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SAFE SCHOOL ZONES GUIDE

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Preface

All around the world, children are vulnerable road users, particularly when going to and from school. In Vietnam, according to statistics from the National Traffic Safety Committee, during 2016 - 2020, road traffic crashes involving people under 18 years old accounted for 6.75% of the total road traffic crashes, while in 2021, they accounted for 10.63% of the total road traffic crashes nationwide.

To protect children and students from further risk, and at the same time reduce the number of traffic crashes that they face on their school journeys, it is necessary to define and highlight that safety in school zones must be a prioritized component taken into account in the preliminary planning stages for every school.

AIP Foundation has extensive experience in the field of school zone safety improvement since 2005. Examples of AIP Foundation's experience in Vietnam include the long-running and award-winning *Slow Zones, Safe Zones* program, and the Safe School Zones manual sponsored by Safe Kids Worldwide. AIP Foundation has been collaborating with the Global Road Safety Partnership (GRSP) with financial support from the Botnar Child Road Safety Challenge to implement the *Slow Zones, Safe Zones* program in Pleiku City, Gia Lai Province, Vietnam.

Based on the successes and lessons learned from the *Slow Zones, Safe Zones* program, and international case studies, AIP Foundation, together with specialists from the University of Transportation and Communications Vietnam, have developed the SSZ Guide.

This SSZ Guide aims to provide guidelines on a multifaceted road safety solution around school zones, which includes considerations around traffic planning, infrastructure development, design, and safety assessment.

Particularly, this SSZ Guide provides the definition of a “Safe School Zone” to serve as a basis for planners, designers, constructors, and policymakers to implement measures to reduce traffic crash risks for students in school zones in Vietnam.

We encourage design and construction engineers, road traffic and technical infrastructure experts, policymakers, and relevant individuals and organizations to use this SSZ Guide as a reference when implementing projects related to the school zones.

This SSZ Guide is a joint effort by the Traffic Safety Department of the Ministry of Transport, the University of Transport and Communication, and AIP Foundation in a mission towards Vision Zero (a world without road injuries or deaths), and sustainable mobility for the future generations of Vietnam.

We would like to express our most sincere gratitude to the FIA Foundation for their technical and financial support in the creation of this guide and to the traffic safety experts for their professional advice and recommendations for the completion of this guide.

We would further like to thank our friends at the Global Road Safety Partnership and the International Road Assessment Programme (iRAP) for their continued support in the development of this guide.

Despite our best efforts in this edition, shortcomings are possible. We look forward to receiving valuable comments from colleagues and readers for further improvement for future editions. Please feel free to send any thoughts or comments to info@aip-foundation.org.

Thank you.

Sincerely,

Mirjam Sidik

Chief Executive Officer | **AIP Foundation**

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Glossary

Lane	a part of the roadway, which is longitudinally marked, and wide enough to accommodate a single line of vehicles divided in longitudinal direction of the road. Lane should be wide enough to support vehicle safe travel.
Priority lane	a lane on which vehicles in traffic are prescribed as priority and are given way by other vehicles in traffic.
Central reservation (median strip)	a road component which cannot be used by vehicles and divides the road into two separate sections. It can also be used to separate motorized and non-motorized traffic lanes or different traffic lanes that are going in the same direction.
Motorized vehicles	consist of automobiles; trailers or semi-trailers pulled by rigids; two-wheel motorized vehicles; three-wheel motorized vehicles; motorcycles (including electric motorbikes) and other similar vehicles designed for freight and passenger transportation on road.
Non-motorized vehicles	consists of bicycles, pedicabs, animal carts, wheelchairs and other similar vehicles without engines for traction.
Bicycle	a vehicle with two or three wheels that can be moved by human power through pedaling with legs or hands, including special-use vehicles for people living with disabilities.
Design speed	the speed chosen to design basic elements of a road in difficult conditions.
Operating speed	the speed at which the driver operates their vehicle

Maximum permissible speed	the maximum speed on a route, road section road or lane prescribed by the competent authority. Vehicle drivers are not allowed to operate vehicles at higher speeds.
Minimum permissible speed	the minimum speed on a route, road section or lane prescribed by the competent authority. Vehicle drivers are not allowed to operate vehicles at lower speeds.
Traffic light phase	a combination of green span and subsequent yellow span where one or more low-conflict traffic flows are allowed to pass through the intersection and stop safely before allowing other traffic flows to move.
Signal light cycle	the sequential execution and completion of a sequence of green, yellow, and red signals.
Road capacity	the maximum traffic flow passing through a cross-section of the road in a unit of time with a given road and traffic condition.
Children	people aged under 16 years old.
Minors	people between full of 16 years old and under 18 years old.
Students	school-age teenagers or children (aged full of 6 years old to 18 years old).
Schools	preschools, elementary schools, secondary high schools, and high schools.
Road traffic signs and signals	refers to a system that includes signals from traffic controllers such as traffic lights, road signs, barriers, road markings, traffic cones or guard lines.
Absolute protection area of the school	the area within a radius of 100 m from the school boundary.

Part 1.
General introduction

1.1. The need

In Vietnam, over 17 million children are commuting between home and school 2 - 4 times per day. Many children share the road with speeding trucks, with no sidewalks to walk on while going to school. Alarmingly, traffic speeds around schools frequently and significantly exceed internationally recommended speed limits in school zones.

According to the National Traffic Safety Committee's report covering the years 2016 to 2020, accidents on the road that involved individuals under the age of 18 constituted 6.75% of the total crash cases. However, in the year 2021, this percentage increased to 10.63% of the total road crash cases.

The above statistics show that, in the context of the rapidly increasing number of vehicles on roads, traffic organization on roads in Vietnam has not yet been implemented with priority measures for the most vulnerable road users (e.g., children, students, people living with disabilities). This leads to road traffic crash risks for students in school zones that tend to hinder the safety of students on their way to school everyday, thus impairing their access to education.

However, the government of Vietnam has put in targets and policies that prove that road safety is a priority for the country. The Vietnam National Strategy for Road Traffic Safety for the 2021 - 2030 period and the vision for 2045 by the National Government set the target as follows, “100% of the school gate areas located along national highways, provincial roads, and major urban roads will be organized to ensure traffic safety and prevent traffic congestions and jams”.

Government Decree No. 48/NQ-CP dated April 5, 2022, on enhancing traffic safety and order and preventing traffic congestion during the 2022 - 2025 period also directs the Ministry of Education and Training “to continue to complete the teaching curriculum and materials, including the legislation education on traffic safety and order, in-traffic safe travel skills, and traffic culture into the main curriculum in the form of integration into the content of some subjects and educational activities from preschools to general education".

In addition, ministries, branches, and localities have coordinated with national and international organizations to implement many road safety measures in school zones. Since 2018, AIP Foundation, in collaboration with the Global Road Safety Partnership (GRSP) with the financial support of the Botnar Child Road Challenge, has been implementing the Slow Zones, Safe Zones program in Pleiku City, Gia Lai Province. Preliminary results of the Slow Zones, Safe Zones program show that road safety improvements at the intervention school zones have contributed to minimizing road traffic crashes, road traffic deaths, and injuries for children in school zones.

Building on the successes of safe school zone interventions by national and international organizations in Vietnam and noting the urgent directions from the Government to improve road traffic safety in school zones, this SSZ Guide is essential to achieving the targets of reducing road crashes, traffic deaths and injuries in school zones across the country.

1.2. Legal basis

The SSZ Guide is developed and compiled on the following legal bases:

- UN General Assembly Resolution A/74/299 on the Decade of Action for Road Safety 2021 - 2030;

- Government Resolution No. 48/NQ-CP dated April 5, 2022 on enhancing traffic safety and order and preventing traffic congestion in the period 2022-2025;

- Prime Minister's Decision No. 2060/QD-TTg dated December 12, 2020 approving the National Strategy on improvement of road traffic safety and order in the 2021 - 2030 period with a vision to 2045;

- Memorandum of Understanding dated October 21, 2021 between the Ministry of Transport and AIP Foundation on the development and implementation of a Safe School Zones Guide in Vietnam.

1.3. Objectives

This SSZ Guide is developed and issued with the following objectives:

General objective:

To solve road safety problems at different stages from traffic planning, and infrastructure development to design, and evaluation of traffic safety in school zones.

Specific objectives:

- To serve as a reference for organizations, individuals, and schools from central to local levels who are implementing road traffic safety enhancement in school zones, including road infrastructure modifications, and improving traffic arrangement in school zones.

- To enable the central and local management agencies, and educational and training establishments to study and assess road safety in school zones within their management scope and responsibility, and to have appropriate investment policies and resources and effective management to minimize road traffic crash risks in students in road traffic.

1.4. When to refer to the SSZ Guide?

This SSZ Guide is designated for organizations and individuals to use when implementing school zone-related projects, such as new school constructions, school modifications, road constructions or upgrades around school zones, and school safety assessments on school investments, new constructions, upgrading and renovation of the schools.

The above-mentioned audiences should refer to this SSZ Guide when they carry out the following stages of a project: (1) planning, (2) investment preparation, (3) design, (4) construction, and (5) operation. In addition to the above stages, they can also refer to this SSZ Guide and apply to (a) audit the road safety and (b) assess road safety in school zones aimed at proposing effective technical measures for road safety improvement in school zones.

1.5. Users of the SSZ Guide

This SSZ Guide can be used by design and construction engineers, road traffic and technical infrastructure experts, policymakers, individuals and organizations working in relevant fields.

1.6. Structure of the SSZ Guide

The SSZ Guide is comprised of the following sections:

Part 1. General Introduction: This section presents the rationale, objectives, purposes, target audiences, and users of this SSZ Guide.

Part 2. Overview of road traffic safety in school zones: This section provides the definitions of a school zone and a safe school zone, presenting major risks to children and students in traffic and some good practice models on safe school zones.

Part 3. Basic principles for school zone planning: This section presents the basic principles for arranging school zones and school gates to meet safety requirements when implementing conceptual projects on transport infrastructure planning, urban planning, residential area planning, and other related planning.

Part 4. Transport Infrastructure Design of a Safe School Zone: This part presents the following contents: (1) basic principles for safe school zone design; (2) steps to be taken when improving and upgrading a safe school zone; (3) technical measures on road safety enhancement in school zones.

Part 5. Methods of Road Safety Assessment in School Zones: This part introduces methods of road safety assessment in school zones.

Part 2.
Overview of road safety in school zones in Vietnam

2.1. Risk factors causing road traffic crashes involving students

Students aged 6 to less than 18 are limited by their physical, psychological, cognitive and behavioral development, thus being exposed to a higher risk of traffic crashes and road traffic injuries as compared with those in other age groups. School zones are often areas where a large number of students are likely to cross the streets at the time of arrival and departure. During these times, there is increased traffic density of road users and vehicles. There are five risk factors affecting the school zone road safety.

2.1.1. Risk factor 1 "Vehicle speed"

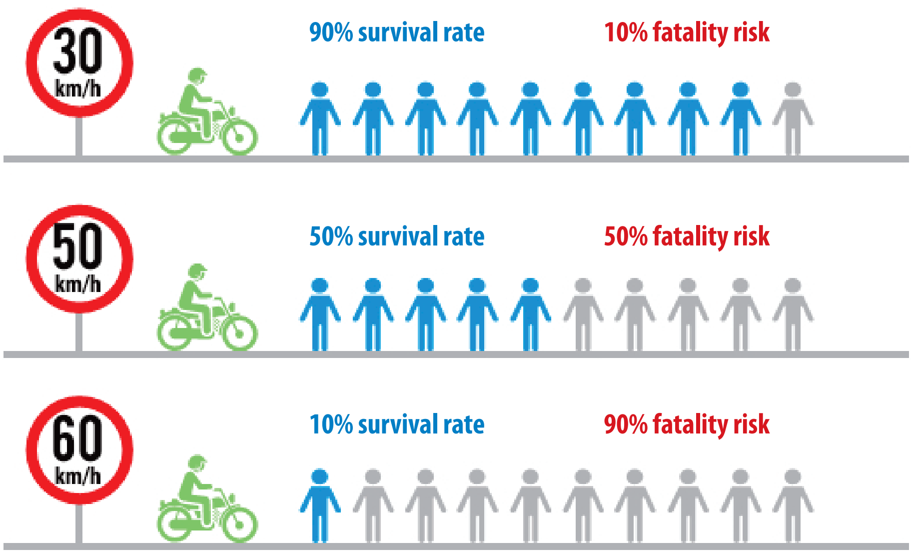

Figure 1. Probability of fatal injury in road crashes in relation to vehicle speed (Source: World Health Organization. 2004)

Vehicle speed is an important factor as higher speeds lead to increased road capacity but also a higher risk of traffic collisions, crashes, and fatal injuries to students walking in school zones.

As can be seen in Figure 1, the likelihood of fatal injury to pedestrians is 90% at a collision speed of 60 km/h, compared to only 10% if hit by a vehicle traveling at 30 km/h. Therefore, any failure to control vehicle speed in school zones could lead to increased forces on victims' bodies during road crashes, significantly elevating the risk of fatal injuries.

2.1.2. Risk factor 2 "Shared lanes for motorized and non-motorized vehicles"

Speed differences between motorized and non-motorized vehicles on the same lanes also potentially lead to traffic collisions and congestion.

Of note, different types of vehicles share lanes in school zones where a large number of students cycle (at a low speed) while motorized vehicles travel at much higher speeds.

2.1.3. Risk factor 3 "Visibility"

Figure 2. Danger of mixed lanes [1]

(1) On December 29th and 30th on lunar calendar, 33 were dead and 26 were injured in road crashes in Vietnam - Tri Thuc VN (trithucvn.org)

Students have a small physique, which limits their visibility, reducing their ability to observe the overall traffic infrastructure elements and vehicles, and affecting their judgment, assessment and prevention of road traffic risks. In addition, the small physique of students, particularly young children, also increases crash risks as they are less likely to be seen by other drivers, especially those driving large vehicles such as trucks and buses.

2.1.4. Risk factor 4 "Technical specifications of vehicles"

Walking, cycling, and riding e-bikes and e-scooters are transport modes among Vietnamese students. Students aged 16 and higher may drive e-scooters and motorcycles with an engine capacity below 50 cm^3, while there is no minimum age requirement for e-bike riders.

