Contributed articles

Road Safety Case Studies

Safety Effectiveness Evaluation of Raised Pedestrian Crossings in Ho Chi Minh City

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Key Findings

- The raised pedestrian crossing is only effective at the value of the 85th percentile of measured speed (V85) for vehicle groups (motorcycles, cars, trucks, buses) is equal to or greater than 35.5km/h;
- The raised pedestrian crossings within 10.5 metre width have shown more effectiveness of the intervention;
- The invention showed positive impact on speed management, with the highest decrease in speed for cars (-13.93%) and lowest for trucks (-6.54%), on 10.5m of raise pedestrian crossings width;
- This measure reduces the speed of the vehicle around 8% approximately at 7.5m of raise pedestrian crossings width.

Abstract

Traffic crashes are one of the immediate and long-term serious problems all over the world including Vietnam. Speed is one of the direct causes of a crash. In recent years, Ho Chi Minh City has synchronously implemented many measures to manage speed, in particular, a pilot implementation of raised pedestrian crossing measures at many locations in the city. Technical efficiency assessment of this measure is necessary to help the city build more scientific evidence for scaling up successful measures. This study was conducted at four locations on Ton Duc Thang Street, District 1, with four vehicle groups including motorbikes, cars, trucks, and buses. The results indicate that this measure had a positive effect on V85 speed with four group of vehicles at 35.5km/h or more. The effectiveness was stronger for greater widths of raised pedestrian crossing i.e., more effective at 10.5m of raised pedestrian crossings width than 7.5m. This measure reduces V85 speed of vehicles by nearly 14% on 10.5m of raised pedestrian crossings width, and positive impacts are highest for cars (13.93%), and lowest for trucks (6.54%). While traffic volume and the surrounding context may impact on the result, they are not considered in this study. These results provide important scientific evidence for scaling up this measure city wide in the future.

Keywords

Traffic safety, Technical efficiency, Raised Pedestrian Crossing, Speed Management

Introduction

Traffic crashes cause great damage to people, property, and socio-economy, particularly in low-incomes and middle-incomes countries. It is estimated that annual traffic crashes cost the world between 1% and 3% of the gross national product (GNP) (WHO, Global Status Report on Road Safety, 2020).

Vietnam is classified as a middle-income country by the World Health Organization (1740 USD/capita), with the proportion of deaths due to traffic crashes per 100,000 people being 24.5 and traffic crashes cause annual losses accounting for 2.9% of GDP (WHO, Global Status Report on Road Safety, 2015). Thus, traffic crashes clearly affect

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not only individuals but also the whole society. Nearly 54% of deaths due to traffic crashes are related to pedestrians (23%), bicycles (3%) and motorbikes (28%) (WHO, Global Status Report on Road Safety, 2018).

Speed is the direct cause affecting the severity of crashes, injury levels and deaths of traffic crashes (Vadeby, Anna & Forsman, Åsa, 2017). Many studies around the world also show that, along with improving the quality of vehicles and road infrastructure, the reduction in speed will improve the efficiency of ensuring and improving the safety of traffic, including a number of cases and severity (Bachani, A. M., Zia, N., Hung, Y. W., Adetunji, R., Cuong, P. V., Faried, A., Jiwattanakulpaisarn, P. & Hyder, A. A., 2017; WHO, Managing Speed, 2017). Specifically, every 1% increase in speed will lead to an additional 4% increase in deaths and 3% of injuries when crashes occur (Finch, D.J., Kompfner, P., Lockwood, C.R., Maycock, G, 1994). When the average speed decreases by 5%, it will reduce 30% of deaths in traffic crashes (WHO, Managing Speed, 2017).

The study also showed that the risk to pedestrians when colliding with cars will increase greatly (4.5 times) when the speed of cars increases from 50 km/h to 65 km/h (Martin, J. and Wu, D., 2017). The risk of death in traffic crashes between cars and cars is up by 85% when the collision speed of cars is 65 km/h (Jurewicz, Sobhani, Woolley, et al, 2016). In another study of speed-related crashes in New Zealand, the study showed that if the average speed on New Zealand's rural roads decreased by 4 km/h, the total number of people killed by road crashes would decrease by about 15% and the total number of injured people will be about 8% less (Frieth, 2005).

