International Journal on Engineering Technology (InJET)

www.kec.edu.np/kec-journal/
Volume 3, issue no. 1, Dec 2025, Page 221 - 229
Received Date: Aug 22, 2025
Accepted Date : Oct 07, 2025
ISSN: 3021-940X (Print)
DOI: https://doi.org/10.3126/injet.v3i1.87070

School Zone Risk Evaluation Using iRAP SR4S Methodology: A Case Study of United School, Nepal

Manjil Khatiwada[1], Asmita Pokhrel[2], Sushil Babu Dhakal[3], Hemant Tiwari[4*]

[1]*Research Intern, Society of Transport Engineers Nepal (SOTEN), Pulchowk, Nepal, manjilkhatiwada2059@gmail.com*
[2]*Civil Engineer, Traffic and Transport Unlimited Solutions, Lalitpur, Nepal, Ashupokhrel02@gmail.com*
[3]*Joint Secretary, Ministry of Physical Infrastructure and Transport, Kathmandu, Nepal, dhakal.sushil45@gmail.com*
[4]*General Secretary, Society of Transport Engineers Nepal (SOTEN), Pulchowk, Nepal, hemu.ioe@gmail.com*

Abstract

Road traffic crashes are the 12th leading cause of death, and is the leading cause of death among the age group of 5-29 globally. Worldwide, nearly 500 children die daily, and many children suffer serious injuries. Nationally, 200 children lost their lives and 805 suffered from serious injuries as a result of road crashes in fiscal year 2024/25 (Nepal Police, 2025) in Nepal. To contribute towards improving child road safety, iRAP introduced a tool for assessing road conditions around school zones to ensure better facilities for road safety furniture, called the Star Rating for Schools (SR4S). The study is based on a school along an urban arterial road in Lalitpur district. All parameters, as outlined in the SR4S coding guide and checklist, including road environment, road features, road type, intersection, flow, speed, curve, sidewalks, and crossings, were collected based on field observations. The initial rating was obtained after coding the data into the SR4S web application. Various interventions were simulated using the SR4S System Demonstrator to analyze improvements to the existing road infrastructure and enhance safety for students. One of the major improvements was observed when the operating speed was reduced to 30 km/h, which improved the star rating to 4.3. The findings offer valuable insights for implementing targeted safety measures in the Nepalese school environment.

Keywords: Star Rating, School zone, iRAP, SR4S, Road safety

1. Introduction

There were an estimated 1.19 million road traffic deaths in 2021, a 5% drop when compared to the 1.25 million deaths in 2010. As of 2019, road traffic crashes are the leading killer of children and youth aged 5 to 29 years and are the 12th leading cause of death when all ages are considered (WHO, 2023). Nearly 500 children lose their lives every day due to road crashes globally, which equates to one child dying on the road every four minutes. Additionally, hundreds of children suffer injuries, with many sustaining serious injuries (iRAP, 2025).

In Nepal, the total number of road traffic fatalities increased from 1,131 in 2008 to 2,883 in 2022, with an increase of 155% (WHO, 2023). According to the crash data released by Nepal Police during FY 2081/82, a total of 2549 individuals lost their lives due to road crashes. The percentage of road crashes in Kathmandu Valley is considerably higher as compared to other parts of Nepal. 2,422 road crashes occurred in Kathmandu Valley, resulting in the death of 304 people. Furthermore, 614 children were involved in road crashes, of which 20 lost their lives, 88 suffered serious injuries, and 506 suffered minor injuries. This data suggests that the safety of children is of significant concern inside the Kathmandu valley. Road crashes not only affect human life but also affect the economy. A study conducted showed that the total cost of road crashes in Kathmandu valley for the fiscal year 2020 was calculated to be 1827.67 million Nepalese rupees (Rizal & Tiwari, 2023).

Star Rating for Schools (SR4S) is an award-winning assessment tool that helps us identify the exposure of risk to the children during their journey to school (iRAP, 2025). The iRAP Star Ratings measure the risk of roads and provide the assessment in terms of rating, ranging from one to five; one star is considered the least safe and five stars is considered the safest (Tiwari & Luitel, 2023).

