

Outcomes of Road Safety Audit of Yamuna Expressway

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Abstract

This study presents the outcomes of the road safety audit done on Yamuna Expressway (YE). YE is a high speed road connecting Greater Noida to Agra in the State of Uttar Pradesh, India. The first objective of the audit is to identify geometric design deficiencies in the YE alignment. Also to check the safety issues at the entry exit ramps, toll booths and road side facilities along the corridor. Second objective is to identify deficiencies in road signages, road marking and crash barriers on the YE corridor. Third objective is to identify high crash locations based on last six year road traffic crash (RTC) data along the corridor. Based on the observations of the audit measures have been suggested to improve road safety compliance along the corridor. Recommendation were based on the current codal provisions of IRC. And where Indian codal provisions are not available recommendations are based on international best practices.

Introduction

Road safety audit (RSA) is an formal procedure to examine the safety performance of an existing or future road. RSA was done on Yamuna Expressway (YE) to assess its safety performance. It is a high speed road connecting Greater Noida to Agra in the State of Uttar Pradesh, India. The expressway has been in operation August 2012. It is a 165.537 km long stretch with six lane divided carriageway and extendable upto 8 lanes throughout the corridor with a 6 m wide median.

The total number of fatal and non-fatal crashes used for the analysis are 560 and 4,557 which occurred from September 2012 to August 2018. Total number of fatalities on expressway was 738. The average annual crash rate per km was found out to be 3.39 based on fatal crash data. Hazardous crash locations were identified after plotting the RTC data on a GIS base. Fourteen locations were identified as hazardous locations based on GIS hot spot analysis. Three sets of audit checklists conforming to the IRC standards were prepared for the entry and exit ramps, linear sections and toll booths. The audit was divided into day time audit and night time. All entry/exit ramps, toll, rest areas and 42 specific location along the linear sections were audited with the help of the checklist. The finding of the crash data analysis and audit observations are presented. The learning from audit will be important for the future design and construction of expressways in India.

