TRAFFIC SAFETY AT INTERSECTIONS BETWEEN ROAD AND RAILWAY IN VIET NAM

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Contents

Introduction

- Viet Nam Railway Rescue and Natural Calamity Response Centre:
  - 6317 rail-road crossings
  - 4846 minor crossways opening by local communities
  - 80% accidents occur at minor rail-road crossings
- Traditional method cannot provided with large number of crossways

→ Necessary to propose a method with wide range of applicable:

CROSSWAY SIGHT DISTANCE

Research Methodology

- Theoretical Principles

$$SSD = d_{BR} + d_B$$

SSD = Stopping Sight Distance

d_{BR} = braking reaction distance

d_B = braking distance

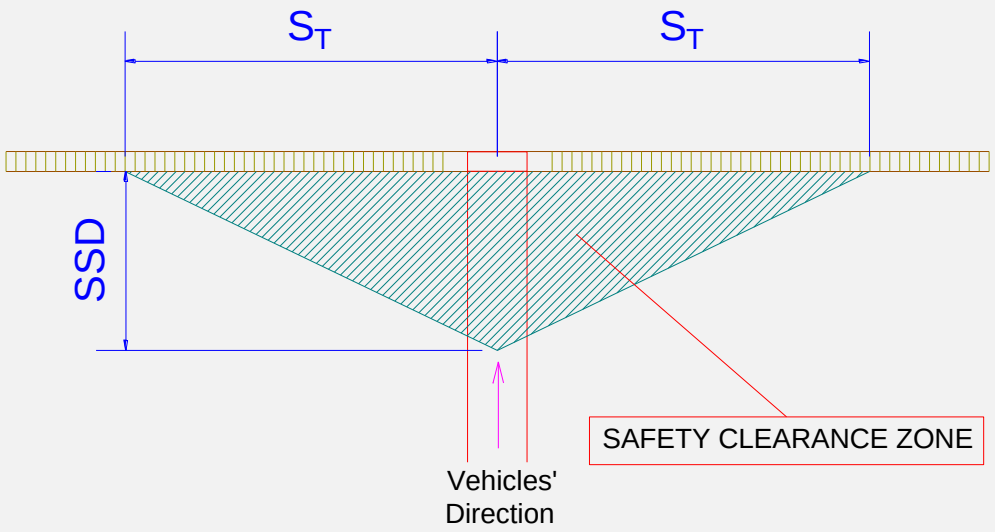
$$S_T = V_T \times T_T$$

S_T = Travelled Distance of Train

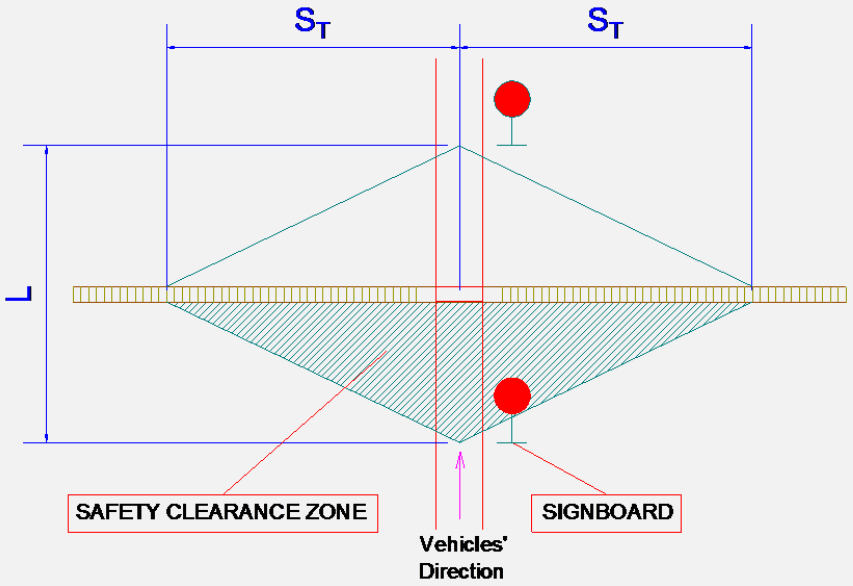
V_T = Velocity of train

T_T = Sum of braking reaction time and braking time

- Models



Model 1



Model 2

Research Methodology

Necessary Parameters

Model 1

Brake reaction time = 2.5 s

Deceleration rate = 3.4 m^2/s

Velocity of train = 70 km/h

Initial Speed	Maneuver Time
km/h	s
5	1
10	1.4
20	1.8
30	2.2
40	2.6

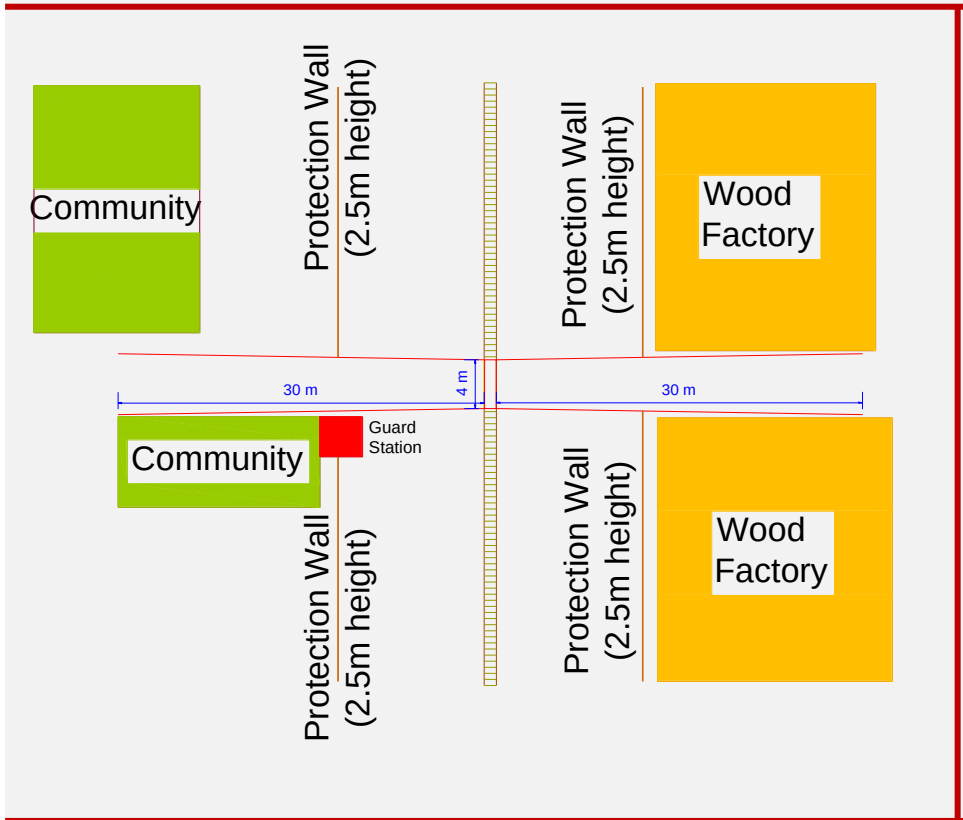
Model 2

Vehicle's Velocity = 15 km/h

L	Observing Time	Starting Time	Moving Time	Total Time
m	s	s	s	s
5	2	1	1.2	4.2
6	2	1	1.4	4.4
7	2	1	1.7	4.7

