Star Rating Methodology for School Traffic Safety in Vietnam

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Abstract: Traffic accidents in Vietnam severely impact public health, especially for vulnerable groups like students. This paper uses the International Road Assessment Programme's (iRAP) Star Rating for Schools (SR4S) model to evaluate road safety at three Hanoi universities. Field surveys and infrastructure assessments reveal average star ratings of 1 to 3, compared to the desired 3-star safety threshold. Critical deficiencies are identified in pedestrian crossings, traffic calming, and signage, creating unsafe conditions. The study proposes prioritized recommendations to improve infrastructure and traffic management, aiming to achieve at least a 3-star rating for all school gates, thus enhancing student safety and community well-being.

Keywords: SR4S, School Traffic Safety, Traffic Safety Improvement, Traffic Infrastructure Assessment

1. INTRODUCTION

Road safety is a critical concern globally (Hultkrantz *et al.*, 2006; Wang *et al.*, 2013; Ziakopoulos and Yannis, 2020), and Vietnam, like many rapidly developing nations, faces significant challenges in ensuring the safety of its citizens, particularly vulnerable populations such as children (Schmucker *et al.*, 2008; Vu and Nguyen, 2018). Traffic accidents in Vietnam result in thousands of serious injuries and fatalities annually, posing a substantial threat to public health and well-being. These accidents not only cause immeasurable personal loss and suffering but also place a considerable burden on the healthcare system and the economy. Within this context, the safety of students traveling to and from school is of paramount importance. The journey to school, which should be a safe and positive experience, can become a source of anxiety for parents and a potential danger for students. Unsafe traffic conditions around schools not only endanger students' physical well-being but also impact their ability to focus on their education and their overall development.

Unsafe school zones in Vietnam present a critical and ongoing safety issue for children, exacerbated by rapid urbanization, increasing motorization, and often inadequate infrastructure planning (Ngoc *et al.*, 2023; Ngoc and Hung, 2020; Swanson *et al.*, 2022). In 2021, children under 18 were involved in 10.6% of all road traffic accidents (Unicef, 2025). Many schools are situated along busy roads characterized by high traffic volumes, limited pedestrian crossings, and insufficient traffic calming measures. Data from the International Road Assessment Programme (iRAP) underscores these deficiencies, revealing that only 10% of evaluated roads achieve a 3-Star safety rating or better for pedestrians, with a mere 5% having sidewalks and 9% offering designated crossings (Unicef, 2025). The presence of high speeds, especially

around schools, significantly amplifies the danger for young pedestrians and children.

This already challenging situation is further complicated by the diverse mix of motorized vehicles, motorcycles, bicycles, and pedestrians commonly found in Vietnamese traffic, creating a complex and often chaotic environment, particularly around school gates during peak hours. While efforts have been made to enhance road safety in Vietnam, including the implementation of traffic regulations and public awareness campaigns, a comprehensive and standardized approach to assessing and improving traffic safety specifically around schools remains a pressing need. Current measures are often insufficient and lack the systematic evaluation required to identify and address the most critical risks effectively.

This paper addresses this gap by leveraging the Star Rating for Schools (SR4S) model developed by the International Road Assessment Programme (iRAP) (CCG, 2024; Luitel and Tiwari, 2024). The SR4S is a globally recognized and evidence-based methodology designed to assess and improve road safety specifically around schools. It provides a structured framework for evaluating infrastructure, identifying potential hazards, and assigning star ratings that reflect the level of safety for students. By applying the SR4S model, it becomes possible to systematically identify high-risk areas, prioritize interventions, and track progress towards safer school environments. The specific objectives of this research are to: (1) Conduct detailed field surveys and infrastructure assessments at the selected university locations; (2) Apply the SR4S model to analyze the collected data and rank the safety levels of the study sites; (3) Identify critical deficiencies in pedestrian crossings, traffic calming measures, and signage that contribute to unsafe conditions; (4) Develop actionable and prioritized recommendations to improve infrastructure and traffic management around the selected universities; (5) Ultimately, contribute to the development of safer and healthier environments for students and the surrounding community.

