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Enhancement of Road Safety in the University of the Philippines Diliman Campus through Effective Data Management

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Abstract: An effective road safety program must be supported by accurate and timely data that can enable users to identify road safety problems and risks, set targets, formulate strategies, develop interventions, and monitor road safety actions. If the data cannot determine the causes of the problem, a review should be done to assess the lacking variables. Some of the road safety interventions may not be applicable not only because the strategies are ineffective but also because the data are not substantial enough or the decisions made were not based on the data. This paper identifies existing road crash data elements of the U.P. Diliman Police (UPDP) and its potential use in identifying road safety problems and formulating strategies. For the purpose of data uniformity and combining sub-national datasets, the data elements of the UPDP are compared with the dataset of the Metropolitan Manila Development Authority (MMDA) as it is where all road crash data in Metro Manila, with the assistance of the traffic enforcement unit (TEU) of the Philippine National Police (PNP) are being forwarded and analyzed. The road crash data from the UPDP were collected, processed, and analyzed. ArcGIS software was used to produce heat maps to visualize concentration of data points. After the analysis, the lacking variables such as road-related data and weather and light conditions were identified, which may be useful to recognize the causes of the problem. The analysis also showed that the accident-prone areas are consistent every year, which may mean that actions for prevention of road crash may not be available or effective. This signifies that data are essential in coming up with road safety interventions to be implemented.

Keywords: road crash, road crash data, road safety, road safety management

1. INTRODUCTION

Road traffic accident has been a serious problem worldwide. The World Health Organization's (WHO) Global Status Report on Road Safety 2018 says that the number of road traffic deaths on the world's roads remain unacceptably high with 1.35 million deaths per year, making it the 8th leading cause of death for people of all ages.

The Philippines has shown worrying figures from the Philippine Statistics Authority (PSA) reflecting the increasing number of deaths due to road crashes. There were 6,869 deaths recorded in year 2006, which increased to 10,012 deaths in 2015.

In Metro Manila alone, a daily average of 299 road crash incidents is reported by the Metropolitan Manila Development Authority (MMDA) from 2010 to 2016. It showed a 14.33% increase of road crashes in the National Capital Region from 95,615 in 2015 to

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109,322 in 2016. Of the 109,322 road crashes, 426 were fatal while 16,416 were non-fatal. Of the 109,322 road crashes, 68,499 cases happened during day time (6:00 AM to 5:00 PM) while 40,823 cases occurred during night time (6:00 PM to 5:00 AM). These numbers indicate the gravity of the road safety condition in the country.

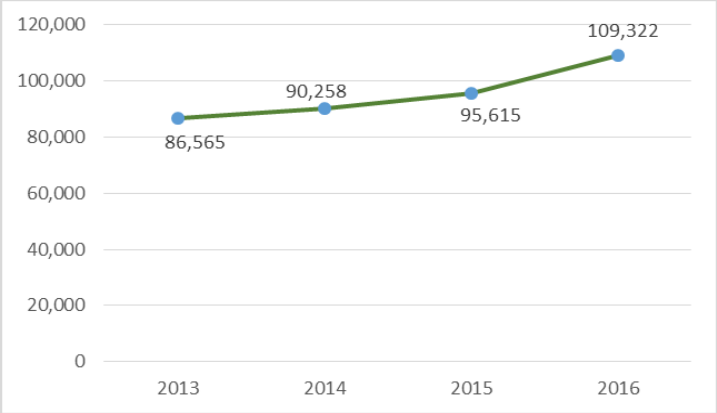

Figure 1. Road Crashes in the National Capital Region (2013-2016)