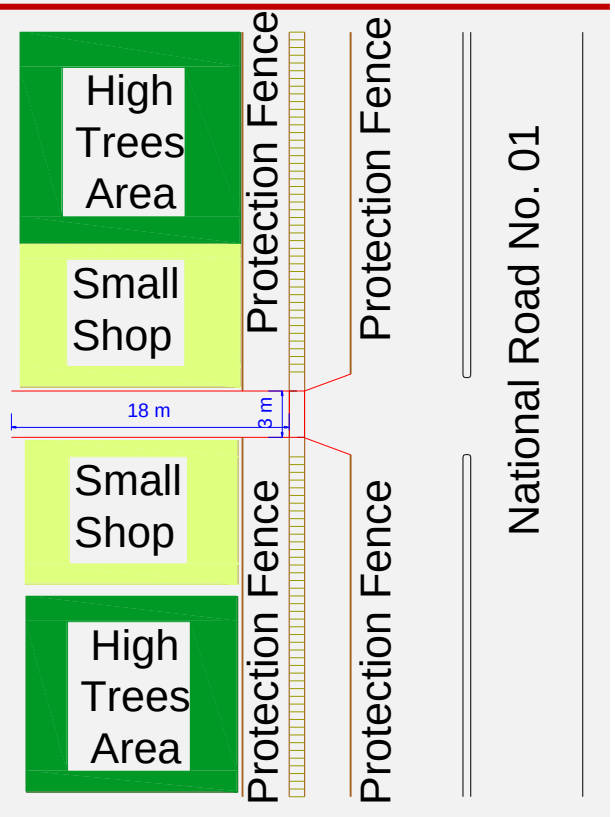
Results

Surveying Intersections Overview



Intersection No.01

Intersection No.02



Intersection No.03

Results

Surveying Intersections Overview

	Location of Intersection	Barrier	Signal Traffic	Sign/ Warning board	Guard	Manually-operated bar	Vision	Satisfy A_{CZ} (max/min)	Notes
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	Km 114 + 400	x	x		x				Major
	Km 114 + 620	Old Ninh Binh Station							
2	Km 114 + 720	x	x		x				Major
3	**Km 116 + 600**			**x**	**x**	**x**		**None**	**NO.01**
4	Km 117 + 600			x	x	x	Good	Min	
5	Km 118 + 500	x	x		x				Major
6	Km 119 + 200			x			Good	Min	
7	Km 120 + 00			x			Limited	None	
8	Km 120 + 400			x			Good	Max	
9	Km 121 + 012			x			Limited	None	
10	Km 121 + 112			x			Good	Max	
11	**Km 122 + 237**			**x**			**Limited**	**None**	**NO.02**
12	Km 122 + 550			x			Limited	None	
13	Km 123 + 350				x	x	Limited	None	
14	Km 124 + 750			x			Limited	Min	
15	Km 125 + 150			x			Good	Max	
16	Km 125 + 450	x	x						
17	**Km 126 + 150**			**x**	**x**		**Limited**	**None**	**NO.03**

Results

Safety Clearance Zone (Model 1) – Calculation Results

V	d_{BR}	d_B	SSD	S_T	A_{CZ} (max)
km/h	m	m	m	m	m^2
5	3.5	0.2	3.7	68.1	252.2
10	7.0	0.9	7.9	75.8	597.0
20	13.9	3.7	17.6	83.6	1470.9
30	20.9	8.3	29.2	91.4	2664.6
40	27.8	14.8	42.6	99.2	4221.2
50	34.8	23.1	57.8	106.9	6183.8

Intersection No.01

V	d_{BR}	d_B	SSD	S_T	A_{CZ} (max)
km/h	m	m	m	m	m^2
5	3.5	0.2	3.7	68.1	252.6
10	7.0	0.9	7.9	75.8	598.7
20	13.9	3.8	17.7	83.6	1478.3
30	20.9	8.5	29.4	91.4	2682.8
40	27.8	15.1	42.9	99.2	4256.3
50	34.8	23.6	58.4	106.9	6243.1

Intersection No.02

V	d_{BR}	d_B	SSD	S_T	A_{CZ} (max)
km/h	m	m	m	m	m^2
5	3.5	0.2	3.7	68.1	251.5
10	7.0	0.9	7.8	75.8	593.9
20	13.9	3.5	17.4	83.6	1457.0
30	20.9	7.9	28.8	91.4	2630.6
40	27.8	14.1	41.9	99.2	4155.6
50	34.8	22.0	56.8	106.9	6073.3

