A Study on Motorcycle Rider Characteristic and Behavior in Metro Manila

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Abstract: This study presents essential information on motorcycle rider characteristic and behavior resulting from the questionnaire survey for riders and non-riders that was conducted along the top 5 roads in Metro Manila with the most number of recorded motorcycle road crashes in the past 5 years. The questionnaire has eight (8) sections that focus on rider’s personal details, driving experience and training, riding habit, opinion on road safety, road crash experience, motorcycle preference and anger and aggression test. The results of the rider and non-rider survey were analyzed to yield significant variables influencing motorcycle road crash experience and frequency. A total of 2,000 motorcycle rider participated in the survey and a total of 600 other road users.

Key Words: motorcycle, road crash, behavior, characteristic

1. MOTORCYCLE ROAD CRASHES IN METRO MANILA

The continuous increase in fuel cost and worsening effect of road congestion has influenced the increase in motorcycle registration. The result of this rapid mode shift is the alarming frequency of motorcycle road crashes. Fig 1 presents the trends in gasoline price, motorcycle registration and road crash count.

![Figure 1 Trends in motorcycle registration, road crash and gasoline price](image)

In 2007, a study on the impact of the increasing number of motorcycle in Metro Manila was completed by the researcher, Uy et al. (2007). Incidence of motorcycle road crashes based on severity, road type, time, weather condition, collision type, junction type, traffic control, road crash factors and classification of people involved were presented. The study concluded that
there is a rapid increase in motorcycle registration and as a result significant increase in motorcycle road crashes was reported. The average road crash rate per 10,000 vehicles from 2002 to 2005 was reported to double each year. The increase on motorcycle registration was reported to be 57% each year. The city with most number of motorcycle road crashes was Quezon City. The top three roads with the most number of motorcycle road crashes were Real Street, EDSA and Commonwealth Avenue. In most cases, about 56%, the motorcycle rider is injured and only 1.5% case when riders are killed. About 20.2% cases reported involved killed pedestrian. The top human factor that caused road crash was too fast driving followed by inattentiveness and being too close to other vehicles. Majority of the road crashes happened along major roads at night time. Motorcycle road crashes frequently happen along straight roads and at no junction control. The most frequent collision type was side swipe and this is consistent to too fast riding, inattentiveness and being too close to other vehicles on the road. In Table 1 below, the statistics on motorcycle registration and crash is related to the total population of people in Metro Manila from 2002 to 2009.

Table 1 Population, motorcycle registration and crash statistics in Metro Manila

<table>
<thead>
<tr>
<th>Year</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registered Number of MCCTC (x1000)</td>
<td>1,470.38</td>
<td>1,552.58</td>
<td>1,647.36</td>
<td>2,157.74</td>
<td>2,409.36</td>
<td>2,647.57</td>
<td>2,982.51</td>
<td>3,200.97</td>
</tr>
<tr>
<td>Registered Number of MCCTC</td>
<td>1,470,383.00</td>
<td>1,552,579.00</td>
<td>1,647,361.00</td>
<td>2,157,797.00</td>
<td>2,409,363.00</td>
<td>2,647,574.00</td>
<td>2,982,511.00</td>
<td>3,200,968.00</td>
</tr>
<tr>
<td>Metro Manila Population</td>
<td>9,932,560.00</td>
<td>9,932,560.00</td>
<td>9,932,560.00</td>
<td>9,932,560.00</td>
<td>9,932,560.00</td>
<td>11,566,325.00</td>
<td>11,566,325.00</td>
<td>11,566,325.00</td>
</tr>
<tr>
<td>Motorcycles per 1000 population</td>
<td>148.54</td>
<td>156.31</td>
<td>185.99</td>
<td>217.24</td>
<td>242.57</td>
<td>228.90</td>
<td>257.86</td>
<td>276.75</td>
</tr>
<tr>
<td>No. of Motorcycle Accidents</td>
<td>285.00</td>
<td>542.00</td>
<td>1,746.00</td>
<td>8,037.00</td>
<td>9,744.00</td>
<td>11,158.00</td>
<td>12,699.00</td>
<td>13,561.00</td>
</tr>
<tr>
<td>Motorcycles crash per 10000 population</td>
<td>0.29</td>
<td>0.55</td>
<td>1.36</td>
<td>0.09</td>
<td>9.81</td>
<td>9.65</td>
<td>10.95</td>
<td>11.72</td>
</tr>
</tbody>
</table>