E-bikes and e-scooters are smaller and lighter than motorcycles. However, considering the physical strength and physique of elementary and lower secondary school students, these vehicles are unsuitable options and their braking system only works efficiently at a maximum speed of 25 km/h. Meanwhile, in Vietnam, many imported e-bikes and e-scooters can travel up to 40-50 km/h and drivers can easily fly off the vehicles in case of sudden braking. The tire contact patch of e-bikes and e-scooters is quite small, so is the friction coefficient. The lack of engine noise in e-vehicles poses a road safety concern, especially when they are changing lanes or approaching an intersection.

2.1.5. Risk factor 5 "Road safety awareness and skills"

Young children and students are rarely the main target audience of road safety awareness raising campaigns. Additionally, young children's accessibility to information about road traffic law is limited as compared to other road user groups.

School students receive road safety education as part of their schooling (i.e., safe walking, safe cycling, safe sitting on a motorcycle, road signs, etc.); however, the training program is neither effective nor practical, resulting in limited real-life skills application among students.

In addition, students have less experience handling dangerous traffic situations as compared to adults. As a result, they frequently make inaccurate assessments of traffic speed and misinterpret the intentions of other drivers. Additionally, they are easily distracted and may impulsively enter the street without checking for oncoming traffic.

2.2. Definition of School Zone and Safe School Zone

Clearly defining safe school zones is essential for planners, designers, construction professionals, and policymakers. This clarity serves as a foundation for implementing measures that effectively reduce traffic risks for children and students in Vietnam.

Definition of school zones is to determine the scope and boundary needed to identify problems and propose measures relating to school zone road safety in the stages of planning, design, construction and operation of school and transport facilities.

Following a review of definitions of school zones in several countries around the world (such as the U.S. and Japan) and based on previous studies in Vietnam(2), school zones and safe school zones used in this guide are defined in more detail in the sections that follow.

2.2.1. Definition of "School Zone"

(1) For urban schools: A school zone means an area within a 300 m radius from each school gate and the absolute protection area is within a 100 m radius.

(2) For schools in rural and mountainous areas with low-volume and low-speed roads: A school zone means an area within a 200 m radius from each school gate and the absolute protection area is within a 50 m radius.

(3) For schools located along national roads or provincial roads outside urban areas, or high-volume roads: A school zone means an area within a 500 m radius from each school gate and the absolute protection area is within a 100 m radius.

(2) Study of solutions for school zone road safety conducted under AIP Foundation's "Slow Zones - Safe Zones" project between 2018 to 2023.

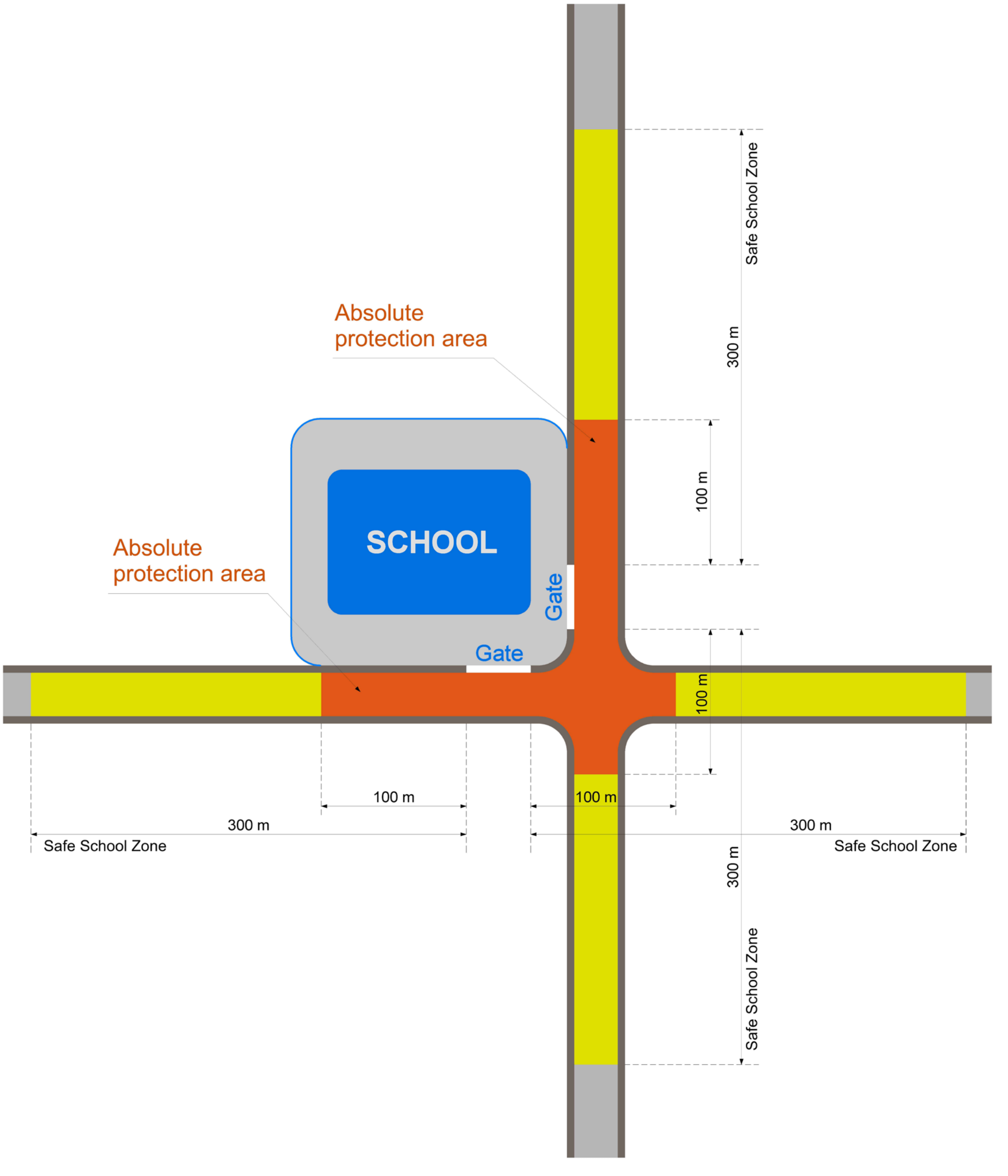

Figure 3. School zone radius from school gates in urban areas

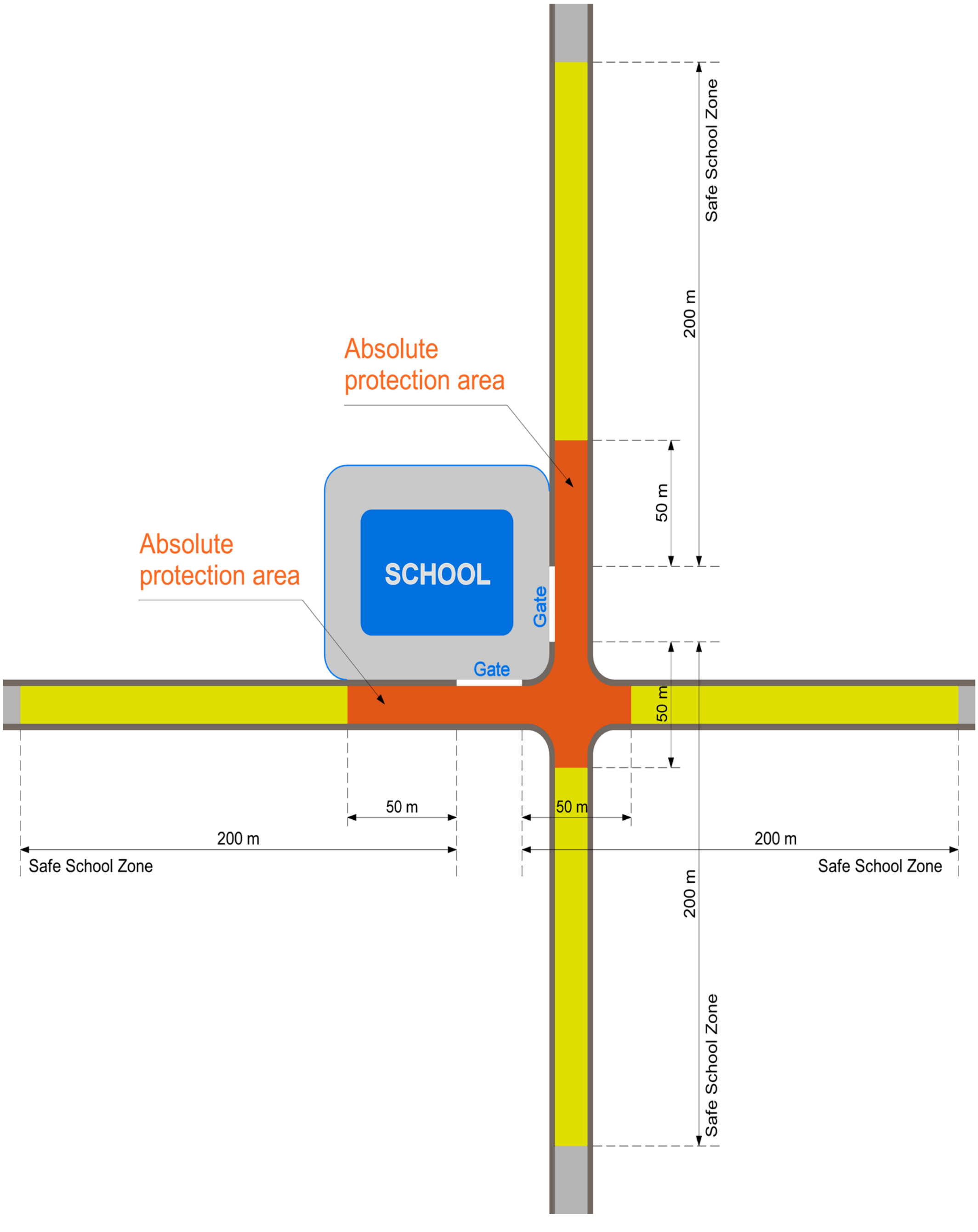

Figure 4. School zone radius from school gates in rural and mountainous areas

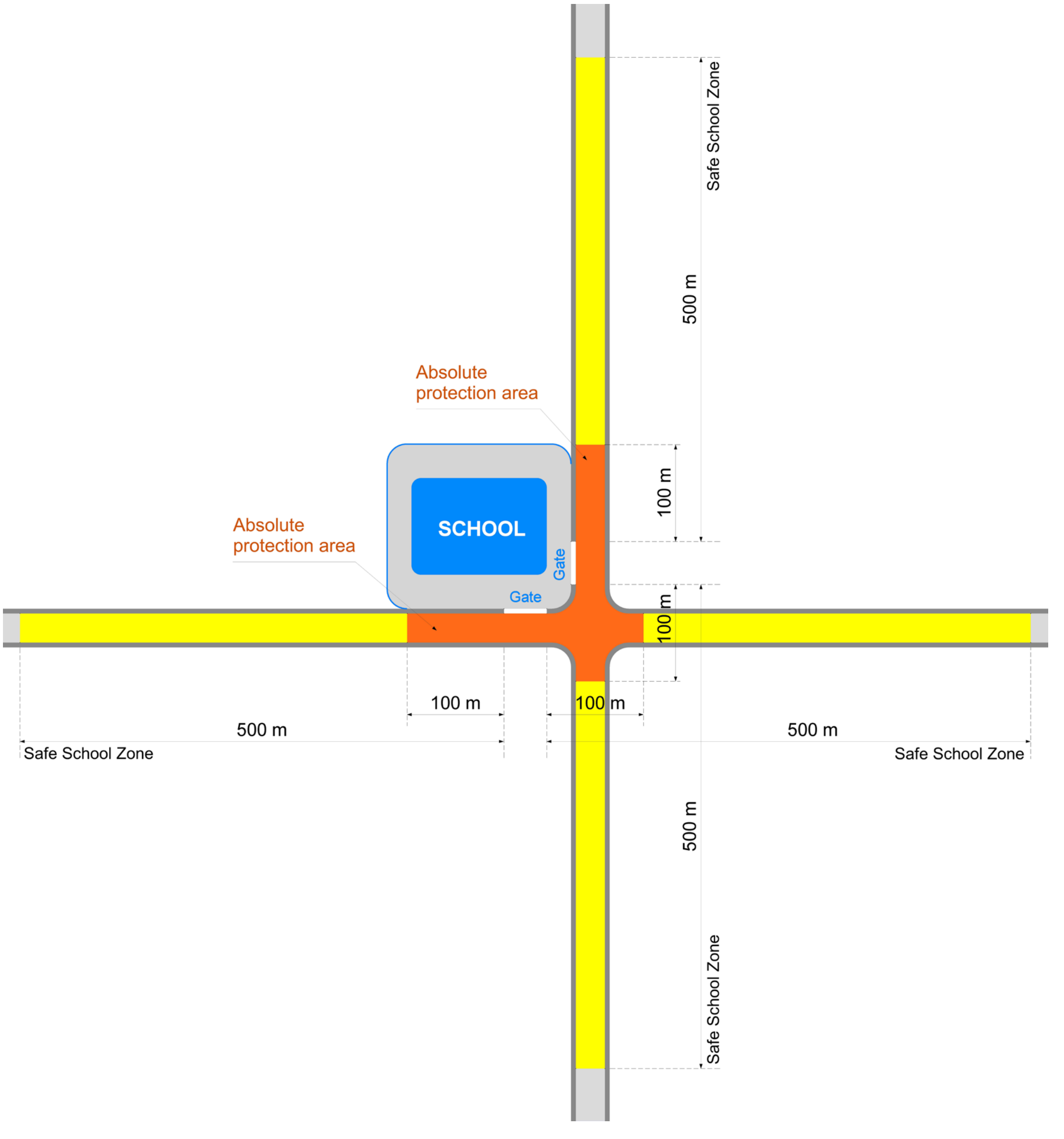

Figure 5. School zone radius from school gates for schools located along national and provincial roads outside urban areas

2.2.2. Definition of Safe School Zone

A safe school zone is made visible by road signs and markings that are designed and installed to manage, to the extent possible, risk factors of traffic collisions and crashes, and to keep children, students, and other road users safe.