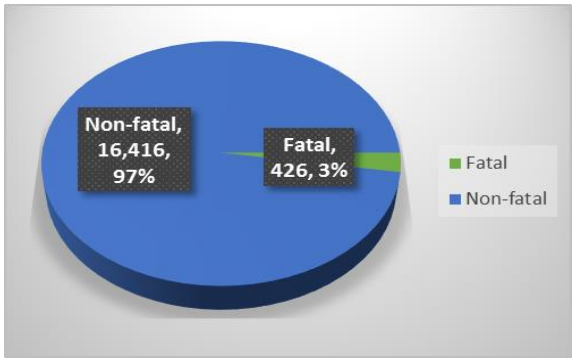

Figure 2. Number Fatal and Non-fatal Injuries from 2016 Road Crash Data

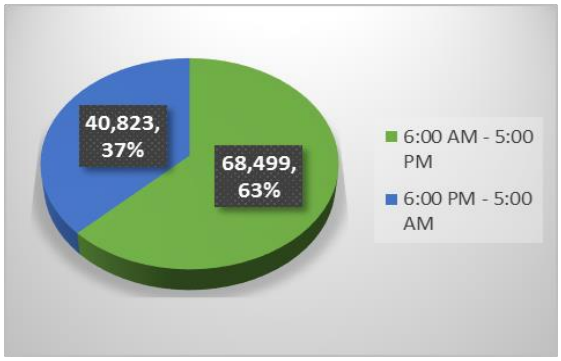

Figure 3. Number Road Crashes by Time of the Day from 2016 Road Crash Data

Road traffic injuries are the leading cost of death for children and young adults (5-29 years of age), that's why it is also important to improve road safety in campuses (WHO, 2018).

In 2008, the Office of the Vice Chancellor for Community Affairs (OVCCA) in cooperation with the Automobile Association of the Philippines (AAP) and U.P. Diliman's National Center for Transportation Studies (NCTS) implemented the U.P. Diliman Traffic Safety Model Zone, a scheme aimed at making U.P. Diliman a "model campus in road traffic management and safety."

An effective road safety management requires data that can enable users to rely on it for accuracy, identify road safety problems and risks, set targets, formulate strategies, and develop interventions, and monitor road safety actions.

A common dataset composed of minimum data elements (variables) will be a key tool to ensure that appropriate data are captured to enable analysis and maximize the consistency and compatibility of data collected across different jurisdictions, whether modifying an existing system or building something new. The purpose of defining minimum data elements and specifying uniform definitions and criteria is to provide a dataset to road traffic crashes, and the injuries from them, which will generate the information necessary for national analysis and road safety improvements. Uniformity of crash data is essential when combining sub-national datasets, and for international comparisons (WHO, 2010).

Research Objectives

The general objective of the study is to evaluate the road crash data management of the UP Diliman. To achieve this, these are the specific objectives:

1. To understand how road crash data in U.P. Diliman are being collected;
2. To determine and compare existing road crash data elements collected by the UPDP with the MMDA;
3. To identify variables that can improve the usefulness of the data collected; and
4. To know how road crash data are being used in the formulation of road safety interventions in the campus.

Significance of the Study

It is hoped that the results of the study will help the UPDP improve its collection and recording system with the end view of enabling researchers and administrators to use the data for analysis and formulating possible interventions. By having data-driven decisions, it can be assured that the problems are addressed with the right interventions and that the budget is not wasted on projects that could not really solve the problem.

2. CONCEPTUAL FRAMEWORK

The conceptual framework shows the road safety management process. It starts with collecting baseline data, analyzing data, setting targets and formulating strategies, implementing targets and strategies, and monitoring and evaluating the implemented interventions.

During the entire process, it is important to assess the datasets to determine whether the existing variables are sufficient to identify the causes of the problems and the factors affecting them. The framework suggests that the question “Are the data enough to identify the problem?” has to be asked after the analysis and after the monitoring and evaluation.

The authors believe that asking this question after the analysis is beneficial because it is in this stage that the problems are more likely to be identified and the factors affecting it need to be acknowledged as well. It is suitable if the data can explain the occurrence of the problem. In cases where the causes of the problem can’t be determined, this is when additional data elements can be added. It is better to identify the necessary data elements early to facilitate modification at the beginning of the process.

In order to achieve the research objectives, and to respond to the questions the authors seek to answer, this framework focuses on the half side (green) of the road safety management process. As illustrated, this paper shall show the importance of data collection and analysis in formulating strategies.

