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# CHARACTERISTICS OF THREE-WHEELER CRASHES

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## ABSTRACT

Despite its popularity in Sri Lanka, little research has been conducted to study the impact of three wheeler on road safety. The objective of this study was to investigate the characteristics of crashes involving three wheelers in Sri Lanka. The different driver, environmental, vehicle, and road related factors that affected three wheeler crashes were identified. More frequent crash conditions for three wheeler crashes occurred while driving on rural roadways, driving during week days in heavy traffic, and driving newer vehicles. It also showed that intersection crashes, and two vehicle crashes are more frequent in Sri Lanka. This study adds detailed information about characteristics of three wheeler crashes to the transportation safety literature.

**Key words:** Three wheeler, para-transit transport, traffic safety

## 1. INTRODUCTION

According to Global status report on road safety (2013), the total number of road traffic fatalities in the world remains high at 1.24 million per year [1]. The overall global road traffic fatality rate in 2013 was 18 per 100,000 population. In the middle-income countries it has been at 20.1 per 100,000, whereas the rate in high-income countries is lowest, at 8.7 per 100,000. South East Asian countries showed increasing trend in the fatality rates during 2000 to 2011 [1]. In this region around 33% of road fatalities were among motorized two or three wheelers, 12% among pedestrians, and 4% among cyclists.

Three-wheelers are popular in Asian countries including Sri Lanka and it is becoming an essential part of public transportation in the country. Figure 1 shows three-wheelers which typically have a capacity to seat three adults in addition to the driver.



Figure 1: Three wheelers

Three wheelers play a major role in Sri Lankan transportation system, as they transport a significant number of people to places where other forms of public transportation, such as buses or trains do not run. Also, they provide employment opportunities for thousands of drivers, and livelihood opportunities to even more people. However, little research has been conducted to understand the impact of these three wheelers on road safety and most of the studies conducted in Sri Lanka were case studies. For example, Somasundaraswaran et al. conducted a questionnaire survey to investigate the reasons for social issues faced by the three wheeler drivers in the Southern Province of Sri Lanka [2]. Sampath and Fonseka in a study investigated the driver characteristics of crashes involving three wheelers in Panadura area [3]. Amerongen studied the regulations of three wheelers in Galle, a city in Southern Sri Lanka [4].

The number of registered three wheelers in Sri Lanka is 766,784 in 2012, which is 15.7% of the total vehicle population [5]. From 2004 to 2012, the number of registered three wheelers in Sri Lanka increased by 260%, with a corresponding 6.4% increase in model share. As the number of three wheelers increase, so does the probability of their being involved in motor vehicle crashes. The objective of this study is to investigate the characteristics of three wheeler-involved crashes.

## 2. METHODOLOGY

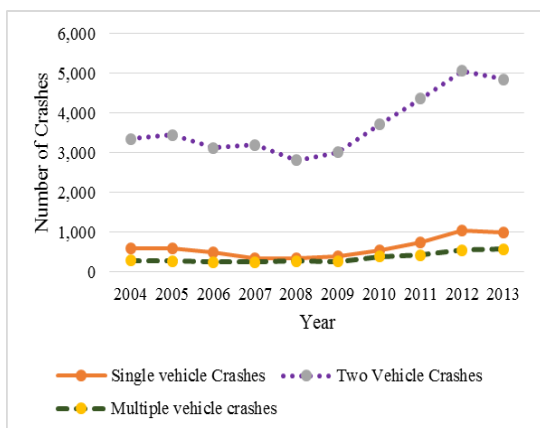
Data was obtained from Traffic Police Head

Quarters' crash records which contains details of police-reported crashes, at all severity levels that occurred in Sri Lanka. The dataset contains information related to every police reported three wheeler crash in Sri Lanka integrating various driver-, vehicle-, environment-, and road-related characteristics that prevailed at the time of the crash. The severity of injury was determined and categorized as fatal, grievous injury, and non-grievous injury based on the level of injury sustained by the vehicle occupants. Crash severity was a variable used for analysis in this study, and was identified based on the highest level of injury severity sustained by the occupants involved in a crash.

The characteristics of crashes involving three wheelers in Sri Lanka were investigated, utilizing ten years of data from 2004-2013. This long span enabled to have a detailed analysis of trends for different characteristics of three wheeler crashes. The number of three wheeler involved crashes has increased during the last ten years with the highest being observed in 2012. In this study the number of three wheeler-involved crashes were analyzed. There could be more causalities due to three wheeler-crashes than the number of three wheeler-involved crashes.