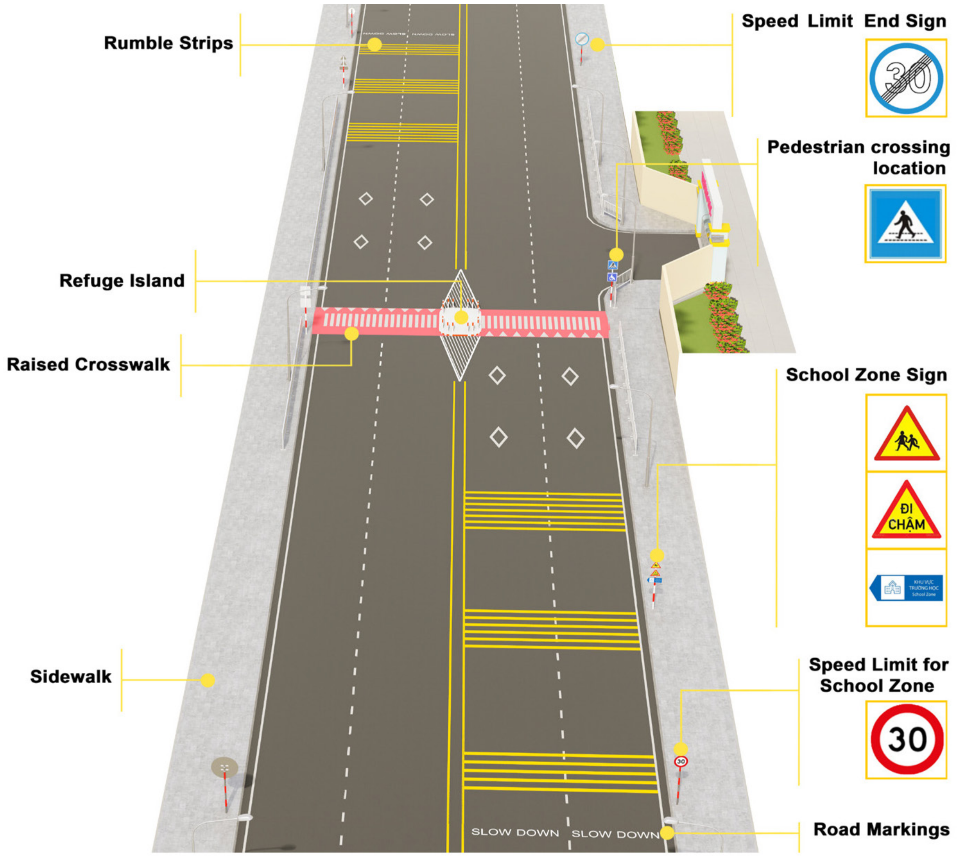

Figure 6. A Safe School Zone model

2.3. Minimum requirements on road infrastructure in a safe school zone

The minimum requirements on road infrastructure in school zones differ depending on road grades specified in the national technical regulations QVCN 01:2021/BXD as below:

- Arterial roads, including: Urban trunk roads, urban main roads, inter-regional roads, urban expressways. Urban expressways are not included in this guide as school zones should not be built along expressways;

-Sub-arterial streets, including: Sub-arterial main streets and sub-arterial streets;

- Local streets, including: zonal streets, bicycle streets, walking streets and local residential streets; with the first two types mentioned in this guide.

The minimum requirements of road infrastructure in safe school zones are presented in Table 1 below.

Table 1. Minimum requirements of road infrastructure in safe school zones

No.	Work items relating to traffic safety	School location		
		On main road	On small road	On alley
1	School zone sign	√	√	√
2	Speed limit sign	√	√	√
3	Road markings (including: pedestrian crossing markings, rumble strips, directional markings and other relevant markings)	√	√	√
4	Footbridge (overpass/underpass)	√	√	-
5	Sidewalk and width of sidewalk	√	√	-
6	Median strip	√	√	-
7	Refuge island	√	√	-
8	Traffic light	√	√	√
9	Bicycle and non-motor vehicle lane	√	-	-
10	Lighting system	√	√	√
11	Pick-up and drop-off area	√	√	-
12	Bus stop	√	√	-

Regarding minimum requirements on road infrastructure of a safe school zone as presented in Table 1, to keep children and students safe in school zones, one should consider the school location, whether it is located in an urban, rural or mountainous area, along a national, provincial, district or communal road, so as to set specific requirements based on 12 criteria as above.

Part 3. Basic principles in school planning and designing

Based on the traffic situation in urban and non-urban school zones[3], apart from compliance with local land use regulations, road network development plans and other infrastructure development plans, the location of a new school should be carefully screened to address the following principles:

3.1. Ensuring a suitable school service radius

A school's location should be selected carefully for optimal service radius (both in terms of its enrollments and accessibility)[4]: The appropriate distance is between 400 - 600 m for pedestrians and between 1.0 - 2.5 km for cyclists.

- According to TCVN 8793:2011 Primary schools - Design requirements, the service radius of primary schools should be as follows: For cities, towns, townships, industrial parks and resettlement areas, the service radius should not be larger than 0.5 km; for non-urban and rural areas: it should not be larger than 1.0 km; for exceptionally socially and economically disadvantaged areas: it should not be greater than 2.0 km.

- The travel distance suitable for those riding e-bikes and 50cc motorcycles is much longer than pedestrians and cyclists. Therefore, the service radius of secondary schools, especially higher secondary schools, is between 3.0 km - 5.0 km or higher[5].

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(3) According to studies in Vietnam, for urban schools, most students walking and cycling to school are less than 300m away from the school gate (accounting for 65% of the total number of students) while, for non-urban schools, most of them are within 500 m from the school gate (accounting for 60% of the total number of students) and those traveling between 500 m - 2,000 m and higher to reach the school gate accounting for 30% and 10% of the total number of students respectively.

(4) Dinh Thi Thanh Binh (2016), Course book on Public Transport Planning and Management of the University of Transport and Communications.

(5) Project "Safe to school, Safe to home" implemented by the Global Road Safety Partnership in Ha Nam (2013-2015), Bac Ninh (2015) and Dong Nai (2014-2015): The service radius of primary and lower secondary schools is 3.0 km - 5.0 km.

3.2. Ensuring land availability for school planning and construction

According to TCVN 8793:2011 on Primary schools - Design requirements, in the total land for a school, structural construction must not exceed 40% of the school's total land area, while playground/garden and internal roads shall not less than 40% and 20% of the school's total land area respectively.

According to TCVN 8794:2011 on Secondary schools - Design requirements, in the total land for a school,structural construction must not exceed 45% of the school's total land area, while playground/garden and internal roads shall not less than 30% and 25% of the school's total land area respectively.

3.3. Ensuring effective implementation of road safety measures around school gates

The principal diagram of the connection of functional road network is shown as follows:

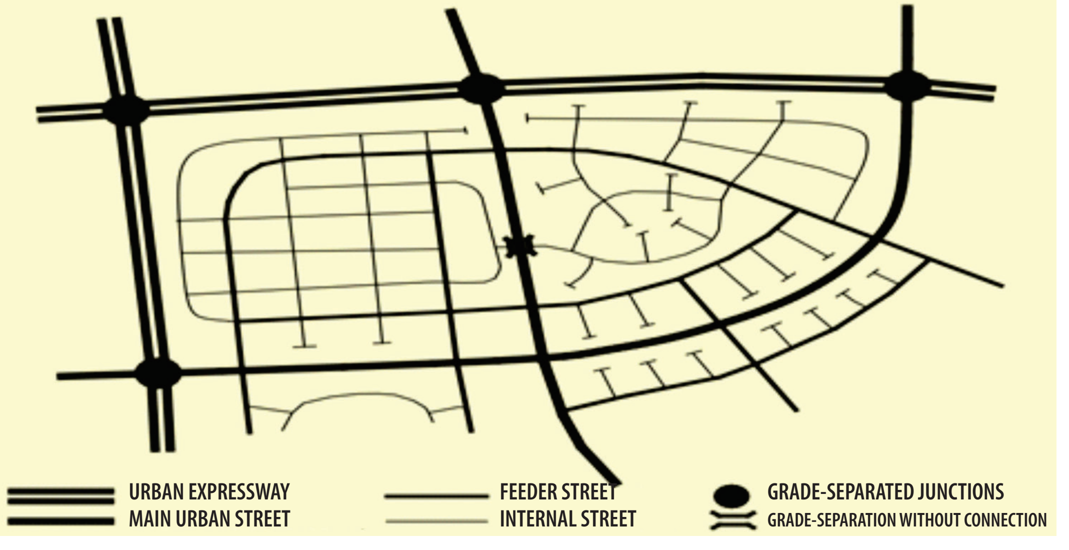


Figure 7. Principles for road network connectivity (*Source: Course book on Transport Planning, the University of Transport and Communications*)

A school should not be sited in an area where its gates are directly connected to an expressway or major national road with operating speeds over 40 km/h.

The location where its gates connect to the roads should be spacious enough to provide full visibility and ensure that, within 300 m (from a school gate) in both directions, measures and solutions can be established to improve road safety conditions for students.

3.4. Ensuring road safety around schools

A school's connections with its surrounding roads should be established as follows:

3.4.1. Scope of road safety measures around school gates

Road safety measures should be implemented within a 100 m - 300 m distance from school gates[6].

3.4.2. Location and layout of school gates

To avoid traffic congestion around school gates, based on the road network in each school zone, during the planning process, it is advisable to design 02 to 03 entrance gates, including: (01) for pedestrians, (01) entry gate for motorcycles and non-motor vehicles and (01) exit gate for motorcycles and non-motorized vehicles (cars should not be allowed to enter the schoolyard area).

Also, based on the number of students, teachers and employees, the school gate area should be designed to be large enough for road safety and reasonable traffic management.

Figure 8. *Safe school gate model*
(Source: Le Quy Don Primary School)

(6) The "Slow Zones - Safe Zones" Project implemented (by AIP Foundation) in Pleiku city, Gia Lai province from 2018 to 2022: the implementation scope of road safety measures is 100 - 300 m from the school gate; "Safe school gate" model (since 2012): the implementation scope of road safety measures is 100m from the school gate.

3.5. Ensuring connectivity with public transport modes

To prevent traffic congestion and ensure smooth driving in school zones, a school siting plan, especially in major urban areas, should specifically define the school location and include measures to integrate walking and cycling with public transport wherein walking and cycling routes to/from schools are linked to stops and stations of public transit.

3.6. Ensuring logical in-school traffic management

A schoolyard area is built with two main functions, including:

(1) Playground for students;

(2) Parking lot for students, teachers, employees and related persons.

Specifically, the parking lot should be designed and built according to TCVN 8793-2011[7] and TCVN 8794-2011[8]. Accordingly, a parking lot for teachers and students in the schoolyard area should meet the following requirements:

(1) Provide enough parking space for vehicles used by 20% - 35% of students and 60% - 90% of teachers and school employees;

(2) Fulfill area requirements: 0.9 m^2/bicycle; 2.5 m^2/motorcycle and 25 m^2/car;

(3) Allocate reserved parking spots for students with disabilities near the entry;

(4) Provide parking space for visitors and parents, which is equal to the parking space used by 50% of students and should be separately sited.

(7) National Standard TCVN 8793-2011: Primary schools - Design requirements.

(8) National Standard TCVN 8794-2011: Secondary schools - Design requirements.

Part 4.
Designing safe traffic infrastructure in school zones

4.1. Design principles

Designing safe traffic infrastructure in school zones should be carried out in line with three basic principles as follows:

4.1.1. Principle 1: Relevance with travel needs of students as priority targets

Designing safe traffic infrastructure in school zones aims to minimize the risk of collision and crash for students on their journeys to and from school while also improving overall road safety conditions in school zones.

Figure 9. Safe road design for students

4.1.2. Principle 2: Conforming with related regulations

Designing safe traffic infrastructure in school zones should be in line with current principles and regulations on investment, management and operation of construction and traffic facilities, in addition to compliance with the National Technical Regulation on Road Signs and Signals (QCVN 41:2019/BGTVT) and other relevant regulations.

4.1.3. Principle 3: Effective operation of traffic infrastructure

The proposed design solutions in management of school zones are expected to prevent traffic congestion and efficiently enhance connectivity with the regional road network, especially with most convenient modes of transport, including mass public transit options such as buses and urban railway trains.

4.2. Steps to design safe traffic infrastructure in school zones

4.2.1. For newly planned and built school zones

Design steps are carried out according to existing procedures and regulations on investment and construction. During each step, solutions to design safe traffic infrastructure in school zones can be explored and employed to put forward road safety solutions in a project's overall design plan.

4.2.2. For school zones or traffic facilities in school zones to be upgraded and renovated

Designing safe traffic infrastructure in school zones is carried out in 5 steps as follow:

Step 1: Assessment of road safety in school zones prior to design and renovation

AHP, iRAP's Star Rating for Schools or road safety audit can be employed to evaluate the road safety in school zones prior to design and renovation with assessment results to quantify and provide star ratings on road safety levels (where one-star is the least safe while five-star are the safest). This assessment enables designers and decision-makers to be aware of actual road safety levels in a school zone so that appropriate design, upgrading and/or renovation solutions can be developed. This step can be carried out independently or as part of a project's general status-quo survey.

Step 2: Designing

Based on the outcomes in Step 1, designers explore design solutions for safe traffic infrastructure in school zones as introduced in this Guide to enhance road safety, in line with the design principles and the operation of existing structures.

Step 3: Delivery of construction

Based on the approved design documents, deliver on-site construction works and measures to enhance road safety in school zones.

Step 4: Re-assessment of road safety in school zones after upgrading and renovating

Similar to Step 1, AHP or iRAP's Star Rating For Schools can be used to evaluate the road safety in school zones upon completion of design, renovation and construction. The assessment results, compared with pre-treatment results, are indicators of road safety improvement and effectiveness of upgrading or renovation solutions delivered while informing additional measures (if needed) for better and more effective operation of relevant structures.

Step 5: Monitoring and evaluation post upgrading and renovation

Specifically looking at road safety measures in school zones in the short and long term, this assessment process is often conducted in 3 - 12 months after the school zone improvement is completed to propose more effective management and law enforcement measures.

4.3. Design of road signs [9]

4.3.1. School zone sign

Road sign used: I.444 "Directional sign".

Purpose: To instruct road users on directions that lead to a school zone.