* *Corresponding author*

Schools are highly sensitive areas, and caution to prevent any casualties must be prioritized. The school areas in Nepal aren't equipped with road safety furniture, increasing the risk to the children. The flow in and out of the school area rises during the peak hour, and the roads are generally busy during those times. This increases the risk of crashes if road safety is not encouraged (Pokhrel, et al., 2025). According to UNICEF, the implementation of a 30 km/h speed limit could reduce child fatality and pedestrian injury by 70% (UNICEF, 2022). The Star Rating for Schools (SR4S) programme continues to create inspiring stories of school journeys, being made safer across the world. As of June 2025, SR4S partners have assessed 2,337 schools in 80 countries, positively impacting the safety of approximately 495,309 students with an investment of USD$11.5 million (iRAP, 2025). In Nepal, most of the schools lack basic road safety elements. This questions the safety of students and increases their vulnerability. Hence, implementing various cost-effective safety interventions around school zones can eliminate the risk of serious injuries and untimely death of school children as well as other road users.

2. Research Objective

The objective of this study is to assess the safety condition of the school in its existing condition through the Star Rating for School (SR4S) methodology and explore the improvement in the star rating with different possible combinations of recommended road safety interventions.

3. Study Area

United School is located in the Lalitpur district of Nepal. It is approximately 400 meters outside the Kathmandu Ring Road (NH-39) along the Gwarko-Lamatar road. Gwarko-Lamatar road is an urban arterial road in Lalitpur district connecting residential areas of Lamatar, Imadol, and Tikathali. The school accommodates nearly 2,500 students, offering classes from 1 to 10. The surrounding area around the school has a mix of residential and commercial land uses. The location of the school is shown in Figure 1.

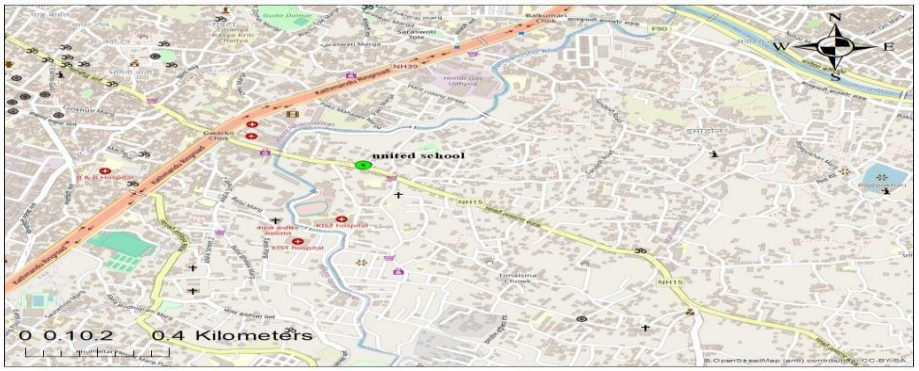

Figure 1. Map of the study area

Figure 2. Study Area

4. Literature Review

SR4S is a widely used tool for the assessment of road safety scenarios across the world. In Khorasan Razavi Province of Iran, SR4S was conducted in seven different schools, among which three schools that were less safe than others were selected for treatment implementations by the local road authority. After treatment, the

star rating of Shohada, Imam Ali, and Azmoodeh School improved from 1 star to 3, 4, and 2 stars, respectively (Zayerzadeh & Zavareh, 2019). Similarly, SR4S was carried out on a large scale in 25 and 41 schools of Zamboanga and Venezuela cities, Philippines, respectively, where the ratings were virtually simulated to observe whether they would improve a road's star rating and score or not by using the system demonstrator feature (Kamid, et al., 2021). Also, a study conducted in the Philippines 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 (Gomintong & Regidor, 2022).