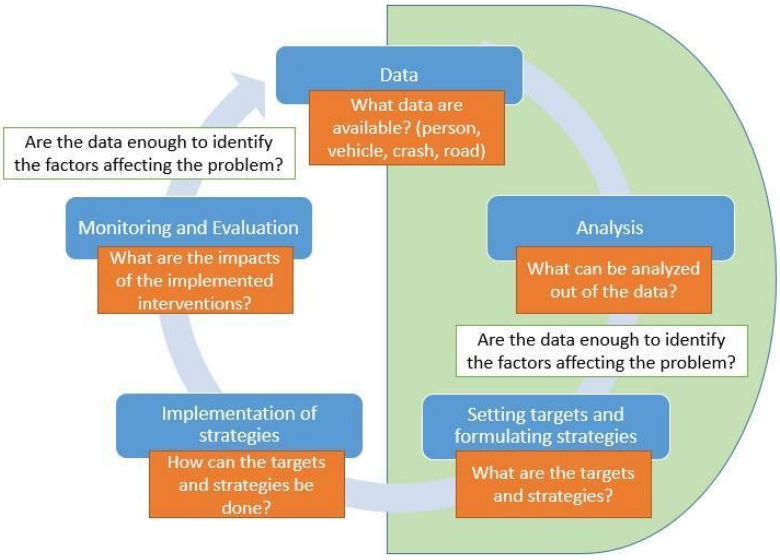

Figure 4. Conceptual Framework

3. METHODOLOGY

Road crash data reported by the UPDP and MMDA were collected to identify the data elements for comparison and to see how reporting can be made consistent. Moreover, the researchers attempted to analyze and interpret the road crash data that are available from the UPDP from year 2014 to 2017. This helped determine what can be carried out in light of the existing dataset and identify data gaps that should be included in the collection of data, which will be useful in diagnosing the real problem. To support the data, maps were also created using ArcGIS to show visual presentations of where road crashes are concentrated.

Key informant interviews (KII) were conducted with the UPDP personnel to map the procedure for road crash recording system and the data being collected. The data elements of the U.P. Diliman road crash recording system are then compared with the MMARAS of MMDA.

Interviews were also conducted in the offices that belong to the Transportation Committee of UPD to know how road crash data are being used in the implementation of interventions in the campus.

4. RESULTS AND ANALYSIS

<u>Road Crash Recording Procedure in U.P. Diliman</u>

The UPDP collects road crash data using cellphone, tape measure, and camera. The Police Officer manually records the data in the accident report form. The data from the accident report form are transferred into the office's database (MS Word file).