Location: The sign should be installed before an intersection to show directions to a local school. On a road section without an intersection, the sign should be installed within 300 m - 500 m from the school gates.

Sign specifications are similar to those of the I.444c sign, as presented in the section 4.3.6 of this Guide.

[9] QCVN 41:2019/BGTVT - National Technical Regulation on Road Signs and Signals

The sign template and specifications are as follows:

Figure 10. I.444 sign indicating a school zone
(Source: QCVN 41:2019/BGTVT)

4.3.2. Children crossing sign

Road sign used: W.225.

In case it is required to determine the length of a road section to which the W.225 sign applies, the S.501 sign should also be mounted underneath.

Purpose: To warn road users of potential dangers as they are approaching a road section where children often cross or gather on the road.

Location: The W.225 sign should be installed at least 200 m - 300 m from a school gate, before an intersection.

The sign specifications are as follows:

Figure 11. Children crossing sign (W.225)
(Source: QCVN 41:2019/BGTVT)

4.3.3. Speed limits in school zones by using road signs

Road sign used: P.127 "Maximum speed limit".

Purpose: To limit the speed of vehicles passing school zones.

Location: The sign should be installed 150 m - 250 m from a school gate. The sign should be affixed to a pole, with its height above the road surface measured from the lower edge of the sign. The height should be set at 1.8 m for roads outside residential areas and 2.0 m for roads within residential areas.

Notes: The traffic organization and density in a school zone should be reviewed to determine an appropriate speed limit.

Recommendations: Approaching vehicles should travel with speeds ranging from 30 km/h - 40 km/h in a school zone. For roads passing through school zones where vehicles can travel ≥ 60 km/h, speed limit signs where the posted speed limit is gradually reduced (such as: 80 km/h → 60 km/h → 40 km/h) shall be installed. For vehicles leaving a school zone, the recommended speed limit is ≥ 40 km/h.

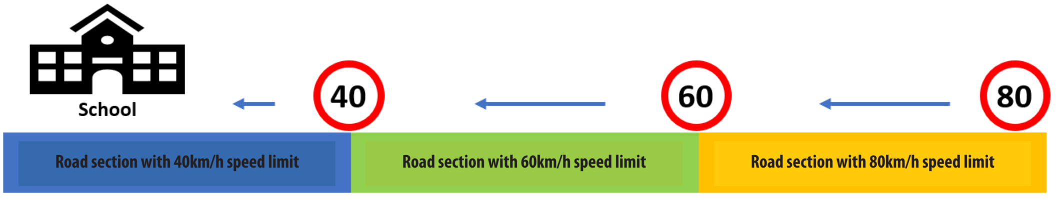


Figure 12. Gradual reduction of posted speed limits

In school zones, the density of road users and vehicles is often highest during student arrival and dismissal periods during which speed limit signs can apply to increase the route capacity. In this case, the S.508 sign can be additionally used to form a time-based speed limit sign, as demonstrated below:

Figure 13. A time-based speed limit sign

safe school zones

At the ending point of a school zone or along the route away from school gates, a specific location should be determined to install the DP.134 "End of maximum speed limit" sign for vehicles to travel at a normal speed. The location of installation depends on the volume of road users and vehicles running through a school zone but, to ensure safety, the recommended location for installation of the sign is ≥ 150 m from school gates.

Specifications of the sign are, as follows:

Figure 14. Maximum speed limit sign (P.127)
(Source: QCVN 41:2019/BGTVT)

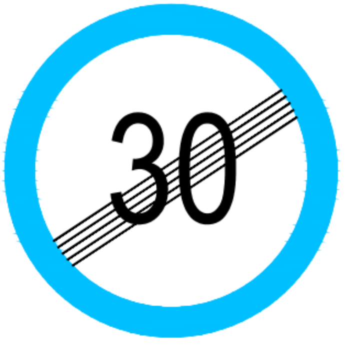


Figure 15. End of maximum speed limit sign (P.134)
(Source: QCVN 41:2019/BGTVT)

In addition to the P.127 sign as above, the W.245 "Slow down" sign can be used to remind drivers to slow down when driving through school zones. In principle, the P.127 and W.245 signs should not be used both at once on a same road section. Thus, for a road section on which speed limits are not required (P.127) but there should be reminders for drivers to slow down, the W.245 sign should be installed.

The sign specifications are as follows:

Figure 16. Slow down sign (W.245)
(Source: QCVN 41:2019/BGTVT)

4.3.4. Pedestrian crossing sign

Road sign used: I.423 "Pedestrian crossing".

Purpose: To allow pedestrians (including students) to cross the road where there is no pedestrian overpass in school zones.

Location: The sign should be installed together with pedestrian crossing markings in a way that they can be easily seen, without affecting the ability of pedestrians and people living with disabilities to travel safely, or causing potentially unsafe situation for vehicles on the roadway.

The sign specifications are as follows:

Figure 17. Specifications for sign I.423 "Pedestrian crossing location"
(Source: QCVN 41:2019/BGTVT)

4.3.5. Bus stop sign

Road sign used: I.434a "Bus stop".

Purpose: To indicate the location of buses or bus stops in case there are public bus stations or school buses in school zones.

Location: The sign should be installed at a location where buses are expected to stop to load and unload students.

The sign specifications are as follows:

Figure 18. Bus stop sign (I.434d)
(Source: QCVN 41:2019/BGTVT)

4.3.6. Parking lot sign

In case there is a parking lot in school zones:

Road sign used: I.444c "Parking lot".

Purpose: To indicate the location of parking lots.

Location: The sign should be installed prior to a location where the road intersects with the point of access to a parking lot.

The sign specifications are as follows:

Figure 19. Parking lot sign (I.444c)
(Source: QCVN 41:2019/BGTVT)

4.3.7. Stop sign

In case there are signalized intersections in school zones:

Road sign used: R.122 "Stop".

Location: The sign should be installed at traffic signals with stop lines and pedestrian crossings to ensure students and pedestrians can safely cross the road.

Purpose: To remind motor and non-motor vehicle drivers to stop when reaching the sign or stop lines, with their ability to drive only based on available signals (either from traffic controllers or traffic lights).

The sign specifications are as follows:

Figure 20. Stop sign (R.122)
(Source: QCVN 41:2019/BGTVT)

4.3.8. "No stopping, no parking" sign

Road sign used: P.130 "No stopping, no parking".

Purpose: To indicate a site where cars are not allowed to stop or park on both sides of a road.

Location: Depending on route-based traffic organization, it is recommended that the sign is installed within a distance of < 500 m from school gates.

In case stopping and parking are not allowed at certain times, the P.130 and S.508 signs should be used together.

The sign specifications are as follows:

Figure 21. No stopping, no parking sign (P.130)
(Source: QCVN 41:2019/BGTVT)

4.4. Design of road markings

4.4.1. Design of rumble strips [10]

Purpose of rumble strips: To signal vehicle drivers of a road section on which they should drive more slowly, and to function as an option to calm aggressive traffic for those driving through school zones.

Rumble strips are designed according to Basic Standard TCCS 34: 2020/TCDBVN - "Rumble strips and speed bumps - Design requirements".

Specifications and requirements for the installment of rumble strips are as follows:

- Rumble strips should be installed prior to or within a road section with limited visibility, intersections, dangerous curves, or a road section with adverse conditions that may come with road safety risks.

- Rumble strips should be installed on asphalt, cement concrete or asphalt cement pavements with high asphalt penetration, and a road width of at least 2.5 m. If the road width is smaller than 2.5 m, installation of rumble strips should depend on its necessity.

- Thermoplastic traffic paint is used for rumble strips according to TCVN 8791:2011. The use of other materials is also accepted as long as it promotes the functions of rumble strips and is approved by the competent authority.

[10] TCCS 34:2020/TCĐBVN - "Rumble strips and speed bumps - Design requirements".

safe school zones

Rumble strips can be installed across the road as clusters (which are perpendicular to the road center line prior to the section where drivers should slow down) or evenly spread out (perpendicular to the road center line along a road section where drivers should slow down).

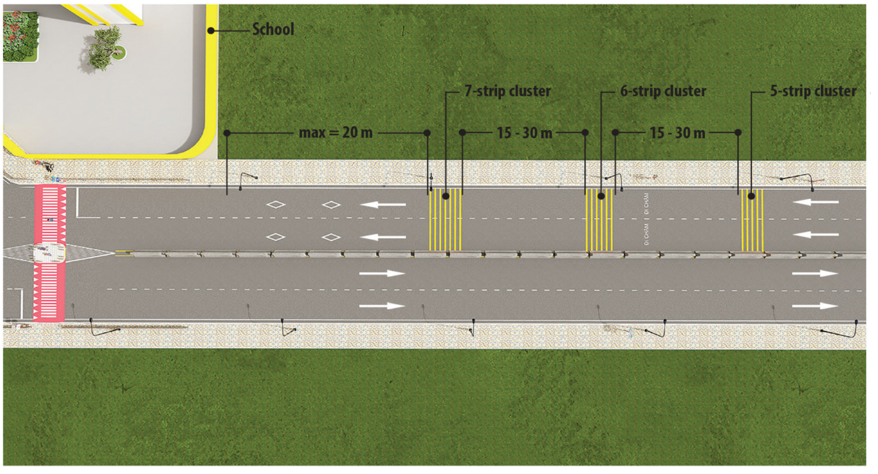


Figure 22. Clusters of rumble strips on roads with medians

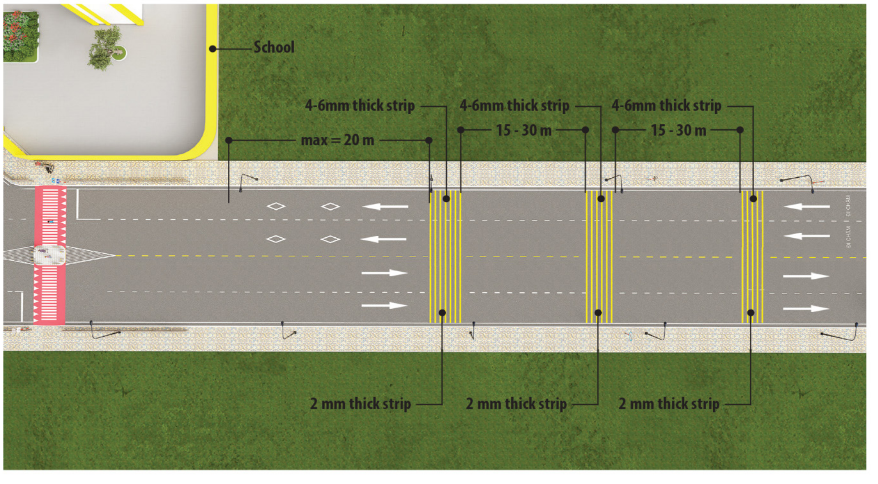
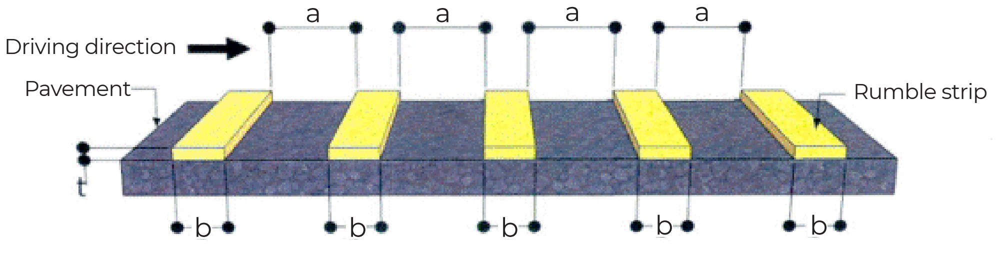


Figure 23. Clusters of rumble strips on roads without medians

Rumble strips should be installed across the road on a lane or roadway where drivers should slow down. In case rumble strips are installed across a two-way road, rumble strips on the opposite-direction roadway are only for warning purposes and should not be more than 2 mm thick.

Depending on road conditions, there can be 1 to 3, or more, clusters of rumble strips while, for shorter road sections, fewer number of rumble strips and clusters can be installed. A cluster usually consists of 5 to 7, or more, strips, which tends to increase gradually in approaching slow zones.



a - Distance between two edges of side-by-side rumble strips;
b - Rumble strip width;
t - Rumble strip thickness.

Figure 24. Design of rumble strips in clusters
(Source: TCVN 8791:2011)

Table 2. Design of a cluster of rumble strips

Specifications	Symbol	Dimensions (mm)
Distance between two edges of side-by-side rumble strips	a	400
Rumble strip width	b	200 ÷ 400 (*)
Rumble strip thickness	t	4 ÷ 6 (**)

(*): In special cases, a rumble strip (b) can be 600 mm wide.
(**): Use smaller values for initial rumble strips of a cluster or on an uphill slope (i_{max}≥ 4%), or near schools and hospitals; and use higher values for clusters approaching slow zones or on a downhill slope; for a > 6% uphill slope, rumble strips can be 2 - 3 mm thick.

For rumble strips to work as effective warnings to vehicle drivers, the maximum distance from the last rumble strip cluster to a slow zone should be 20 m.

4.4.2. Pedestrian crossing markings [11]

Marking type used: 7.3 “Pedestrian crossing markings”.

Purpose: To determine scope of pedestrian crosswalks.

Location: In places designated for pedestrians to cross a road, the distance between two pedestrian crossings on the same road section should be greater than 150 m apart.

[11] QCVN 41:2019/BGTVT - National Technical Regulation on Road Signs and Signals.

The minimum width of a pedestrian crossing must not be smaller than 3 m, which, depending on the number of pedestrians, can be increased step-wise, by 1.0 m each step.

Pedestrian crossing markings should not be installed on unusual road sections (limited visibility, high longitudinal slopes, large turning angles, small radius curves, presence of unpredictable hazards, or on narrowing road sections).

For students and other pedestrians to safely cross a road, the 7.3 markings should be used in combination with the I.423 "Pedestrian crossing" sign, or with stop lines and traffic lights, or with rumble strip clusters installed prior to pedestrian crossings.