The total motorcycle road crash recorded in Metro Manila Accident Reporting and Analysis System (MMARAS) from 2005 to 2009 is about 55,169.00. There were about 512 fatal, 27,059 non-fatal and 27,598 damage only road crash type based on severity. A crash is classified as fatal when there is at least one casualty who died due to the crash. Crash where there are casualties that are slightly or seriously injured and no death is classified as non-fatal crash. Road crashes that resulted only to vehicle or road facility or structure damage is classifies as damage only to property crash. Quezon City has the highest recorded motorcycle road crash at 14,368 followed by Marikina at 4,525 and Pasig City at 4,465. In terms of severity most motorcycle road crashes are classified as non fatal and damage only. In Quezon City there is almost equal number of damage only and non fatal road crashes at 6,315 and 7,904 respectively. The numbers of damage only and non fatal road crashes in most cities are almost equal. It can be noted that average fatal road crash in each city is about 0.88% of the sum of damage only and non fatal road crash. Fatal road crashes can also be noted to be approximately 2% of damage only or non fatal road crashes. MMARAS records confirmed that motorcycle road crashes mostly involve cars. Car road crash has the most recorded road
crash of the total cases in the last five years. The top road crash factor identified as caused of road crash is too fast driving. Inattentiveness and bad overtaking are other major road crash factors that can be related to training and experience of the rider. Motorcycles also are frequently involved in road crashes because of too close maneuver through other road user. Motorcycle riders can usually go through between other vehicles and this increase the risk of road crash involvement. The third top factor is bad turning. The total estimated cost of motorcycle related road crash in Metro Manila from 2005 to 2009 is estimated to have reached 12.15 Billion Pesos. There has been extensive research effort devoted to improve motorcycle safety considering the vehicle and traffic flow but the relationship between rider characteristic, behavior and crash is still not well understood. It is the objective of this study to present a comprehensive report on motorcycle rider characteristic and behavior and analyze significant variables influencing road crash experience and frequency.

2. METHODOLOGY

The questionnaire survey was conducted at motorcycle parking areas and gasoline stations along the top 5 roads with the most number of motorcycle road crashes namely Commonwealth Avenue, Alabang-Zapote Road, EDSA, Quirino Highway and J.P. Rizal Street. The survey was conducted between June to November 2010.

![Figure 2 Location of top 5 roads with most number of motorcycle road crashes](image)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Road</th>
<th>Required Respondents</th>
<th>Adjusted No. of Respondents (+5%)</th>
<th>Motorcycle AADT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Commonwealth Avenue</td>
<td>381</td>
<td>400</td>
<td>25,593</td>
</tr>
<tr>
<td>2nd</td>
<td>Alabang – Zapote Road</td>
<td>381</td>
<td>400</td>
<td>7,880 (obs.)</td>
</tr>
<tr>
<td>3rd</td>
<td>EDSA</td>
<td>381</td>
<td>400</td>
<td>35,091</td>
</tr>
<tr>
<td>4th</td>
<td>Quirino Highway</td>
<td>381</td>
<td>400</td>
<td>14,832 (obs.)</td>
</tr>
<tr>
<td>5th</td>
<td>J.P. Rizal Street (Marikina)</td>
<td>381</td>
<td>400</td>
<td>6,368 (obs.)</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td>2000</td>
</tr>
</tbody>
</table>

The location of these roads is shown in Fig 2. The questionnaire has eight (8) sections that focus on rider’s personal details, driving experience and training, riding habit, opinion on road
3. MOTORCYCLE RIDER QUESTIONNAIRE SURVEY RESULT

3.1 Personal Details of Motorcycle Riders
Out of the 2,000 respondents 91% were male and 9% were female. The age distribution of the respondents is shown in Fig 4. Majority of the respondents are within the age range of 21 to 35 years old (73%). The average age of the respondents is 30 years old. It can also be noted that there is about 1% of respondents who are below 18 years old.

In Fig 5 it is shown that most of the respondent went to college (60%) and this was followed by high school (35%). On livelihood in Fig 6, majority of the riders are employed (74%) with an average monthly income of PHP 15,530.
Rider’s income and experience is presented in Fig 7 and 8. Majority of the respondent’s monthly income is between PHP 8,000 to 15,000. Most of the respondents have only one motorcycle. Majority of the respondents have 3 to 5 years experience in riding.