Methodology

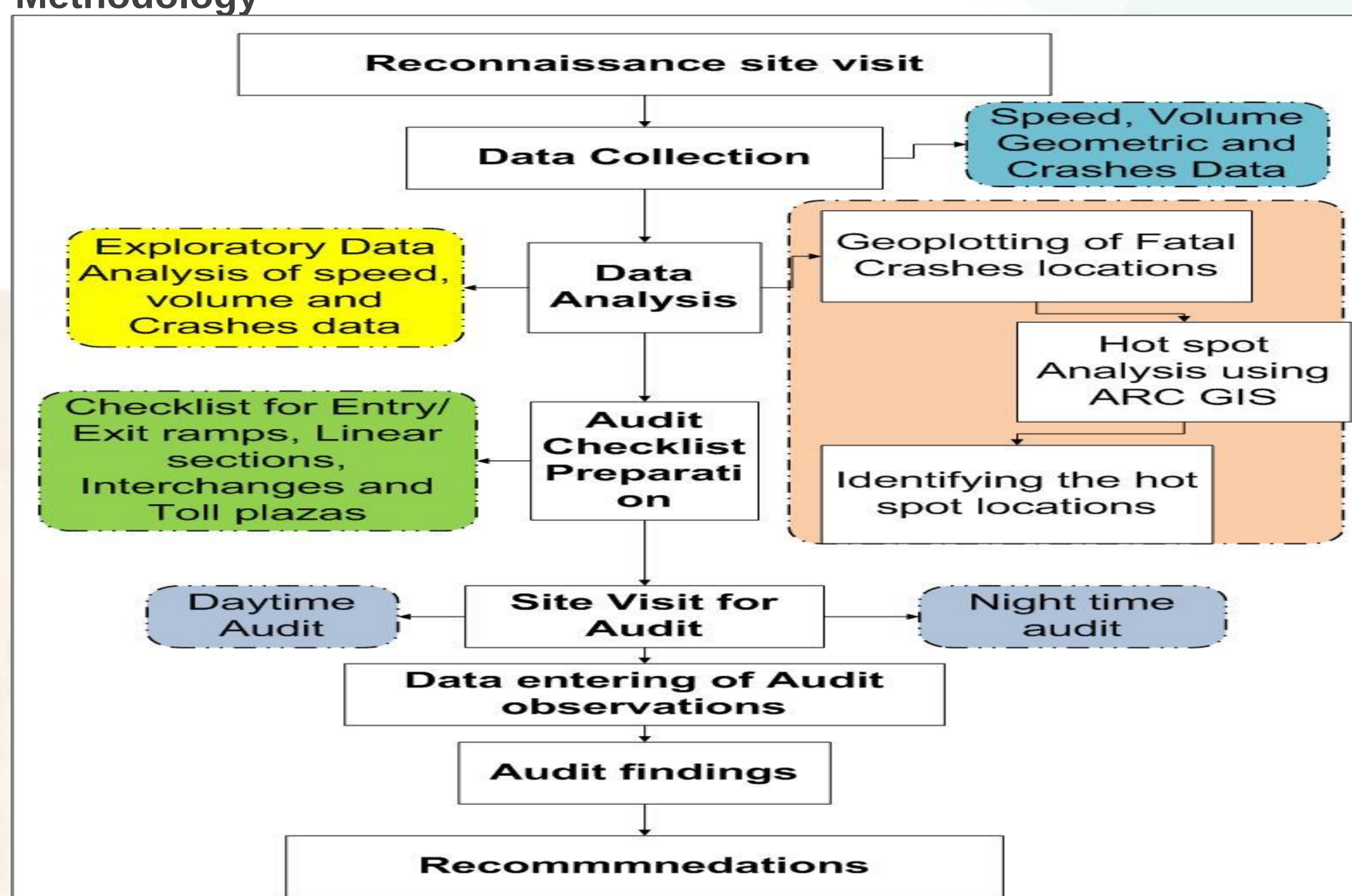


Fig 1: Flow chart of audit methodology

Results

Crash Data Analysis

The crash data analysis revealed the following patterns. First, the crash pattern is similar for both type of crashes based on the types of collision. Rear-end collision comprises of 41% of the total RTCs in fatal crashes and 33% in the non-fatal crashes. Second, the proportion of the crashes involved with the roadside infrastructure such as hit guardrail, hit median, hit bridge parapet, hit culvert are significant. Third, there is significant number of single vehicle crashes being recorded. Analyses of these crashes show that 23% fatal crashes and 44% non-fatal crashes are single-vehicle crashes respectively. These crashes are mainly known as run-off the road (ROR) crashes, where the vehicle leaves the road and enters the roadside. Hence, this is an important inference for the improvement or modification in the design of roadside environment as well as the design of guardrail.

Conclusions

- Rear-end crashes have the highest share in the total crashes for both fatal and non-fatal crashes.
- Expressway design features were as per old codal provisions.
- Raised median is conducive to crashes.
- Guardrail installation is not as per standard.
- Entry and exit ramp sections are unsafe.
- Crash cushions and chevron markings are not installed as per standard.