Specifications of pedestrian crossing markings are as follows:

a) Perpendicular form *b) Cross cut form*

Figure 25. Specifications of pedestrian crossing markings
(Source: QCVN 41:2019/BGTVT)

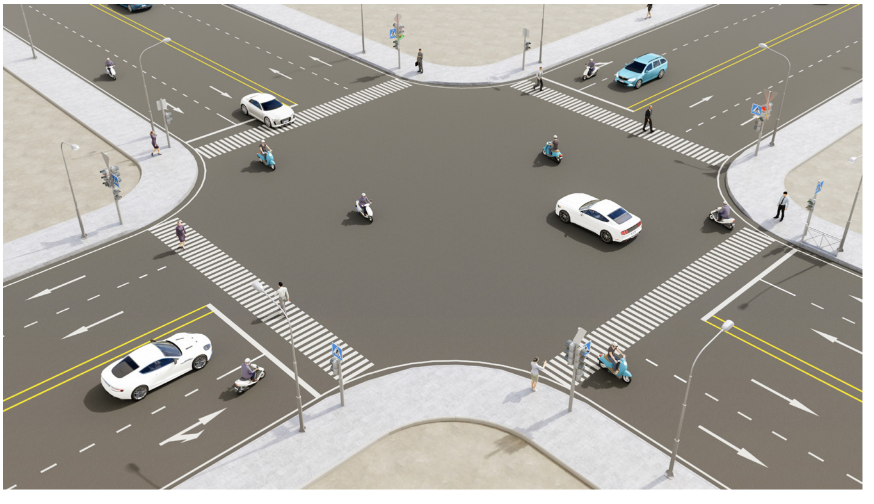
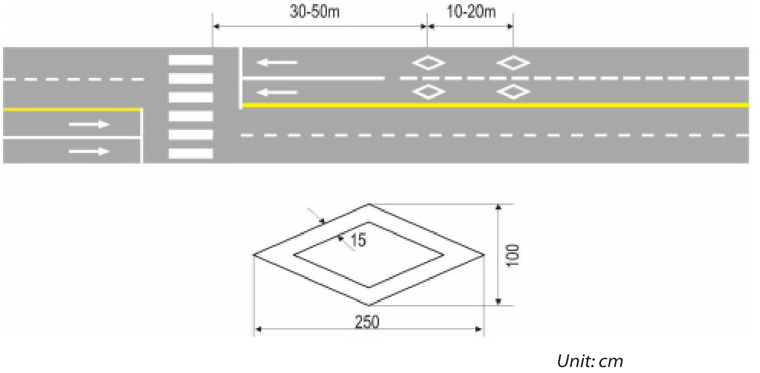


Figure 26. Pedestrian crossing markings at an intersection

In addition, pedestrian crossing markings can be installed together with other pavement markings or road safety installations to improve safety conditions for students and pedestrians crossing the road, as shown below:



(Pedestrian crossing markings combined with markings signifying a crosswalk ahead (7.6) and directional arrow pavement markings (9.3))

Figure 27. Crosswalk markings combined with pavement markings *(Source: QCVN 41:2019/BGTVT)*

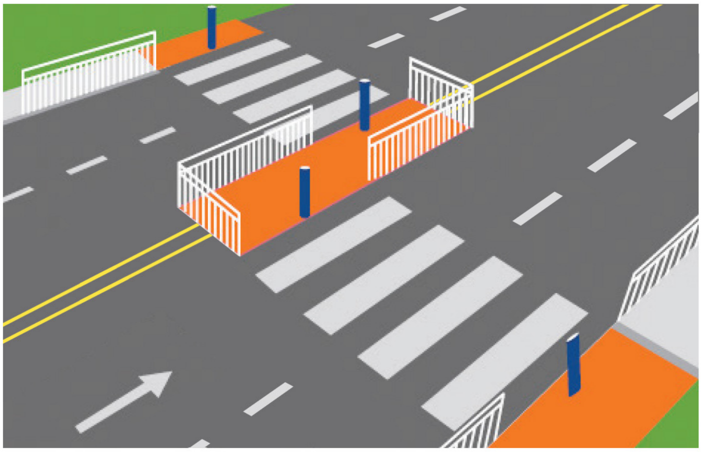


Figure 28. Road safety installations for pedestrians

For road crossings design in school zones, raised crosswalks are recommended, as they bring motorists and pedestrians to the same eye level. This is especially important for the safety of children.

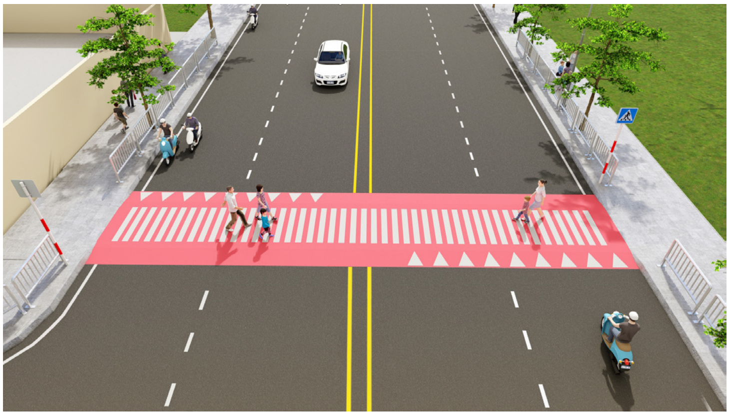


Figure 29. Raised crosswalk design

4.4.3. Road signal markings [12]

In school zones, when there is a need to enhance clarity in traffic organization, the following symbol markings on the road surface can be used for design on road, specifically:

Marking type used: 9.3: "Directional arrow pavement markings".

Purpose: To indicate directions a vehicle must travel.

Location: Mainly used at intersections where lane changing and merging is allowed, and on multi-lane roads. Directional arrow markings can be used for one-way roadways to indicate the traffic flow direction.

Specifications of markings are as follows:

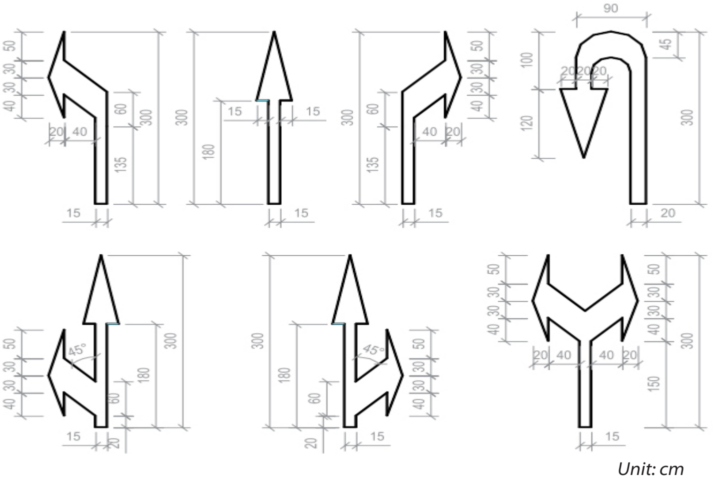


Figure 30. Specifications of directional arrow pavement markings
(Source: QCVN 41:2019/BGTVT)

[12] QCVN 41:2019/BGTVT - National Technical Regulation on Road Signs and Signals.

In addition to 9.3 markings, text- or symbol-based pavement markings can be used as guidance to drivers where text-based markings are white-painted at a height of 1.6 m in urban areas and 2.5 m in non-urban areas (except for expressways); the vertical distance between rows of texts or numbers is 1.0 m - 1.5 m, and the line width is 12 cm - 18 cm.

Figure 31. Text-based markings
(Source: QCVN 41:2019/BGTVT)

The "Bicycle road markings" (9.6): Bicycle road markings: white-painted markings that illustrate bicycles, with their dimensions determined by the width of bike lanes. Width and height dimensions of markings can be either 75 cm x 120 cm; 110 cm x 170 cm, or 170 cm x 275 cm.

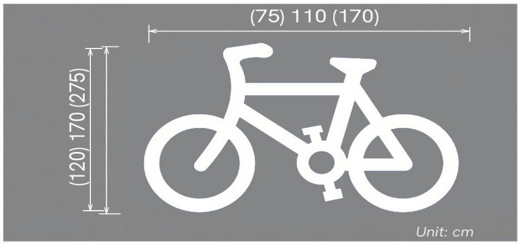


Figure 32. Bicycle road markings
(Source: QCVN 41:2019/BGTVT

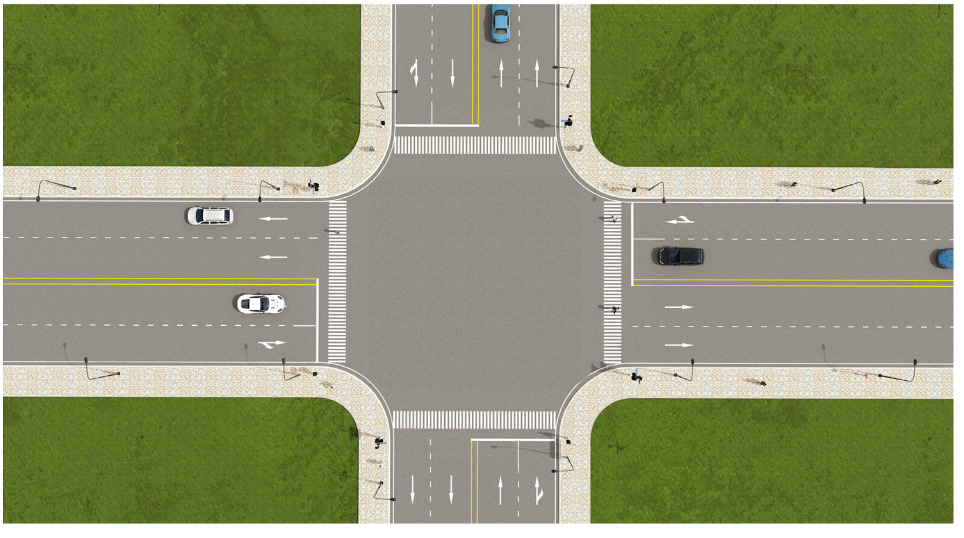


Figure 33. A combined use of pavement markings

4.5. Design of other basic infrastructure components

4.5.1. Roadway design

To ensure effective implementation of road safety solutions in school zones (i.e, speed limits, lane markings...), roads passing school zones must be solidly built with asphalt or concrete pavements. To provide more safety to students in school zones, asphalt pavements are recommended. Pavement thickness should be calculated and determined based on the traffic volume and load of motor vehicles driving through the school zones, ensuring that all calculations are based on applicable industry standards.

4.5.2. Design of parking locations in front of school gates

School gates are where student are often dropped off and picked up, especially during pick-up hours when there is a significant surge of vehicles traveling through school zones. For efficient traffic management and prevention of traffic congestion around school gates, parking areas, not on roadway, must be designed so that parents of at least 50% of students can park their vehicles while waiting for their children. A sidewalk by school gates should be used, to the extent possible, to arrange parking space for parents.

The standard parking lot size is: 0.9m2/bicycle; 2.5m2/motorcycle; 25m2/car; Parking space, by vehicle categories, should be calculated and determined on a case-by-case basis.

In designing parking areas, solid yellow center lines (1.2) that indicate two-way traffic in opposite directions or edge lines (3.1a) to mark the outside edge of the roadway or separate lanes for motorized and non-motorized vehicles can be used according to QCVN 41:2019/BGTVT. The 1.2 lines are single, solid and yellow lines which are 15 cm in width each, while the 3.1a lines are single, solid and white lines which are 15-20 cm in width each.

4.5.3. Traffic signal design

In case there is any at-grade intersection in a school zone, traffic signals should be installed as an extra safety measure. Basic technical specifications of traffic signals are in line with the National Technical Regulation on Road Signs and Signals (QCVN 41:2019/BGTVT), with priority settings for pedestrians and non-motor vehicles.

The light bulbs, which are 300mm in diameter, are installed on mast arm poles about 35 m - 45 m from stop lines, facing oncoming pedestrians and vehicle drivers.

When placed on a sidewalk pole, signal heads should be 1.7 m - 2.8 m off the ground while the pole should be 0.5 m - 2 m from the nearest edge of the roadway. When placed on a mast arm pole, signal heads should be 5.2 m - 7.8 m off the ground.

a) Hung on a gantry *b) Hung on a pole*

Figure 34. Traffic signal design

The minimum interval for a green light in one direction should be 15 seconds. The walk interval should be at least 7 seconds in length. For narrow two-lane roads which are not priority roads and where pedestrian traffic is low, the interval can be reduced but must not be less than 4 seconds. The average crossing speed is 1.2 m/s; for locations where people with disabilities can cross the road, the crossing speed should be lower than 1.2 m/s while other site conditions should also be considered to set suitable signal timing.

To ease road crossing, especially among persons with visual impairments, hard of hearing or disabilities, pedestrian detectors or pushbuttons can be used. Pedestrian pushbuttons include: push buttons and blinking lights installed on the same pole on sidewalks where pedestrians start crossing the road.

A push button might come with locator tones which have a duration of 0.15 seconds and shall repeat at 1-second intervals. Pushbutton locator tones should be audible 1.8 m to 3.7 m from the pushbutton, no more than 5 dBA louder than ambient sound but not higher than 89dB, and can be deactivated when the blinking light cycle ends. Site conditions must be evaluated properly before installing push-buttons.

4.5.4. Design of pedestrian refuge islands

Refuge islands are usually installed to ensure students and pedestrians can safely cross roads that have at least 04 motorized vehicle lanes. Therefore, median dividers should be in place, together with road safety installations, to best locate where pedestrians can stop, observe and cross the roads when safety is ensured.

The design of refuge islands must include the “Pedestrian crossing markings” (7.3) and relevant road signs.

The refuge island width is designed according to the median divider width as follows:

- For grade-II 4-lane roads, a refuge island should be at least 1.5 m wide; if kerbs are built, with tactile paving and bollards, then its minimum width should be 2.5 m.

- For grade-I roads, the minimum width is 3.0 m. In case of safety reinforcement, the minimum width is 4.0 m.