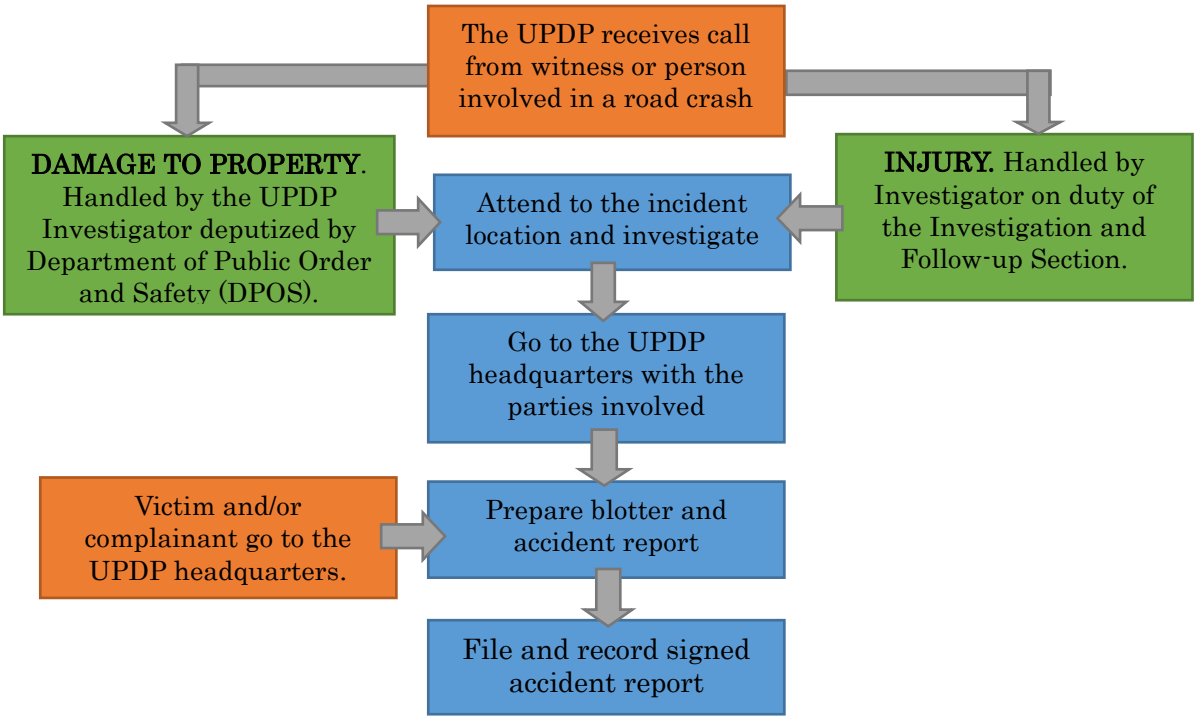

Figure 5. Road Crash Recording Procedure of the UPDP

Road Crash Data of the MMDA and the UPDP

Table 1. Road Crash Data of the MMDA and the UPDP

Road Crash Data	MMDA	UPDP
Person Related	• Name • Age • Address	• Name • Age • Address • Status in U.P. Diliman (student, resident, employee, outsider) • Injury severity
Vehicle Related	•Vehicle type • Vehicle plate number	• Vehicle type • Vehicle plate number
Crash Related	• Road crash category (damage to property, non-fatal injury, fatal) • Collision type (head on, rear end, angle, side swipe, hit and run, etc.) • Crash location • Crash municipality/place • Crash date and time • Weather type (fair, rain, wind, smoke, fog, etc.)	• Crash type (damage to property, vehicular accident, traffic accident, hit and run) • Crash location • Crash date and time
Road Related	-	-

The data collected by the MMDA and the UPDP are relatively similar. For data on "Person Related," both offices take basic information of the drivers and victims such as name, age, and address. In addition, the UPDP keeps a record of the severity injury incurred by the driver/victim.

Both the MMDA and the UPDP take the vehicle type and the vehicle plate number. When it comes to "Crash Related" data, the MMDA added collision type and weather type which are not collected by the UPDP. Also under "Crash Related" data, the UPDP's Crash Type is a combination of the MMDA's Road Crash Category and Collision Type. Data from the two (2) offices appear to lack information on the roads in which the crashes occurred.

Analysis of the UPDP's Road Crash Data

These are the results of the analysis from the road crash data collected from the UPDP:

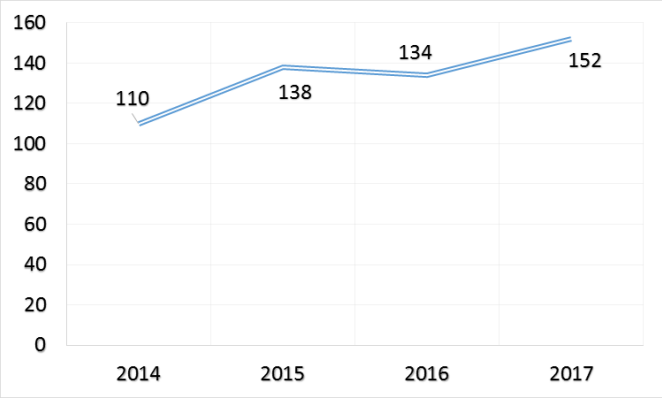

Figure 6. Number of road crashes per year (2014-2017)

• The number of road crashes increased by 38% from 2014 to 2017.

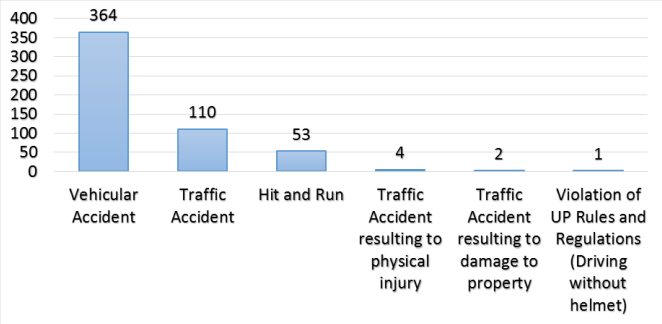

Figure 7. Number of road crashes per crash type (2014-2017)

• Of the 534 road crashes, 364 were vehicular accident, 110 were traffic accident, and 53 were hit and run. There were also accidents that resulted to physical injury (4) and damage to property (2).