In India, SR4S methodologies were used in collaboration with the Government of Haryana, MG Motor, and TRAX (India), at the Government High School Sahupura in Sector 65, Faridabad. After the suggestion of various interventions, the ratings improved from 2 to 3 stars, resulting in a safe journey for students (IndiaRAP, 2022).In Indonesia, researchers combined the SR4S methodologies with youth participation while carrying out the safety assessment at Junior High School 1 Surakarta City, where seven high-risk locations impacted by the Manahan flyover development were used as the survey locations. The coding was based on the field surveys with the students. The input data for coding were generated from the views of the students and their perspectives as road users. All the problems were mapped into the SR4S application. Using the SR4S application, six locations were rated 1-star or 2-star. Only one location was rated 3-star (Ellizar, et al., 2023).

In Botswana, SR4S was conducted at the entrance of Tsabong Primary School, where a 3.8-star rating was obtained. After interventions such as speed calming measures, reduction of vehicle speed, and installation of new signs, the star rating increased to 4.3 (EA991, 2025). In Chile, the Aleatica Foundation has successfully implemented its "#SeguroEsCool" program, where SR4S was conducted at three public schools in Naucalpan. After the implementation of the proposed interventions, the ratings improved from 1.6, 2.6, and 3.6 stars to 3.8, 4.1, and 4.7 stars, respectively (SR4S, 2025). Similarly, in India, SR4S was carried out at Government Senior Secondary School for Girls in Sohana, Mohali, and after various proposed interventions, the rating improved from 1 to 3.2 (SR4S, 2025).

In Nepal, SR4S was conducted in 4 schools of Kathmandu Valley along with the assessment of their risk factors. After the initial ratings were obtained, various cost-effective measures were recommended, which range from various traffic signs, speed limit, road markings, and the provision of a road crossing supervisor. Due to these interventions, the rating improved to 3, 4, and 5 stars for 1, 2, and 1 schools (Luitel, et al., 2023). Similarly, the study was carried out in eight schools in Kathmandu Valley, and after the proposed interventions, the ratings improved to 3, 4, and 5 stars at 2, 4, and 2 schools (Tiwari & Luitel, 2024). In the study carried out at Shree Sahid Jung Prakash Shah Sanskrit Secondary School at Nuwakot, it was found that after the proposed interventions were applied, the star rating remained unchanged, but the risk factor decreased by 0.66 (Pokhrel, et al., 2025).

It has also been found that operating speed plays a crucial role in determining the rating and scores in a star rating application (Ayuningtyas, et al., 2024). A study claims that the speed at which a vehicle travels directly influences the risk of a crash as well as the severity of injuries sustained, and the likelihood of death resulting from that crash (Bista & Tiwari, 2024). A study on major black spots in Kathmandu Valley found that speed, combined with traffic volume, is the primary factor influencing crash occurrence (Tiwari, 2015).

5. Methodology

The methodology of the study is shown in Figure 3.