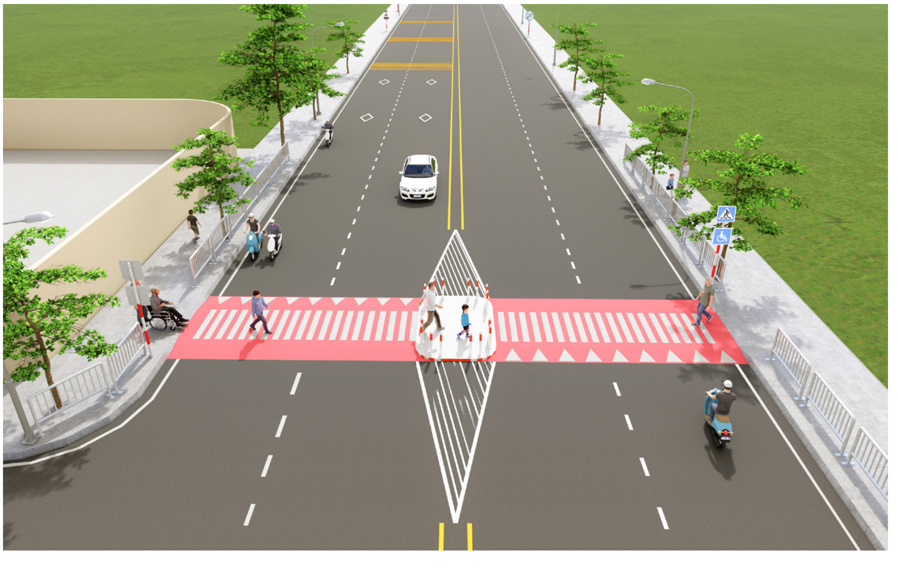


Figure 35. Refuge island design

The length of a refuge island is based on an assessment of the pedestrian traffic volume across a road.

Safety installations of a refuge island are designed with steel guardrails, or concrete or steel bollards of less than 80 mm in diameter. Safety installations must be designed with both pedestrian safety and road aesthetics in mind. To achieve this, in addition to requirements on construction materials, it is necessary to decide colors of tactile paving that are reflective while still ensuring local aesthetics.

Refuge island are normally raised from 5 cm to 10 cm above ground, with the kerbs reflectively painted in yellow or red.

4.5.5. Design of bicycle lanes

According to current regulations in Vietnam, those aged 16 and older can drive motorcycles or similar vehicles with an engine capacity of 50 cm3 or lower, meaning that these are common means of transportation among secondary students. Others mostly either walk or cycle to school. Thus, in addition to pedestrian protection measures, it is also necessary to design transportation infrastructure that supports cyclists. Cycling infrastructure is developed according to current regulations, as follows:

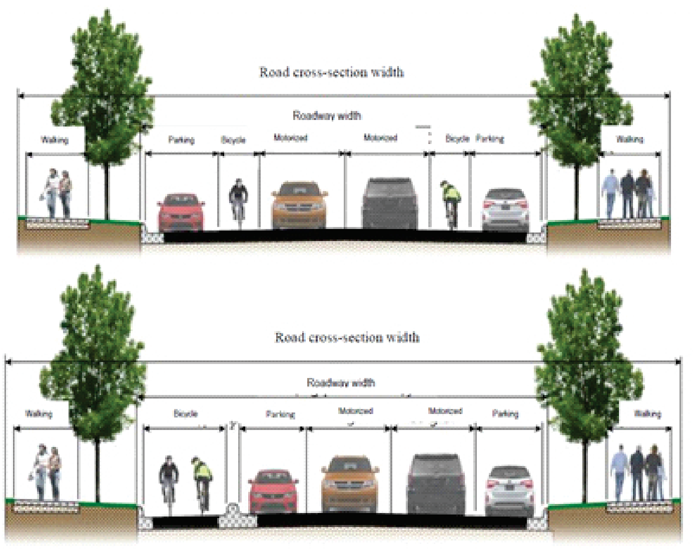


Figure 36. Bicycle lane design
(Source: Le Van Thanh - Report on technical transport solutions to improve road safety in school zones, Workshop on School Zone Road Safety

- For urban roads: According to Vietnam Building Code 01:2008/BXD and National Technical Regulation 07-4:2016/BXD, bicycle lanes should be designed for sub-arterial main streets or higher-tiered ones.

- For non-urban roads, the National Standard TCVN 4054-05 should be followed: Grade I and Grade II roads shall have separated cycle paths, 2.5 m - 3.5 m wide, for bicycles and non-motorized vehicles. In sections where cycle paths cannot be designed, dedicated lanes for bicycles and non-motorized vehicles must be in place, protected by a divider and guardrails of at least 0.8 m high off the ground. For Grade III roads, similar dedicated lanes of 2.0 m - 2.5 m wide must be in place using the hardened shoulders, separated with the motorized vehicle lane by a painted line. Grade IV and V roads do not have dedicated lanes for bicycles and non-motorized vehicles; these vehicles travel on the hardened verge which is 0.5 m - 1.0 m wide. For Grade VI roads, bicycles and non-motorized vehicles share the same roadway[13].

- In principle, the width of a bicycle lane is based on: design speed, traffic volume of bicycles and other vehicles sharing the same lane with bicycles, longitudinal slope, location of bicycle lanes in the cross-sectional plan of a road, specifically:

Table 3. Bicycle lane width and protection measures depending on the travel speed of motorized vehicles

Travel speed of motorized vehicles V 85% (maximum actual speed)	Type of bicycle lane/ path	Bicycle lane width (m)	Notes
≤ 30 km/h (Traffic volume <2,000 motorized vehicles/ day)	Shared lanes, used by bicycles and motorized vehicles.	Use the entire pavement width.	Use support solutions to reduce motor vehicle speed (i.e., speed limit signs, rumble strips...); Use bike signs and symbols on pavements.

[13] Le Van Thanh - Report on technical transport solutions to improve road safety in school zones, Workshop on School Zone Road Safety, Pleiku, 2019.

Travel speed of motorized vehicles V 85% (maximum actual speed)	Type of bicycle lane/ path	Bicycle lane width (m)	Notes
≤ 30 km/h (Traffic volume < 2,000 motorized vehicles/day)	Physically protected bicycle lanes.	Minimum width of 2.0 m and buffer zone width of 1.0 m.	One-way lane close to the right roadside, using the 4.1 lines (channelizing lines) representing the buffer zone according to the National Technical Regulation QCVN 41:2019/ BGTVT.
≤ 40 km/h (Traffic volume < 6,000 motorized vehicles/day)	Dedicated bicycle lanes.	Minimum width of 1.5 m and buffer zone width of 0.5 m; Minimum width of 2.0 m, no buffer zone.	One-way lane close to the right roadside, using the 3.1a lines (solid lines) and 4.1 lines (channelizing lines) according to the National Technical Regulation QCVN 41:2019/ BGTVT.
> 50 km/h	Separate cycle paths.	Minimum 2.0 m-wide one-way cycle paths; Minimum 3.0 m-wide two-way cycle paths.	Suitable for recreational and tourist cycling routes, roads on which motorized vehicles can travel at high speeds and the bicycle traffic is high, and lakeside and riverside roads.

Figure 37. Share lanes for both bicycles and motorized vehicles
(Source: WRI, 2021)

- Pavement design of bike lanes: Pavements in bike lanes should be designed based on the design speed of bicycles as can be seen in the table below:

Table 4. Pavement design of bike lanes according to the design speed

Type of bicycle	Type of pavement	Maximum speed
Conventional bicycles	Asphalt pavement	20 km/h
	Tile pavement	9 km/h

In order to improve road safety of cyclists, pavements in bike lanes can have colors that are different as compared to those of motorized vehicle lanes.

Figure 38. Pavement design of bike lanes
(Source: WRI, 2021)

- Longitudinal slope and slope length: slope length and (uphill) longitudinal slope significantly influence the level of comfort of cycling infrastructure as cycling is human-powered. The longitudinal slope of a road and bike lane must not exceed 3.5%.

Table 5. Longitudinal slope and slope length of a bike lane

Uphill longitudinal slope (%)	Slope length (m)
3.5	100
3	140
2.5	200
< 2	No limits

4.5.6. Sidewalks Design

In order to ensure the safety for walking to school in school zones, it is necessary to review and design a walking plan for pedestrians, including students. The design of sidewalks depends on whether the roads in a school zone are urban or non-urban roads.

4.5.6.1. For non-urban roads without sidewalks for pedestrians

Based on the design road grades defined in TCVN 4054-2005, the shoulders and hardened shoulders should be used as sidewalks while still exploring other reinforcement options to ensure pedestrian safety.

The width of shoulders and hardened shoulders that can be best fit for a sidewalk is from 1.5 m to 3.5 m depending on road grades, specifically:

Table 6. With of pedestrian lane by road grade

Road grade by design	I	II	III	IV	V	VI
Width of shoulders and hardened shoulders (m) for a sidewalk	3.5 (3.0)	3.0 (2.5)	2.5 (2.0)	1.0	1.0	1.0

4.5.6.2. For urban roads

Sidewalks designed should meet 06 minimum requirements as follows:

(1) Sidewalks must be accessible to people with disabilities;

(2) Pavements are not slippery and height changes should be small;

(3) Ramps must be built at critical road junctions to enable access by people with disabilities, usually at a slope of ≤ 10%;

(4) The pathway must be free of obstacles;

(5) Sidewalk lighting systems must provide sufficient illumination without leaving road users dazzled or disrupting their vision;

(6) Traffic junctions must have traffic signals and road signs, in addition to audio signals or braille symbols to support persons with visual impairments in crossing the road.

Figure 39. Sidewalk access for people with disabilities

4.5.6.3. Technical requirements

- The sidewalks should be ≥ 2.0 m wide and at least ≥ 50 cm from the edge of the driveway.

- Support solutions could be used to ensure space and safety for pedestrians:

  • Using 3.1a lines to define the pedestrian lane boundary on sidewalks;

  • Using the 9.5 painted lines - either as texts, numbers or color lines on pavements; both in line with QCVN 41:2019/BGTVT.

Figure 40. Design of sidewalks in a school zone

In addition, to ensure pedestrian safety from unwanted impacts of motor vehicles, support solutions can be used, such as safety guardrails. These safety guardrails can be installed at the outer edge of sidewalks, between the pedestrian lane and the driveway.

Safety guardrails are installed one after another, with open space at junctions and points of access to other construction works and housing areas. These installations are between 700 mm and 1,000 mm in height and should have no sharp edges in order to protect children and pedestrians in case of road crasshes.

4.5.7. Design of smart traffic management solutions

Smart traffic management solutions can be adopted in a school zone, including smart parking lots, smart traffic signals and smart road signs, etc. However, this Guide only suggests smart traffic signals and smart road signs for reference purposes.

Adoption of these solutions should be in line with industry regulations and standards.

4.5.7.1. Changeable message signs

Changeable message signs are electronic signs that show alternate messages on the same sign. These signs are used to show information which can be altered when required depending on traffic situations. Depending on the purpose, messages on a sign can be instructions, prohibitions, commands, danger warnings, or other warnings. The signs should not be used for advertising, or any illustrations. Flashing lights or moving parts should also not be displayed.

Messages are displayed within three lines of text, using up to 20 characters each. Spacing between characters in a word shall be 25% – 40% of the character height. Spacing between words in a message shall be 75% – 100% of the character height. The minimum character size is 300 mm when used in zones where the speed limit is 70 km/h.

In school zones, the volume of road users and vehicles often significantly surges during student drop-off/pick-up, as compared to other times in the day. Therefore, these signs can be used to change the driving speed on a route. For example, the speed limit should be 30 km/h during students' arrival and dismissal while, in other time periods, the driving speed can change suitably in accordance with the actual traffic situation on the road.

Figure 41. Safety guardrails on sidewalks in school zones

4.5.7.2. Smart traffic signals

In case there is a signalized intersection in the school zone, given the same traffic characteristics in school zones as above, smart traffic signals can be used, with timing intervals programed and adjusted according to the actual traffic volume on roads. Specifically, green and red intervals depend on the queue length on each road arm at junctions. When a queue is longer than the traffic capacity, potentially leading to traffic congestion, the traffic signals will be automatically adjusted for a longer green interval to allow more vehicles on jammed road segment to go through junctions, while still ensuring that the minimum green interval for one traffic flow direction is 15 seconds.

4.5.8. Mitigation of other road safety risks

In winter in Northern Vietnam, when the days are short and the nights are long, sometimes it is already dark when students arrive at school or reach home.

In addition, in mountainous provinces, it is densely foggy at times, limiting visibility and increasing road safety risks. In addition to requirements on the use of reflective signals and road lines, lighting solutions should be adopted from time to time, including installation of crosswalk lights, in addition to active traffic calming measures such as painting or installation of rumble strips.

Figure 42. School zone lighting system

Flashing yellow signals can be additionally installed as warnings and reminders to road users on a need to slow down.

Figure 43. Sample flashing yellow signals

Part 5. School zone road safety assessment methods

5.1. iRAP Star Rating for Schools (SR4S)

5.1.1. Rationale

The iRAP (International Road Assessment Programme)[14] Star Ratings for Schools (SR4S) is now used in countries around the world for road infrastructure safety management, including school zone road safety.

The iRAP's SR4S method provides assessment and star-rating of road infrastructure safety in connection with different road user groups. Quantitatively, among others, road safety is star-rated where one-star road segments are the least safe (with highest risks) while five-star are the safest (with lowest risks).

To assess road infrastructure safety in a school zone, the iRAP Star Rating for Schools (SR4S)[15] can be further explored before use. This is a systematic, evidence-based tool. It has been used to measure, monitor and provide insights on the risk children are exposed to on their school journeys in over 1,000 schools in 63 countries. This tool also informs and suggests measures to improve school zone road safety and prevent risks of traffic collisions.

School selection criteria for assessment: Priority is given to high-risk locations, but it is also clever to align the school zone assessment plans with the strategy developed by road authorities and local governments. Crash data or an existing school zones program with priority school areas already mapped can be used.

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[14] https://irap.org/.

[15] https://irap.org/project/star-rating-for-schools/.

The local partners will then define the critical locations around a school to be assessed. The selection of locations should consider important road segments around the school such as: shops, transit stops and intersections. It is very important to engage the school community in this part of the process and conduct surveys and activities to understand the risk perception of students, teachers and parents.

The SR4S assessment can be undertaken by any trained road safety professional. Once collected, data must be submitted to an accredited reviewer to check its consistency.