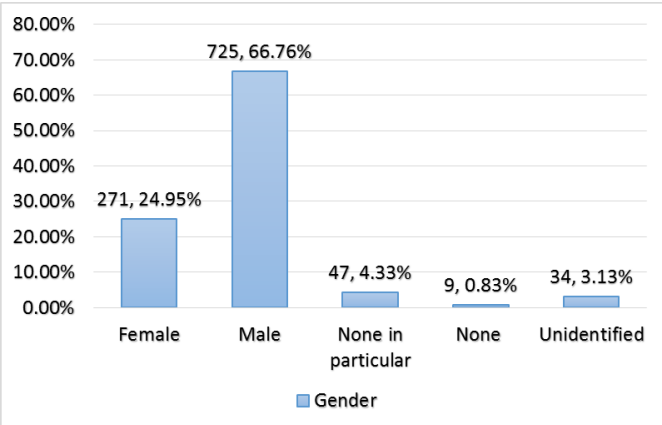

Figure 8. Number of people that encountered road crash by gender (2014-2017)

• Males are usually the ones experiencing road crashes in the campus.
• Of the 1,086 people that encountered road crash from 2014-2017, 725 (66.76%) are males, 271 (24.95%) are females, 47 (43.33%) none in particular, 9 (0.83%) none, and 34 (3.13%) are unidentified.

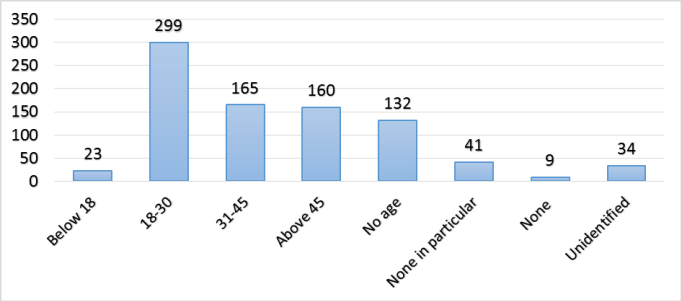

Figure 9. Number of people involved by age (2014-2017)

• During 2014, the UPDP did not take details of age of those who were involved in road crashes

• Of the 863 people involved in road crashes from 2015-2017, age group 18-30 shares the biggest number with 299 (34.65%), followed by 31-45 with 165 (19.12%), and above 45 with 160 (18.54%).

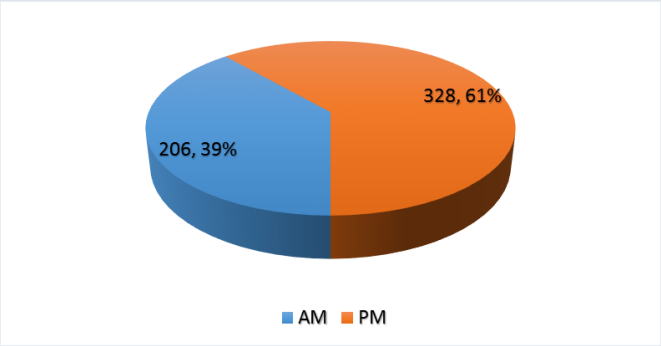

Figure 10. Number of road crashes by time of the day (2014-2017)

• Most of the road crashes happened during afternoon and evening.

• Of the 534 road crashes from 2014-2017, 328 (61.42%) happened during afternoon and in the evening (12:00 NN – 11:59 PM) while 206 (38.58%) happened during morning (12:00 AM – 11:59 AM).