Traffic crashes in Ho Chi Minh City (HCMC) in recent years have seen positive changes including the number of accidents and the number of deaths and injuries. In 2020 in HCMC, traffic crashes decreased under all three indicators (641 accidents, 560 deaths, 141 injuries) when compared to 2019, all of these indicators tend to decrease with the corresponding 5.74%, 11.67%, 13.5%. (HCMC TSC, 2019; HCMC TSC, 2020)

Analysis of data related to causes of traffic crashes in the city for 5 years (2016-2020), indicates speed is always one of 6 leading causes of traffic crashes in the city and tends to increase in recent years, 2019 (ranked 6th) and 2020 (ranked 5th). Hence, the city government has prioritised the synchronous implementation of multiple measures for speed management from policy measures, (speed reduction on some roads) to technical interventions, (installation of signs, speed humps, yellow flashing lights…), and especially the raised pedestrian crossings.

However, until now, there has been no research to evaluate the effectiveness of these measures in terms of their technical effectiveness. Therefore, this implementation of technical efficiency assessment at some raising the pedestrian crossings on Ton Duc Thang Street is considered as the initial research result for this assessment and is essential in the current situation. The framework of this article, will focus on collecting actual speed data at the site of 4 main vehicle groups (motorcycles, cars, trucks, and buses) at 4 locations, which have constructed raised pedestrian crossing measure on Ton Duc Thang Street, District 1, HCMC.

The results of this analysis will be the initial assessment of the technical efficiency of the measure to improve the pedestrian crossing and be the basis for implementing future studies, as well as scaling up this measure city wide.

Methods of Data Collection & Analysis

This analysis was carried out at 4 locations, which have built raised pedestrian crossings on Ton Duc Thang Street as shown in Figure 1.

- Location 1: intersection of Ton Duc Thang - Ham Nghi (30m from Ham Nghi Street);
- Location 2: in front of Majestic Hotel;
- Location 3: in front of the Statue of Tran Hung Dao;
- Location 4: in front of Ton Duc Thang Museum.

All inventions at 4 locations have the same height of 0.07m, while the locations 1 and 3 have the raised pedestrian crossing width of 10.5m, the locations 2 and 4 have

Table 1. Summary of traffic crashes data in HCMC for 5 years (2016-2020)

Year	Number of cases/ percentage change in comparsion with previous year	Number of deaths/ percentage change in comparsion with previous year	Number of injuries/ percentage change in comparsion with previous year
2016	887	797	238
2017	788/ –11.16%	714/ –10.41%	216/ –9.24%
2018	743/ –6.19%	691/ –3.89%	197/ –7.51%
2019	680/ –11.46%	634/ –10.96%	163/ –18.91%
2020	641/ –5.74%	560/ –11.67%	141/ –13.5%

(HCMC TSC, 2016; HCMC TSC, 2017; HCMC TSC, 2018; HCMC TSC, 2019; HCMC TSC, 2020)

Figure 1. Survey - data collection on Ton Duc Thang Street

their widths of 7.5m. The team used speed gun software developed by Aamir Ullah to measure the actual speed of the vehicle. Speed Gun software compatible with iPhone, iPad, and iPod requires iOS version 8.0 or higher. This is a smart software used to measure the movement speed of objects in space with a smart camera of the device, as shown in Figure 2, and Figure 3.

As the software is a non- commercially available version, the developer doesn't confirm its reliability. Therefore, to assess the reliability of this software, the research team organized an experimental assessment. We drew two lines on a straight road, with 30 meters distance from first line to the second line. Four motorbikes (Grande, Exciter, Winner, and Honda blade), which have electronic odometers, ran at 40km/h at the first line and 35km/h at the second line. Eight inspectors had been arranged for this task, and divided into two groups, one group to get data at the first line and other one at second line to measure 50 data for each inspector using iPhone 6s. The results show that the reliability of the software is around 83% (82.6%).

