DATA MINING REPORT ON TRAFFIC OFFENCES 2011-2016

Ministry of Information & Communications

ICT Division & PPD

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Abbreviations

eRaLIS	Electronic Registration and Licensing System
HV	Heavy vehicle
LV	Light Vehicle
MoH	Ministry of Health
MV	MV: Medium Vehicle
OL	Ordinary License
PD	PD: Professional Drivers
RBP	RBP: Royal Bhutan Police
RSTA	Road Safety and Transport Authority

1. Introduction

With the ever-increasing number of vehicles on the road in Bhutan, traffic offences have also increased gradually over the years, which would have contributed directly to traffic accidents resulting in immense social and economic costs as well as burden on the health sector. In order to combat such incidences in terms of traffic crashes on our roads, there is a need to effectively combat the occurrence of traffic offences and lower the level of disobedience among road users through introduction of smart technologies, improving traffic engineering, education, and administration of law and advocacy.

Thus, this study has performed data classification of traffic offence in the country for the period of six years from 2011 to 2016, maintained with e-Registration & Licensing Information System (eRaLIS). eRaLIS is a web-based application which maintains information related to all vehicle registrations and driving licenses pertaining to the road safety system in Bhutan. The data sets were evaluated on the 59,746 offences recorded after removing outliers & missing data from the actual 91,507 offence records.

The purpose of this report is to highlight the most common offences and contraventions recorded in the country, and to examine interrelationships between socio demographic characteristics of drivers and traffic offences through a Descriptive Data Mining process. The data mining is done without any preconceived hypothesis; though it may assist the Road Safety & Transport Authority (RSTA) in generating new information and unlock the various insights of traffic offences in the country. Such initiative would ultimately contribute towards National Key Result Areas 15 and the Key Performance Indicator 15.3 ("Road Safety Enhanced") for the 12th FYP. Further, this report will also contribute towards the prioritized Sustainable Development Goals (SDG) of Bhutan, in particular Goal 3 (Good Health and Wellbeing) and Goal 11 (Sustainable Cities and Communities).

The study found out that the maximum number of offences was recorded in the year 2015, in the month of May and on Fridays. The age demographics between 25-31 have recorded the most number of offences, and male drivers dominate the offence figures. "Using Handheld/Mobile phone while driving", "Drink Driving" and" Speeding" are the three major offence mostly committed by novice drivers. Over all, 86,761 drivers have no offence recorded with the system during the study period. It was also observed that most drivers did not have any offence record after attending the refresher course conducted by the RSTA-the refresher courses have a positive impact on the driver's behavior.

Accordingly, in line with the findings from the study, measures such as public advocacy programs, introduction of smart technologies, enhancement of eRaLIS system, increase road safety inspection and compulsory refresher courses for traffic offenders are needed, in which increased cooperation, innovation, and commitment among stakeholders should be prioritized for safe roads in Bhutan.

2. Objectives

a. To find out the most common traffic infringements in the country
b. To find out associated factors of major offences
c. To find out the relationship between traffic offenders and their socio demographic profile (driver's age, driving experience, gender, and vehicle type)
d. To recommend appropriate actions to reduce traffic offences
e. Find out the impact of the refresher course conducted by RSTA

3. Materials and Methods

The study was conducted on the basis of primary data recorded in eRaLIS by the RSTA. The study was conducted over a six-year period commencing from January 2011 to December 2016. Before employing any data mining method all the attributes were integrated into a single data matrix and inconsistencies were removed from data. A total of 59,746 records were successfully captured in this study. The data was processed into MS Excel and analyzed using Rapid Miner 5.3 tool. Descriptive summary statistics in the form of frequency distributions, charts, and graphs were constructed.

Pivot tables were developed using Excel, which provide examples in visualizing responses of some variables from the dataset and allows users to summarize a list of information in a simple format.

For the purpose of clarity**,** seven variables corresponding to the traffic offences were selected to study and determine the traffic offence trends as shown in the Table 1.

The variable of driver's age was calculated based on the date of birth and on the offence date. Similarly the variable of drivers driving experience was calculated based on the issue date and the offence date.

Table 1: Variables of the data set

SL. No	Variable Name	Remarks
1	Offence Type	Types of offences
2	Offence date	The date on which the offence was committed
3	Gender	Gender of the offender (Male :M and Female : F)
4	Vehicle number	Registration number of the vehicle involved in the traffic offence: Bhutan Private (BP),Bhutan Government (BG), Bhutan Taxi (BT)
5	Vehicle type name	Vehicle type involved in the offence such as Two Wheeler (TW), Light Vehicle (LV),Heavy Vehicle (HV),Medium Vehicle (MV), Taxi, Medium Bus (MB) ,Heavy Bus(HB),Power Tiller (PT),Tractor and Earth Moving

		Equipment (EME)
6	Diving License number	Driving license number of the drivers involved in the offence: T-Thimphu,P-Phuntsholing,G-Gelephu,S-S/Jongkhar,M-Mongar and PD-Professional Driving License.
7	Issue date	The date on which the driving license was issued
8	Date of Birth	The exact date on which the driver was born, including the year.

4. Data Limitation

Variables like "offence time", "offence date", and "Offence location" could not be considered, as these variables were not clearly updated in the system.

31,761 offence records did not hold all those six variables listed in Table 1, since the license number could not be captured for the "Unlicensed driving" & "Driving with Learner License" offences.

Similarly offences such as "no registration certificate on the spot", "invalid registration certificate " and "faulty tyres" were recorded against the vehicle and as such did not have driver's details.

Since the data set of the traffic offences had to be cleaned (remove outliers and missing data), they are accurate for this data set. Therefore, the data set potentially do not tell the entire story or it may be biased because not all of the data is known.

5. Findings

5.1 Traffic Offences by Year

The graph (figure 1) shows an overall upward trend of traffic offences throughout the study period for both male (represented by the blue line) and female drivers (the orange line). However, there is a sharp decrease of traffic offences in the year 2014 (decreased by 8% for male and 7% for female) and 2016 (decreased by 7% for male and 6% for female drivers). On the other hand, 2015 has the highest offence recorded with 17,239 offenders for male drivers and 1,095 for female drivers. The irregularity of the offence trend throughout the years could be due to the enforcement of "Zero Tolerance Day" by the Traffic Police, in which the every car was inspected for the road safety compliance every Friday since 2014.

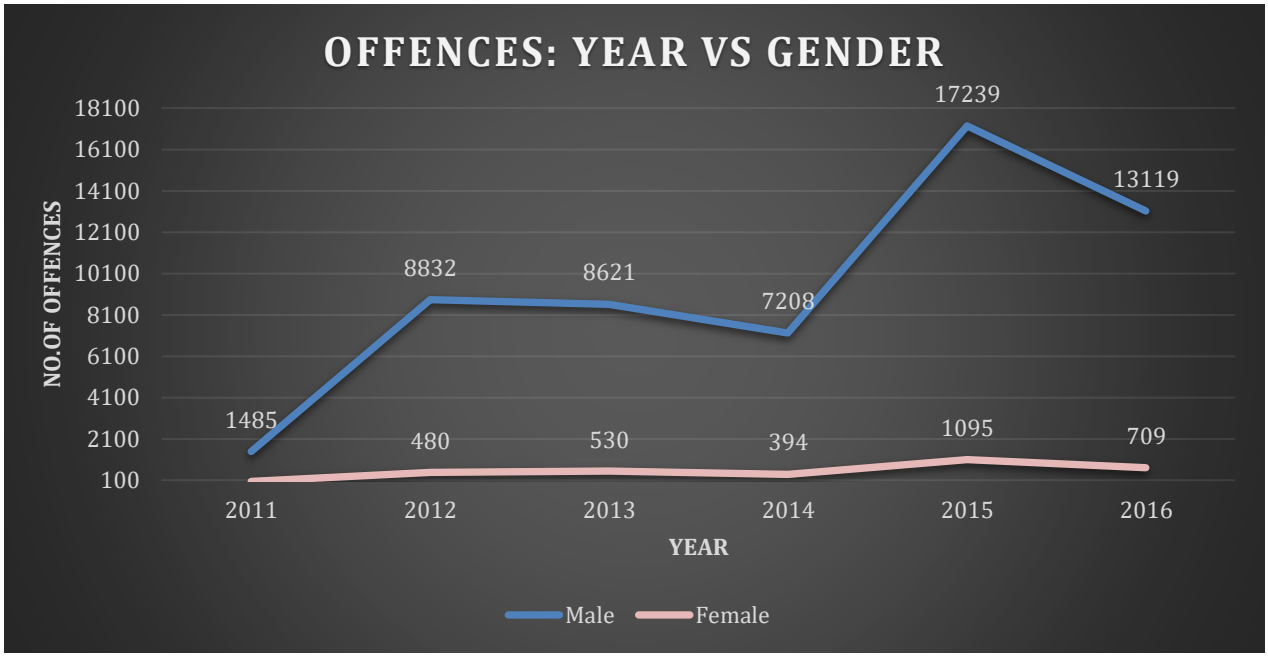


Figure 1: Traffic Offences vs. Year against gender

5.2 Traffic Offences by Month

The month of May (represented in red color) by far has the highest number of traffic offences with 6,885 offences during the period under review, which is more than double the lowest month, February, with 3,029 offences. October with 6097 offences (represented in yellow) and April (represented in green) with 5,852 offences demonstrates as the second and third highest monthly offences, respectively (Figure 2). Overall, there is an increase by one percent every month from January to May and then a sharp decrease by 6% in June, followed by a steady increase until September. Due to this trend, it is imperative to further examine these months in order to find out the possible reason behind the high motor vehicle offences.

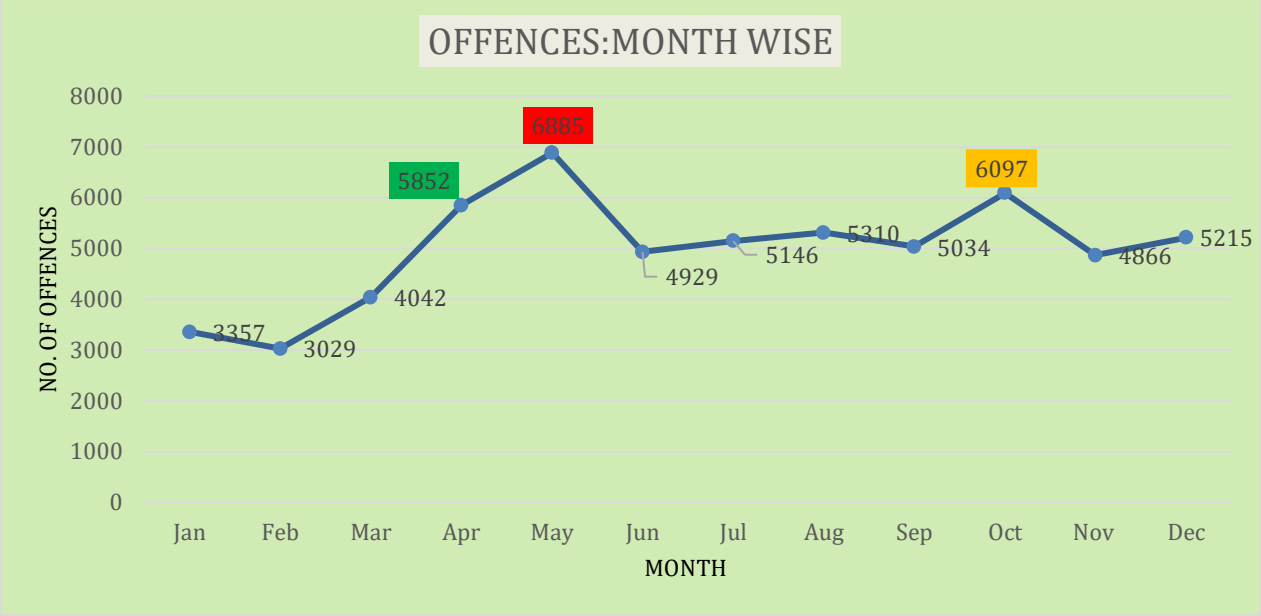


Figure 2: Offences per Month

Table 2: Details of Monthly traffic offences

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2011	126	59	87	226	226	78	111	114	113	118	83	185	**1526**
2012	157	298	503	580	747	711	655	1193	1032	1185	1123	1137	**9321**
2013	669	476	833	919	932	888	837	1057	650	772	593	525	**9151**
2014	742	644	585	785	756	624	872	569	573	550	480	422	**7602**
2015	585	701	726	1930	2760	1413	1717	1497	1636	2308	1500	1561	**18334**
2016	1078	851	1308	1412	1464	1215	954	880	1030	1164	1087	1385	**13828**
Total	**3357**	**3029**	**4042**	**5852**	**6885**	**4929**	**5146**	**5310**	**5034**	**6097**	**4866**	**5215**	**59762**

5.3 Traffic Offences by Day

The most frequent days on which most of the offences took place during the study period were on Fridays with 17,409 offences, which is 29% more offences committed than any other days of the week (Figure 3). Wednesdays and Saturdays with 9,609 and 8,553 offences recorded the second and third highest days with offences respectively. Overall, there is alternate increase and decrease in the offence every day.