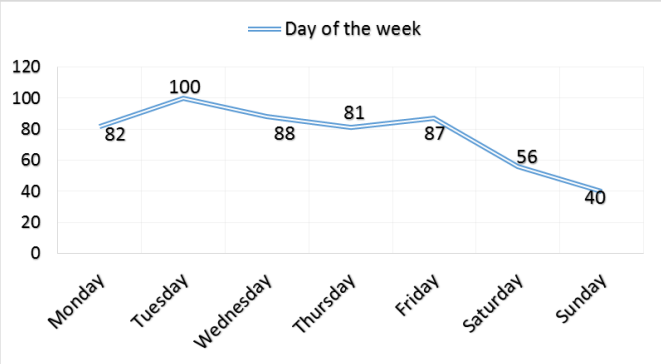

Figure 11. Number of road crashes by day of the week (2014-2017)

• Road crashes in the campus usually happen during Tuesdays, Wednesdays, and Fridays.

• Of the 534 road crashes from 2014 to 2017, 100 (18.73%) happened during Tuesday, 88 (16.48%) during Wednesday, and 87 (16.29%) during Friday.

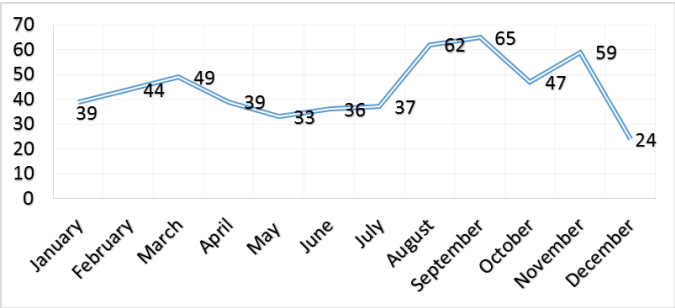

Figure 12. Number of road crashes by month (2014-2017)

• According to the data, August and September seem to be the months where the number of crashes occurred are consistently high.

• Of the 534 road crashes from 2014 to 2017, 65 (12.17%) happened during September, 62 (11.61%) during August, and 59 (11.05%) during November.

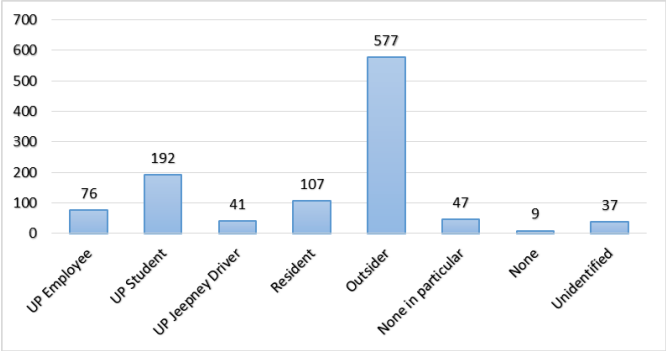

Figure 13. Number of people involved in road crash by status in U.P. Diliman (2014-2017)

• Of 1,086 people that encountered road crash from 2014 to 2017, outsiders share the biggest number with 577 (53.13%), followed by UP students with 192 (17.68%), residents with 107 (9.85%), and UP employees with 76 (7%).

