

A CORRELATION OF TRAFFIC ACCIDENT FATALITIES, SPEED ENFORCEMENT AND THE GROSS NATIONAL INCOME OF THAILAND AND ITS CROSS-BORDER COUNTRIES

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ABSTRACT

Currently, the ASEAN Community has opened and this has resulted in the expansion of the road network between member countries, making it more convenient to drive crossing the border. However, the difference in laws relating to the speed limits and their enforcement may result in drivers unknowingly violating the laws in each country, leading to an increased risk of accidents. This research aims to determine the statistical correlation between the traffic accident fatalities, the enforcement of speed limits with the gross national incomes of Thailand and its cross-border countries. Linear and non-linear regression analyses were applied to develop models explaining their correlations at 95% confidence level. The results indicated that those countries with higher efficiency in enforcement on speeding laws and greater gross national income have a lower rate of traffic accident fatalities. The results of this study are useful for responsible agencies to determine the required traffic safety strategies in order to reduce the number of traffic accidents within ASEAN countries.

Keywords: Gross national income; Traffic accident fatality; Speed enforcement

1. INTRODUCTION

The ASEAN Community is currently engaged in the development of a road network connecting member countries, such as Thailand, Cambodia, Myanmar, and Malaysia, making travel by road vehicles more convenient. Transit through Thailand will continuously increase as the country serves as a crossroads for the neighboring countries of China, Vietnam, Laos, Cambodia, Myanmar, Malaysia, and Singapore as shown in Figure 1.

However, Thailand currently encounters numerous serious collisions on its roads; as the country's rate of traffic accident fatalities is amongst the highest throughout the ASEAN region (Table 1). It is noticeable that Thailand also has the lowest score of speed law enforcement, this is in contrast to Singapore which has lowest fatality rate, thus the highest score. Speeding is the main factor causing a high rate of traffic accident fatalities in Thailand. This was also confirmed with the traffic accident data, recorded by Royal Thai Police, that the speeding was the main cause of traffic accidents in Thailand (Royal Thai Police, 2013).

Moreover, the speed limits among ASEAN countries are significantly different as presented in Table 2. Thailand and Malaysia has a high urban high speed limit, 80–90 kph, but China, Cambodia, Laos, Myanmar, and Vietnam have urban speed limits lower than 50 kph.

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Figure 1 Road network and driving condition in Southeast Asian countries (Adapted from http://www.unescap.org/sites/default/files/AH-map_GIS.pdf)

Table 1 Rate of traffic accident fatalities and score of speed law enforcement

Country	Rate of Traffic Accident Fatality (per 100,000 population)	Score of Speed Law Enforcement*			
	2015	2009	2013	2015	Average
Cambodia (CB)	17	1	7	4	4
Lao PDR (LA)	14	5	6	4	5
Malaysia (ML)	24	6	5	6	6
Myanmar (MM)	20	5	5	5	5
Singapore (SP)	4	8	7	8	8
Thailand (TH)	36	2	3	3	3
China(CN)	19	8	4	8	7
Vietnam(VN)	25	6	7	6	6

*Scores from 0(inefficient)to 10 (high efficient)
Source :Global Status Report on Road Safety 2015 (WHO, 2015)

A previous study on the correlation between speed limit and the rate of traffic fatalities found that the higher speed limits have a greater rate of traffic fatalities (Davis et al., 2015). WHO stated that a pedestrian hit by a vehicle with a speed in excess 50 kph results in a greater than 80% possibility of a fatality, however if the speed is reduced to less than 30 kph, the fatality rate falls to below 10%, as displayed in Figure 2 (WHO, 2008).

The low efficiency of speed limit enforcement in Thailand combined with the obvious difference in speed limits among ASEAN countries results in a significant risk of traffic accidents, especially involving foreign drivers driving across the border into Thailand. To find out the appropriate road safety strategies amongst the neighboring countries to Thailand, the correlation of accident fatality and relating factors would be initially explored.

Table 2 Speed limits of Asian border crossable countries by road type

Country	National speed limit (kph)		
	Urban speed limit (kph)	Rural speed limit (kph)	Motorway speed limit (kph)
Cambodia (CB)	40	90	100
Lao PDR (LA)	40	90	-
Malaysia (ML)	90	90	110
Myanmar (MM)	48	80	-
Singapore (SP)	70	-	90
Thailand (TH)	80	90	120
China (CN)	50	-	120
Vietnam (VN)	50	80	-

Source: Global Status Report on Road safety 2015 (WHO, 2015)