Fridays, Wednesdays, and Saturdays are regarded as "social days" since the vast majority of the people are either going or coming from visiting a family or friends. These findings could also mean that the law enforcers are monitoring roads more frequently than other days considering the social trend "Fridays, Wednesdays, and Saturdays" have in the country. Minimum number of offences were recorded on Sundays with 3,815 offenders which is 18% lesser than Fridays.

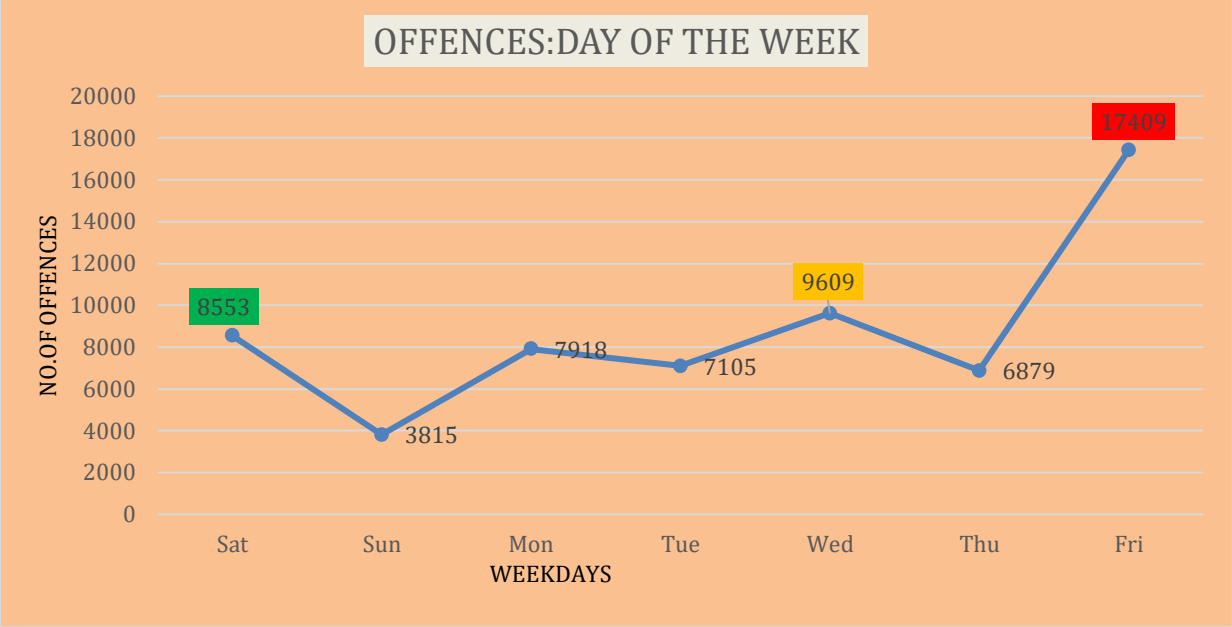


Figure 3: Offences per Day of the Week

5.4 Traffic offences by Gender

Out of 59,746 traffic offences recorded, 56,947 (95%) were male drivers and 3,249 (5%) were female drivers as illustrated in Figure 4. The average age for male offenders is 34 years old, and 35 for female drivers. This shows that male drivers have more offences recorded during the time frame studied. This could also mean that there are relatively few women drivers in Bhutan compared to their male counterparts, as the record maintained with RSTA as of December 2016 show 101,963 male and 13,797 female drivers.

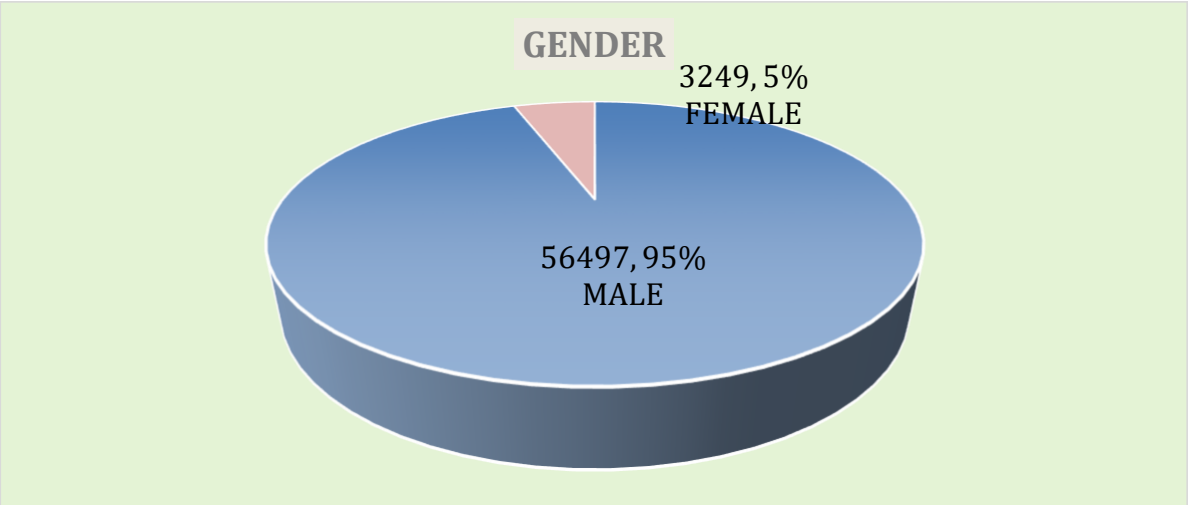


Figure 4: Number of offences according to gender

5.5 Traffic Offences by Vehicle type

Light Vehicles (LV) dominated the number of traffic violations during the study period. Out of the ten vehicle types (Figure 5), 34,211 traffic violations are caused by drivers of LV, indicating that the 57% of the LV were responsible for overall traffic violations within the study period.

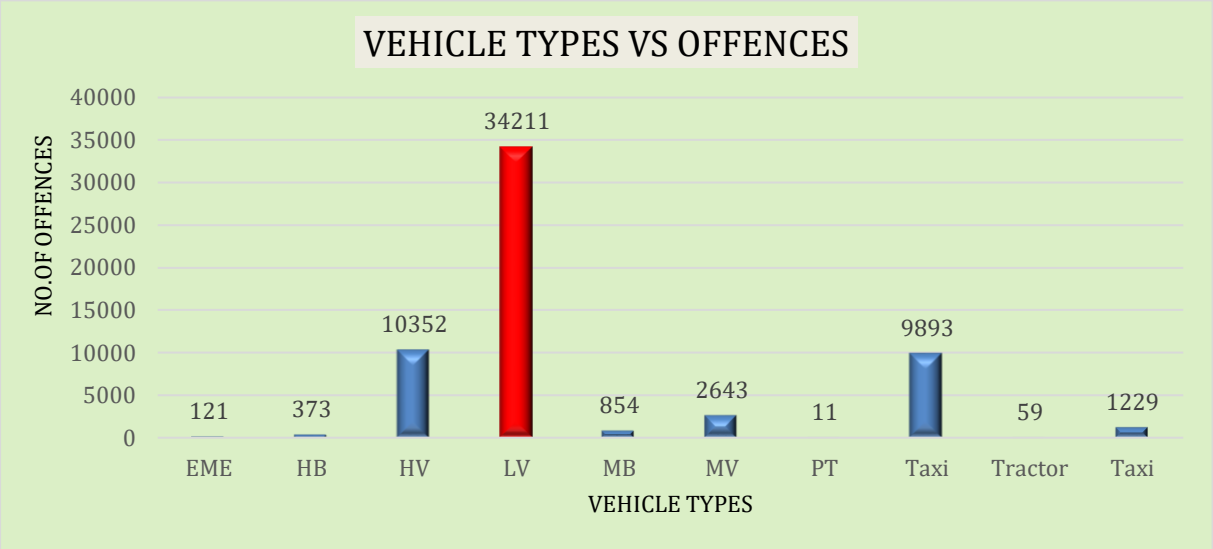


Figure 5: Offence according to vehicle types

Using "Handheld/Mobile phone while driving" recorded the highest number of offences for LV with 5,087 violations, the "Exceeding Weight Limits" offence with 1,894 violations for HV and the "Driver Not in Proper Dress or Not Behaving Properly" offence with 1,870 violations for Taxi drivers. Figure 6 shows the top offence against each vehicle types.

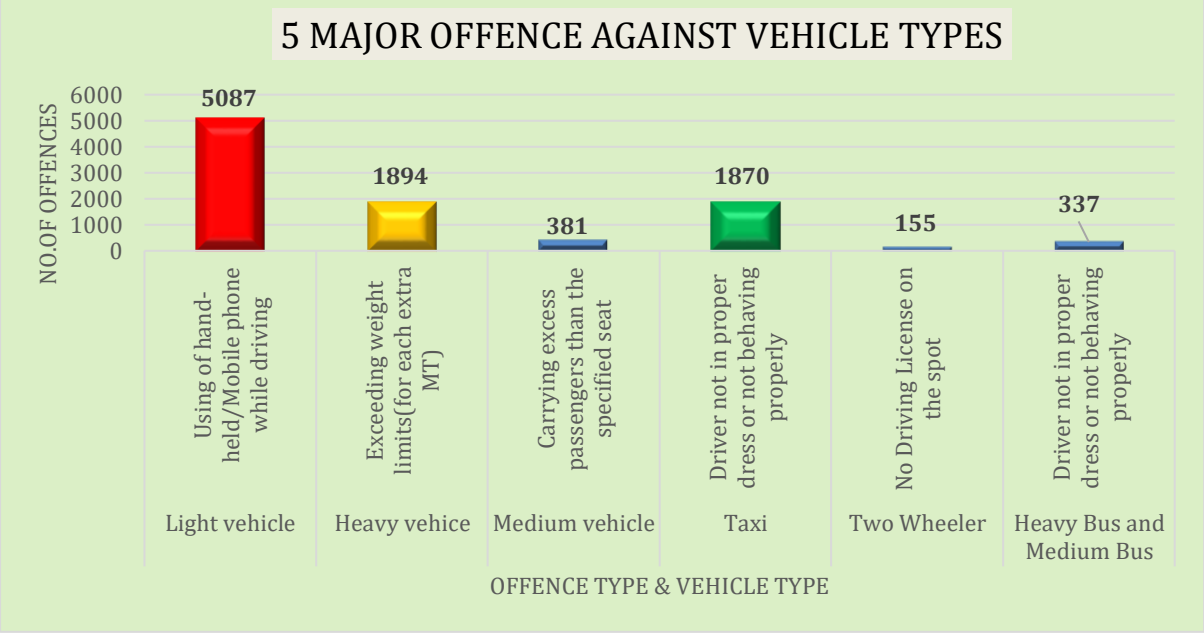


Figure 6: Top offence against each vehicle type

5.6 Traffic Offences by License Type [Ordinary License Vs (Thimphu, Phuentsholing, Samdrupjongkhar, Gelephu and Mongar) Professional Drivers (PD)]

Out of 111,342 OL drivers and 16,734 PD registered with the RSTA until 2016, the percentage of OL and PD offences are 36% and 85% respectively, this indicates that the PDs have recorded 49% more offences than OL holders within the study period.