Heat maps using ArcGIS software

Figure 14. 2014 Road Crash Map of U.P. Diliman

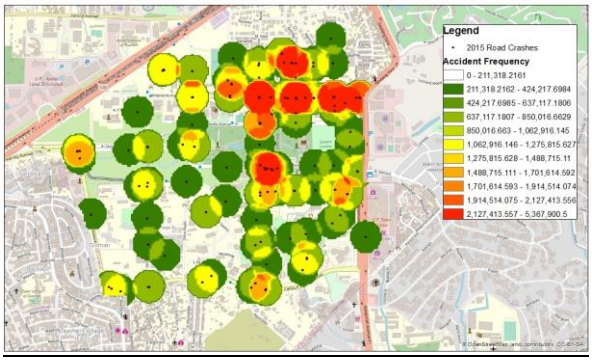

Figure 15. 2015 Road Crash Map of U.P. Diliman

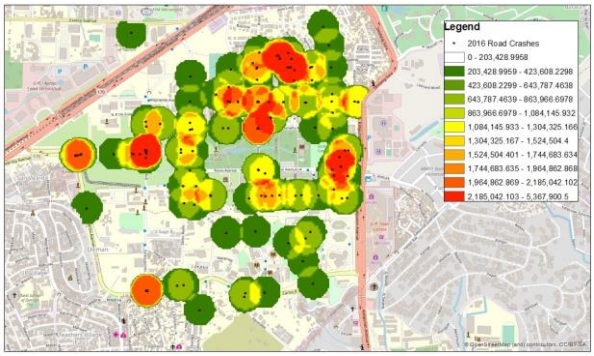

Figure 16. 2016 Road Crash Map of U.P. Diliman

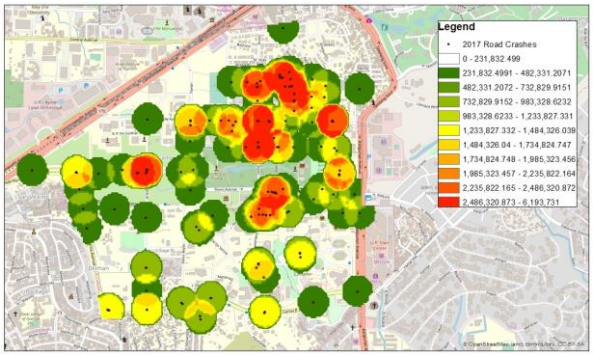

Figure 17. 2017 Road Crash Map of U.P. Diliman

The researchers created heat maps using ArcGIS. Heat map is a two-dimensional geographical presentation that applies color to the map according to interpreted values. By having this visual presentation, it would be easier to identify where most of the crashes are concentrated.

Figure 14 shows that road crashes are heavily concentrated on two (2) intersections, University Avenue corner E. Jacinto Street (6 incidences) and Magsaysay Avenue corner F. Ma. Guerrero (6 incidences). Five (5) incidences happened on a street corner, A. Roces near All U. P. Workers Union, and on a three-way conjunction, Vicinity of Vinzons (A. Ma. Regidor and Roxas) (5 incidences). Four (4) incidences occurred both on Laurel Avenue in front of Shopping Center and C.P. Garcia Avenue near the traffic light along Sarah's.

However, in 2015, the number of road crashes on University Avenue corner E. Jacinto Street and Vicinity of Vinzons (A. Ma. Regidor and Roxas) decreased. It is showed in Figure 14 that Six (6) incidences happened on an intersection, Magsaysay Avenue corner Roces Street, followed by Palma Hall Parking Lot (6 incidences), Laurel Avenue in front of Shopping Center (5 incidences), Magsaysay Avenue corner Apacible Street (4 incidences), and Magsaysay Avenue going to Katipunan Avenue (4 incidences).

Figure 16 shows that in 2016, University Avenue corner E. Jacinto Street and Vicinity of Vinzons (A. Ma. Regidor and Roxas) became one of the accident-prone areas again having 6 incidences each, followed by two (2) parking lots in Palma Hall (5 incidences) and Shopping Center (5 incidences), and the three-year consistent black spot, Laurel Avenue in front of Shopping Center (4 incidences).

Figure 17 shows that road crashes are still concentrated on the accident black spots in the previous years. Nine (9) incidences occur in University Ave. cor. E. Jacinto Street. Road crashes on Palma Hall Parking Lot (7 incidences) and Shopping Center Parking Lot (6 incidences) are still on top. It is followed by the four-year black spot, Laurel Avenue in front of Shopping Center (5 incidences), Magsaysay Ave. cor. Roces Street (5 incidences), Osmeña Ave. cor. Roces Street (5 incidences), and A. Roces near All U. P. Workers Union (4 incidences).

Based on analysis of the data and heat maps, these are the top 6 accident-prone areas in U.P. Diliman Campus from 2014-2017:

Table 2. Top 6 Accident-Prone Areas in U.P. Diliman (2014-2017)

Location	Number of incidences
University Avenue corner E. Jacinto	21
Palma Hall Parking Lot	18
Laurel Avenue in front of Shopping Center	18
Shopping Center Parking Lot	14
Vicinity of Vinzons (A. Ma. Regidor and Roxas)	14
Magsaysay Avenue corner Roces Street	13