The type of motorcycle mostly used by the respondents is a learner motorcycle (125cc or below) at 61% followed by Scooters at 24%. In terms of the make, it is mostly Honda (41%) and was purchased between years 2006 to 2010. The engine size is mostly 110cc and the odometer reading is mostly below 20,000 km.
Summary of details related to purchase of motorcycle is presented in Fig 13 to 14. The price range of motorcycle when purchased is between PHP 40,000.00 to 70,000.00 and was paid by majority on installment terms (65%).

3.2 Training and Experience of Motorcycle Riders
Summary of details related to training and experience is presented in Fig 15 to 17. Most of the respondents have acquired their driving license 3 to 5 years ago. About 80% rode their motorcycle upon receiving their driver’s license. It can be noted that 90% of the respondents confirms they have taken actual examination and 68% was required to pass an actual test ride. The majority of the respondents confirmed that they have taken and passed written examination and test ride for license application but it should also be noted that the percentage of respondents who admitted that they were not required for a test ride is significantly high at 32%. It can be also noted that 62% confirmed that they have not received any formal training. A total of 72% is allowed to use motorcycle of any engine size. It was also determined that 87% is allowed to drive other types of vehicle. Most of the respondents (70%) believe that they ride their motorcycles within 20 kilometers everyday which suggest that the use of motorcycle is used for short distance trips. Most of the respondents confirm that their purpose of using motorcycle is for work or business (49%) followed by personal need (24%) and leisure trips (15%).

![Pie Chart of Payment Type](image1)

Figure 13 Motorcycle payment terms

![Histogram of MC Price](image2)

Figure 14 Motorcycle purchase price

![Bar/Column Plot of multiple variables](image3)

Figure 15 Summary of rider’s response on license exam and training related questions

1 USD = 43.58 PHP
3.3 Motorcycle Riding Habits

On riding habits it was determined that only 38% of the respondent claim that they use bright and reflective clothing at least 50% of the time. About 53% confirms that they use their headlights even during day time 50% of the time. This two items focus on motorcycle visibility on the road. A positive 78% of the respondent confirms they always wear their helmet when riding their motorcycle. A significant percentage of 77% confirms they often change lane at least less than 50% of the time on the road and 75% uses their signal light when they have intention to change lane 50% of the time.

An alarming 73% rides their motorcycle even they are tired and 48% confirms they ride with the influence of alcohol or drugs at least less than 50% of the time.
About 73.80% of the respondents usually go through small spaces between other vehicles on the road and 62% misjudge the speed needed to negotiate bends in the road. 52% overtakes other vehicle on the road that is over the allowed speed limit and usually (71.32%) overtake more than two vehicles.

3.4 Opinion on Road Safety
The top 3 most important safety measures for motorcyclist are regular maintenance (15.60%), wearing of helmet and other protection (15.48%) and no riding when in the influence of alcohol (15.37%). The top 3 least important safety measures for motorcyclist are driving when tired (16.12%), prohibit motorcycle along major roads (14.40%) and exclusive lanes for motorcycle (13.91%). On the question of the most likely category of road user to cause road crash with motorcycle rider’s a surprising 44.63% believes it’s also motorcycle riders this was followed by bus or truck (28.60%) and cars (14.03%). The perceived most frequent road crash type is bad overtaking (31.91%) followed by side-swipe (18.65%) and misjudging bends (13.68%). Majority of the respondent’s (97.67%) use motorcycle helmet. The most frequent helmet colors used are black (33.45%), red (23.88%) and blue (21.75%). Majority of respondents helmet cost between 500 to 1,500 Pesos (52.26%) and 72.89% of the respondents stated that they were offered by the motorcycle supplier a helmet. Majority of the respondents (76%) believes they use standard and good quality helmets. About 24% of the respondents admit they do not use standard helmet and most of them confirms that the cost of helmet is the main reason for this.

3.5 Road crash Experience
As shown in Fig 22, a surprising 29% of the respondents admit they have experience motorcycle road crash. In terms of severity there are about 6% fatal, 49% non fatal and 45% damage only. Majority happened at night time but there is only small difference in count and can be considered statistically even.

The weather condition during the accident was usually rainy (46%) and sunny (44%). The location and junction type was frequently at straight sections (52.39%) and intersections (31.39%). Top 3 cause of collision are alone and no collision (45.40%), fallen back rider or things (18.42%) and side-swipe (7.28%). Top 3 human factors that cause road crash are too fast riding (18.81%), out of control (8.65%) and too close riding (8.35%).