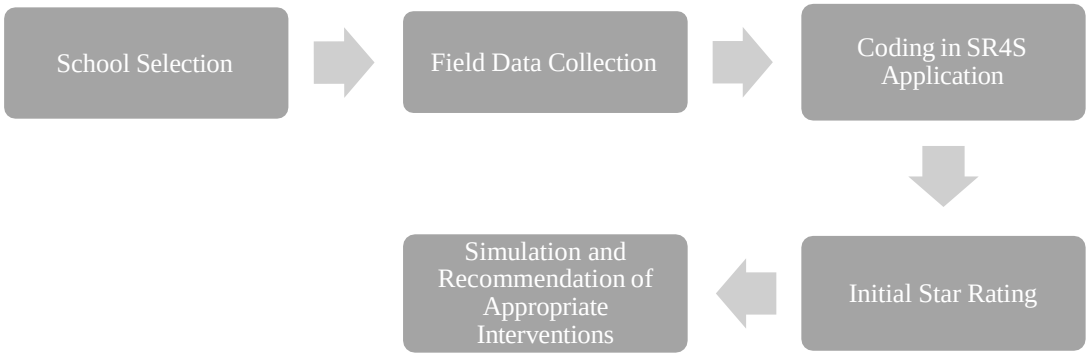

Figure 3. Methodological Flowchart of the study

Road safety assessments around the school zones can be systematically carried out using the SR4S application. The assessment process involved several stages, including school selection, field data collection, data coding, and determination of the initial star rating. At the initial stage, the school is selected based on factors such as student vulnerability and traffic exposure. Following school selection, field data collection was conducted around the study area using the SR4S coding guide and checklist. The SR4S checklist contains 40 parameters as shown in Figure 4. These parameters include various road features, traffic volume, speed data, etc. These parameters were documented during the collection of field data. Then, the data were coded into the SR4S web application to obtain the initial star rating of the school.

Figure 4. SR4S Parameters

After obtaining the initial star rating, potential safety interventions were simulated through the system demonstrator of SR4S to assess their impact on the overall safety level. Various interventions, such as installation of raised pedestrian crossings, improvement of sidewalks, placement of guardrails, and enhancement of traffic signs and markings, were virtually tested to estimate their effectiveness in increasing the star rating. The difference between initial and simulated ratings helped identify the most effective strategies to improve safety. This study focused on the star rating of United School using the new rating system of SR4S, where ratings were obtained in decimal form (1.5, 2.8, 3.1, etc.), whereas in the old rating system, ratings were obtained in number form (1, 2, 3, etc.). In both systems, the rating still ranges from 1 to 5.

6. Result and Discussion

6.1 Speed Observation

A spot speed study was conducted to observe the operating speed (85th percentile) of the vehicles flowing through the school zone. The speed of the vehicles flowing in both directions was recorded by using a radar gun. A frequency distribution curve was plotted using the speed data of various vehicles. The operating speed (85th percentile) at the study area was found to be 43 km/h, which can be seen in Figure 5.

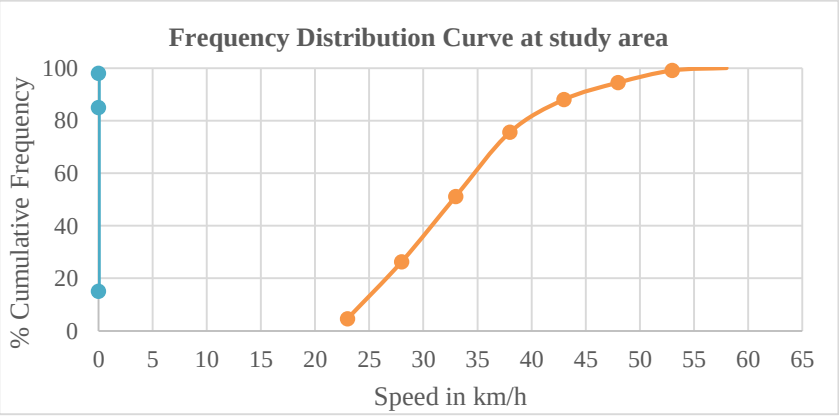

Figure 5. Frequency distribution curve in the study area

6.2 Traffic Volume Observation

The traffic volume of the study area was observed by recording the number of vehicles flowing through the study area in both directions. The study was conducted for one hour during peak hour from 9 A.M. to 10 A.M. The flow was recorded in 15-minute time intervals. The total traffic volume in one hour was found to be 2,230, which can be seen in Table 1 and Table 2..