The scope of this study is limited to three universities in Hanoi, (1) Hanoi University of Culture - HUC (Fig. 1a); (2) University of Art and Design - UAD (Fig. 1b) (3) University of Transport and Communications - UTC (Fig. 1c). While the findings may not be directly generalizable to all schools in Vietnam, they can provide valuable insights into the challenges and opportunities for improving school traffic safety in urban areas. Data availability and resource constraints may also present limitations. However, this research will contribute to the growing body of knowledge on school traffic safety in Vietnam and offer practical recommendations for improving the safety of students on their daily journeys to and from university.

Figure 1. Three surveyed universities for the SR4S assessment: a) Hanoi University of Culture – HUC, b) University of Art and Design – UAD, and c) University of Transport and Communications – UTC (Source: streetview.vn)

2. METHODOLOGY OF STAR RATING FOR SCHOOLS

This study employs the Star Rating for Schools (SR4S) methodology, developed by the International Road Assessment Programme (iRAP), to evaluate and propose improvements to traffic safety at three universities in Hanoi, Vietnam. The SR4S provides a comprehensive and standardized framework for assessing road safety risks specifically around schools, focusing on the journeys students take to and from their educational institutions. It moves beyond simply counting crashes to proactively identifying and mitigating risks before they result in injuries.

The SR4S methodology is founded on core principles that adapt iRAP's broader Star Rating system to prioritize child road safety. It employs an evidence-based risk assessment, utilizing extensive research to pinpoint how specific road features directly correlate with crash risks for pedestrians, especially children, through a predictive model. This approach is inherently proactive, assessing the "built-in" safety of infrastructure to enable interventions before crashes happen, rather than relying on often incomplete historical accident data. Crucially, SR4S maintains a sharp focus on vulnerable road users, specifically children as pedestrians and cyclists, acknowledging their unique vulnerabilities like smaller stature, developing risk perception, and susceptibility to distraction, ensuring their safety is paramount in the assessment.

The SR4S assessment process comprises several following key steps.

2.1 Data Collection

The foundation of the SR4S assessment lies in the collection of detailed data related to the road environment surrounding the selected universities. This involves both field surveys and the gathering of supplementary information.

1) Field Surveys

On-site observations are conducted at each university during peak student arrival and departure times to capture real-world traffic conditions. Collected data, on a range of factors relevant to pedestrian and cyclist safety, includes:

- Road geometry: Measurements of road width, number of lanes, intersection angles, and presence of curves were recorded.
- Traffic volume and composition: Counts of vehicles (cars, motorcycles, buses, trucks) and pedestrians are conducted, categorized by type and direction. Special attention is paid to traffic flow patterns and congestion levels.
- Pedestrian and cyclist activity: Observations of pedestrian and cyclist behavior, including crossing locations, volumes, and adherence to traffic rules, are documented.
- Infrastructure assessment: Detailed assessments of existing infrastructure are carried out, including:
    - Pedestrian crossings: Type (zebra crossing, pedestrian signal, underpass, overpass), location, visibility, and condition.
    - Traffic calming measures: Presence and effectiveness of speed humps, chicanes, roundabouts, and other traffic calming devices.
    - Signage and markings: Assessment of the adequacy, visibility, and clarity

of traffic signs, road markings, and school zone signage.
    - Footpaths and cycle paths: Condition, width, and accessibility of footpaths and cycle paths leading to the university gates.
    - Street lighting: Evaluation of street lighting levels and coverage in the vicinity of the university.
    - School gate environment: Assessment of the immediate area around the school gates, including drop-off zones, parking areas, and pedestrian flow management.

2) Supplementary Information

In addition to field surveys, supplementary data is gathered where available to provide a more complete picture of the traffic environment. This included:

- Crash data: Historical crash records for the area surrounding the universities, obtained from local traffic authorities (if accessible), are reviewed to identify any existing hotspots or patterns.
- Traffic volume data: Existing traffic volume data collected by local authorities may have been used to supplement the field survey data.
- University plans and policies: University transportation plans, policies related to student safety, and any existing traffic management measures implemented by the university are reviewed.