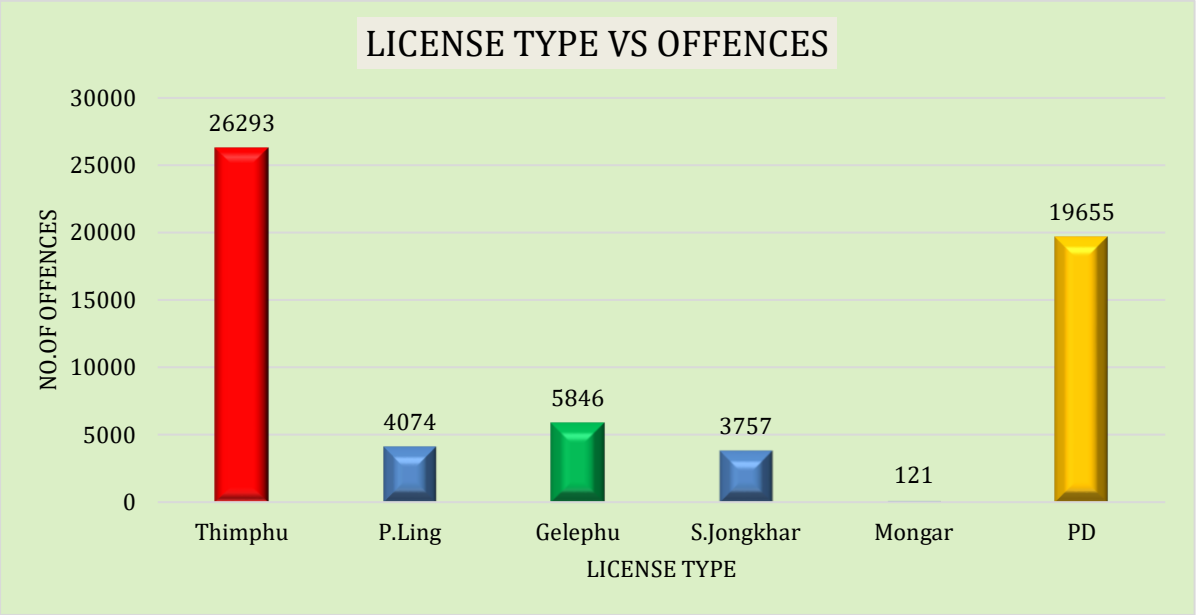


Figure 7: Offences by region

5.7 Five Major Traffic Offences

The major traffic offence recorded in the country was "Using of Hand Held/Mobile Phone While Driving" (Figure 8). Out of 59,746 traffic offences registered, 6,648 offences were attributed to this offence type. That is 11% more than any other offence, indicating that in every 100 motor vehicles fined during that period, 11 individuals are recorded for this offence.

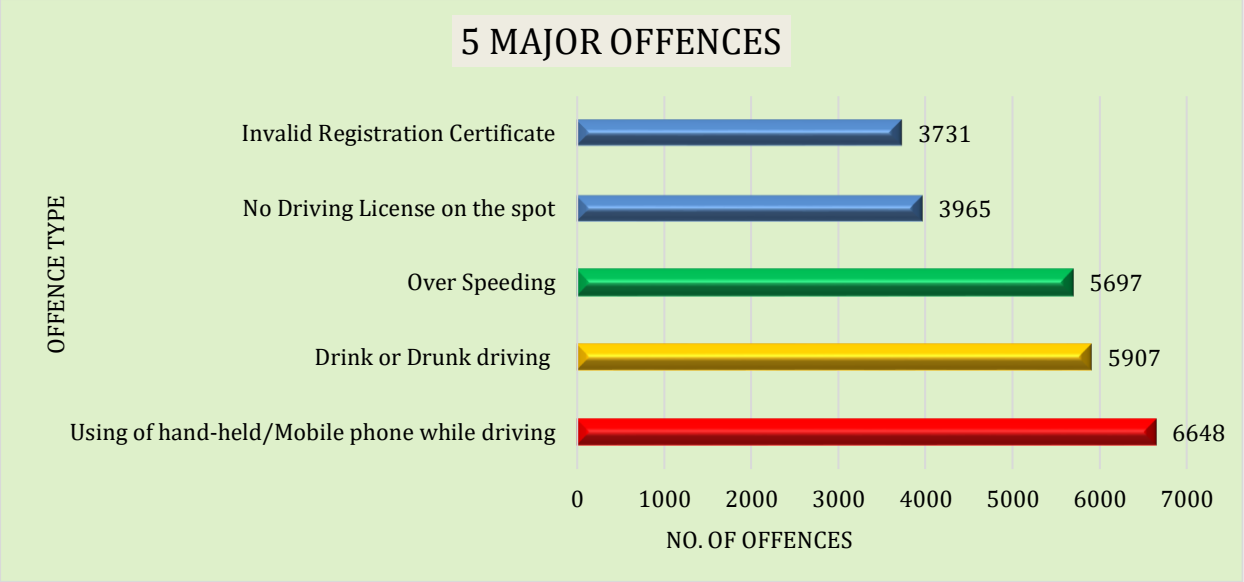


Figure 8: Five Major Offences

The second and third major causes of traffic offences recorded were "Drink Driving"(if the level of alcohol in their blood exceeds 0.08 grams per 100 milliliters while driving on the road.) and "Speeding" (Driving at a speed in excess of a speed limit sign applying to the section of the highway/road on which the diver is driving) related issues with 5,907 (9.8%) and 5,697 (9.5%) offences respectively. The fourth and fifth prominent causes of traffic violations were "No Driving License on the Spot" and "Invalid Registration Certificate" related issues with 3,965 (6.6%) and 3,731 (6.2%) respectively. This helps us conclude that the five major causes of traffic violations are "Use of Handheld/Mobile Phone While Driving", "Drink Driving", "Speeding", "No Driving License on the Spot" and "Invalid Registration Certificate", which together accounts for more than 43% of all the traffic violations recorded within the study period.

5.8 Five Major Traffic Offences by Gender

Categorizing top three offences by gender, male drivers share similar trend to that of overall top three offences, with "Using of Handheld /Mobile While Driving" as the highest offence, followed by "Drink Driving" and "Speeding" in second and third place respectively. The only difference between female and male drivers is the swapping of "speeding" offence in second place from "Drink Driving", which was in third place for male drivers. This finding clearly suggests that the top three offences for both male and female are "Using of Hand Held/Mobile Phone While Driving", "Drink Driving" and "Speeding" (Figure 9 & 10).

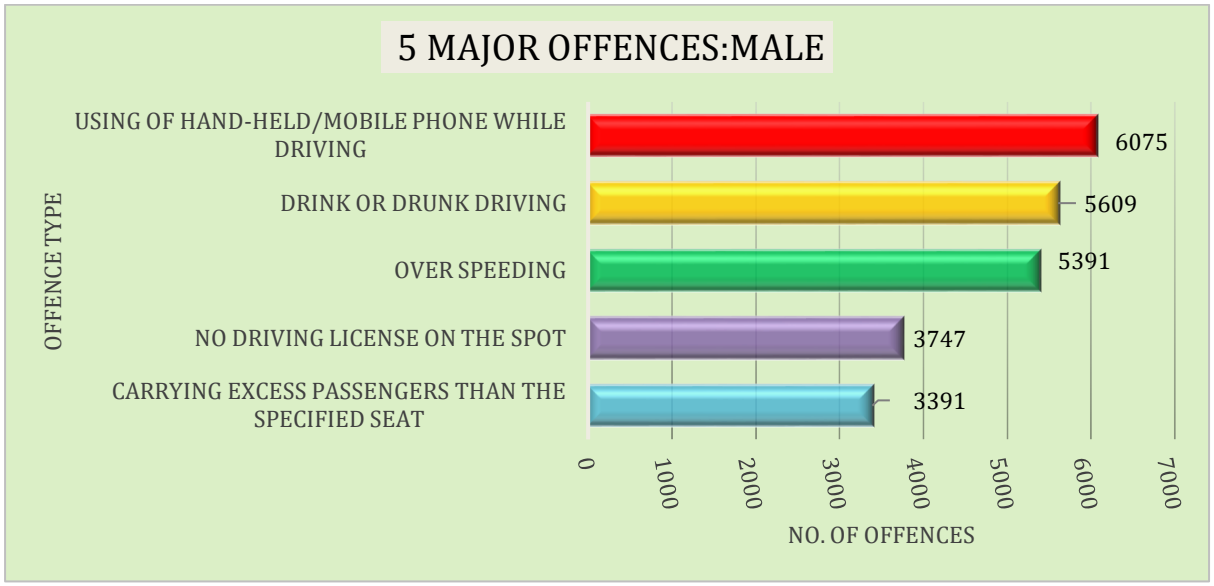


Figure 9: Five major offences by male drivers

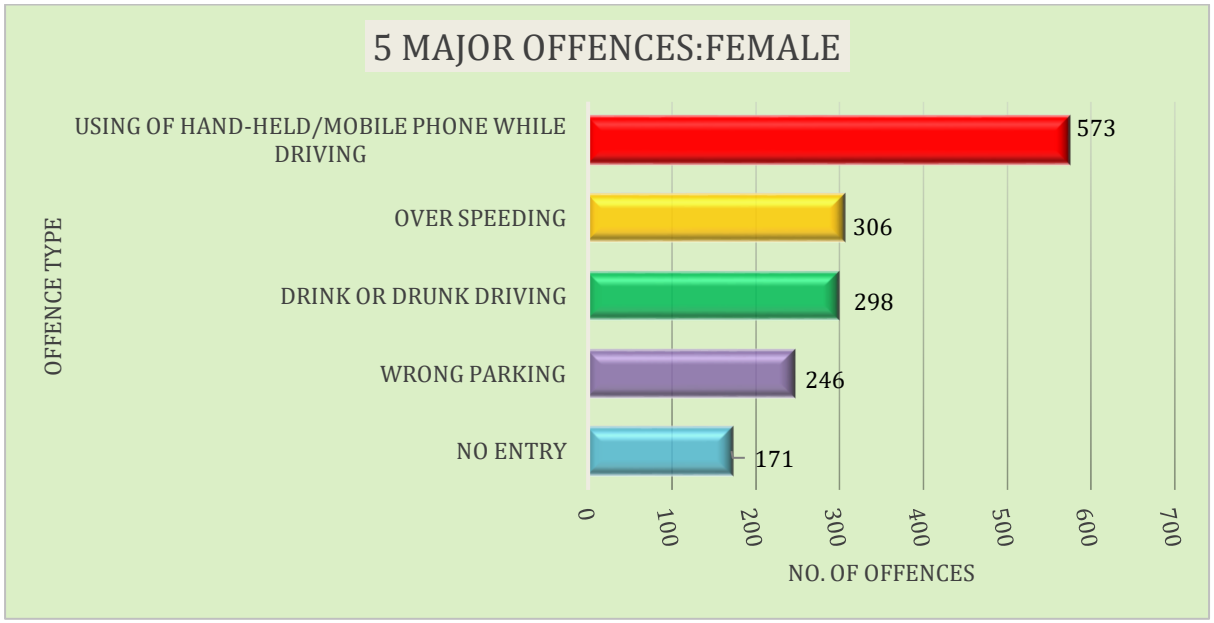


Figure 10: Five major offences by female drivers

5.9 Relationship between Top Three Offences, Drivers Age & Driving Experience

5.9.1 Driver's Age and Driving Experience on "Using of hand-held/Mobile while Driving"

A study on "mobile phone use as a growing problem of driver distraction" (WHO, 2011) shows that young and novice drivers (Drivers holding driving license with less than a year from the issue date) are more prone to distraction and more susceptible to effects of distraction. The study shows a similar trend in Bhutan with both male and female drivers having recorded this offence highest within their first year of driving experience (Figure 11) with 11% each for male and female drivers.