Table 1.Table showing left side flow passing through the study area

Left Side Flow (Towards Lamatar)			
Time / Vehicles	**Motorcycle**	**Light Vehicles (Car, Taxi, Micro, etc.)**	**Heavy Vehicles (Bus, Truck, etc.)**
9:00-9:15	**189**	**66**	**7**
9:15-9:30	**151**	**88**	**9**
9:30-9:45	**176**	**72**	**9**
9:45-10:00	**157**	**61**	**6**
Total	**673**	**287**	**31**

Table 2.Table showing the right side flow passing through the study area

Right Side Flow (Towards Gwarko)			
Time / Vehicles	**Motorcycle**	**Light Vehicles (Car, Taxi, Micro, etc.)**	**Heavy Vehicles (Bus, Truck, etc.)**
9:00-9:15	**217**	**95**	**11**
9:15-9:30	**190**	**98**	**7**
9:30-9:45	**196**	**104**	**8**
9:45-10:00	**207**	**97**	**9**
Total	**810**	**394**	**35**

6.3 Parameters Observation

The parameters recorded during field data collection to obtain the initial star rating are shown in Table 3.

Table 3. Initial Data of School Zone

S.N.	**Parameters**	**Coding**
1	**Location**	Gwarko, Lalitpur
1.1	School	United School
1.2	Road name	Gwarko-Lamatar Road
2	**Road Environment**	
2.1	Land use left	Commercial
2.2	Land use right	School

S.N.	Parameters	Coding
2.3	Area type	Urban
2.4	Vehicle parking	None
2.5	Sight distance	Adequate
3	**Road Type**	
3.1	Number of lanes	1 each way
3.2	Lane width	3.6 m (Wide)
3.3	Shoulder rumble	Not present
3.4	Road condition	Good
3.5	Grip	Medium
3.6	Grade	0 to <7.5%
3.7	Carriage way type	Undivided
4	**Road Features**	
4.1	Middle of the road	Centre line
4.2	Lines and signs	Poor
4.3	Street lightning	Present
5	**School Zone**	
5.1	School warning	Signs/markings
5.2	Crossing supervisor	No supervisor
6	**Sidewalks**	
6.1	Sidewalk left	None
6.2	Sidewalk right	1.95 m (1 to 3m)
6.3	Road edge left	0.52 m (0 to 1m)
6.4	Road edge right	0.52 m (0 to 1m)
6.5	Pedestrian channelization	Not present
7	**Crossing**	
7.1	Crossing mainroad	Marked
7.2	Crossing sideroad	None
7.3	Crossing quality	Poor
8	**Flow**	
8.1	Vehicles (peak hour)	2230
8.2	Crossing flow	Not present
8.3	Left side flow	Present
8.4	Right side flow	Present
8.5	Motorcycle present	66.5% (61% to 80%)
8.6	Heavy vehicle present	2.96% (0 to 5%)
9	**Intersection**	
9.1	Intersection type	No intersection
9.2	Driveways	Not applicable
9.3	Intersection side flow	No
9.4	Intersection quality	No intersection
10	**Curve**	
10.1	Curve type	Straight
10.2	Curve quality	Adequate
11	**Speed**	
11.1	Speed limit (in number)	40
11.2	Speed limit unit	km/h
11.3	Operating speed	43

S.N.	Parameters	Coding
11.4	Speed management	Not present

6.4 Existing Star Rating Assessment

The Star Rating for Schools is a robust tool that uses the pedestrian component of Star Ratings to provide a measure of the contribution of road design to the risk of each pedestrian. It combines a central web application and a data collection mobile app (SR4S, 2025). After coding the above parameters shown in Table 1 into the SR4S web application, the SR4S analysis produced a 1.8-star rating, which suggests that the safety features around the school zone are not sufficient and need improvement. The rating has been verified by an SR4S-accredited reviewer. The observation of the parameters showed the lack of sidewalk on the left side, the lack of pedestrian channelization, and the presence of poor crossing markings, which can significantly reduce pedestrian safety. The absence of speed management measures such as speed humps and raised crossings can significantly add to high vehicle operating speed (43 km/h), which is unsafe around school zones. Furthermore, the lack of sufficient traffic signs and markings could reduce the awareness of drivers in school zones.

6.5 Improvement of Star Rating through recommended safety intervention

After the initial star rating was produced, the system demonstrator was used to simulate different types of interventions to observe the effect on star ratings due to those interventions, which can be seen in Figure 6.