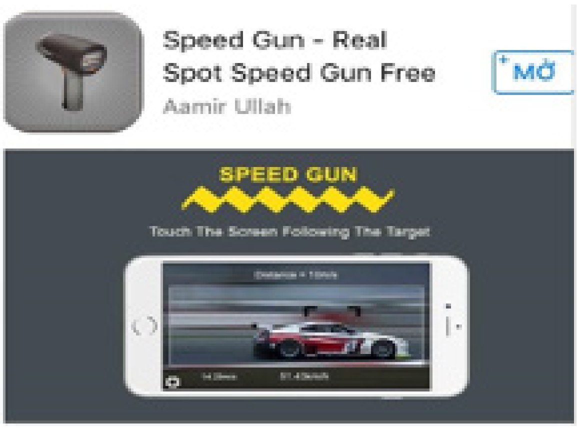

Figure 2. Speed Gun software

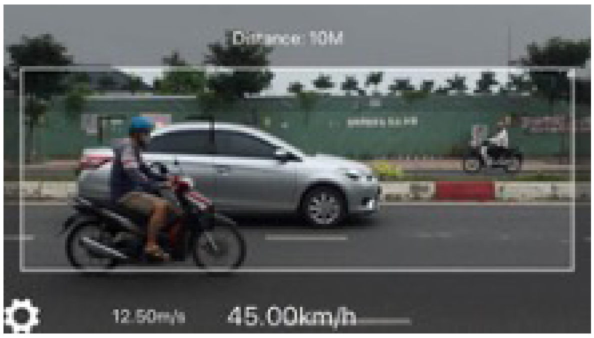

Figure 3. Speed Gun software interface when collecting data

To collect data at the site, the team arranged 8 surveyors, (trained students), divided into two groups, each group of 4 people, standing at 30m distance before the interventions apart, one group standing at the actual position measure following the direction of the vehicle. Each surveyor was equipped with walkie talkies to confirm which vehicles will be detected for speed. Each surveyor at the site measured a vehicle belonging to the required group of vehicles. Due to the limited functionality of the software, (non-commercial version), to ensure accuracy, the team focused on data collection at three period times per location per day (off-peak hours): 9:00-10:30'; 14h00'-15h30'; 21h30-23:00'. Each location collected 200 data samples for each vehicle group.

Users of speed gun software first need only enter the distance from the position to the vehicle to measure its speed, then move ttransfer speed on the screen according to the target to measure speed. The results on the screen will indicate the speed of the measured object in m/s and km/h.

The analytical results show that there are differences in efficiency in speed reduction for the four groups of vehicles (motorcycles, cars, trucks, buses) at raised pedestrian crossings within 10.5, and 7.5m width, as follows:

The Raised Pedestrian Crossings within 10.5m Width (position 1 and 3 according to Figure 1)

The analytical results indicate that raising pedestrian crossings had only positively affects (reduced vehicle speed) to the behavior of road users for four groups of vehicles when the value of the 85th percentile of measured speed (V85) of vehicles is equal to or greater than 35.5km/h. When the operation speed was less than 35.5km/h, the vehicle speed did not decrease and even it increased because the road users tried to remain at the operation speed at interventions as shown in Figure 4, 5, 6, 7, 8. This effect was also different for each group of vehicles, the highest efficiency was for cars (decreased 13.93%) and the lowest was trucks (decreased 6.54%) (Table 2). This is not really hard to understand because if the speed of vehicles is less than 35.5km/h, the interventions have very weak negative impact on vehi-

Table 2. V85 Speed group of vehicles before and after passing the measures (10.5m)

10.5m raised pedestrian crossings width	Motorcycles	Cars	Trucks	Buses
V85 Initial(km/h) (Vb)	48.2	51.7	42.8	38.7
V85 Final (km/h) (Va)	43.8	44.5	40.0	35.2
Va - Vb (km / h)	-4.4	-5.2	-2.8	-3.5
%	-9.13	-13.93	-6.54	-9.04