Table 1. Survey data for three locations

Criteria	**University**		
	HUC*	**UAD****	**UTC*****
Land Use Left/Right	Residential	Residential	Residential
Area Type	Urban	Urban	Urban
Vehicle Parking	Two Side	One Side	Two Side
Sight Distance	Poor	Poor	Adequate
Number of Lanes	1_1	1_1	4_4
Lane Width	Medium	Medium	Medium
Shoulder Rumble Strips	Present	Present	Present
Road Condition	Medium	Medium	Medium
Grip	Poor	Poor	Medium
Grade	0-7.5%	0-7.5%	0-7.5%
Carriageway Type	Not Applicable	Not Applicable	Divided
Middle of Road	Center Line	Center Line	Separated 1-5m
Lines & Signs	Adequate	Poor	Adequate
Street Lighting	Present	Present	Present
School Warning	No School Zone	No School Zone	No School Zone
Crossing Supervisor	No Supervisor	No Supervisor	No Supervisor
Sidewalk Left/Right	0-1m Away	0-1m Away/ None	1-3m Away
Road Edge Left/Right	0-1m Wide	0-1m Wide	0-1m Wide
Pedestrian Channelisation	Not Present	Not Present	Not Present
Crossing Main Road	Marked	None	Bridge/Tunnel

Criteria	University		
	HUC*	UAD**	UTC***
Crossing Side Road	None	None	Bridge/Tunnel
Crossing Quality	Poor	Poor	Adequate
Vehicles/Day	5000	4000	10000
Crossing Flow	Present	Present	Present
Right/Left Side Flow	Present	Present	Present
Intersection Type	No Intersection	No Intersection	No Intersection
Driveways	> 2 Residential	> 2 Residential	1-2 Residential
Intersection Side Flow	5000	4000	10000
Intersection Quality	Not Appicable	Not Appicable	Poor
Curve Type	Straight	Straight	Straight
Curve Quality	Not Curve	Not Curve	Not Curve
Speed Limit	50 km/h	50 km/h	60 km/h
Operating Speed	30 km/h	25 km/h	40 km/h
Speed Management	Not Present	Not Present	Not Present
Motorcycle %	61-80%	41-60%	41-60%
HGV**** %	5-10%	5-10%	5-10%

**HUC-Hanoi University of Culture;*
***UAD-University of Art and Design;*
****UTC-University of Transport and Communications;*
*****HGV-Heavy vehicle percent*

2.2 SR4S Scoring and Star Rating

The collected data is inputted into the demonstrator platform of iRAP SR4S. The platform uses a standardized risk assessment methodology to evaluate the safety of the road environment for children. Based on the collected data, the SR4S platform calculates star ratings. The star ratings range from one to five stars, with one star representing the lowest level of safety and five stars representing the highest. The star rating is determined by considering the likelihood of a crash occurring and the severity of potential injuries, taking into account factors like traffic volume, speed, infrastructure quality, and pedestrian/cyclist exposure. The SR4S platform also identifies specific risk factors contributing to lower star ratings.

2.3 Data Analysis

The SR4S star ratings and associated risk factors are analyzed to identify the most critical safety issues at each university. This involves comparing the star ratings achieved at each site with the desired 3-star safety threshold, which iRAP considers a minimum acceptable level of safety for school zones. The analysis focuses on understanding the specific infrastructure deficiencies and traffic management challenges that contribute to lower star ratings. This information provides the basis for developing targeted recommendations for improvement.

3. STAR RATING RESULTS AND SUGGESTIONS FOR IMPROVEMENT

3.1 Star Rating Results

Traffic volume at the university gates is recorded and categorized by vehicle type during peak and off-peak hours. Vehicle types counted included motorcycles, cars, heavy trucks, and other vehicles. Data collection is performed through direct observation and manual recording. To account for the varying impact of different vehicle types on traffic flow, a conversion factor is applied. Motorcycle counts are converted to passenger car unit (PCU) using a factor of 0.3, while heavy truck counts are converted using a factor of 1.3.