3.6 Anger and Aggression Test
The anger examination was made using the Deffenbacher Driving Anger Scale (Deffenbacher et al., 1994). The respondents were instructed to imagine that each of the enumerated situations described in the survey instrument was actually happening to them and they were required to rate the amount of anger that would be provoked. The anger assessment tool makes use of a 5
point scale. To determine the anger score, the sum the ratings for the 14 road situations stated in the survey questionnaire was computed. The highest possible score is 70 points. The summary of the result is presented in Fig 24 below. The aggression examination was made using the Aggression Questionnaire of Buss & Perry (1992). Using a 5 point scale, the respondents were required to indicate how uncharacteristic or characteristic each of the enumerated statements is describing them. The Aggression scale consists of 4 factors, Physical Aggression (PA), Verbal Aggression (VA), Anger (A) and Hostility (H). The total score for Aggression is the sum of the factor scores. The highest possible score is 135 points. The summary of result is presented in Figure 25 below. One of the aims of the research is to compare the anger and aggression score of motorcycle riders with other road users. The summary of results are shown if Fig 24 and 25. It can be noted that using the anger scale test, results showed that other road users except bus drivers has higher anger score than motorcycle riders. These results would suggest that given a situation on the road, the other road users will feel and express anger more rapidly than motorcycle riders. In terms of aggression, motorcycle riders average total score is the lowest among considered road users. This result would suggest that motorcycle riders are exposed to more aggressive road users. The aggression test results would somehow provide us information on determining the most possible initiator of a road crash.

Figure 24 Average score for Driving Anger Scale for all respondents

Figure 25 Average score for aggression test for all respondents
4. RIDER CHARACTERISTIC AND BEHAVIOR INFLUENCING MOTORCYCLE ROAD CRASH EXPERIENCE AND FREQUENCY

4.1 Significant Variables Influencing Rider Road Crash Experience

Using the result of the motorcycle rider questionnaire survey the incidence of road crash experience based on rider characteristic and behaviour was analyzed. Variables derived from the result of the survey were screened to eliminate insignificant factors. T-test revealed significant difference in the mean of rider’s age with and without road crash experience. This suggests that younger riders at age 22 to 37 experience road crash. Figure 26 presents the histogram of rider’s age and relevant statistical results.

Figure 26 Histogram of rider’s age (with and without crash experience)

The observation on the age range of riders with crash experienced is confirmed by the MMARAS record. Out of almost ten thousand cases wherein the investigator was able to include the age of riders involved in the crash the age range of 22 to 37 is confirmed. T-test result presented confirmed that there is no significant difference between the mean of the rider’s age with crash experience from the questionnaire survey result and MMARAS age data. Figure 27 presents the histogram of rider’s experience in years. The mean of experience in
years for rider’s with and without road crash experience were revealed to be significantly different. The result suggests that a chance of road crash experience is negatively influenced by more years of riding. The result of the aggression assessment between riders with and without road crash experience is revealed to be significant in the variable screening process. The aggression score data for rider’s with and without road crash experience is presented in Figure 28. The data passed the normality test. The result suggests that riders with road crash experience have higher aggression scores.

Figure 28 Histogram of aggression score (with and without crash experience)

Figure 29 Histogram of verbal aggression score (with and without crash experience)

Figure 29 to Figure 31 presents the detail of the aggression score through the examination of the four areas of aggression. Analysis revealed verbal, anger and hostility as significant aggression factors. Verbal aggression score is a measure of rider’s tendency to be verbally argumentative. Figure 29 presents the data and statistics on verbal aggression for riders with and without road crash experience. Anger score measures rider’s anger-related arousal and sense of control. Figure 30 presents the histogram of anger scores for riders with and without road crash experience.
crash experience. There is approximately one point difference between the means. Hostility score is a measure of rider’s feelings of resentment, suspicion and alienation. These feelings seriously undermine physical and psychological health. Figure 31 presents the histogram of hostility scores for riders with and without road crash experience. There is an observed 2 point difference between the means.