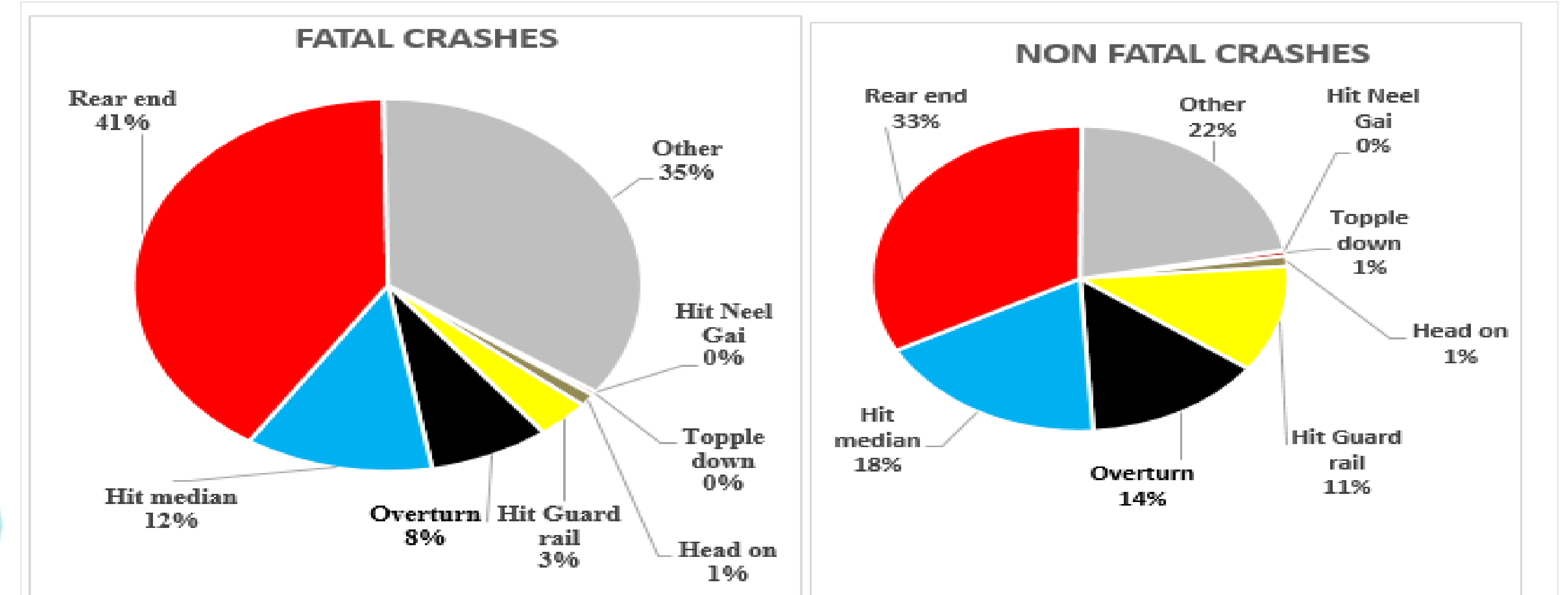


Fig 2 Comparison of fatal and non-fatal crashes

Proportion of Crashes According to the Time of Day

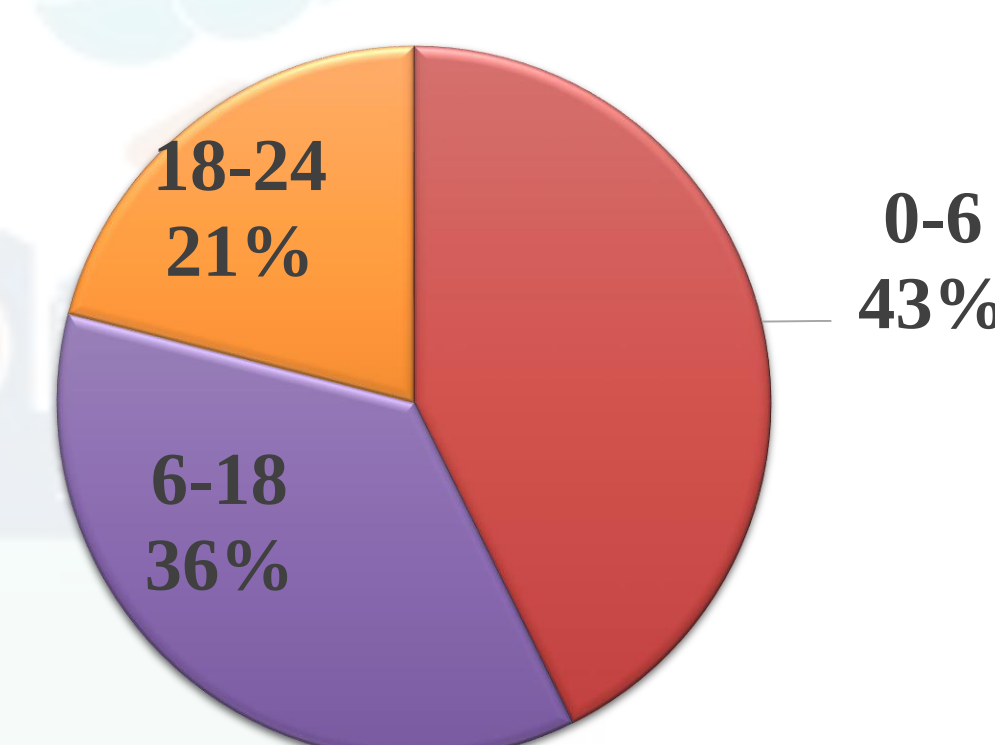


Fig 3 Distribution of fatal crashes as per time of day

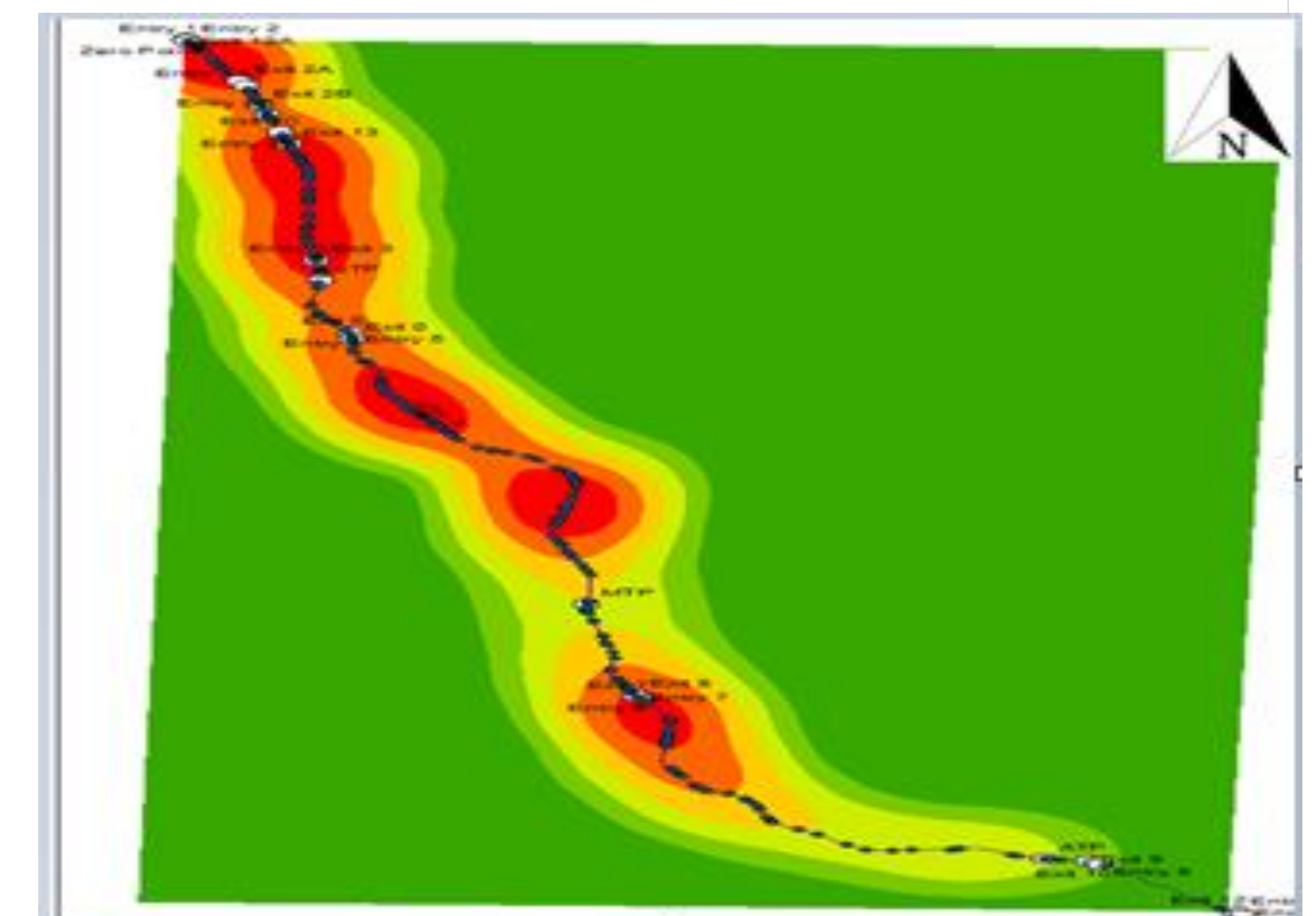


Fig 4 Hot spot locations as per KDE

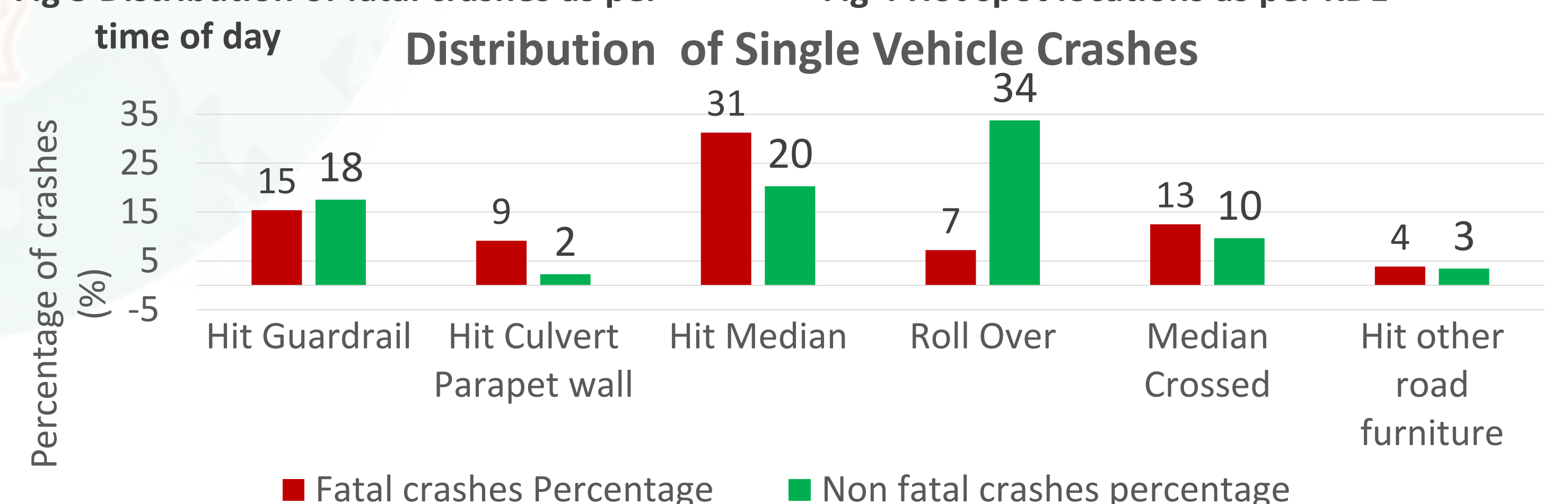


Fig 5 Comparison of distribution of single vehicle crashes

Major audit observations

- Median is raised.
- Height of crash barrier is not as per standard.
- Crash barrier for the gantry poles present on the shoulder is incorrect.
- Damaged crash barrier is not replaced.
- Crash cushions are not as per standard.
- Chevron marking not as per standard.
- Directional markings are inadequate.
- Advance warning signs are missing.
- Transitions between steel w beam guardrail and concrete culvert is inappropriate.
- Hazards are present in clear zone.
- Pedestrians and 2W are using the expressway.
- Non-standard signages are present.
- Hard shoulder is marked as 2W lane.
- At entry and exit ramp location wrong side driving was observed.
- Acceleration and deceleration lane markings not as per standard.



Recommendations

- Review and modify the geometric design features of expressway.
- Change the existing raised median to flushed median.
- Shoulder rumble strips installed as per as per recommendations of FHWA T 5040.39 Revision 1.
- Enforcement implementation by police with support from the concessionaire.
- Speed control measures: Installment of additional speed cameras
- Installation of guardrail on median as well as on shoulder side as per IRC:SP:87-2013.

References

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