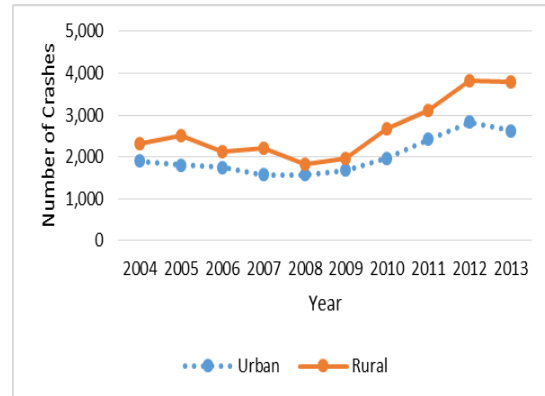
### 3. RESULTS

A total of 46,435 three wheeler-involved-crashes were recorded on Sri Lankan roadways during the ten-year period. The majority of three wheeler crashes involved two vehicles, a three wheeler and another vehicle, followed by a significant number of single-vehicle crashes, and multiple vehicle crashes. Figure 2 shows the distribution of three wheeler-crashes based on the number of vehicles involved.



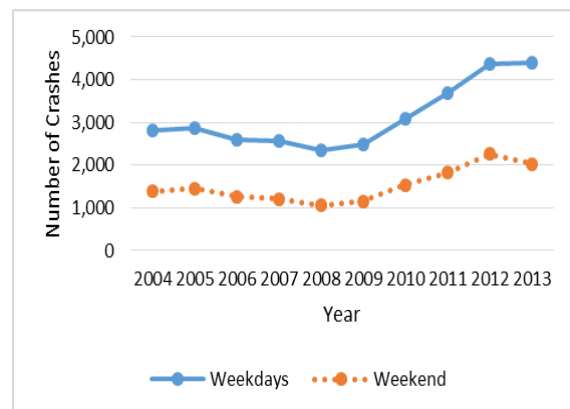
**Figure 2: Distribution of three wheeler-crashes based on number of vehicles involved**

Figure 3 indicates that the number of three wheeler crashes in rural areas is higher than that in urban areas. This may be because there is more three wheeler travel in rural areas, resulting in a greater probability of involving a crash.



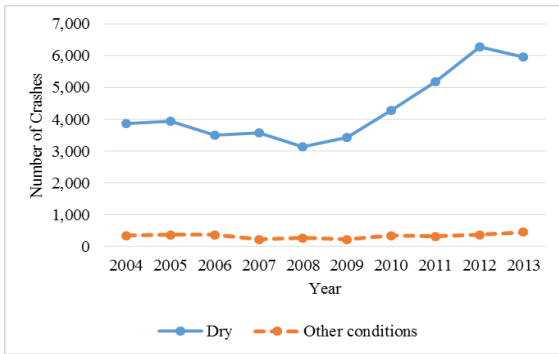
**Figure 3: Three wheeler crashes by rural/urban nature**

The number of three wheeler crashes that occurred during weekends was relatively fewer than those on weekdays. Figure 4 shows the distribution of three wheeler-crashes in weekdays and weekends.

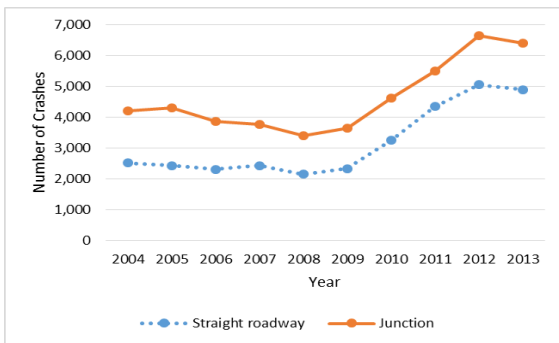


**Figure 4: Three Wheeler Crashes by Day of Week**

The roadway on which a three wheeler crash occurs is an important consideration in understanding the characteristics of three wheeler crashes. Figures 5-6 show the distribution of three wheeler-crashes in Sri Lanka based on the road condition and the section of the road. Dry surface conditions and intersections respectively, constituted the majority of crashes under each category. One possible explanation is that more three wheelers travel under such conditions, resulting in a greater probability of those conditions characterizing a crash.

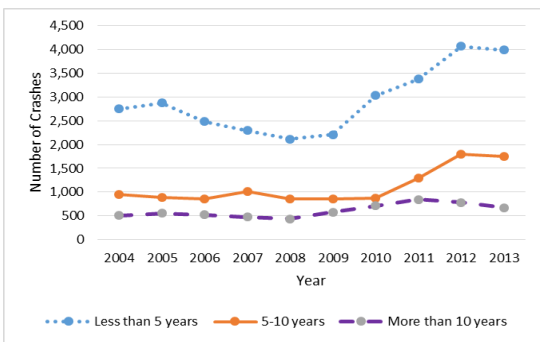


**Figure 5: Three wheeler-crashes by road surface condition**



**Figure 6: Three wheeler-crashes by roadway section**

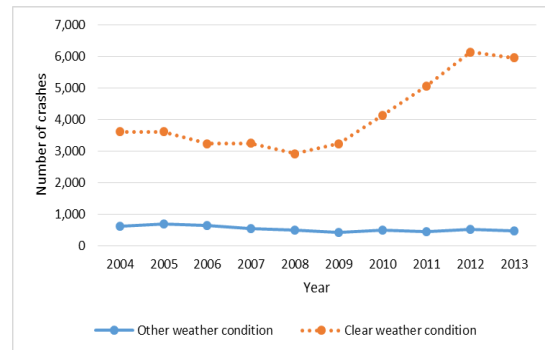
As shown Figure 7, newer vehicles also contribute to a high number of crashes, while older three wheelers are less likely to be involved in crashes.