![Figure 30 Histogram of anger aggression score (with and without crash experience)](image1)

![Figure 31 Histogram of hostility score (with and without crash experience)](image2)

### 4.2 Significant Variables Influencing Rider Road Crash Frequency

The riding habit score derived from the questionnaire survey passed the variable screening requirement. The riding habit score range is +20 to -20. Positive value denotes good riding habit and vice versa. It can be noted that roads with more positive riding habit score has lesser motorcycle road crash count. This is presented in Figure 32 below. Aggression level is observed to have very large influence on motorcycle road crash count along roads. Figure 33 presents the linear relationship between aggression score and road crash count with correlation coefficient R of 0.6691. It can be stated that aggression score has a very large effect on road crash count. Aggressive drivers have the tendency to be easily provoked under various negative traffic and road conditions. This can be related to the top human factors that caused
road crash that is presented in chapter III. Over speeding and riding too close to other vehicles can be considered as rider’s response to negative traffic or road conditions. Larger aggression score corresponds to higher road crash count because of negative responses of riders that contributes to occurrence of road crash.

**Figure 32 Scatter plots & statistics of average riding habit score & crash count**

Among the four areas of aggression measure, anger and hostility can be noted to have large influence on road crash count. The higher anger score corresponds to quicker anger development resulting to negative responses that contributes to road crash occurrence. Figure 34 and 35 presents a good model on the influence of anger and hostility aggression score with a coefficient of correlation R of 0.6413 and 0.7447 respectively.

**Figure 33 Scatter plots & statistics of average aggression scores & crash count**

Among the four areas of aggression measure, anger and hostility can be noted to have large influence on road crash count. The higher anger score corresponds to quicker anger development resulting to negative responses that contributes to road crash occurrence. Figure 34 and 35 presents a good model on the influence of anger and hostility aggression score with a coefficient of correlation R of 0.6413 and 0.7447 respectively.
5. CONCLUSION & RECOMMENDATIONS

Since, motorcycle is considered as the most vulnerable and unstable vehicle on our roads, the Land Transportation Office should require all motorcycle rider license applicants to attend and complete a mandatory training program on road safety and proper riding habits prior to filling of application. It should be noted that based on the results, there is 62% of respondents of the questionnaire survey who admitted that they had no formal training but passed the licensure examination. The training program should also include knowledge and behavioural assessment like the anger and aggression test. The result of aggression test will aid in determining proper training to be given to riders. The adoption of aggression score requires the development of a scale to further differentiate level of aggression and recommend appropriate training that will
be required to minimize probability of road crash experience. The riding habit score have shown significant influence on crash frequency. The developed riding habit assessment tool adopted in the study as part of the questionnaire may be further enhanced and adopted for rider licensure examination. Researches that would allow collection of actual blood pressure or heart beat during drive test should be conducted for a more in-depth analysis and understanding on rider’s behaviour and its influence to road safety. Rider’s age was found to be significant in motorcycle crash experience and severity. It is recommended that accident insurance should be promoted or if possible required. It should also be noted that majority of the respondents used motorcycle for work or business. Thus, the cost of insurance should be shouldered by the employer or company. Business that require their employees the use of motorcycle should ensure that fatigue, stress and exposure is considered and addressed. Further study on this area may be considered by researchers to determine the implication of motorcycle riding as required by an individual’s work. Since there is an alarming percentage of a rider who claimed that they ride even under the influence of alcohol, initiatives should be implemented to address this problem. Concerned agencies should support laws prohibiting driving under the influence of alcohol or drugs and work for its immediate approval and enforcement. Amendment on the helmet law should be done in order to make standard helmet a required protective gear when purchasing a motorcycle. All motorcycle suppliers should automatically include the purchase of standard helmet. The cost of standard helmet should be included in the total purchase price or package. This recommendation is supported by the result of the questionnaire survey wherein significant number of respondents considered cost as the major reason why they do not use standard helmet. In our current state, riders have the option not to buy standard helmet because it is not required during purchase of the motorcycle. Concerned government agencies and motorcycle associations should promote motorcycle visibility and protection on the road through various initiatives like trainings and seminars. Reflective or bright clothing should be promoted among motorcycle riders and the use of signal and head light. Initiatives like the “Helmet and Headlight ON” (H20) is an excellent example. To further improve motorcycle visibility, motorcycle manufacturers and suppliers in the Philippines should be required to design the motorcycle to automatically turn on its head light when engine is on and signal light during left and right manoeuvres. This specification will significantly improve motorcycle visibility and avoid motorcycle road crash along narrow and congested roads. The most significant factors that was found to influence road crash experience are rider’s age, experience in years and aggression scores. It should be emphasized that the aggression scores significantly differentiates riders with and without crash experience. The result of analysis concludes that younger and aggressive riders are most likely to experience road crash. The most significant factors that influence motorcycle road crash frequency are riding habit score and aggression scores.

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