Hanoi University of Culture – HUC

The road fronting the HUC is a two-lane urban road (one lane per direction), 3.0 meters wide per lane. This road carries a high volume of traffic, estimated at approxi-mately 5,000 vehicles/day. The road segment surveyed is straight with an average longitudinal slope of 3%. The asphalt concrete surface exhibits average roughness, although localized cracking and minor depressions are observed, potentially impacting traffic safety.

Traffic conditions in this area are complex due to high population density and significant pedestrian activity, particularly students. Frequent vehicle parking directly in front of the university gate exacerbates accident risk. The narrow sidewalk is often obstructed by parked vehicles and commercial establishments, forcing pedestrians to walk on the roadway itself.

The existing traffic control infrastructure is inadequate and ineffective. Road markings, signage, and traffic signals are poorly maintained and inconsistently placed, and the pedestrian crossing is difficult to discern. Applying the SR4S assessment criteria, a detailed analysis of the HUC gate area, considering traffic infrastructure, operating conditions, and pedestrian safety, resulted in a 1-star rating (see Fig. 2). This rating indicates a high level of risk for all road users, especially students and pedestrians.

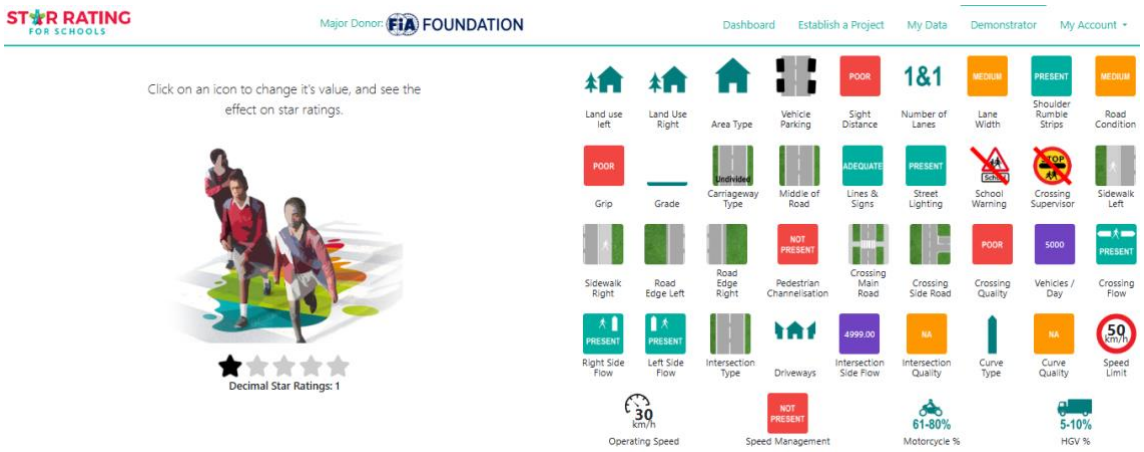

Figure 2. SR4S Star Rating: Hanoi University of Culture - HUC

University of Art and Design – UAD

The road segment fronting the University of Art and Design features two lanes (one per direction), each 2.75 meters wide. This narrow width restricts vehicle maneuver-ability, particularly when compounded by illegal parking.

The road segment's average longitudinal slope of approximately 5% is consistent with the local terrain but presents a potential slipping hazard, especially during inclement weather. The road segment is straight. Traffic composition is complex due to the high population density and includes a mix of motorbikes, cars, and trucks. An average daily traffic volume (ADTV) of

approximately 4,000 vehicles, coupled with frequent illegal parking, creates traffic congestion and increases the risk of accidents, especially during peak hours.