Intersection No.03

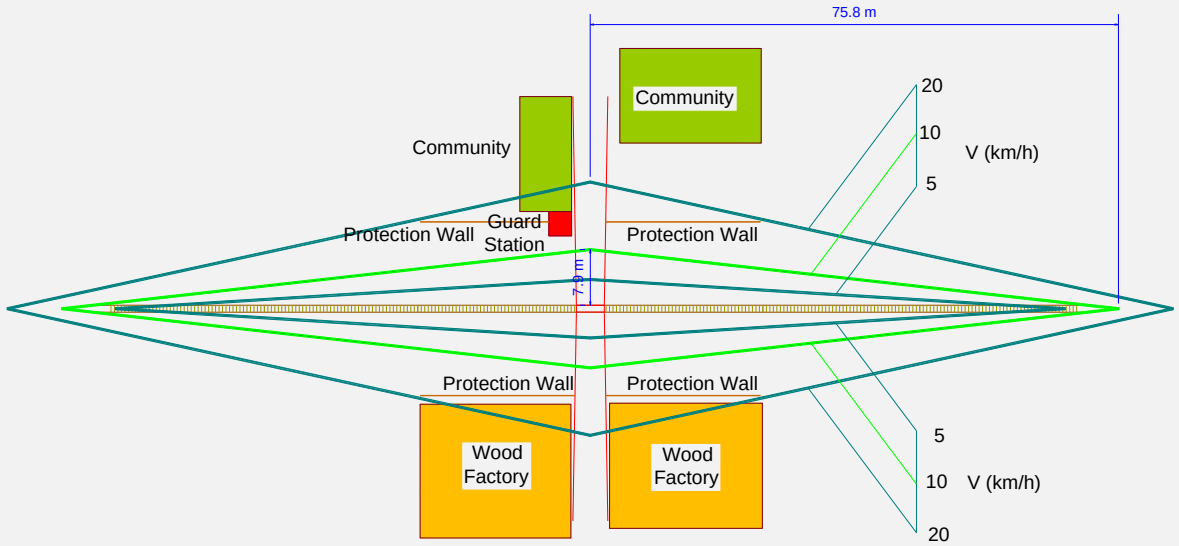
Results

Safety Clearance Zone (Model 2) – Calculation Results

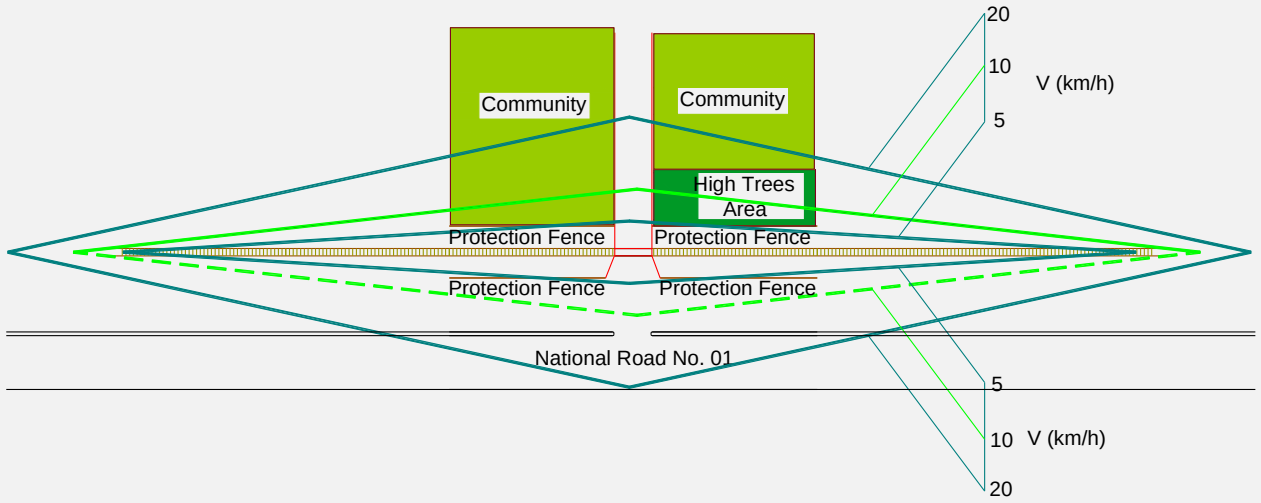
L_1	L_2	V	T	S_T	$A_{CZ\ (min)}$
m	m	km/h	s	m	m^2
5.0	2.0	15.0	4.2	81.7	163.3
6.0	2.5	15.0	4.4	85.6	213.9
7.0	3.0	15.0	4.7	91.4	274.2

Results

Safety Clearance Zone (Model 1)