After the locations assessed are approved in the Quality Review, the data can be processed, and the Star Rating can be performed. Once road safety risks are defined, effective measures to mitigate such risks can be considered by exploring different intervention scenarios. Measures can, for example, include active speed management, on-site infrastructure renovation or relocation of school gates to a safer location. Once such measures are completed, the assessment team will be able to reassess road infrastructure and safety improvements. Finally, the implementation of the improvements can be tracked for both partners and investors to see the outcomes of their investment and for teaching staff to educate their students on proper use of modified infrastructure.

Figure 44. SR4S assessment results before and after infrastructure modification

5.1.2. Calculation of Star Rating Scores

A Star Rating Score (SRS) is calculated for each segment of road and each of the four road users, using the following equation:

$$\textbf{SRS} = \sum \textbf{Crash Type Scores}$$

Where:

(1) The SRS represents the relative risk of death and serious injury for an individual road user;

(2) Crash Type Scores = Likelihood x Severity x Operating speed x External flow influence x Median traversability.

Where:

- “Likelihood” refers to road attribute risk factors that account for the chance that a crash will be initiated;

- “Severity” refers to road attribute risk factors that account for the severity of a crash;

- “Operating speed” refers to factors that account for the degree to which risk changes with speed;

- “External flow influence factors” account for the degree to which a person’s risk of being involved in a crash is a function of another person’s use of the road;

- “Median traversability factors” account for the potential that an errant vehicle will cross a median.

The descriptions above on iRAP Star Rating For Schools are only for general introduction and its actual deployment is done through the manufacturer's software. For accurate assessment of school zone traffic safety using this method, users must participate in a formal training course provided by the International Road Assessment Program (iRAP) or an SR4S Main Partner, while also using licensed software.

5.1.3. Strengths and weaknesses for the application of iRAP Star Rating for Schools in Vietnam

Strengths: Automation and highly accurate results, with calculation results less dependent on the subjective assessment of evaluators. Additionally, the assessments are carried out by trained surveyors, which makes the results credible.

Weaknesses: While not a weakness in the method itself, training users to conduct accurate school zone road safety assessments takes time and resources.

5.2. Analytic Hierarchy Process (AHP)

5.2.1. Rationale of Analytic Hierarchy Process (AHP)[16]

Based on the Analytic Hierarchy Process (AHP)[17], this Guide provides a set of criteria for school zone road safety assessment that is simple, easy to implement and practical, with weights assigned to each criterion.

The assessment criteria of school zone road safety are presented in Table 7 below:

Table 7. Assessment criteria for school zone road safety

No.	Group of criteria	Criteria
I	State management	1. Traffic congestion situation
		2. Traffic crash situation
		3. Coordination between functional agencies for road safety
II	Transport infrastructure system	1. Visibility
		2. Parking space for student drop-off and pick-up
		3. Road signs and signals to ensure road safety
		4. Road pavement quality
III	Traffic organization	1. Specific traffic organization plans for road safety
		2. Connected public transport
IV	Vehicles	1. Legal non-compliance among students in driving motorized vehicles
V	Education and information sharing	1. Practical driving and road safety training
		2. Proportion of students having road safety knowledge
		3. Information sharing to relevant audiences

The scores of assessment criteria of school zone road safety are determined by the following formula:

$$\sum_{ij} X_i a_{ij} = \sum_{j=1}^{3} X_1 a_{1j} + \sum_{j=1}^{4} X_2 a_{2j} + \sum_{j=1}^{2} X_3 a_{3j} + X_4 a_{j4} + \sum_{j=1}^{3} X_5 a_{5j}$$

[16] MSc. Vu Thu Huong, Ministerial-level Science and Technology Research Project titled "Research and proposal of solutions for school zone road safety" coded DT 194014, 2020

[17] https://123docz.net/trich-doan/2847436-phuong-phap-danh-gia-thu-bac-ahp.htm.

Where:

X_i : is the weight assigned to the criterion group i;

a_{ij} : is the score of criterion j in the criterion group i.

The corresponding values of X_i and a_{ij} are shown in Table 8 below:

Table 8. Scores of assessment criteria of school zone road safety

No.	Value	Criteria	Maximum value ($X_i a_{ij}$)
I	$\mathbf{X_1}$	**State management**	**15**
1	a_{11}	Traffic congestion situation	5
2	a_{12}	Traffic crash situation	5
3	a_{13}	Coordination between functional agencies for road safety	5
II	$\mathbf{X_2}$	**Transport infrastructure system**	**35**
1	a_{21}	Visibility	10
2	a_{22}	Parking space for student drop-off and pick-up	8
3	a_{23}	Road signs and signals to ensure road safety	12
4	a_{24}	Road pavement quality	5
III	$\mathbf{X_3}$	**Traffic organization**	**30**
1	a_{31}	Specific traffic organization plans for road safety	20
2	a_{32}	Connected public transport	10
IV	$\mathbf{X_4}$	**Vehicles**	**5**
1	a_{41}	Legal non-compliance among students in driving motorized vehicles	5
V	$\mathbf{X_5}$	**Education and information sharing**	**15**
1	a_{51}	Practical driving and road safety training	5
2	a_{52}	Proportion of students having road safety knowledge	5
3	a_{53}	Information sharing to relevant audiences	5

The value of the criteria set is ranked by star. Details are provided in Table 9 below.

Table 9. Star ratings by scores given using the criteria

No.	Scores	Star ratings	Evaluation
1	< 50	★	Poor
2	50 - 64	★ ★	Average
3	65 - 79	★ ★ ★	Good
4	80 - 90	★ ★ ★ ★	Very good
5	> 90	★ ★ ★ ★ ★	Excellent

5.2.2. Scoring rules

5.2.2.1. Criterion 1: Traffic congestion situation (maximum score of 5)

a) Evaluate if there are traffic congestions during arrival and dismissal in the strictly protected area (100 m radius from the school boundary). Scores are given as follows:

- With traffic congestions: 0;

- Without traffic congestions: 5.

b) Assessment method: Occurrence of traffic congestions is determined through direct field survey and assessment using indicators, including:

- Levels of service and the traffic capacity coefficient of a road in school zones (within 100m radius) according to Vietnam Standard 104:2007;

- The level of service is E or higher, corresponding to the traffic capacity coefficient of 0.9 and higher;

- The average speed of traffic flow: less than 5 km/h;

- Travel times compared to a normal travel time without congestion: over 150%.

5.2.2.2. Criterion 2: Traffic crash situation (maximum score of 5):

a) Evaluate if there are traffic crashes during student arrival or dismissal in the school zone (within 300 m - 500 m from the school boundary). Scores are given as follows:

- With traffic congestion: 0;

- Without traffic crashes: 5.

b) Assessment method: Collect statistics on the number of traffic crashes, deaths and injuries involving children under 18 during student arrival or dismissal. Traffic crashes rated to be minor accidents or higher by functional agencies (traffic police, health care facilities, etc.) are included.

5.2.2.3. Criterion 3: Coordination between functional agencies for road safety (maximum score of 5):

a) Evaluate if there is coordination between functional agencies in traffic management and control in school zones during student arrival and dismissal. Scores are given as follows:

- With coordination in place: 5;

- Without coordination: 0.

b) Assessment method: During student arrival and dismissal, traffic police, ward/commune police, militia and self-defense force members and school guards jointly work on traffic organization, traffic flow separation, handling of traffic congestions or other measures to ensure road safety.

5.2.2.4. Criterion 4: Visibility (maximum score of 10)

- This criterion is scale-rated (2, 4, 6, 8, 10), where: 10 indicates clear visibility on two sides of the road for both school entry and exit; and 2 indicates limited visibility on two sides for both school entry and exit.

- Assessment method: Based on field surveys in school zones: observing directions of vehicles approaching a school zone to see if there are obstacles (e.g. trees, equipment, infrastructure works, etc.) that disrupt the vision of vehicle drivers and prevent them from observing the students' movement.

5.2.2.5. Criterion 5: Parking space for student drop-off and pick-up (maximum score of 8):

a) This criterion is scale-rated (2, 4, 6, 8), where: 8 indicates availability of parking space for student drop-off and pick-up by parents and for other student transportation vehicles in and out of the school or in the vicinity to ensure that they do not block the traffic flow and cause road safety risks, while 2 indicates crowded traffic and risks due to occupation of road space.

b)Assessment method: Based on field surveys in school zones: observing if student drop-off and pick-up by parents is chaotic and if the roadway is occupied, obstructing the traffic flow and causing road safety risks.

5.2.2.6. Criterion 6: Road signs and signals to ensure road safety (maximum score of 12):

a) Evaluate if there are road signs and signals installed within 100 m from the school gate to ensure road safety. Specifically:

- School Zone signs installed: 4;

- Speed limit signs installed: 2;

- Rumble strips and speed bumps installed: maximum score of 2 in case rumble strips and speed bumps painted in outstanding colors;

- Pedestrian crossings marked: 2;

- Crosswalk lights installed: 2.

b) Assessment method: Conduct on-site surveys and counting in the target school zones.

5.2.2.7. Criterion 7: Road pavement quality (maximum score of 5):

a) Survey the road pavement within a 100 m radius from the school gate:

- Chip sealing, asphalt concrete and concrete pavements are of good quality, without cracks: 5;

- For other road pavements (gravel roads or earth roads, etc.) or road pavements with potholes and cracks: 0.

b) Assessment method: Conduct on-site surveys and counting in the target school zones

5.2.2.8. Criterion 8: Specific traffic organization plans for road safety (maximum score of 20):

a) Evaluate if there is any traffic organization plans for road safety in a school zone during arrival and dismissal:

- A traffic organization plan in place for organization of traffic lanes and flows (including restricted entry for some vehicles): 10;

- Speed limits in school zones: 5;

- Other solutions (organization of one-way traffic for all vehicles or each vehicle category, stopping and parking prohibition, etc.): 5.

b) Assessment method: Conduct on-site surveys and counting in the target school zones.

5.2.2.9. Criterion 9: Connected public transport (maximum score of 10):

a) Evaluate if, within a 300 m - 500 m radius of the school gate, there are any parking spaces for public transport means or other public student transportation vehicles (e.g., contracted buses/school buses):

- Bus stops/bus stop shelters or urban railway stations in place: 4;

- Student transportation using contracted buses: 3;

- Student transportation using school buses: 3.

b) Assessment method: Conduct on-site surveys and counting in the target school zones.

5.2.2.10. Criterion 10: Legal non-compliance among students in driving motorized vehicles (maximum score of 5):

a) Evaluate if students are driving motorized vehicles against the Road Traffic Law in school zones:

- More than 10% of students violating the law: 0;

- Less than 10% of students violating the law: 3;

- No violation reported: 5.

b) Assessment method: Conduct on-site observation, in an area of 300 m - 500 m in a school zone, of at least 100 randomly selected students using motorcycles over 50 cm^3 (for upper secondary schools) and e-scooters/motorcycles with an engine capacity over 50 cm^3 (for lower secondary or primary schools).

5.2.2.11. Criterion 11: Practical driving and road safety training (maximum score of 5):

a) Evaluate if practical driving and road safety training is in place to determine scores, as follows:

- Practical driving and road safety training program is part of the mandatory curriculum: 5 points;

- Practical driving and road safety training program is part of extracurricular activities: 3 points;

- Practical driving and road safety training is not integrated in the curriculum: 0 point.

b) Assessment method

Discuss with the school management or interview students to see if practical driving and road safety training is in place. Situational drills relevant to each age group and educational level, including:

- For elementary schools: drills on safe walking, safe cycling, safe riding on the back of motorcycles, cars, school buses, and public transport means. Drills in different situations when participating in road traffic;

- Lower and upper secondary schools: drills on safe driving of bicycles or other motorcycles as legally allowed, drills on prevention of road crashes in different situations.

5.2.2.12. Criterion 12: Proportion of students having road safety knowledge (maximum score of 5):

The percentage of students having road safety knowledge is determined by random interviews (with more details in Part IV). Scores are given as follows:

- 90% - 100% of the interviewed students correctly answer over 80% of interviewed questions: 5;

- 50% - 90% of the interviewed students correctly answer over 80% of interviewed questions: 3;

- Less than 50% of the interviewed students correctly answer over 80% of interviewed questions: 0.

5.2.2.13. Criterion 13: Information sharing to relevant audiences (maximum score of 5):

- The school organizes different forms of road safety communication to relevant audiences (e.g., teachers, parents, students, etc.): 5;

- Only communications to certain groups: 3;

- None: 0.

5.2.3. AHP's strengths and weaknesses

Strengths: This tool is easy to use and produces relatively accurate results. Prior training of how it works is required before deployment, but does not involve any licensing issues.

Weaknesses: The implementation is time-consuming and the results are highly dependent on subjective assessment and skills of evaluators.

5.3. Road safety audit

5.3.1. Road safety audit process[18]

Road safety audit is carried out using the following process:

a) Collect necessary documents; update existing information on road crashes on upgraded and rehabilitated road sections.

b) Review collected documents for potential road safety issues; come up with initial countermeasures for each identified issue; draft a list of potential safety risks and issues for further checks during on-site audit.

c) Conduct on-site audit to identify, cross-check and confirm potential safety issues (taking into account weather conditions, local conditions and customs). Road safety audit, before official launch for public use, must be conducted during both daytime and nighttime.

d) Consult people living along the route (if any) on local road crashes and travel demand.

e) Prepare a road safety audit report that clearly states potential road safety issues and proposes countermeasures according to Article 62 of Circular 50/2015/TT-BGTVT before reporting to the project developer.

5.3.2. Road safety audit steps in details

Step 1: Provision of documents for road safety audit

The developer provides drawings and necessary information to road safety inspectors as requested.

[18] Circular 50/2015/TT-BGTVT dated September 23, 2015 of the Ministry of Transport.

Step 2. Review of documents

- Review of documents relating to the project in question.

- If the project has been inspected for road safety in the previous stage, the previous road safety audit report should be reviewed.

- Road safety inspectors must evaluate if there are any safety issues or unsafe interactions between elements in the design.

- Identify potential hazards.

Step 3. Conduct site surveys (on the main route, intersections, crossings, adjacent areas, etc.)

- Conduct site surveys to determine the relationship between the project and existing structures and surrounding areas.

- During on-site audit, it is essential to examine the project site and its issues. However, general issues in the neighborhood and actual traffic conditions should also be inspected. A project should not create hazards in the neighborhoods, by, for example, diverting traffic to local roads and causing a sudden and significant surge of vehicles on these routes.