The asphalt concrete road surface exhibits signs of deterioration, including localized subsidence and minor surface spalling, which negatively impacts safe vehicle operation. While the average surface roughness provides adequate skid resistance in dry conditions, it may become hazardous in wet weather.

Traffic safety infrastructure is deficient. Traffic signage is inadequate, road markings are faded, and designated pedestrian crossings are absent, making safe road crossing challenging for students and residents. Despite high pedestrian volumes, particularly during school dismissal, effective traffic management measures to protect this vulnerable group are lacking.

Applying the iRAP assessment criteria, the University of Art and Design gate area received a 1-star rating (see Fig. 3), indicating a low level of safety and a high potential for risk, particularly for pedestrians.

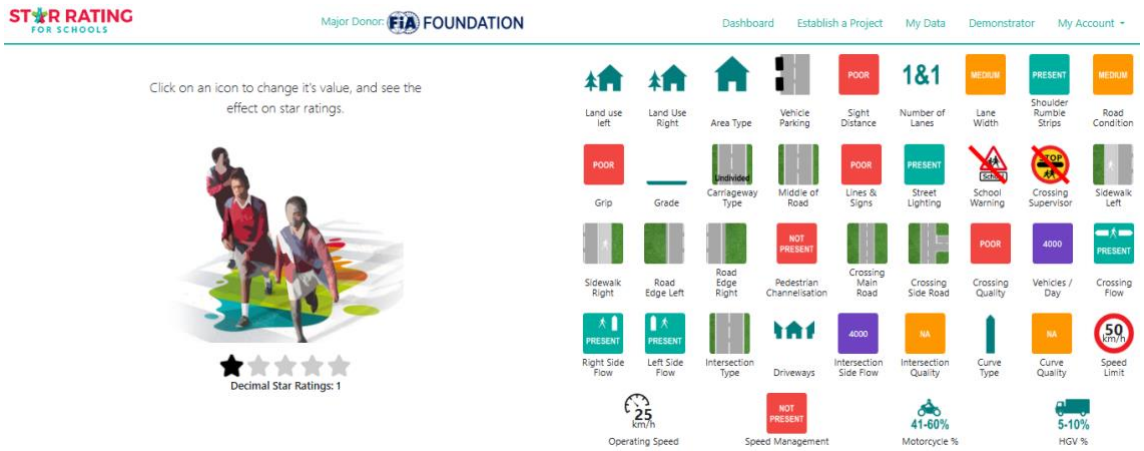

Figure 3. SR4S Star Rating: University of Art and Design – UAD

University of Transport and Communications – UTC

The road fronting the University of Transport and Communications gate is a 4x4-lane, one-way urban road (four lanes per direction), with each lane measuring 3.5 meters wide, accommodating the heavy traffic demands of this central area. The road segment is straight with an average longitudinal slope of 2%, conforming to urban road standards and generally promoting safe vehicle operation.

Traffic composition is highly diverse, including motorbikes, cars, buses, and trucks, with an average daily traffic volume of approximately 10,000 vehicles. The road surface, constructed of high-quality asphalt concrete, exhibits a high degree of roughness, providing excellent skid resistance in both dry and wet conditions. The posted speed limit is 60 km/h.

Traffic conditions are complex, primarily due to the frequent operation of buses, particularly at bus stops located near the university gate. This, coupled with substantial pedestrian traffic, creates a high potential for traffic conflicts. While the traffic control system is relatively comprehensive, featuring clear signage, traffic signals, and road markings, including dedicated bus lanes, the sidewalk near the university gate is frequently obstructed by illegally parked vehicles, posing a significant hazard to pedestrians.

With the presence of pedestrian overpasses, signage, and signals, the University of Transport and Communications gate area receives an SR4S rating of 3.5 stars (see Fig. 4). This rating achieves the 3-star standard for school safety as defined by iRAP.