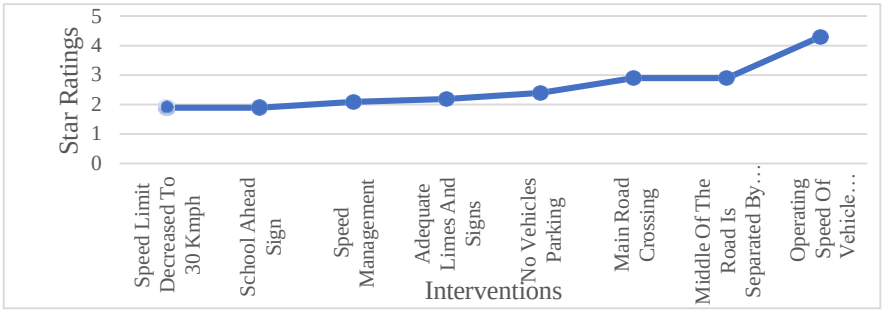

Figure 6. Star Rating Vs Interventions

From Figure 6, it can be seen how different interventions affect the star rating of a road section. Measures like reducing the speed limit and installing a school ahead sign resulted in a minor increase in rating to 1.9. Moderate improvements were observed with measures like speed management, adequate lines and signs, restricting vehicle parking, increasing the rating to 2.1, 2.2, and 2.4, respectively. Significant gain was observed with measures like safer main road crossing and installing a flexible barrier at the road median, uplifting the rating to 2.9. Among all the interventions, a significant improvement was observed when the operating speed of the vehicle was reduced to 30 km/h, which raised the rating to 4.3. Also, when both speed limit and operating speed are reduced to 30 km/h without changing any other parameters, the rating significantly increased to 3.4. This analysis indicated that while traffic management and signage contribute towards safety, the most significant impact is achieved by controlling actual vehicle operating speed.

6.6 Comparison with previous literature

The findings of this study align with studies by Luitel et al. (2023) and Tiwari & Luitel (2024), which also reported low initial ratings of 1 to 2 stars for various schools in the Kathmandu Valley due to insufficient road safety furniture. Internationally, in Iran (Zayerzadeh & Zavareh, 2019) and the Philippines (Kamid, et al., 2021) similar improvements were noted where implementing interventions like raised crossings, clear markings, and reduced speed limits significantly improved star ratings.

In this study, a decrease in the operating speed to 30 km/h while simulating interventions resulted in a notable improvement to 4.3 stars, which aligns with the recommendations of UNICEF (2022) and Ayuningtyas et al. (2024). This literature highlighted the critical role of speed control in reducing crash risks. The findings also support Bista & Tiwari (2024), who concluded that vehicle speed and traffic volume are key contributors to crash risk in urban Nepal. Therefore, the study confirms that implementing SR4S-based interventions can substantially improve the safety of school zones.

7. Conclusion

The purpose of this study was to evaluate the condition of road safety features around United School, situated in Gwarko, using the SR4S coding guide and checklist to document the data, and then the SR4S web application to obtain the initial star rating. After receiving a low rating of 1.8 stars, it can be concluded that the condition of the road safety features around the school zone is insufficient to safeguard the lives of students and to reduce the probability of serious injuries or even death. So, various interventions were analyzed using the SR4S system demonstrator to improve the road safety furniture around the school zone, and also to improve the star rating. During the study, it was found that not only United School but also most of the schools in Nepal lack basic road safety features around the school zones. So, it's high time that the local government, school management, and various stakeholders should focus on the compulsory implementation of road safety furniture around school zones to ensure the safety of students as well as other road users.

8. Disclaimer

The views expressed in this research article is of authors' personal views and not those of their affiliated institutions.

References

Ayuningtyas, K. N. S., Kusumawati, A., Pangestika, S. H. & Hadiyanti, I., 2024. The Relationships Between iRAP Star Rating Score and Various Safety Performance Indicators. International Journal of Technology, XV(5), pp. 1349-1360.