- External variables, such as bad weather conditions, fog or flooding during the rainy season, can also affect the safety of a structure.

- The traffic flows, especially actual traffic volume, must be documented and the design should include expected locations for vehicle turning, stopping and parking by all road users. Road safety inspectors should role-play as road users (including pedestrians) driving through the project area.

- Road safety inspectors must look for new issues, if any, that have not been presented in the road safety audit documents. It could be places for hawkers, a crosswalk where many can cross the road, or where there are special driving behaviors.

- Observations during on-site audit can be noted in technical drawings or documented as a list. Photos should be used as illustrations to assist in interpreting the issues identified on site.

Step 4. Road safety audit report

- Based on the list of road safety issues and observations during literature review and on-site audit, road safety inspectors shall prepare a report presenting the nature of identified issues and discussing proposed solutions.

- Road safety inspectors are required to propose some remedial measures for each specific issue. All these proposals must be presented as text. In some cases, even if there is no particular solution to an issue, the issue must still be included in the report.

Clearly defining such issue is important, and this can be best done by comparing the chainage or the kilometer posts in the area. Diagrams, sketch plans or annotated copies of project design drawings must be provided as illustrations. Proposed remedial solutions or options must clearly state the actions that need to be taken, but road safety inspectors are not responsible for designing these changes.

Annex. Some safe school zone case studies

1. A Case study of Pleiku City, Gia Lai Province, Vietnam

The collaboration with various governmental partners, including the National Traffic Safety Committee, the Ministry of Education and Training, the Ministry of Transport, the Gia Lai Provincial People's Committee, the Gia Lai Provincial Traffic Safety Committee, and related departments of Gia Lai Province under the *Slow Zones, Safe Zones* program, has led to the renovation of infrastructure around school zones and a reduction of speeds in school zones to 30 - 40 km/h.

The *Slow Zones, Safe Zones* program - implemented from 2018 to 2023 - uses a multi-pronged approach that includes the construction of tailored school zone modifications, public awareness campaigns, law enforcement initiatives, legislative advocacy, and the development of a Traffic Safety E-curriculum. This program, which aims to reduce injuries and fatalities on school roads, is supported by Fondation Botnar, the Global Road Safety Partnership (GRSP), FIA Foundation, the FIA, and the International Road Assessment Program (iRAP).

The first phase of the program began with two primary schools in 2018. Pre-intervention assessments showed roads near these schools scored 3 stars or below on the iRAP Star Rating for Schools (SR4S). Star Rating for Schools is an objective measure of the level of safety, with 1-star roads having the highest risk and 5 - star roads having the lowest risk. After the infrastructure intervention, both pilot schools successfully increased their road safety rating to 5.

The program also incorporated speed enforcement initiatives and speed reduction regulations during school rush hours. Before the pilot program, vehicle speeds were measured as high as 70 - 80 km/h at target schools, significantly exceeding the internationally recommended 30 km/h speed in school zones.

After the interventions, maximum speeds at both target schools were reduced by as much as 18 - 21 km/h. Among self-reported student-involved road crashes, the rate of crashes near target schools decreased from 34.1% to 30.4%. In addition, 86.1% of surveyed drivers reported driving slower when passing target school zones.

Figure 45. Handling school zone violations in Pleiku City by the traffic police officers

In 2020, based on the *Slow Zones, Safe Zones* program results, and Circular No. 31/2019, the Gia Lai provincial government issued a Legal Document, lowering speed around school zones and calling for Pleiku City to allocate funds from the city's budget to install road modifications in school zones. The provincial government mandated that Pleiku City authorities install speed limit signs and enforce limits during peak school arrival and departure hours on school roads with speeds not exceeding 30 km/h on two-way, non-divided roadways and one-way roadways or 40 km/h on two-way divided roads and one-way two-lane roads.

The Legal Document represents a landmark step towards defining and securing safer school zones throughout Vietnam, demonstrating the government's heightened commitment to protecting children on the roads and the growing potential for Pleiku City to serve as a model city for safe school zones nationwide.

Figure 46. Phan Dang Luu Primary School's model before and after modifications

Based on experiences gained from the *Slow Zones, Safe Zones* program, AIP Foundation continued working with Gia Lai Provincial Traffic Safety Committee and other relevant stakeholders to cover the remaining 29 primary schools in Pleiku City under the program's Phase II.

School modifications at primary schools in Pleiku City included:

- Renovating, expanding, and building 804,080 square meters of asphalt concrete and concrete pavements;
- Constructing 2,080 square meters of sidewalk, entrance and cement concrete yard;

- Installing 136 road signs (including school zone signs, parent and child parking signs, speed limit signs, slow-down signs, stop signs, intersection signs, etc.);

- Painting 735.88 square meters of road lines;

- Installing 49 clusters of rumble strips;

- Installing 19 pedestrian crossings;

- Installing 146.17 meters of guardrails to separate walkways and parking areas;

- Installing 14 sets of solar-powered yellow flashing lights.

Results

-According to Star Rating for Schools (SR4S) assessment results, all 25 surveyed schools were upgraded to 3 stars and above. 21 out of 25 schools were upgraded to 5 stars - the highest-ranking regarding safety with SR4S.

The first School Zone Definition was approved by the Pleiku's People's Committee on May 16 at Decision No. 1566/UBND-QLDT. This School Zone Definition is to be applied to new schools and existing schools undergoing modifications in the city, providing better protection for students commuting to and from school.

In addition, thanks to their coordinated implementation of the *Slow Zones, Safe Zones* program, the National Traffic Safety Committee and the Ministry of Education and Training have been awarded with The Prince Michael International Road Traffic Safety Award 2020 while the International Vision Zero for Youth Leadership Award 2022 was given to the Gia Lai Province People's Committee and Pleiku City People's Committee.

Program sustainability and replicability

The program started with two primary schools and eventually reached 31 primary schools in Pleiku City. From May to September 2022, Pleiku City government completed the school modifications for one primary school.

In addition, the Gia Lai Provincial Government decided to upgrade other 56 schools located on the provincial roads. These improvements are all funded by the Gia Lai Provincial Government.

2. Model of New Jersey, U. S [19]

To ensure safety for students, the design and traffic organization for roads passing a school zone are done as follows:

- Installing the warning sign W.225 “Children”, “Slow down” painted markings are installed within a minimum range of 200 m - 300 m from the school boundary;

- Installing sign P.127 “Speed limit” (40 km/h) within a minimum range of 100m from the school boundary to limit vehicle speeds;

- Installing pedestrian crossing markings near the school gate;

- Installing pedestrian light on the sidewalk prior to the pedestrian crossing markings at a position where it is easily seen by drivers.

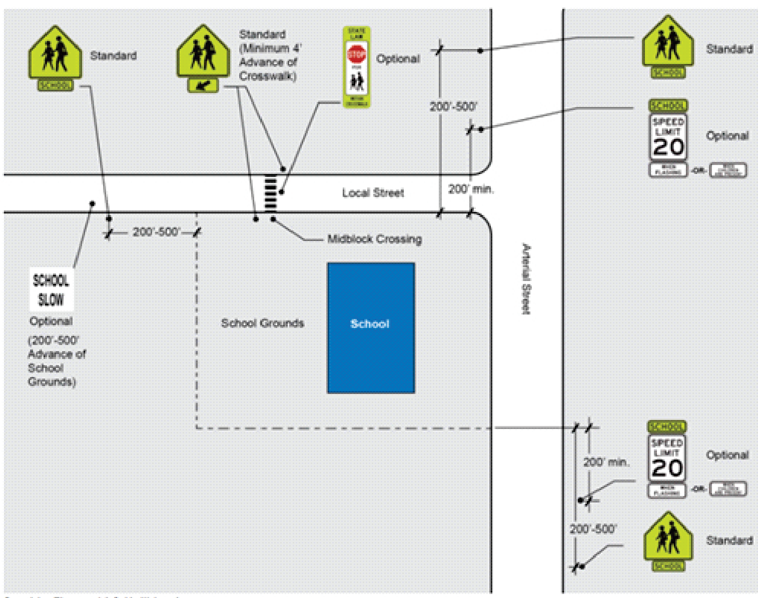

Figure 47. Model of Safe School Zone according to the New Jersey School Zone Design Guide
(Source: New Jersey School Zone Design Guide)

[19] New Jersey School Zone Design Guide; https://www.state.nj.us/transportation/community/srts/pdf/ schoolzonedesignguide2014.pdf.

3. Model of World Research Institute (WRI)

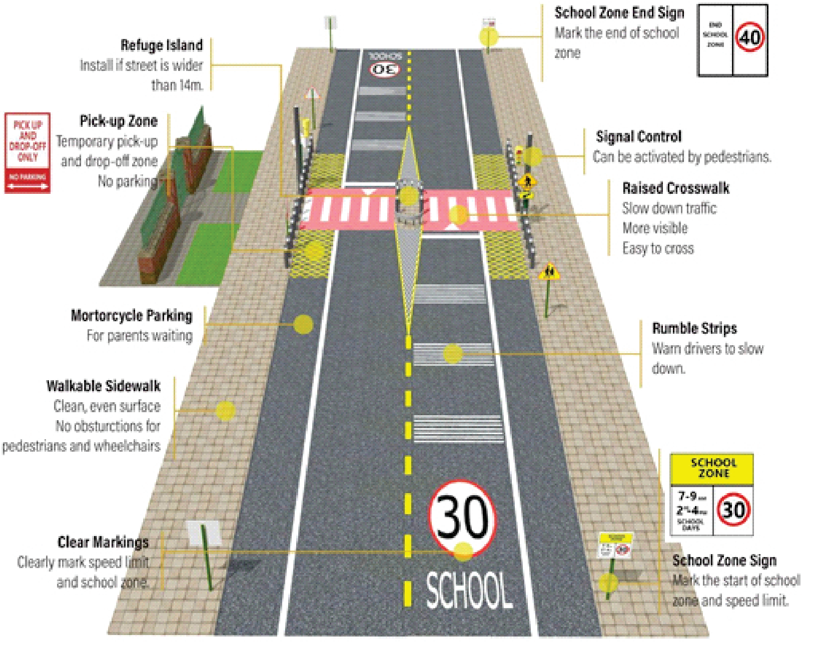

Figure 48. Model of Safe School Zone by WRI
(Source: WRI, 2019)

References

1. Vietnam Road Traffic Law 2008.

2. Circular 54/2019/TT-BGTVT on issuance of the National Technical Regulation QCVN 41:2019/BGTVT on Road Signs and Signals.

3. National Standards TCVN 4054:2005, Highways - Specifications for designs, 2005.

4. Basic Standards of the Directorate for Roads in Vietnam TCCS 34 : 2020/TCĐBVN: Rumble Strips, Speed Hump, Speed Bump on the road - Specifications for design.

5. National Standards TCVN 8793-2011: Elementary schools Specifications for designs.

6. National Standards TCVN 8794-2011: High schools - Specifications for designs.

7. Study on the proposed measures on improvement of road safety in school zones, Guide on safe school model of AIP Foundation.

8. Safe school zone model in Pleiku city under the *Slow Zones, Safe Zones* program implemented by AIP Foundation in 2018 - 2022.

9. JBIC (SAPROF), Project on Road Safety Improvement in Vietnam 2006.

10. Global Road Safety Partnership (GRSP), Monitoring and Evaluation Report on Star Ratings of road safety for the targeted schools of "Safe to school - safe to home" Project in Ha Nam Province; 2015.

11. Nguyen Ngoc Thach, Research on synchronous solutions to enhance road traffic safety in Vietnam, LATS - MS 62.84.01.03, 2015.

12. MSc Le Van Dat, Ministry-level Scientific and Technological Research: "Research on technical solutions on arrangement of motorbike-exclusive lanes on National Highway 5", MS: DT 103018, 2011.

13. MSc Vu Thu Huong, Ministry-level Scientific and Technological Research: "Research and proposal of solutions on ensurance of traffic safety in school zones", MS: DT 194014, 2020.

14. Transport Development and Strategy Institute, Research on the influence of road technical management factors on traffic safety, 2006.

15. AIP Foundation, Pedestrian Data Research Report, 2011.

16. Ministry of Labour, Invalids and Social Affairs, Synthesis report on child injury prevention in Vietnam, 2010.

17. MSc Pham Tuan Anh, Ministry-level Scientific and Technological Research, "Research and proposal of a set of statistical and evaluation indicators in the traffic safety field to serve the work of advising and proposing policies on ensuring traffic safety", MS DT164042, 2017.

18. Kerajaan Malaysia, Guidelines for the Selection of Speed Limit, 2016.

19. Fundación MAPFRE, Road Safety Inspection Manual for School Zone, 2014.

20. WHO, UNICEF, Children and road crashes, 2013.

21. The New Jersey Department of Transportation, New Jersey School Zone Design Guide, 2014; https://www.state.nj.us/transportation/community/srts/pdf/schoolzonedesignguide2014.pdf

22. U.S. Department of Transportation, Manual on Uniform Traffic Control Devices for Streets and Highways - Part 7; https://mutcd.fhwa.dot.gov/index.htm

23. Henrik Gudmundsson, Refined Sustainable Urban Transport Index (SUTI) for cities in Asia. CONCITO, 2017.

24. World Business Council for Sustainable Development, Sustainable Mobility Project 2.0, 2015.

25. Tara Ramani, Josias Zietsman, William Eisele, Duane Rosa, Debbie Spillane and Brian Bochner, Developing Sustainable Transportation Performance Measures for TXDOT's Strategic plan. Texas Department of Transportation - University of A&M Texas, 2009.

26. Todd Litman, Developing Indicators for Sustainable and Livable Transport Planning, Victoria Transport Policy Institute, Canada, 2016.

27. Castillo, NH and Pitfield (2010) ELASTIC a methodological framework for identifying and selecting sustainable transport indicators. Loughborough University, 2010.

28. Leong Lee Vien & Ahmad Farhan Mohd, Sustainable Transportation Indicators: Case study of users from Kuala Lumpur and Penang, Universiti Sains Malaysia, 2010.

29. Le Thi Anh Tuyet, Sustainable Urban Transport Assessment - Evaluation opportunities for Asia cities: The case of Hanoi. Master of Science in Urban Planning and Policy Design - Polytechnic University of Milan, Italy, 2012.