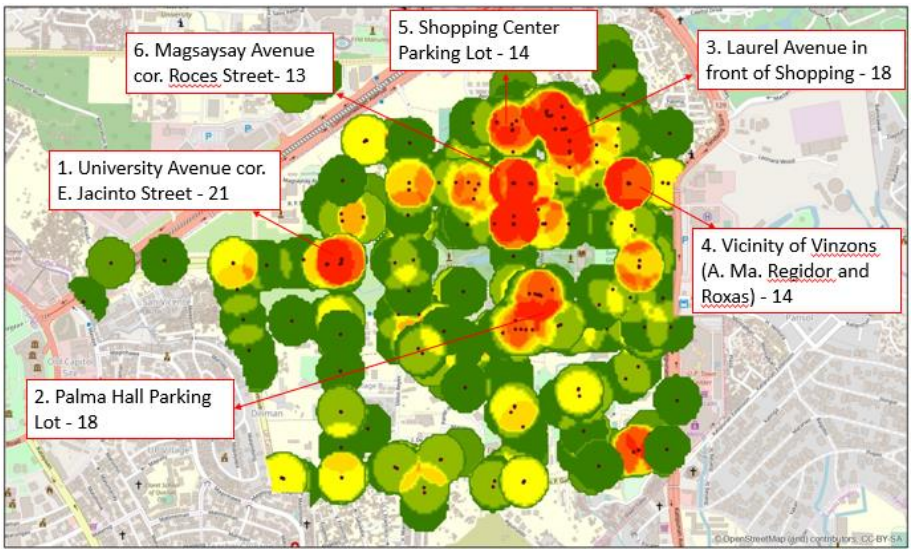

Figure 18. Top 6 Accident-Prone Areas in U.P. Diliman (2014-2017)

The UPDP's data can determine the accident-prone areas in the campus as well as the crash type (vehicular accident, traffic accident, hit and run, etc.) but it does not provide the reasons why road crashes occur there.

How road crash data are used

The result of the interviews with key personnel of the offices involved in maintaining road safety in U.P. Diliman showed that road crash data are not fully utilized and that most of the interventions are based on requests from the community and initiative of the office itself.

5. CONCLUSIONS AND RECOMMENDATIONS

On road crash data collection in U.P. Diliman

In U.P. Diliman, the UPDP collects the road crash data using cellphone, tape measure, and camera. The Police Officer manually records the data in the accident report form. The data from the accident report form are transferred into the office's database (MS Word file).

The following are the recommendations of the researchers on improving the data collection of the UPDP:

1. For a more accurate accident mapping, the UPDP can use cellphone with GPS in identifying locations of the crashes and include the coordinates in their recording. It is imperative to locate the right location so that interventions will be implemented at the right places;
2. Since the current road crash records of the UPDP are in Word file, the researchers recommend to transfer these to Excel file to perform analysis easily.

On road crash data of the MMDA and the UPDP and variables that can improve usefulness of data

The data that are being collected by the MMDA and the UPDP are relatively similar. The UPDP has to be clear of the definitions of the variables under the Crash Type. Both offices lack road-related data. Under the "Crash Related" data, the MMDA takes data on collision type and weather type, which the UPDP does not collect. The UPDP's data can determine the accident-prone areas and the crash type but not the factors affecting the crashes like vehicle defect, driver's state, weather and lighting condition, road type and road condition, etc. The lacking data mentioned may be useful to determine those factors.

The following are the recommendations of the researchers on improving the road crash data of the UPDP:

1. Re-examine the definitions of the variables under the Crash type to attain data uniformity with the MMDA;
2. Take into account the roadway lighting and weather condition since 328 or approximately 61% of the 534 road crashes in U.P. Diliman from 2014 to 2017 happened during afternoon and evening;
3. Collect data on roads where crashes occur because not all crashes can be attributed to human error and vehicle alone, as there may be other factors that may be affected by road conditions and road types;
4. The UPDP can also get data on possible alcohol use and drug use if it is possible and if the data is not difficult to collect.

On how road crash data are being used in the formulation of road safety interventions in U.P. Diliman

In U.P. Diliman, the road crash data are not fully utilized and most of the interventions are based on requests from the community and initiative of the office itself. There are no personnel specifically assigned to analyze the data. As a result, the data that are being provided to the offices which are members of the Transportation Committee in UPD are unprocessed. The researchers recommend to hire additional UPDP personnel who can take charge of the data analysis.

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