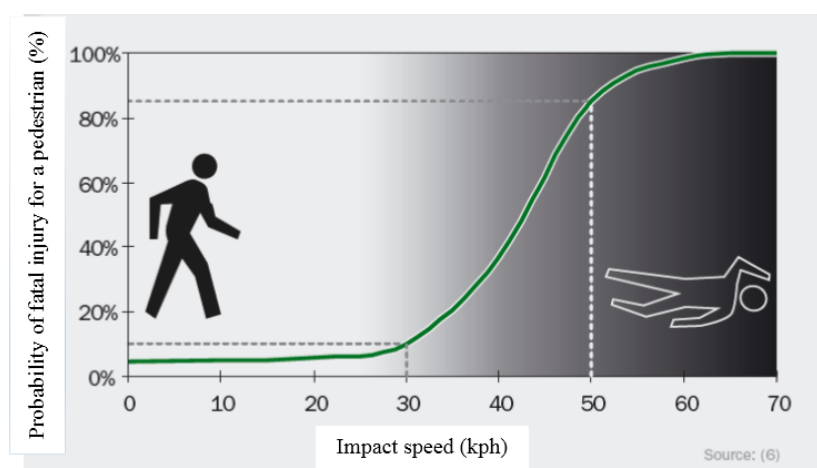


Figure 2 Relation between speed of vehicles and accident severity. Adapted from: speed management report on a road safety manual for decision-makers and practitioners (WHO, 2008)

Therefore, the objective of this research is to determine the correlation between the rate of traffic accident fatalities, the efficiency of speed law enforcement and the gross nation income of ASEAN countries. The case study countries consist of Thailand (TH) and its border crossable countries, including Lao People's Democratic Republic (LA), Singapore (SP), Malaysia (MY), Cambodia (CB), Myanmar (MM), Vietnam (VN) and China (CN).

2. METHODOLOGY

2.1. Data for Analysis

Secondary data was given by the global status report on road safety by WHO in 2009, 2013, and 2015, respectively (WHO, 2009; WHO, 2013; WHO, 2015). The three variables were: traffic accident fatality rate, speed law enforcement efficiency and gross national income.

2.2. Statistical Method

This study applied linear and non-linear regression analysis to develop the models explaining the correlations among the traffic accident fatality rate, speed law enforcement and gross national income at 95% confidence level.

3. RESULTS AND DISCUSSION

3.1. Correlation between Traffic Accident Fatality and Speed Enforcement

The correlation analysis indicated that the efficiency of speed enforcement has a significant and decreasing correlation with the number of traffic accident fatality at 95% confidence level ($R^2 = 0.40$; $p = 0.011$). This therefore suggests that higher efficiency in speed enforcement could reduce traffic fatalities amongst the countries investigated in this study, as shown in Figure 3. Many previous studies proved that enhancing speed enforcement could reduce the number of traffic accidents, these include the application of speed cameras on the motorway in Guangdong, China (He et al., 2013) and on the urban arterial roads in Khon Kaen, Thailand (Tankasem et al., 2015; Satiennam et al., 2015).

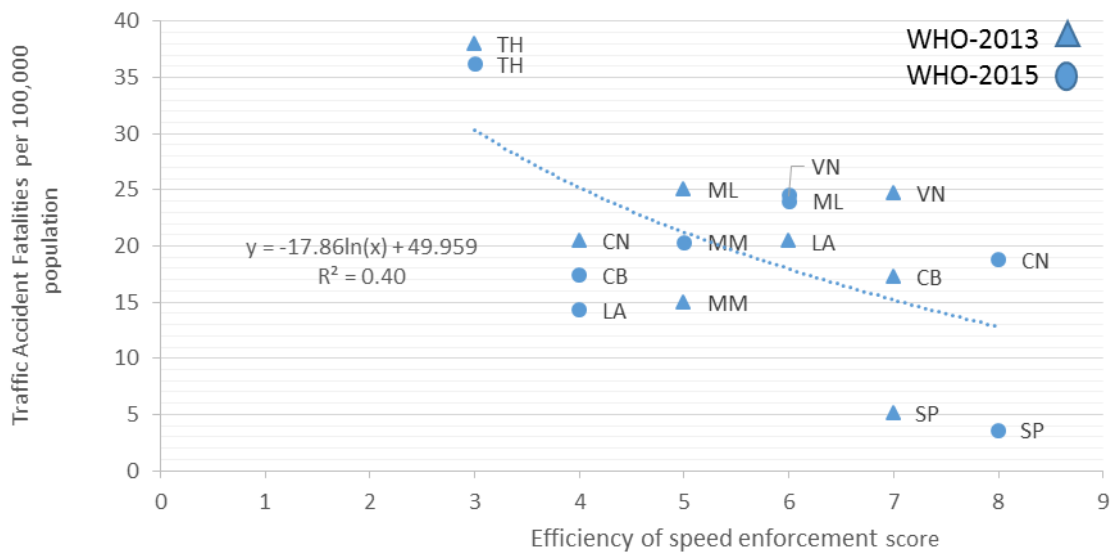


Figure 3 Correlation between traffic accident fatality and efficiency of speed enforcement