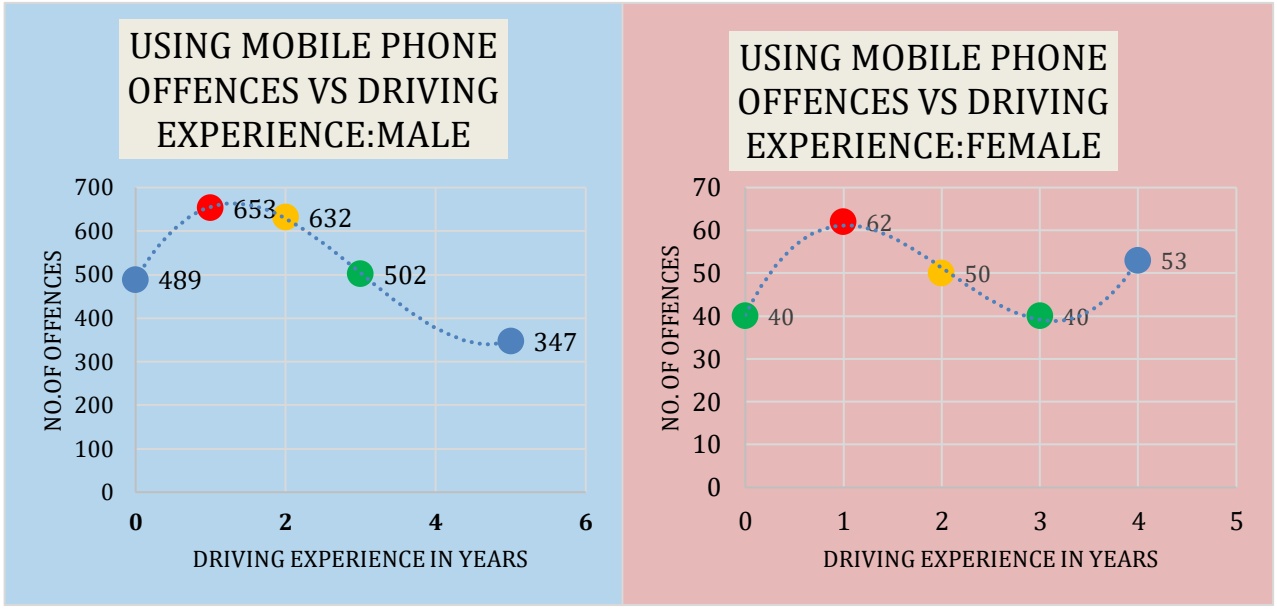


Figure 11: Use of mobile phones while driving vs driving experience.

In case of a driver's age, this offence is recorded highest in the age group of 27-31 and 28-34 respectively for male and female drivers (Figure 12). This seems to suggest that young drivers are prone to using mobile phones while driving compared to other age groups. However the prevalence of "Using of hand-held/Mobile While Driving" offences decreases with the increase in driver's age and driving experience.

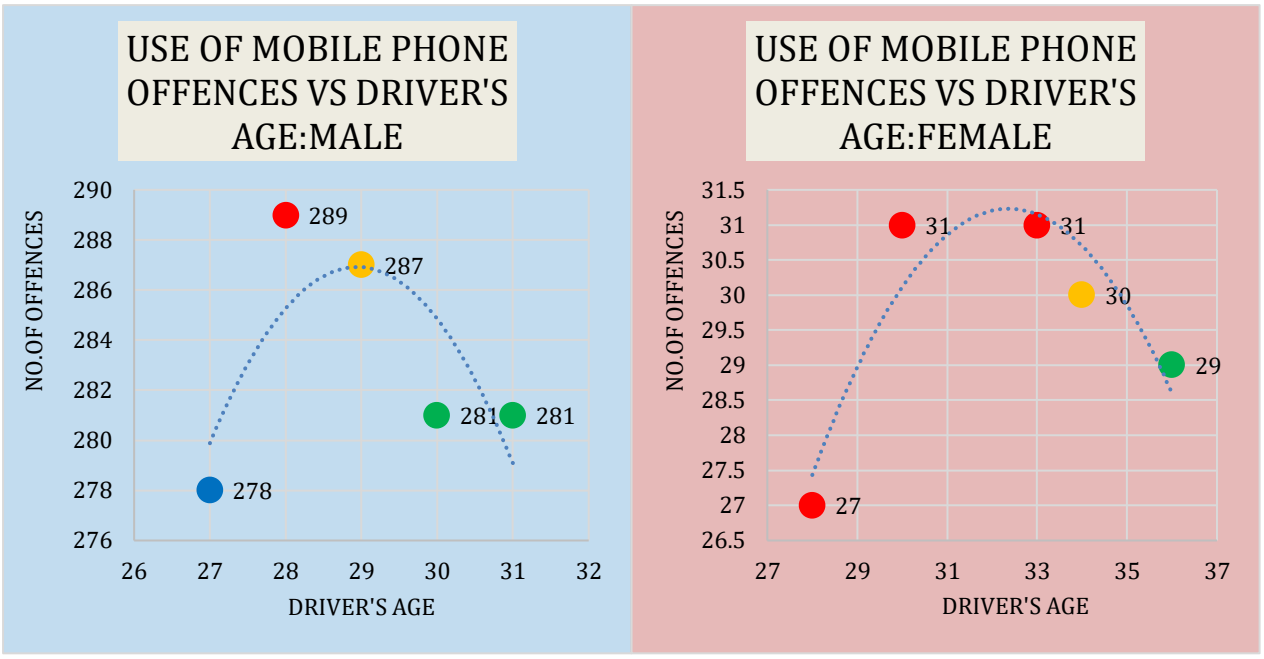


Figure 12: Use of mobile phones while driving vs. driver's age

5.9.2 Driver's Age and Driving Experience on Drink Driving

Out of 5,907 "Drink Driving" offences, 5,609 (95%) of these offences are recorded for male drivers, accounting only 5% for female drivers. Highest "Drink Driving" offences for males were recorded at the age of 29, and 31 for the female drivers (Figure 13).

However, there is a gradual decrease in the 'Drink Driving" offence with increase in age for

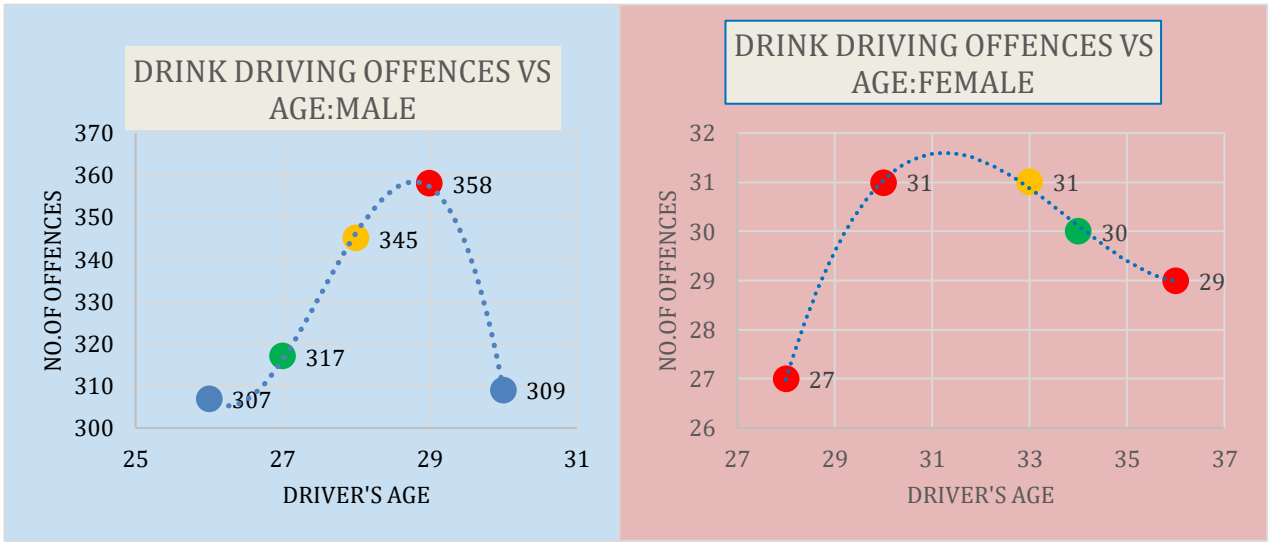


Figure 13:Drink Driving vs.driver's age

both male and female drivers. The age demographic of Drink Driving offenders follows a linear pattern downwards from the age of 29 onwards for male drives, and after 33 years for female drivers. Novice drivers have recorded the highest Drink Driving offence with 705 for male and 48 for female drivers. The data trend however shows a decrease in Drink Driving offences with an increase in driving experience for both male and female drivers (Figure 14).

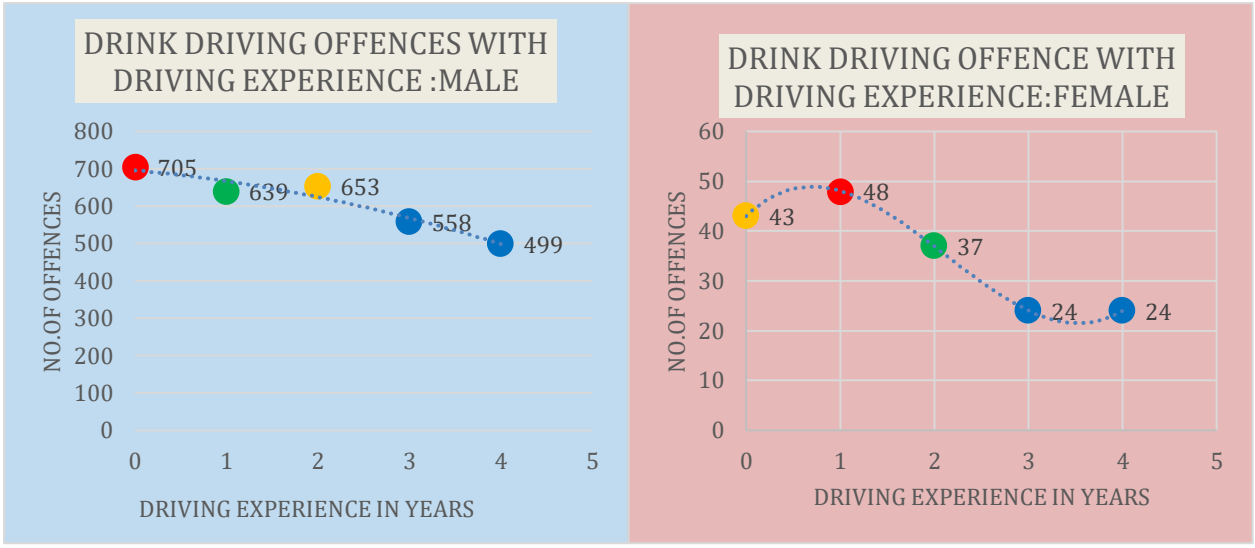


Figure 14: Drink Driving offence vs driver's experience

5.9.3 Driver's Age and Driving Experience on Speeding

Young male drivers (age 26 to 30 years) are heavily involved in "Speeding" violations with 6,648 offences (95%). Though the rate of the "Speeding" offence is not significant for female drivers, drivers aged between 25-36 have recorded the highest offence. The age demographic of this offence follows a linear downwards pattern for male drivers from 27 years onwards and there is no significant age demographic pattern for female drivers (Figure 15).

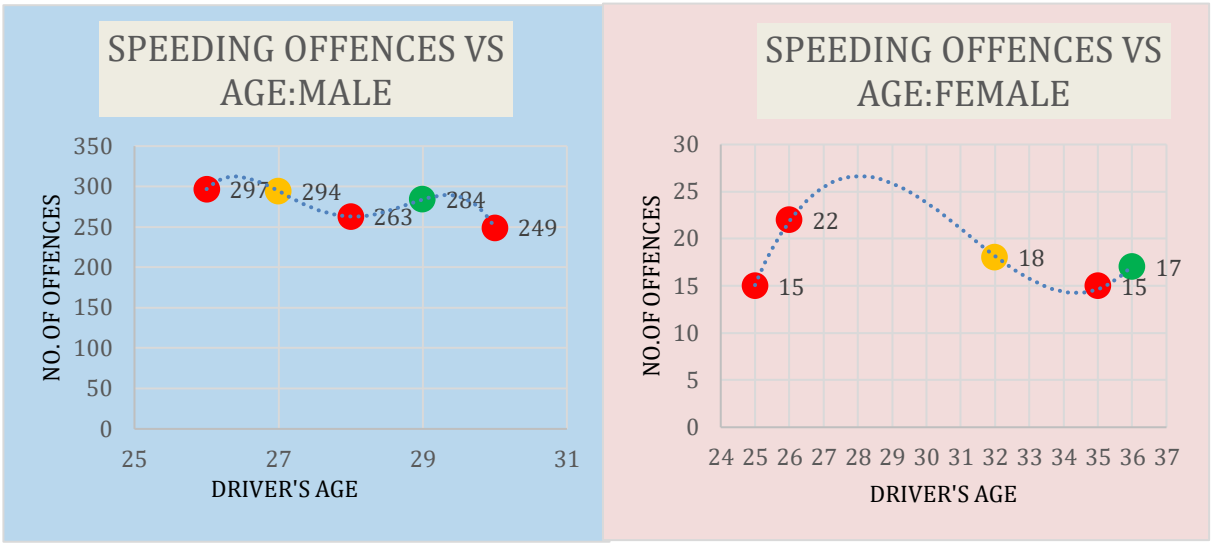


Figure 15: Speeding Offence against drivers' age

Male drivers have recorded highest speeding offence in their first year of driving experience and with an increase in driving experience following a linear downward pattern, indicating that older male drivers are less likely to violate this regulation. Additionally, there is no impact of driving experience on speeding offence for female drivers as the graph below shows almost linear pattern from the day they were issued a driving license (fig. 16). This indicates that the driving experience in female drivers does not influence the speed at which female drive.