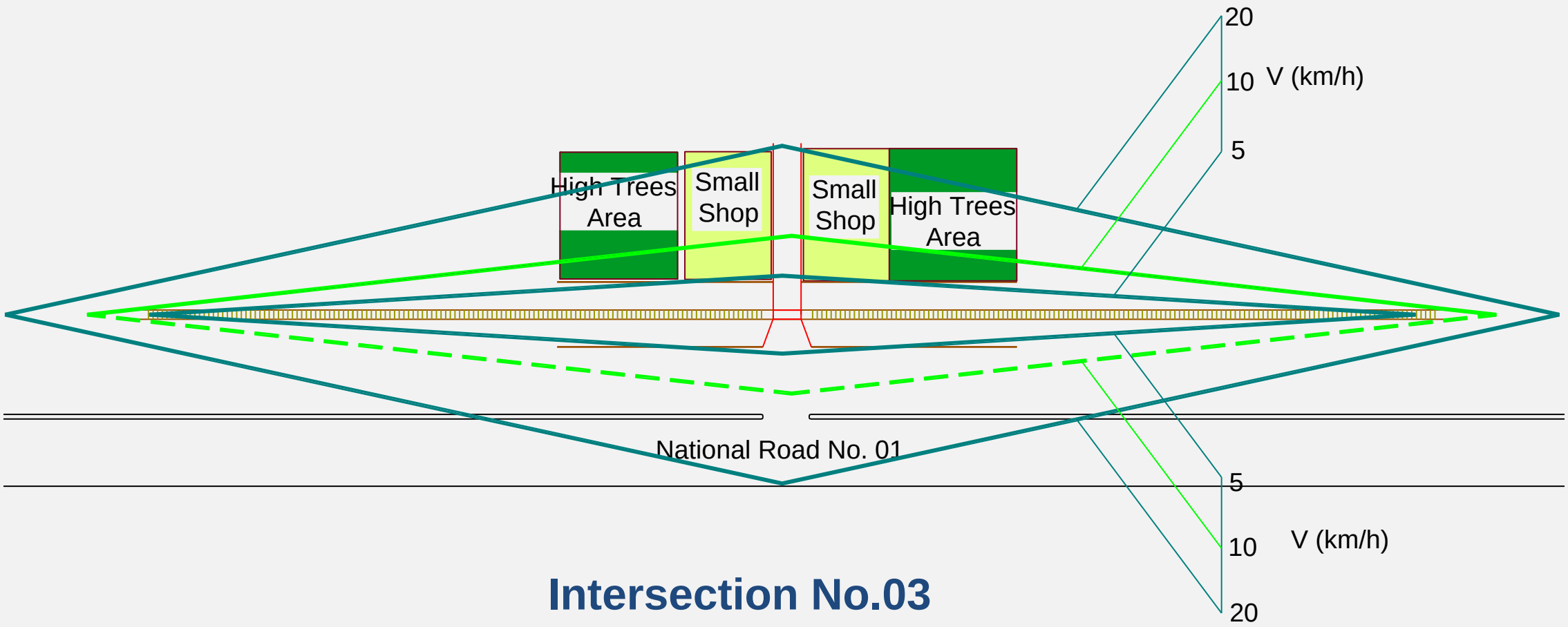
Intersection No.01



Intersection No.02

Results

Safety Clearance Zone (Model 1)



Intersection No.03

Results

Follow-up Solutions

- It is better to provide follow-up solutions that go together with CSD method to achieve highest level of traffic safety
- Principle: warning vehicle at the intersection when train enter SCZ
  - **People Warning (basing on train schedule)**
  - **Signal Traffic (basing on sensors or detectors)**
  - **Intelligent Traffic System (basing on physical characteristics of train)**

Results

Cost – Effectiveness Study

Unit: 1,000 VND

Monthly Salary	Budget for Staff (VND)			
1 person	1 year	5 years	10 years	20 years
3,000	216,000	1,080,000	2,160,000	4,320,000

Budget for Traditional Method

Unit: 1,000 VND

Items	Intersection No.02		Intersection No.03	
	Area	Budget	Area	Budget
Unit	m^2	VND	m^2	VND
Residential Land	110	880,000		
Business Land			150	600,000
Total		880,000		600,000

Budget for Cross Sight Distance Method

Conclusion and Recommendation

For Model 1

- The higher velocity of vehicles requires much higher area for clearance
- It is suggested to determine SCZ with velocity of vehicle at 10 km/h
- Drivers are recommended to operate their vehicle at speed of 5 km/h

→More benefits for safety condition due to combination of higher SCZ and lower velocity corresponding to this SCZ

For Model 2

- The distance L_2 = 2.5 m should be chosen to set up signboard

Conclusion and Recommendation

- It is better to set up SCZ follow model 1 (vehicle do not stop when crossing the rail)
- In case of difficulties, model 2 (vehicle must stop before crossing the rail) would became reasonable solution
- It is reachable method for both the authorities and local communities
- It is recommended to put follow-up solutions to achieve the highest safety conditions

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Thank you for your listening!

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