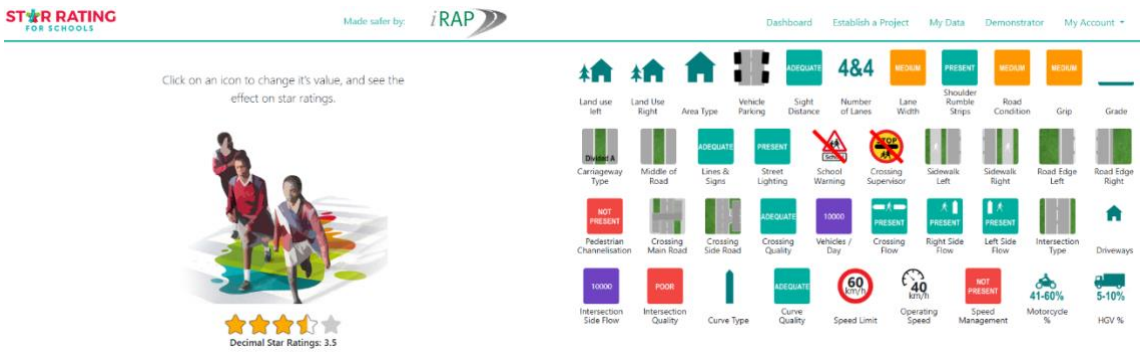

Figure 4. SR4S Star Rating: University of Transport and Communications – UTC

3.2 Suggestions for Improvement

To achieve the iRAP 3-star standard (or higher), improvements to pedestrian infrastructure are essential, particularly for student walkways. Given the impracticality and high cost of altering road width, lane configurations, or constructing pedestrian overpasses at all three university locations, this study proposes interventions to minimize conflicts between pedestrians and vehicles. These include implementing speed limit signage, installing pedestrian crossing signals, and providing or maintaining clear sidewalk markings and signage. Table 2 details these proposed solutions and their projected impact on the star ratings for each university, demonstrating significant potential for improvement.

Implementing a 40 km/h speed limit at the University of Transport and Communications is projected to increase its star rating to 4.9 (see Figure 7). The Hanoi University of Culture and the University of Art and Design, however, require more comprehensive improvements, including 40 km/h speed limit signage, pedestrian crossing signals, and upgraded road markings, signage, and sightlines. These combined interventions are estimated to yield star ratings of 3.7 (see Figure 5) and 3.5 (see Figure 6), respectively.