Bista, T. C. & Tiwari, H., 2024. Assessment of Stratified Speed Characteristics and Compliance with Posted Speed Limit in an Urban Area: A Case Study of Section of Karnali Highway, Nepal. International Journal on Engineering Technology, pp. 187-194.

EA991, 2025. EA991 and Partners Improve Road Safety at Tsabong Primary School to 4-stars (Botswana). [Online]
Available at: https://starratingforschools.org/2025/05/ea991-and-partners-improve-road-safety-at-tsabong-primary-school-botswana/

Ellizar, E. et al., 2023. Youth Participation in School Safety Zones Assessment: A Case Study in Indonesia. Journal of Road Safety, XXXIV(2), pp. 1-9.

Gomintong, C. L. & Regidor, J. R. F., 2022. Pedestrian Safety Assessment Within Public Elementary School Zones in Quezon City Using Star Rating for Schools. Journal of the Eastern Asia Society for Transportation Studies, Volume XIV, pp. 2057-2076.

IndiaRAP, 2022. Case Studies of Implementation - IndiaRAP, s.l.: s.n.

iRAP, 2025. Let's make every school journey safe for our kids!. [Online] Available at: https://starratingforschools.org/

Kamid, S. A., Latonero, G. S. D., Sigua, R. G. & Regidor, J. R. F., 2021. Star Rating for Schools (SR4S): The Case of Zamboanga and Valenzuela Cities in the Philippines. Journal of the Eastern Asia Society for Transportation Studies, Volume XXV, pp. 2113-2132.

Luitel, S., Tiwari, H., Gautam, S. & Bhattarai, S., 2023. Evaluating Road Safety Scenario of Four Schools Using Star Rating for Schools. s.l., s.n., pp. 141-145.

Pokhrel, A., Luitel, S. & Tiwari, H., 2025. School Road Safety Assessment in Nepal: A Case Study Using SR4S Ratings. International Journal on Engineering Technology (InJET), pp. 51-57.

Rizal, S. & Tiwari, H., 2023. Analysis of Road Traffic Crash Cost in Kathmandu Valley. s.l., s.n., pp. 100-109.

SR4S, 2025. #SeguroEsCool: Aleatica Foundation for Road Safety and partners improve school zone safety with tactical urbanism and Star Rating for Schools. [Online] Available at: https://starratingforschools.org/2025/03/seguroescool-aleatica-foundation-for-road-safety-and-partners-improve-school-zone-safety-with-tactical-urbanism-and-star-rating-for-schools/

SR4S, 2025. HOW IT WORKS. [Online] Available at: https://starratingforschools.org/how-to/

SR4S, 2025. New SR4S Case Studies: Showcasing Safer Journeys to School in India and Moldova. [Online] Available at: https://starratingforschools.org/2025/05/new-sr4s-case-studies-showcasing-safer-journeys-to-school-in-india-and-moldova/

Tiwari, H., 2015. Dependency of Road Accidents with Volume and Speed (A Case Study of Major Black Spot Location within Kathmandu Valley). s.l., s.n., p. 339–343.

Tiwari, H. & Luitel, S., 2023. Re-orienting towards Safer Roads Infrastructure in Nepal. Journal of Recent Activities in Infrastructure Science, VIII(3), pp. 14-27.

Tiwari, H. & Luitel, S., 2024. Evaluation of Enhancement of Star Rating and Risk Factor in Eight Schools of Kathmandu, Nepal. Journal of the Eastern Asia Society for Transportation Studies, Volume XV, pp. 2964-2974.

UNICEF, 2022. Technical Guide for Child and Adolescent Road Safety, s.l.: UNICEF.

WHO, 2023. Global Status Report 2023: Country and territory profiles, s.l.: WHO.

WHO, 2023. Global Status Report on Road Safety, s.l.: WHO.

Zayerzadeh, A. & Zavareh, M. F., 2019. School Zone Road Safety Assessment Using the iRAP Star Rating for Schools (SR4S) Methodology in Khorasan Razavi Province. s.l., s.n.