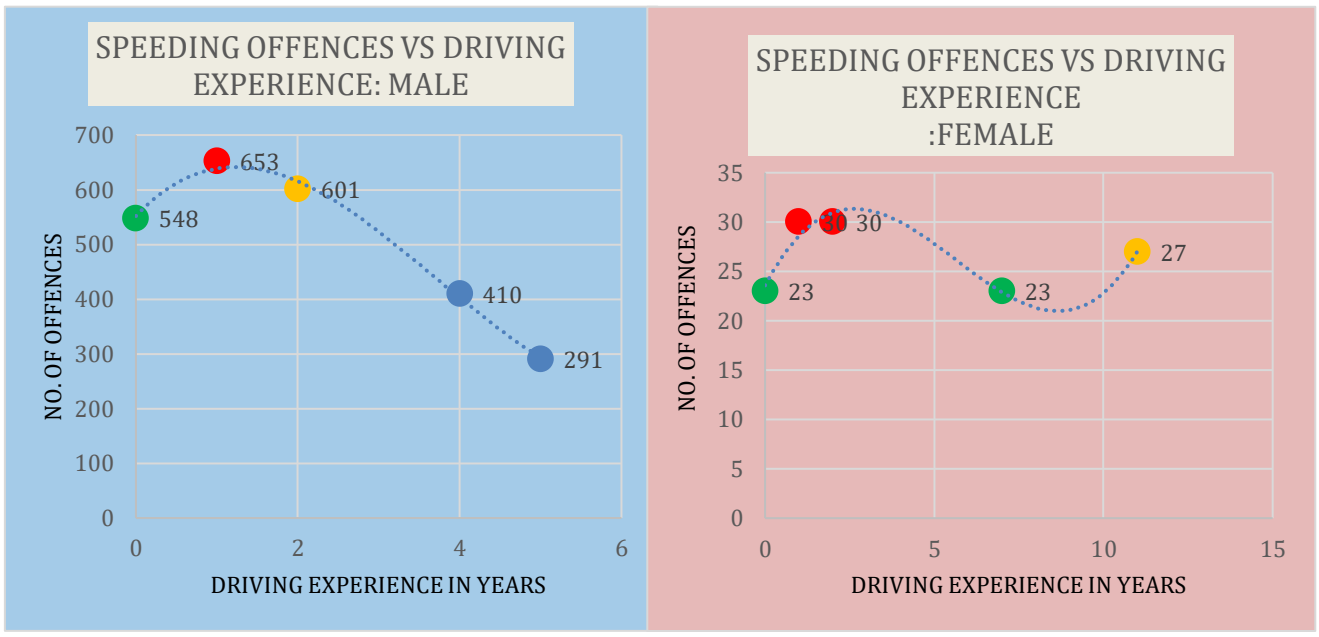


Figure 16: Speeding Offence against driver'' experience

5.10 Drink Driving and Unlicensed Driving Trend

5.10.1 Drink Driving Offences by Month

The highest "Drink Driving" offences were recorded in the month of August with 739 offences, followed by May and July with 709 and 657 offences respectively (Figure 17). It is imperative to further examine these months in order to find out the possible reason behind these high level offences among others.

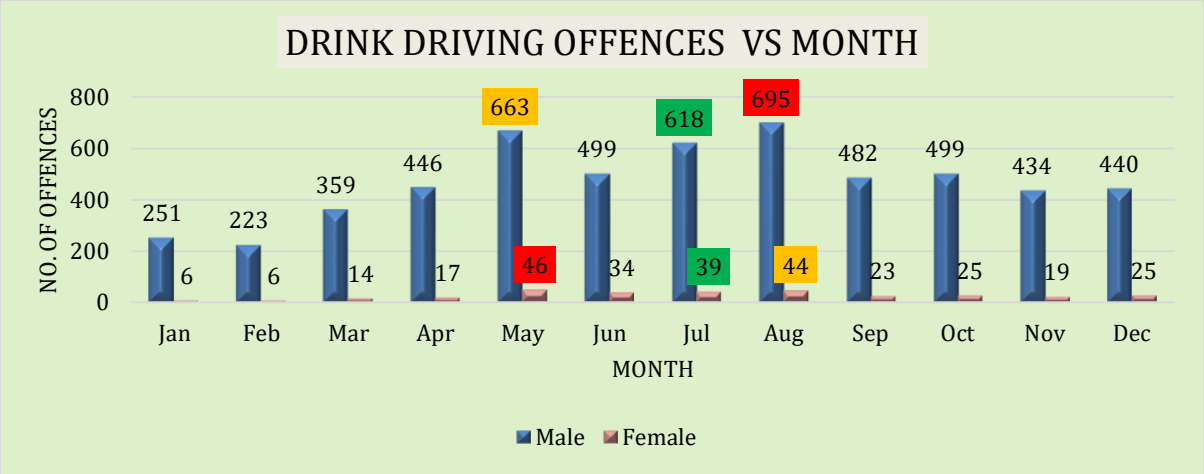


Figure 17: Drink Driving offences per month

5.10.2 Drink Driving by Days

A clear trend can be seen on the days of the week in which the "Drink Driving" offences were the highest. Overall, the three highest weekdays for "Drink Driving" offences were on Saturdays, Fridays and Mondays with offences being 2066, 1859 and 480 as identified with red, yellow, and green labels respectively. However, there is variation between male and female drivers for the highest records of "Drink Driving" offence days with 1,946 offences on Saturdays for male drivers and 122 offences on Fridays for female drivers. It is understandable that a higher number of people drinking on weekends; however, it is crucial to understand the reason behind "Drink Driving" on Mondays (Figure 18).

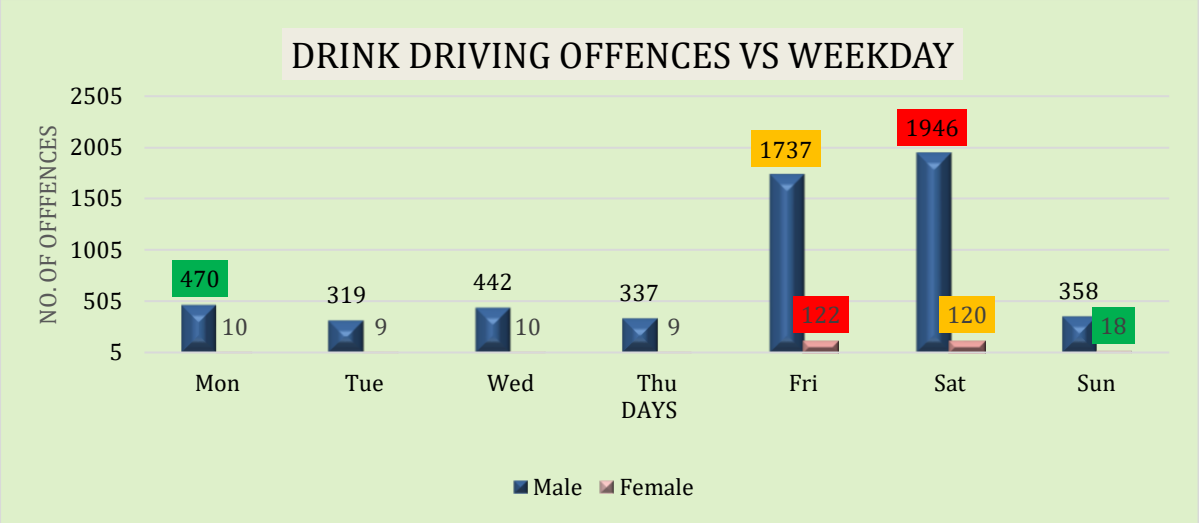


Figure 18: Drink Driving offences per weekdays

5.11 Unlicensed Driving

5.11.1 Unlicensed driving by Year

"Unlicensed Driving" offences have increased every year during the study period except for 2014 with a 76% decrease in "Unlicensed Driving" offences compared to that of 2013. The highest 'Unlicensed Driving" offences were recorded in 2016 with 1,405 offences, that is a 1% increase from 2015, making it the second highest year of "Unlicensed Driving" offences. The sharp increase in the year 2015 could be due to the implementation of "zero-tolerance day" by the traffic police in which every car was inspected for the road safety compliance every Friday (Figure 19).

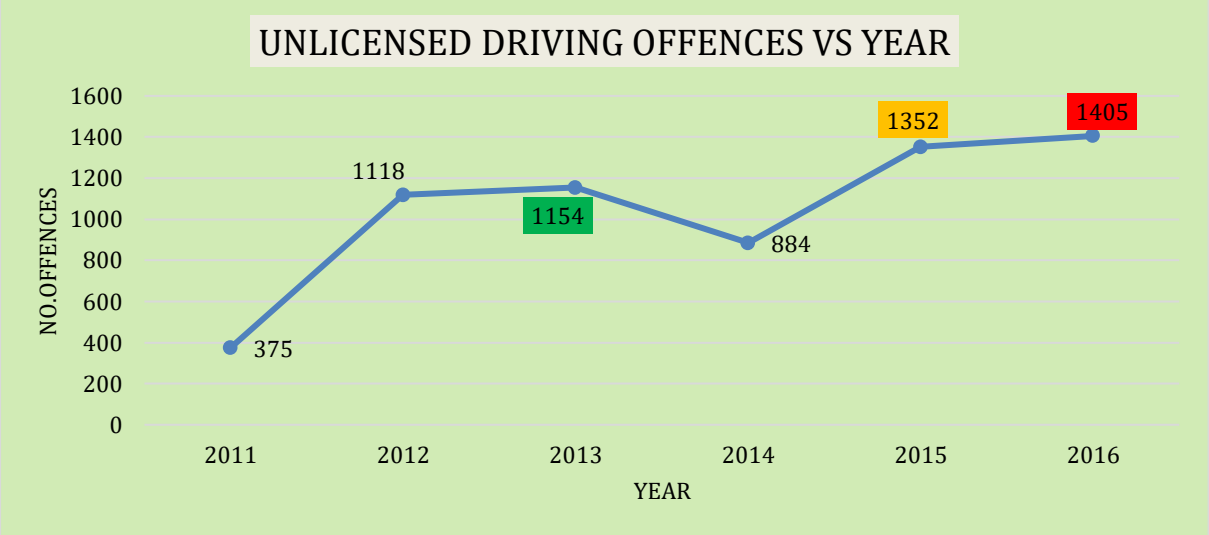


Figure 19: Unlicensed driving per year

5.11.2 Unlicensed Driving by Days of the Week

Similar to trend found with the "Drink Driving" offences, the highest "Unlicensed Driving" days were also recorded on Fridays with 1,407 offences (Figure 20). In absence of appropriate technology to validate "Unlicensed Driving" for "Drink Driving", there is a general perception among law implementers that the "Drink Driving" offender often declare themselves as "Unlicensed Driving" in order to forego a punch in their driving license.

Wednesdays and Saturdays with 964 and 913 offences recorded the second and third highest offence days respectively. Fridays and Saturdays are generally regarded as weekend nights with majority of youngsters and young adults preferring to spend time outside their homes for various reasons.