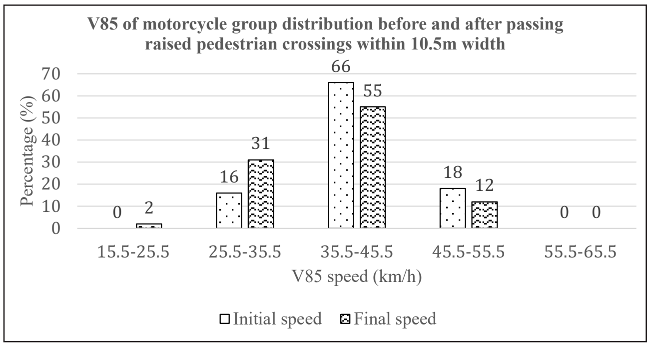

Figure 4. V85 speed of motorcycle group distribution before and after passing raised pedestrian crossings within 10.5m width

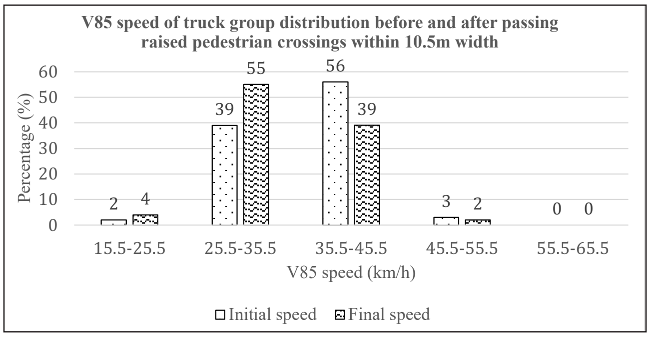

Figure 6. V85speed of truck group distribution before and after passing raised pedestrian crossings within 10.5m width

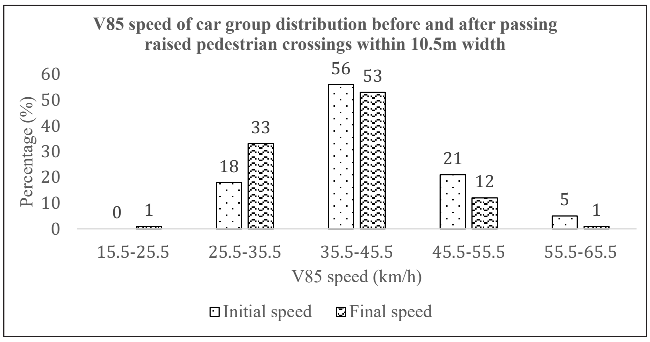

Figure 5. V85 speed of car group distribution before and after passing raised pedestrian crossings within 10.5m width

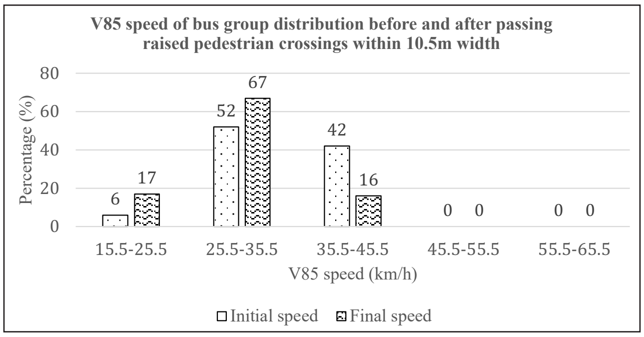

Figure 7. V85 speed of bus group distribution before and after passing raised pedestrian crossings within 10.5m width