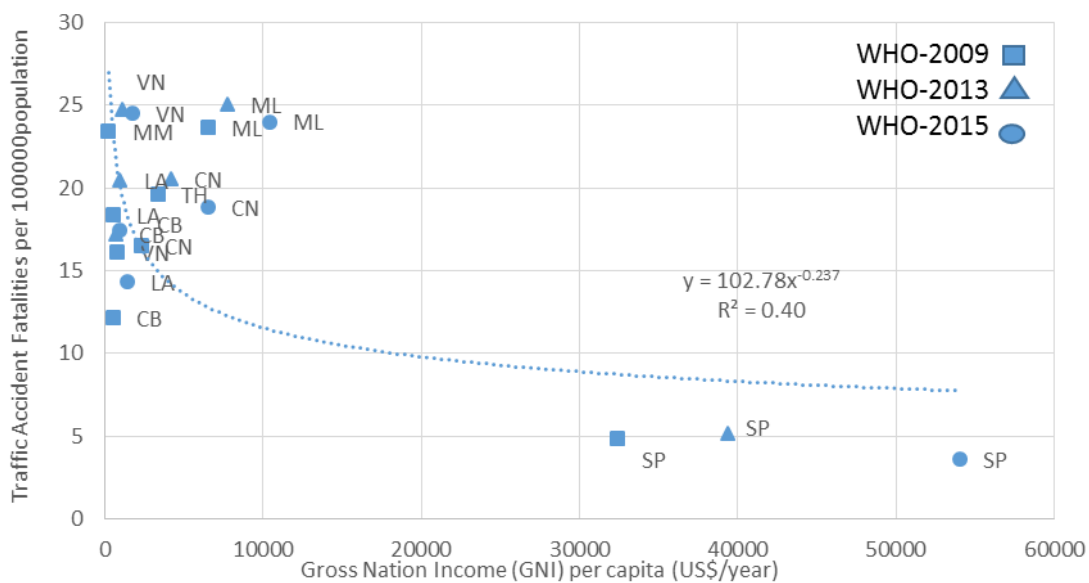


Figure 4 Correlation between traffic accident fatality and gross national income

3.2. Correlation between Traffic Accident Fatality and Gross National Income

The correlation analysis demonstrated that increasing gross national income has a significant and positive effect on reducing the number of traffic accident fatalities at 95% confidence level ($R^2 = 0.40$; $p = 0.003$). The higher income countries have a lower rate of traffic accident fatalities as shown Figure 4. This result is in good agreement with previous studied that highlighted that lower income countries have more serious traffic accidents than higher income countries (Koren & Borsos, 2012; Mohan, 2011; Klungboonkrong & Faiboun, 2014). Traffic accident fatalities are lower amongst higher income countries, because there is a greater social awareness involving road safety. In addition, the countries with higher economic status, like Singapore, have a more efficient enforcement of traffic law and harder penalties for violating laws, contributing to safer driving behavior of Singaporeans (Police News Release, 2014).

3.3. Correlation between Speed Enforcement and Gross National Income

The correlation analysis indicated that the efficiency of speed enforcement has been positively and significantly correlated with the gross national income at 95% confidence level ($R^2 = 0.21$; $p = 0.034$) as shown in Figure 5. This finding means that countries with higher gross national income have more efficiency speed enforcement systems. This result is in agreement with similar research (Klungboonkrong & Faiboun, 2015). The higher income countries have increased budget allocations to support speed enforcement by providing a greater number of policeman as well as the technology and tools for speed enforcement.