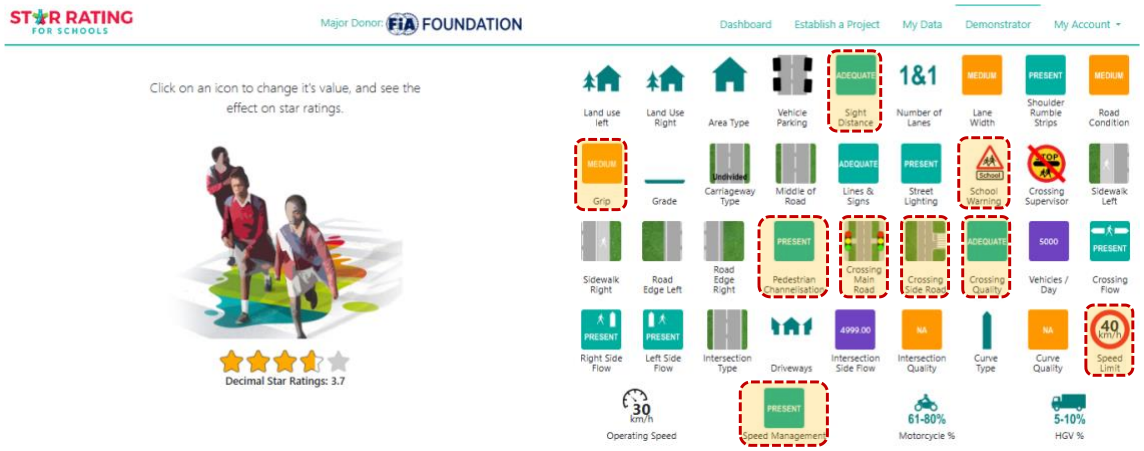

Figure 5. SR4S Star Rating with improvements: Hanoi University of Culture – HUC

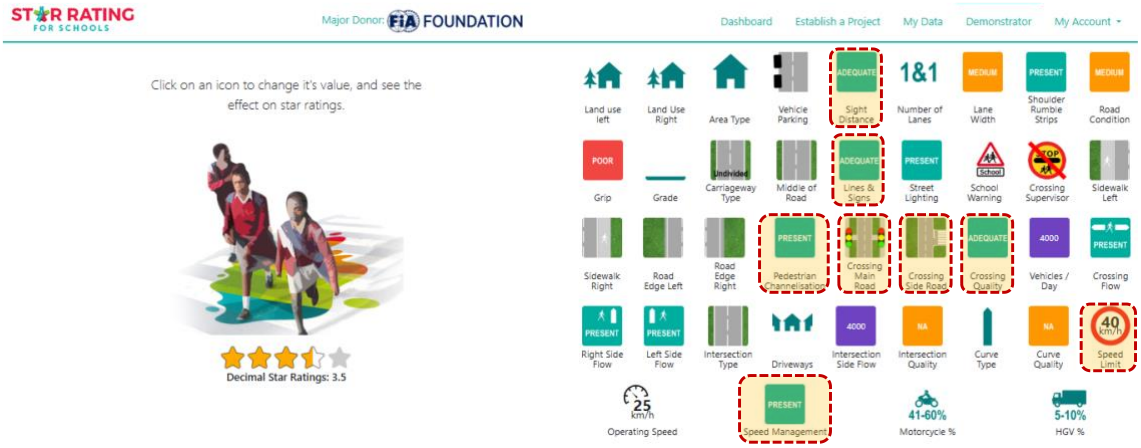

Figure 6. SR4S Star Rating with improvements: University of Art and Design – UAD

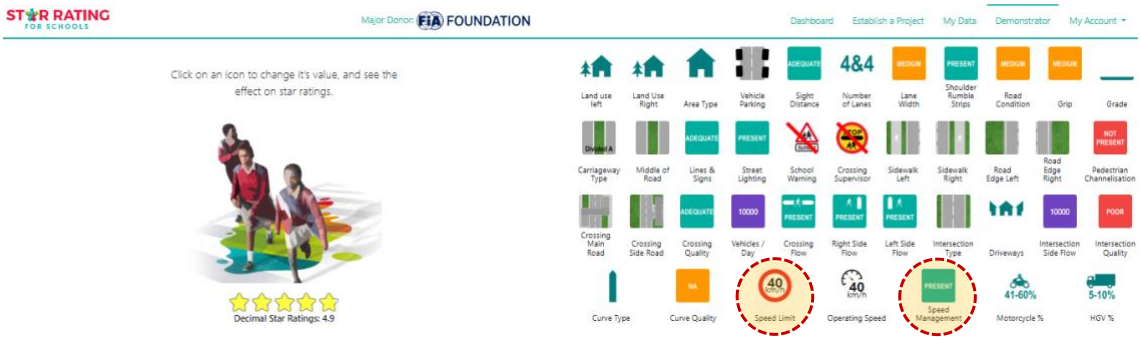

Figure 7. SR4S Star Rating with improvements: University of Transport and Communications – UTC

Table 2. Solutions and Star Rating results for school safety

University	Solutions	Star Rating Score	
		Before	After
Hanoi University of Culture – HUC	• Use speed limit sign of 40 km/h. • Provide Lights for Crossing Main Road and Marking for Crossing Side Road. • Improve Sight Distance to Adequate. • Improve pavement quality (Grip) to Medium.	1	3.7
University of Art and Design – UAD	• Use speed limit sign of 40 km/h. • Provide Lights for Crossing Main Road and Marking for Crossing Side Road. • Improve Sidewalk Right 0-1m. • Improve Lines and Signs.	1	3.5

University of Transport and Communications – UTC	• Use speed limit sign of 40 km/h.	3.5	4.9