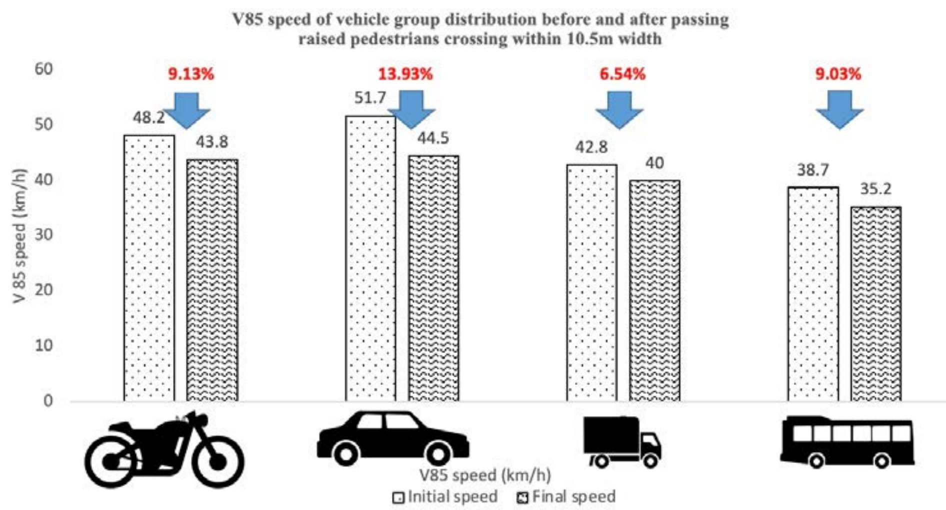

Figure 8. V85 speed of vehicle group distribution before and after passing raised pedestrian crossings within 10.5m width

Table 3. V85 Speed group of vehicles before and after passing the measures (7.5m)

7.5m raised pedestrian crossings width	Motorcycles	Cars	Trucks	Buses
V85 Initial(km/h) (Vb)	43.5	44.5	42.5	37.5
V85 Final (km/h) (Va)	41.0	41.8	39.5	34.5
Va - Vb (km / h)	-2.5	-2.7	-3.0	-3.0
%	-5.75	-6.07	-7.06	-8.00%

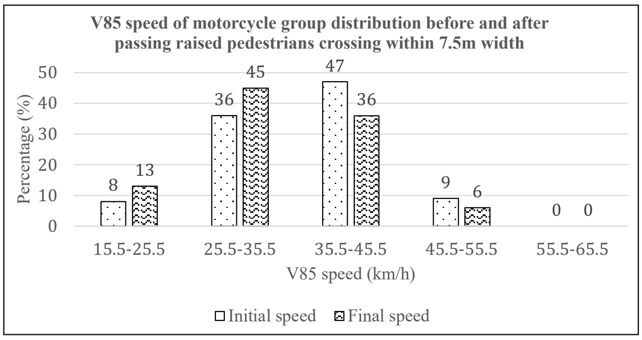

Figure 9. V85 speed of motorcycle group distribution before and after passing raised pedestrian crossings within 7.5m width

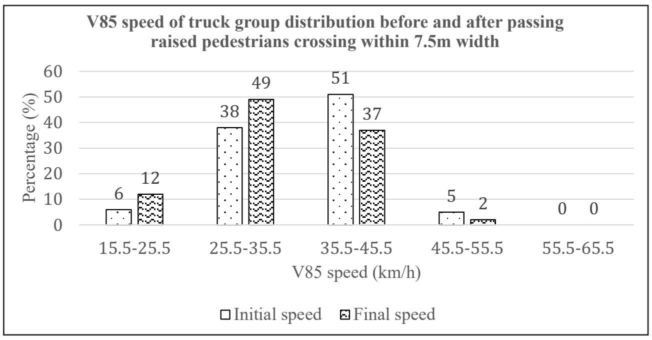

Figure 11. V85 speed of truck group distribution before and after passing raised pedestrians crossing within 7.5m width

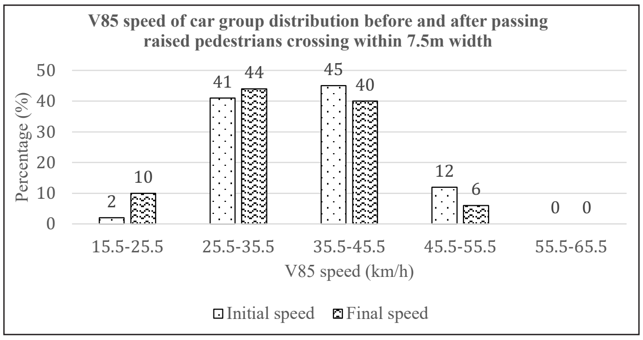

Figure 10. V85 speed of car group distribution before and after passing raised pedestrians crossing within 7.5m width