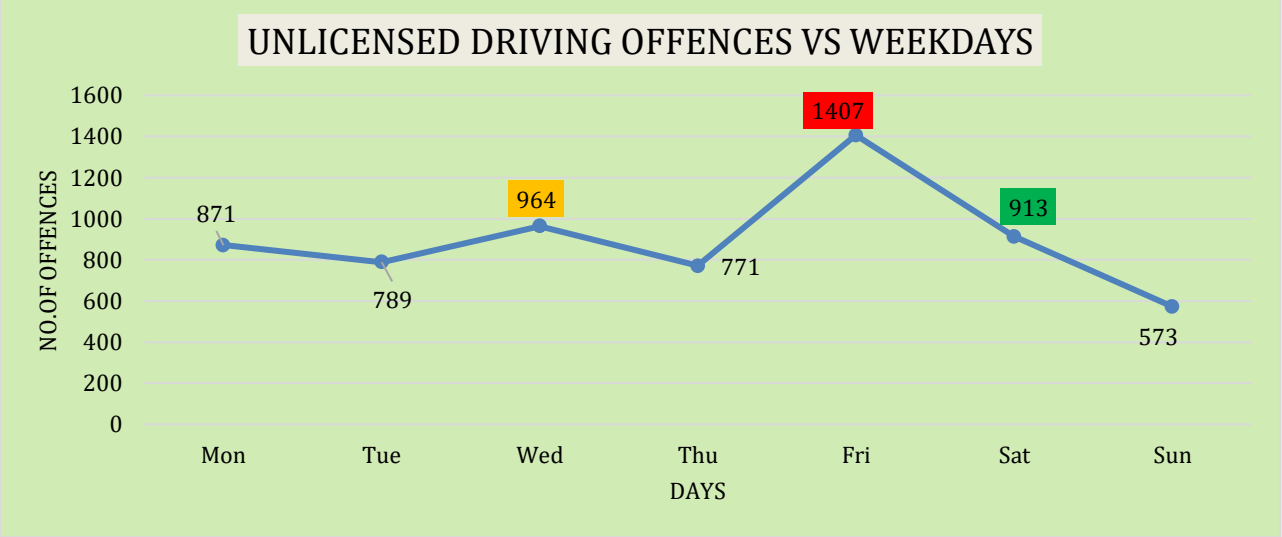
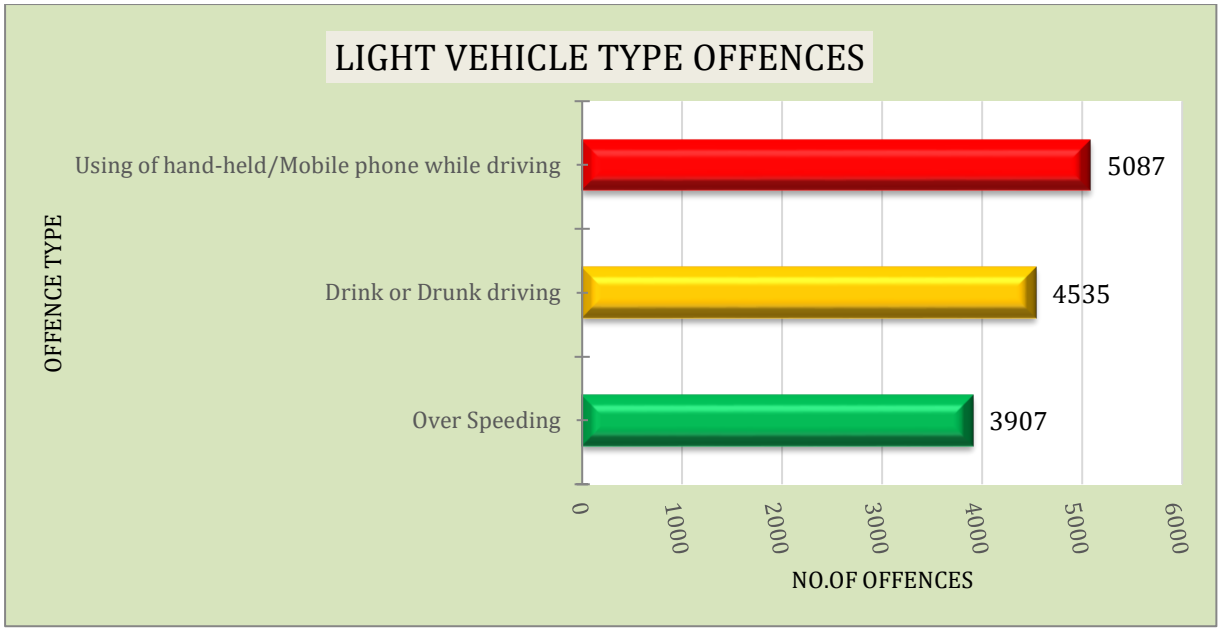
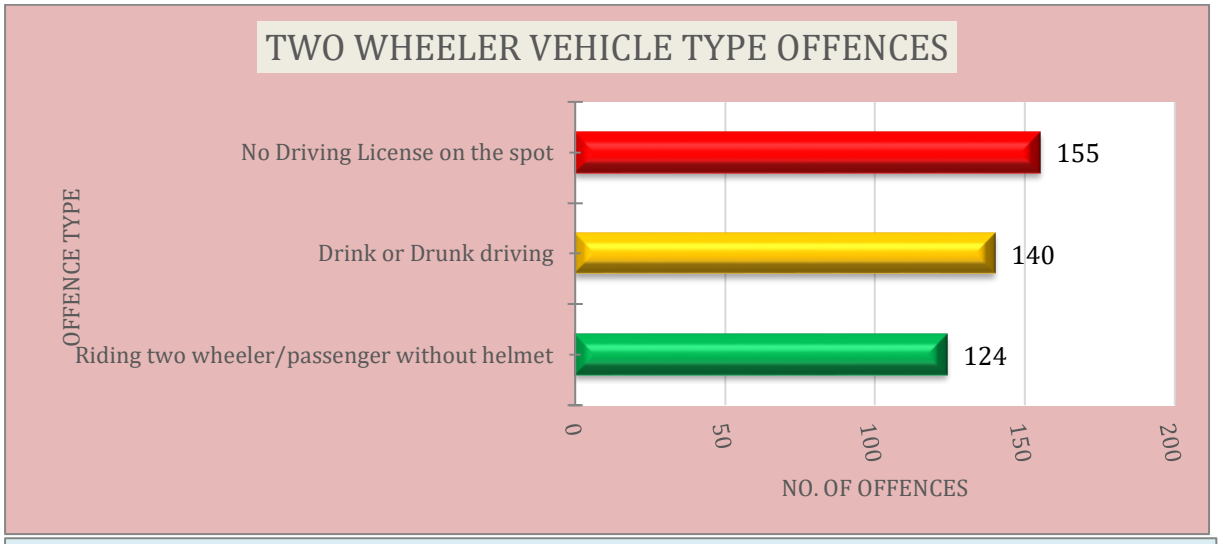


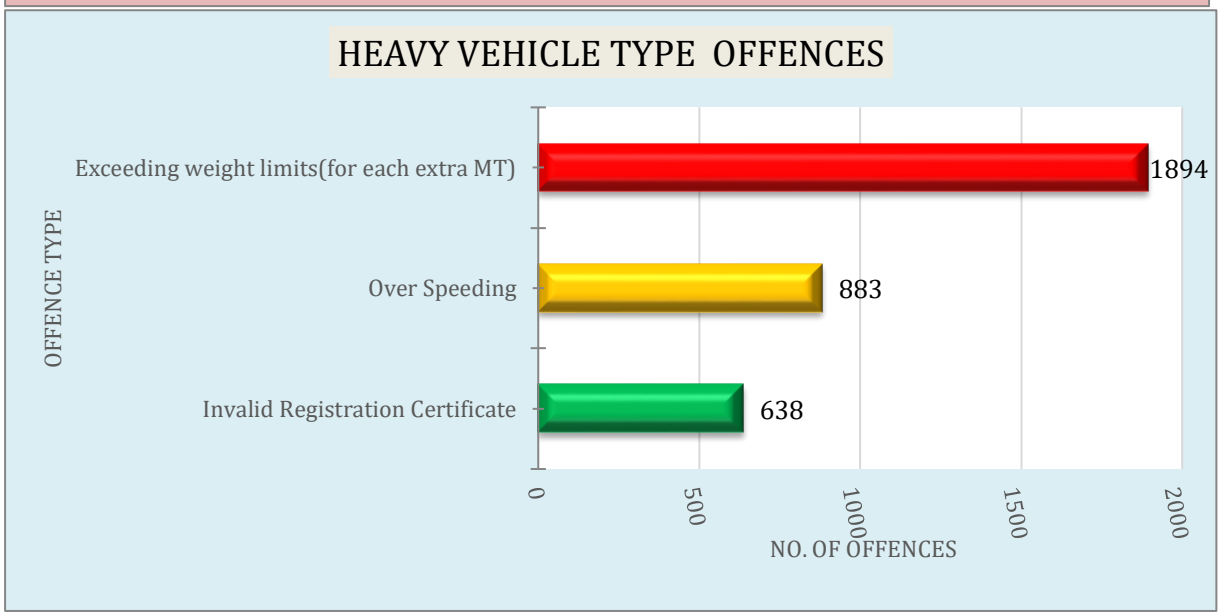
Figure 20: Unlicensed driving vs. days of the week

5.12 Three Major Offences by Vehicle Types

"Speeding" offences are common in all three-vehicle types (LV, MV and HV), while "Drink Driving" offences are more common in LV and Two Wheeler vehicle types (Figure 21). The "Use of Mobile Phone" while driving is recorded highest for the LV, "Exceeding Weight Limit" for the HV, "Carrying Excess Passengers" for MVs and "No Driving License on the Spot" for two wheelers vehicle types.







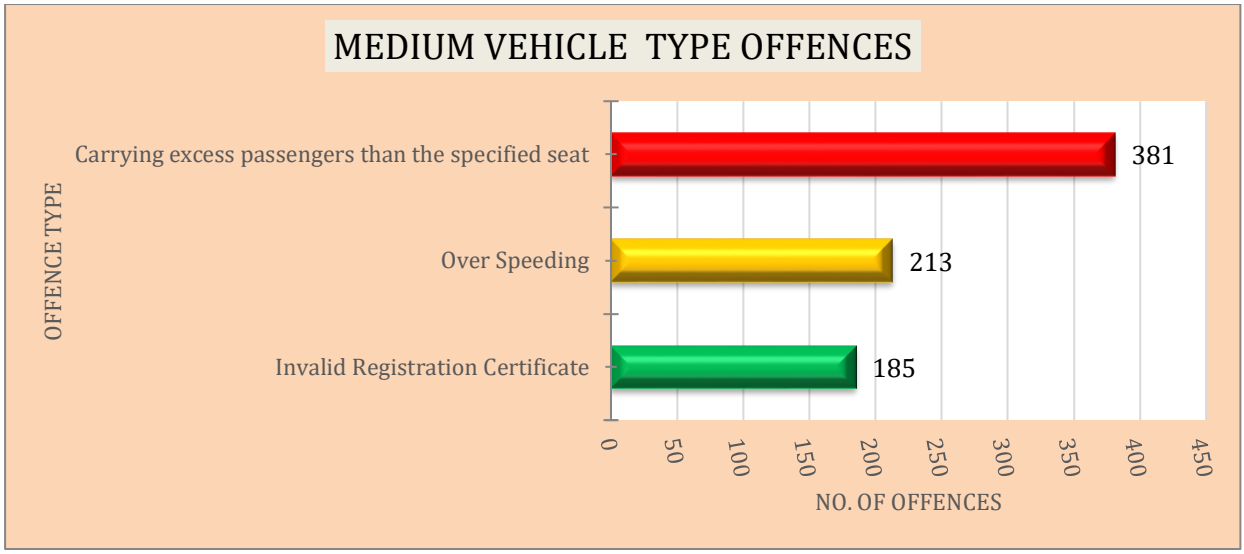


Figure 21: Common offences for non-commercial vehicle types

Figure 22 illustrates the three major offences for passenger carrying commercial vehicle types (taxi, medium and heavy bus), in which "Driver Not in Proper Dress or Not Behaving Properly" is the highest offence recorded. Similarly "Using of Mobile/Handheld Mobile While Driving" is also the highest offence with 224 offences for the government vehicle types, followed by "Carrying Excess Passengers" and "Drink Driving " offences with 175 and 185 offences respectively (Figure 23).