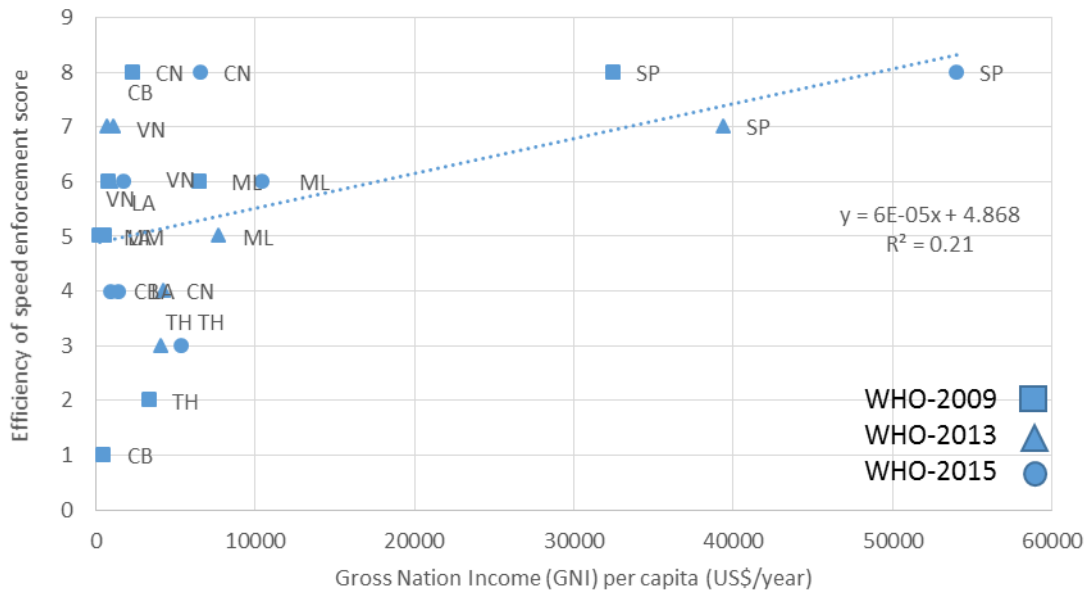


Figure 5 Correlation between efficiency of speed enforcement and gross nation income

4. CONCLUSION

The result reveals that the traffic accident fatalities of those case study countries is negatively correlated with the performance of speed law enforcement; it means that countries with a higher efficiency of speed law enforcement would have a lower rate of traffic accident fatalities. As well as, the countries with higher gross national income levels have a higher efficiency of speed law enforcement. It can be concluded that effective enforcement of speed laws would decrease the number of traffic accident fatalities. The countries with high gross national income levels provide higher budget allocations to support the enforcement of speeding laws. Sufficient and effective policing (police men and enforcement equipment) would increase the performance of speed law enforcement.

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6. REFERENCES

- Davis, A., Hacker, E., Savolainen, P.T., Gates, T.J., 2015. Longitudinal Analysis of Rural Interstate Fatalities in Relation to Speed Limit Policies. *Transportation Research Record: Journal of the Transportation Research Board*, Volume 2514, pp. 21–31
- Douglas, C., Montgomery Elizabeth, A., Peck, G., Geoffrey Vining., 2012. *Introduction to Linear Regression Analysis*
- He, J., King, M., Watson, B., Rakotonirainy, A., Fleiter, J., 2013. Speed Enforcement in China: National, Provincial and City Initiatives and Their Success. *Accident Analysis and Prevention*, Volume 50, pp. 282–288
- Klungboonkrong, P., Faiboun, N., 2014. Road Traffic Fatalities Analysis in AEC Countries. *Advanced Materials Research*, Volume 931-932, pp. 546–550
- Klungboonkrong, P., Faiboun, N., 2015. The Urgent Road Safety Action Plans of Thailand: The Right to Safer Roads. In: Proceedings of the 6th Rajamangala University of Technology International Conference; 2015 Sep 1-3; Nakhonratchasima, Thailand, Nakhonratchasima: Rajamangala University of Technology Isan
- Koren, C., Borsos, A., 2012. The Advantage of Late-comers: Analysis of Road Fatality Rates in the EU Member States. *Procedia-Social and Behavioral Sciences*, Volume 48, pp. 2101–2110
- Mohan, D., 2011. Analysis of Road Traffic Fatalities Data for Asia. *Journal of the Eastern Asia Society for Transportation Studies*, Volume 9, pp. 1786–1794
- Organisation for Economic Co-operation and Development, 2014. *International Transport Forum: Road Safety Annual Report*, Paris, France
- Police News Release, 2014. *Annual Road Traffic Situation*, Singapore
- Royal Thai Police, 2013. *Injuries and Deaths Report 2006-2013*, Thailand [in Thai]
- Satiennam, W., Tankasem, P., Satiennam, T., 2015. A Study of Speed Limits and Speed Control Measures for the Urban Arterial Road, *KKU ENGINEERING JOURNAL*, Volume 42(2), pp. 193–202 [in Thai]
- Tankasem, P., Satiennam, W., Satiennam, T., 2015. An Evaluation of Speed Limit Measure: A Case of the Mittraphap Highway Passing Through Khon Kaen City, *KKU ENGINEERING JOURNAL*, Volume 42(2), pp. 135–144 [in Thai]
- World Health Organization (WHO), (2009), *Global Status Report on Road Safety 2009: Time for action*, Geneva, Switzerland
- World Health Organization (WHO), 2008. *Speed Management: A Road Safety Manual for Decision-Makers and Practitioners* Geneva, Switzerland
- World Health Organization (WHO), 2013. *Global Status Report on Road Safety 2013: Supporting a Decade of Action*, Geneva, Switzerland
- World Health Organization (WHO), 2015. *Global Status Report on Road Safety 2015*, Geneva, Switzerland
- World Health Organization (WHO), French Cooperation, Belgian Cooperation., Cambodia Road Traffic Accident, Victim Information System, 2004. *Annual Report*, Phnom Penh: Cambodia