4. CONCLUSION AND RECOMMENDATIONS

This study applies the iRAP Star Rating for Schools (SR4S) methodology to assess and propose improvements to traffic safety at three universities in Hanoi, Vietnam. The findings reveal a range of safety conditions, from critically unsafe (1-star) at the Hanoi University of Culture (HUC) and the University of Art and Design (UAD) to moderately safe (3.5-star) at the University of Transport and Communications (UTC). The assessments highlight key deficiencies in pedestrian infrastructure, traffic control, and vehicle management contributing to these varying safety levels. HUC and UAD suffer from narrow roads, high traffic volumes, inadequate pedestrian facilities, and uncontrolled parking, resulting in significant risks to students. While UTC benefits from a more robust traffic infrastructure, including pedestrian overpasses, its 3.5-star rating indicates that further improvements are necessary, primarily addressing the high traffic volume and the lack of school zone-specific traffic management.

The results underscore the urgent need for targeted interventions to enhance school zone safety in Vietnam. The SR4S methodology proves valuable in identifying specific areas of concern and quantifying the associated risks. The stark contrast in star ratings between the studied universities demonstrates the impact of infrastructure and traffic management on student safety and highlights the potential for improvement.

Based on the findings of this study, the following prioritized recommendations are proposed to enhance traffic safety at the studied university locations and potentially serve as a model for other school zones in Vietnam:

Short-Term, Low-Cost Interventions (All Universities):

• Speed Limit Reduction and Enforcement: Implement and enforce a 40 km/h speed limit in the immediate vicinity of all university gates, particularly during peak hours. This is a crucial first step in reducing the severity of potential collisions.

• Enhanced Signage and Markings: Improve the visibility and clarity of traffic signs, road markings, and pedestrian crossing markings. This includes installing clear school zone signage to alert drivers to the presence of students. At HUC and UAD, special attention should be paid to delineating pedestrian crossings clearly.

• Improved Pedestrian Crossings: Install or upgrade pedestrian crossing signals at strategic locations near university gates, especially at HUC and UAD. These signals should be pedestrian-activated and timed appropriately to allow sufficient crossing time.

• Sidewalk Management: Enforce regulations against illegal parking and encroachment on sidewalks near university gates. Clear signage and regular monitoring are essential to ensure that sidewalks remain accessible to pedestrians.

Medium-Term, Moderate-Cost Interventions (HUC and UAD):

• Traffic Calming Measures: Implement traffic calming measures, such as speed humps or raised crosswalks, on roads leading to the HUC and UAD gates. These measures can help to reduce vehicle speeds and create a safer environment for pedestrians.

• Dedicated Pedestrian Zones: Explore the feasibility of creating dedicated pedestrian zones or drop-off areas near the university gates to separate pedestrian and vehicular traffic. This may involve minor road modifications or the use of barriers.

Long-Term, Higher-Cost Interventions (Consideration for Future Develop-ment):

• Infrastructure Improvements: While major infrastructure changes are currently deemed impractical, they should be considered in long-term urban planning. This could include

widening roads, adding dedicated pedestrian and cycle lanes, and constructing pedestrian overpasses or underpasses in particularly high-traffic areas.

Policy and Enforcement Recommendations:

• Standardized School Zone Safety Guidelines: Develop and implement standardized guidelines for school zone safety in Vietnam, incorporating the principles of the SR4S methodology.

• Increased Enforcement: Strengthen traffic law enforcement in school zones, particularly regarding speeding, illegal parking, and pedestrian right-of-way.

• Community Engagement: Engage with university communities, local residents, and transport authorities to raise awareness about school zone safety and promote responsible road user behavior.

By implementing these recommendations, local authorities can significantly improve traffic safety around schools in Vietnam, creating safer and healthier environments for students and the wider community. The SR4S methodology provides a valuable tool for prioritizing interventions and tracking progress towards achieving safer school zones. Future research could focus on evaluating the effectiveness of these interventions and expanding the application of the SR4S model to other schools across the country.

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