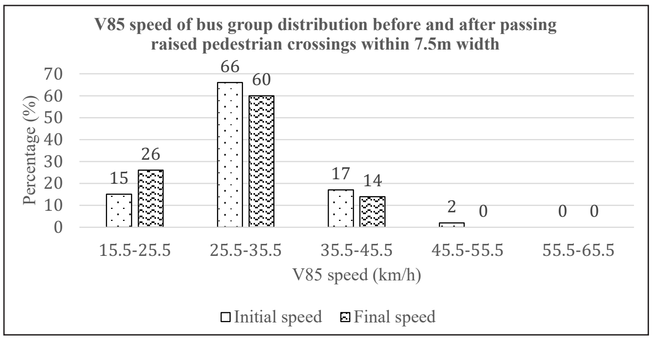

Figure 12. V85 speed of bus group distribution before and after passing raised pedestrian crossings within 7.5m width

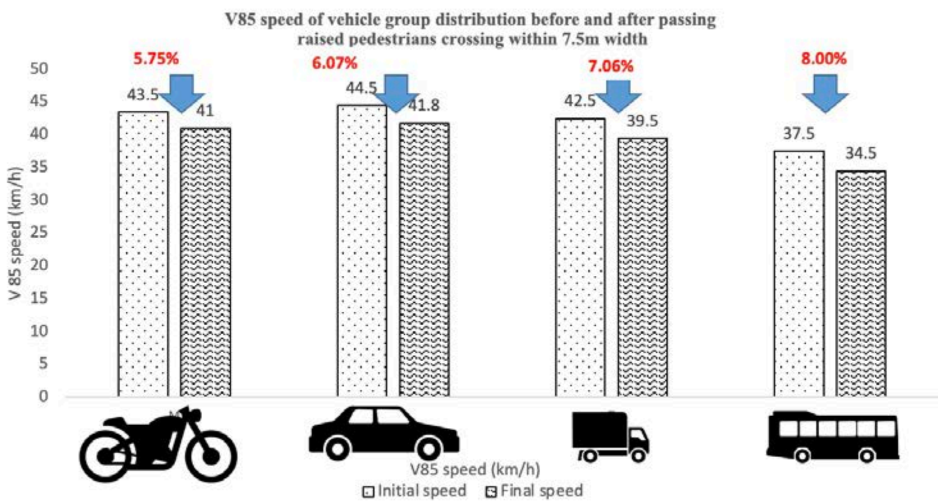

Figure 13. V85 of vehicle group distribution before and after passing raised pedestrian crossings within 7.5m width

cles, as most of drivers keep operating at the same velocity when they pass over this treatment.

The Raised Pedestrian Crossings within 7.5m Width (position 2 and 4 according to Figure 1)

Similarity findings above, the analytical results also show that the raised pedestrians crossing had only positive effects (reducing vehicle speed) to behavior of road users for four groups of vehicles when the value of the 85th percentile of measured speed (V85) of vehicles is equal to or greater than 35.5km/h. When the operation speed was less than 35.5km/h, the vehicle speed did not decrease and even it increased because the road users tried to remain at the operation speed at interventions as shown in Figure 9, 10, 11, 12, 13. This is not really hard to understand because if the speed of vehicles is less than 35.5km/h, the interventions have very weak negative impact on vehicles, as most of drivers keep operating at the same velocity when they pass over this treatment. However, the effect of this measure was also different between the raised pedestrian crossings width (7.5m and 10.5m), the highest efficiency was buses (decreasing 8.0%), and the lowest was motorcycles (decreasing 5.75%) (Table 3

Conclusions

Research analysis shows the raised pedestrian crossing is only effective at operation speeds for vehicle groups (motorcycles, cars, trucks, buses), when the V85 speed of the vehicles is equal to or greater than 35.5km/h.

It was observed that higher the raised pedestrian crossings width higher was the effectiveness of the intervention.

For 10.5m of raised pedestrian crossings width, this intervention is positive impact on speed management with the highest decreasing speed for cars (-13.93%) and lowest decreasing speed for trucks (-6.54%).

When the raised pedestrian crossings width are 7.5m, there is no significant difference observed in speed management among vehicle groups. However the intervention reduces the speed all the vehicle groups by 8% approximately.

The traffic volume, and the surrounding context may impact on the result, but they are not considered in this research.s

Finally, the findings of this research will be an important scientific evidence for the first step in this approach study for the scaling up this intervention on city wide in the near future.

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