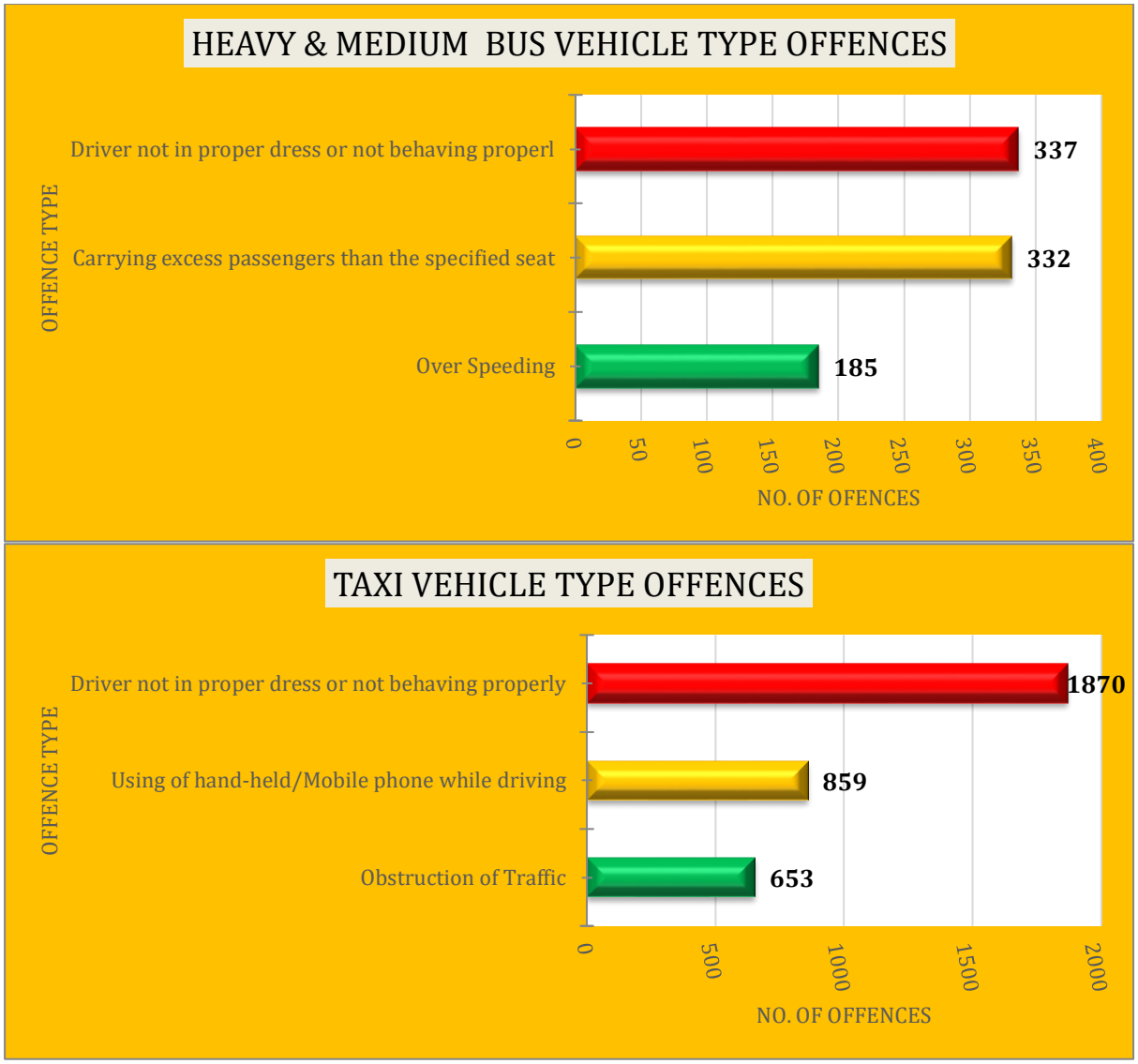


Figure 22: Common offence for commercial vehicle types

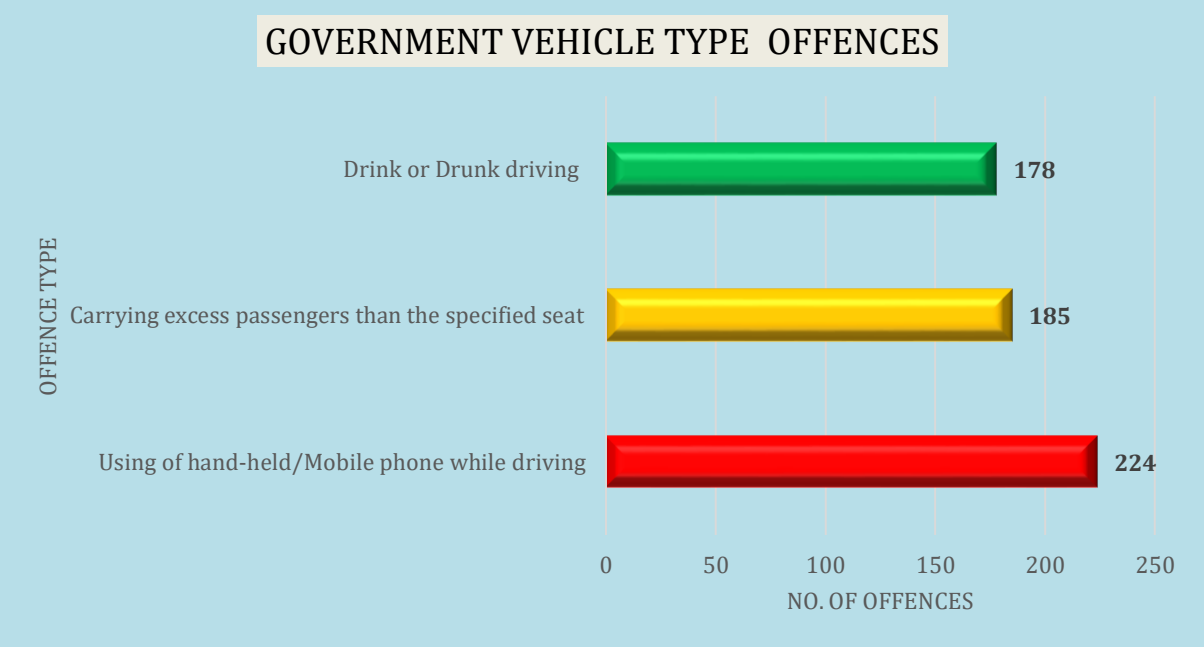


Figure 23: Common offence for government vehicle types

5.13 Repeat Offenders

Out of total 59,746 traffic Offences recorded, 43,225 offences have been contributed to repeat offenders, accounting for 72% of all offences being committed by repeat offenders within this study period (Figure 24 & Figure 25). Overall, 6,244 male and 443 female drivers have repeated traffic offences 2 times, and a single male and female driver have repeated traffic offence as high as 24 and 9 times respectively.

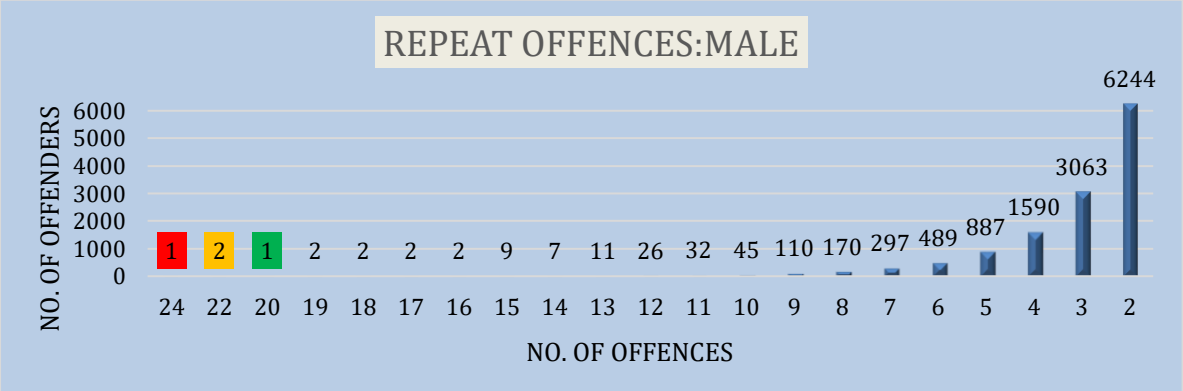


Figure 24: Repetitive traffic offenders for male

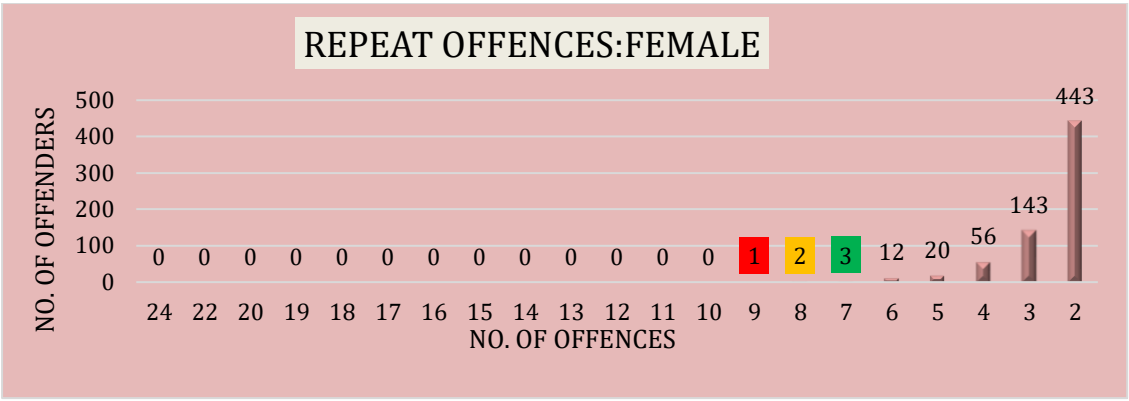


Figure 25: Repetitive traffic offenders for female

Examining the given age group for Repeat Offenders (Figure 26), 14,736 drivers between the age group of 28-32 have committed the maximum number of repeated offences, followed by 12,234 and 11,200 offenders within the age group of 23-27 and 33-37 respectively. On the other hand, the study shows that the incidence of repeat offences gradually decreases with the increase in age. This indicates that only 9.8% of repeat offender cases were recorded from older generations (48 years and above) compared to the younger group.

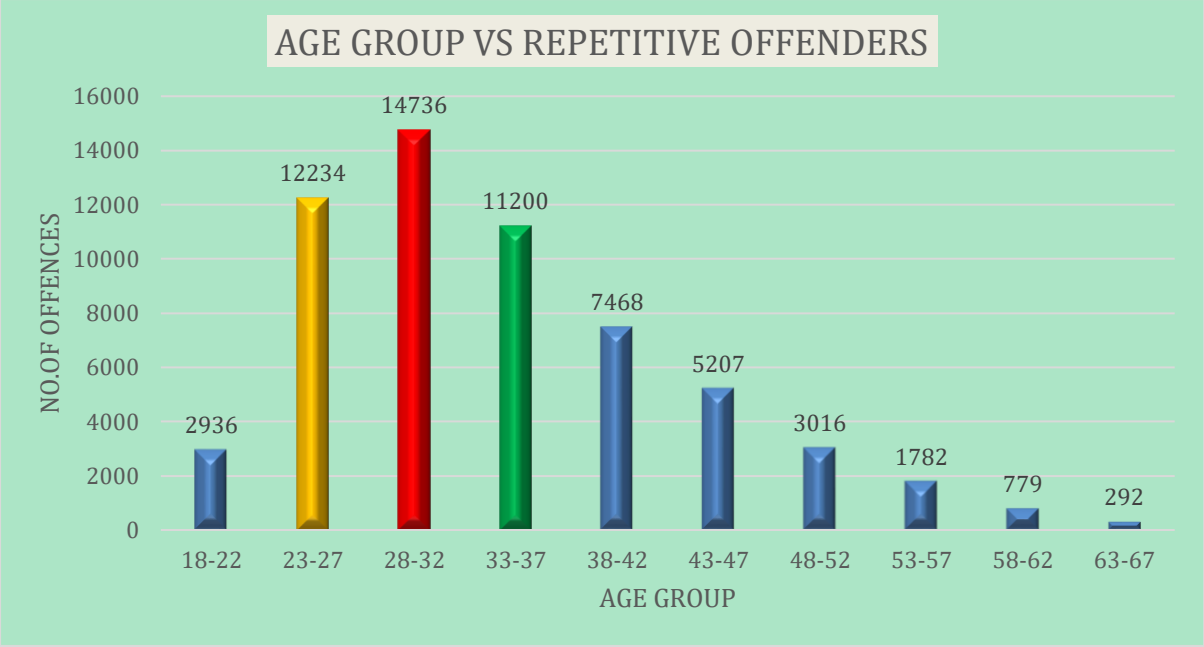


Figure 26: Repetitive offenders vs. age group

5.14 Impact of Refresher Courses

In order to find out the impact of refresher courses on traffic offenders, random data of 1,178 drivers with earlier offence records, who attended the refresher courses during the same period (2011-2016), were evaluated. The findings reveal that only 1% (16 drivers) committed traffic offences after attending the refresher course, while 99% (1,162) of the drivers have not recorded any traffic offence after the course.