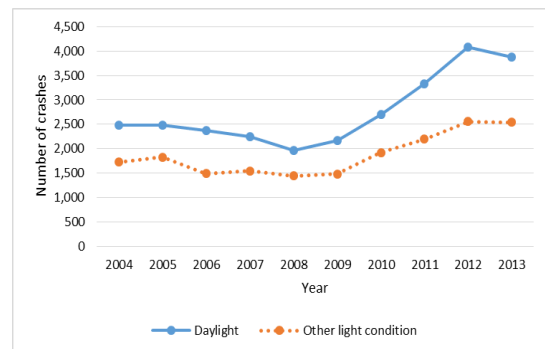
**Figure 7: Three wheeler-crashes by age of the vehicle**

Three wheeler crashes in Sri Lanka were categorized based on weather conditions that prevailed during crash occurrences. Analysis reveals that a majority of three wheeler-crashes occurred under clear weather conditions. Figure 8 shows the distribution of crashes by weather conditions. Cloudy, rain, and fog/mist were considered as other weather conditions. The number of crashes under other weather conditions were considerably lower when

compared to the clear weather condition. Figure 9 shows the distribution of three wheeler crashes based on different light conditions. A majority of three wheeler-crashes have occurred in daylight conditions. One possible reason for this finding could be that more three wheelers are on the road during the day.



**Figure 8: Three wheeler-crashes by weather condition**



**Figure 9: Three wheeler-crashes by light condition**

The study has taken into consideration all drivers involved in three wheeler crashes and the total number of male drivers in crashes is considerably higher than that of female drivers as shown in Figure 10. This could be due to there being more male three wheeler-drivers than female drivers.



**Figure 10: Three wheeler-crashes by gender of driver**

Age of the three wheeler-driver is one of the factors useful for understanding the characteristics of crashes involving three wheelers. Figure 11 shows the distribution of crashes involving three wheelers based on the age of the three wheeler driver. Data analysis reveals that a majority of three wheeler drivers involved in crashes were 21-30 years of age, followed by those who were between 31-40 years old. While there were some young and older drivers, overall 66% of three wheeler drivers involved in crashes were between 21 and 40 years old.

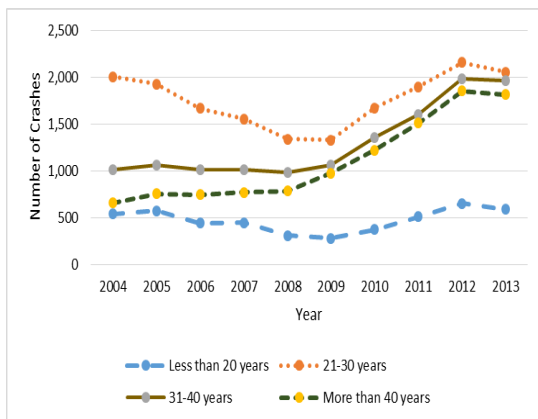


Figure 11: Three wheeler-crashes by age of driver

Crash severity is the variable which explains the severity of the crash. Overall, 6.1% crashes were fatal crashes; 24.0% were grievous injury crashes and the rest of them were non-grievous injury crashes. Figure 12 shows the distribution of the crashes over the ten-year period.

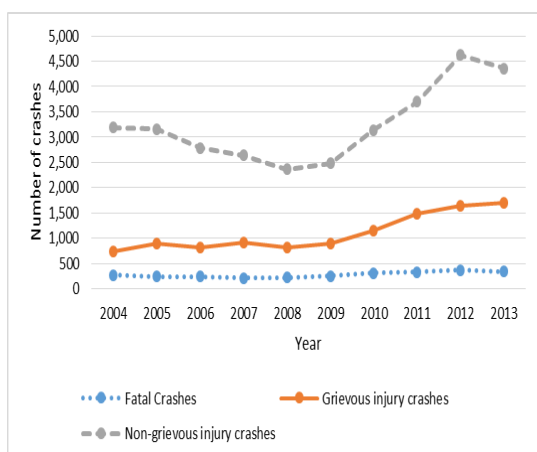


Figure 12: Crash Severity of three wheeler-crashes

#### 4. CONCLUSION

A significant increase in number of three wheeler

crashes in recent years has been observed. This study identified characteristics of three wheeler-crashes relating to vehicle, driver, environment, road, and other related factors. The majority of three wheeler-crashes were found to have occurred during daylight conditions and under clear weather conditions. Of all three wheeler-crashes, majority were two-vehicle crashes. Majority of all three wheeler-crashes which occurred during the relevant study period happened on weekdays. A large number of three wheeler-crashes occurred when the three wheelers were driven by male drivers between the ages of 21 and 40. Intersection locations predominantly characterized three wheeler-crashes.

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#### ACKNOWLEDGMENT

The author would like to express her appreciation to the staff of Sri Lanka Traffic Police for their continuous effort to record data and help in providing crash data.