration (2024). *MMUCC Guideline Model Minimum Uniform Crash Criteria* (6th ed.). https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813525
Nyagwui, A. E., Fredinad, N., Longho, C. B., & Yulia, B. (2016). Motorcycle injury among secondary school students in the Tiko municipality, Cameroon. *Pan African Medical Journal*, *24*. https://doi.org/10.11604/pamj.2016.24.116.5069
Oxley, J., Ravi, M. D., Yuen, J., Hoareau, E., & Hashim, H. H. (2013). Identifying contributing factors to fatal and serious injury motorcycle collisions involving children in Malaysia. *Annals of Advances in Automotive Medicine*, *57*, 329. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3861809/
Sayyed Hoseinian, S. H., Ebrahimzadeh, M. H. ., Peivandi, M. T., Bagheri, F., Hasani, J., Golshan, S., & Birjandinejad, A. (2019). Injury Patterns among Motorcyclist Trauma Patients: A Cross Sectional Study on 4200 Patients. *Archives of Bone and Joint Surgery*, *7*(4), 367–372. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6686071/
Singh, S. G., & Vasantha Kumar, S. (2022). Development of Mode-Wise Speed Prediction Models for Urban Roads with Side Friction Characteristics. *Communications - Scientific Letters of the University of Zilina*, *24*(3), E108–E121. https://doi.org/10.26552/com.C.2022.3.E108-E121
UNICEF. (2020). *Children's way to school - the journey of worry UNICEF Viet Nam*. https://www.unicef.org/vietnam/stories/childrens-way-school-journey-worry
WHO. (2023). *Global Status Report on Road Safety*.