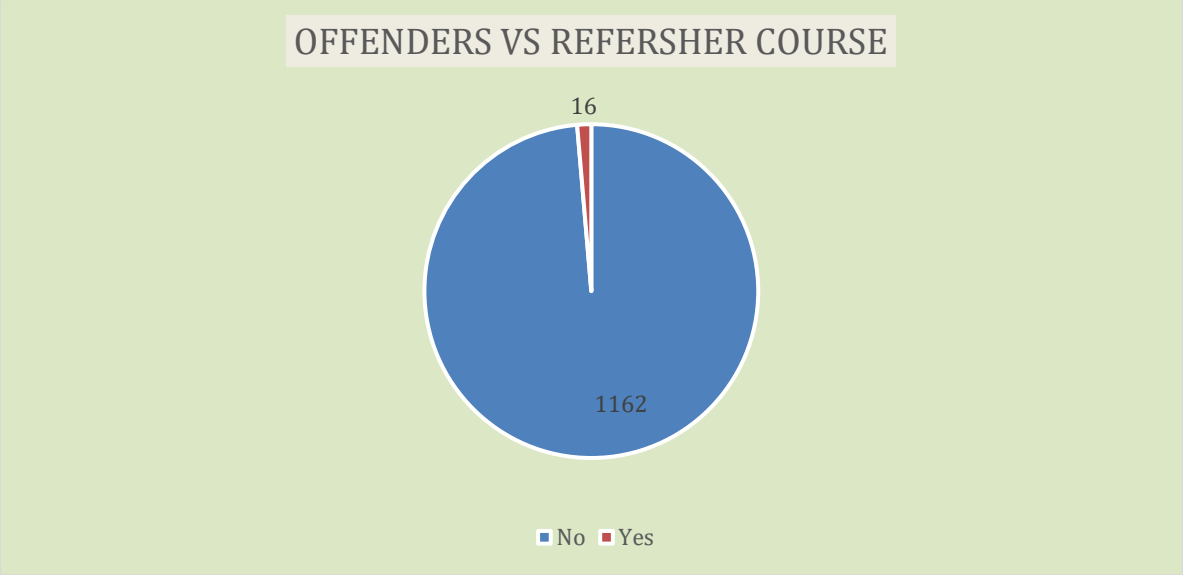


Figure 27: Number of offenders after Refresher's course

6. Discussions & Recommendations

6.1 Enhance eRaLIS System

The enormous potential of eRaLIS is not yet fully utilized, and additionally, more effective functions and procedures need to be developed and implemented to harness this source in support of increased law compliance. With further improvement of eRaLIS system, it will not only facilitate the administration of road traffic legislation, it will also contain comprehensive, accurate and timely data, information and statistics on most aspects relating to road traffic management.

The incorporation of crash details (currently maintained by the RBP) of road accidents in eRaLIS system could also enable the government to find out the relationship between traffic offenders and road accidents.

Since some of the data fields captured by eRaLIS were incomplete or incorrect (data which was removed and/or missing data), there is an urgent need to clean the data to facilitate future use.

The eRaLIS users must accurately update the data (location of the offence, date and time of the offence and offence type) against the offender's license number and not against the vehicle number. Similarly, RSTA must keep proper record of the drivers who have attended the refresher course.

There is urgent need to incorporate point based offence-recording system against traffic offenders in eRaLIS system.

Further, the eRaLIS system should capture important socio-demographic characteristics like ethnicity, education level, marital status, employment status, etc, to enable meaningful and actionable insights to assist MoIC/RSTA in making better administration decisions.

6.2 Introduce smart technologies

In the past we have been relying too much on the human factor in our efforts to manage and control road traffic. Although we will never be able to replace the human element, the time has come to make use of technologies that are available. Current technologies available with RSTA and RBP are not able to close the gap law enforcement officers are facing. A case in point is the finding on "Unlicensed Driving" offence being highest on Saturdays and Sundays. This could mean that Drink Driving offenders could be claimed as Unlicensed Driving in order to avoid heavier penalty of Drink Driving (Nu.1750 and a punch in the license according to the severity of the case). Equipping law enforcement officers with smart technology like data cards and tablet computers would mean gaining roadside access to information about such drivers, vehicles, owners, etc, contained in the eRaLIS and then penalizing accordingly. With smart technologies (not limited to data cards and tablet computers/pocket computers) in place, it is envisaged to bring about a radical change in working smarter and more effectively for enhanced road safety in the country.

In addition to availability of physical smart technologies, mobile applications should be developed and loaded on such Pocket Computers to allow officers to record traffic violations electronically at the road side and transfer the information via a central server to a traffic offence register. This server will amongst others be linked to eRaLIS.

6.3 Increase road safety inspection

From this study we have concluded that Wednesdays, Fridays and Saturdays are the days that have recorded the highest offences within the study period. This could mean that the road safety inspections were carried out regularly on these days being conscious of social nights and its impact on road safety in the country. To ascertain that traffic offences are committed highest on these days or on social nights, there is need to conduct road safety inspection with equal focus throughout the week at least for few years, until next study is carried out to confirm current finding.

6.4 Reinforce the general deterrent effects of laws and their enforcement by conducting periodic, well-designed public education campaigns

6.4.1 Use of hand-held/Mobile phone while driving

Since this is the highest offence committed irrespective of gender, there is an urgent need to educate drivers on the consequences of using mobile phones while driving. Many studies around the world agree that use of mobile phones while driving is dangerous and pervasive (Charlotte, L, 2007, Mazzae, E.N, 2004, and Mc Cartt, A.T, 2003). Researchers estimate that 50 minutes of chatter a month leads to a five-fold increase in the likelihood of a crash (Violanti J.M and Marshall J.R, 2006). Global Status Report on Road Safety also shows that there is a four-fold increase in crash risk when talking on a mobile phone while driving (WHO, 2013, 2015). Public advocacy and education has been effective worldwide in combating this offence. For instance a report by WHO states that high levels of enforcement and continuous public education can reduce, and has been found effective, in reducing Drink Driving offences drastically (WHO, 2010).

Therefore, besides current, and before the introduction of stronger deterrents, there is a need to share sufficient information to drivers on the imminent dangers associated with driving while using a mobile phone through appropriate forms of advocacy materials, which is lacking in the current scenario. To make individuals aware of the equally distracting, and dangerous, risks of Hands-Free Calls, it is important that an advocacy program emphasize the dangers associated with Hands-Free Calling. This will not only reinforce the deterrent effect of the road safety enforcement, but also hopefully contribute to longer-term improvements in community attitudes and values of safe road use.

6.4.2 Drink Driving

Drink driving offences are one of the major risk factors that have direct linkage to vehicle crash occurrence (WHO, 2016). For instance in the year 2015, in the United States, 10,265 people died in alcohol-impaired driving crashes, accounting for nearly one-third (29%) of all traffic-related deaths, and every day about 800 people are injured in Drink Driving crashes (CDCP, 2017). Alcohol takes toll on the driver in different facets and results in poor coordination, poor judgment, and false sense of confidence and overestimation of abilities (YOURS, 2017). All these factors while driving cause accidents and many a times it proves fatal. With current finding on Drink Driving Offences being the second highest offence, it is a serious impediment for the country to establish a safe road for Bhutan.

As recommended by WHO report on Road Safety, public education with effective police enforcement must be repeatedly campaigned with highly visible checkpoints to make enforcement of Drink Driving obvious (WHO 2015). Identifying Sobriety checkpoints would allow police to briefly stop vehicles at specific, highly visible locations to see if the driver is impaired.

The administrative license revocation or suspension laws, which allow police to take away the license of a driver who tests at or above the legal BAC limit for a minimum of 90 days was also found effective in mitigating such offence (CDC 2017).

6.4.3 Speeding

Vehicle over-speeding is one of the main causes of traffic accidents and is considered one of the most serious offences in the world (Alonso et al 2013). The relationship between over speeding and road crashes is often overwhelming and most fatal accidents occur due to over speeding (EU, 2017). The speeding car not only jeopardizes your life but also the safety of other road users and nearby settlements. As the third highest traffic offence in the country, it is obvious that Over-Speeding offences can have negative impact on health and social cost on the society.

Therefore, there is an imperative need to educate the general public for greater attention to road safety and over-speeding through reinforcing the existing deterrent laws and by conducting periodic, well-designed public education campaigns. Dangers associated with such offences should be actively promoted through social programs (including, but not exclusive of children) with widespread educational initiatives so as to alert the public to the existing risks, the need to protect themselves appropriately to reduce those risks, and how enforcement will be increased to help accelerate behavioral changes (awareness raising and influencing acceptance of road safety interventions).

6.5 Incorporation of educational materials in Driver Training Module

In line with the top 3 offences recorded, there is need to incorporate a Driving Curriculum module to educate drivers on the consequences of using Handheld/Mobile While Driving, Drink Driving, and Speeding," and also to seek behavioral and attitude change towards such offence. Such subjects must be reemphasized and incorporated while providing refresher courses for drivers, and provide the offender with the skills they need and strategies they can use to avoid committing further traffic offences.

Since Commercial Passenger Carrying Drivers offence is recorded highest in "Driver Not in Proper Dress or Not Behaving Properly", the commercial drivers needs to be educated on code of conduct outlining their acceptable or expected behavior. The codes of conduct should be communicated/promoted during training period and refreshers course to set clear expectations of behaviour and standards of service of those within the Commercial Passenger Carrying Drivers.

6.6 Strengthen the deterrent effect of traffic offence penalties and sanctions

As a deterrence for general offenders, deterrent effect of traffic offence penalties and sanctions can be strengthened through the adoption of license disqualification for serious offences, graduated penalties for repeat offending, and a demerit point scheme for less serious offences.

6.7 Refresher Course on Traffic Offenders

As shown above, attending a refresher course should be made mandatory for all drivers with one or more offences within the age group of 25-31, since it has the highest offence record. This would also prevent repeat offenders in the future. Although, this method may not be the only internationally accepted method for preventing traffic violations, current evidence does show that such intervention will be sensible in both short and long term approach to reduce traffic offences.

6.8 Collaborate with relevant agencies to improve road safety

Royal Bhutan Police (RBP): Liaise with the RBP to incorporate crash details of road accidents in eRaLIS system to enable the government to find out the relationship between the traffic offenders and road accidents.

Ministry of Health (MoH): coordinate with MoH to include road safety in health promotion and disease prevention activities and also seek MoH's support in campaigning for greater attention to road safety, based on the known health impact and costs.

7. Conclusion

This report attempts to contribute to the body of knowledge on road safety through Descriptive Data Mining, with the data set of 59,746 traffic offences maintained with the eRaLIS system, RSTA from 2011 to 2016. The results from the present study suggest following:

- "Using of Handheld Mobile" as the highest offence.
- The year 2015 recorded the maximum number of offence.
- Categorizing by months and days, May and Fridays recorded the highest offences
- The age demographics between 25-31 have recorded most offences and male drivers dominate the offence figures.
- "Using hand Held/Mobile phone while driving", "Drink Driving" and" Speeding" are the three major offence mostly committed by the novice drivers.

- 99% of the drivers did not commit offence after attending the refresher course conducted by RSTA, indicating the effectiveness of the refresher course on the driver's behaviors.

Accordingly, in line with the above findings, measures such as public advocacy programs, introduction of smart technologies, enhancement of eRaLIS system, increased road safety inspection, and compulsory refreshers course for traffic offenders are recommended with enhanced collaboration and integrated inspection system.

Since road traffic offences are predictable and therefore preventable. It is hoped that this report will encourage and facilitate increased cooperation, innovation, and commitment to preventing traffic offence in the country through close coordination and collaboration, using a holistic and integrated approach, across many sectors and many disciplines.

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