

# Assessment of the Accident-Prone Areas of Barangay Dolores Junction in City of San Fernando, Pampanga

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**Abstract:** - In today's world, road accident is one of the leading causes of injury-related deaths. As more people own vehicles for transportation, the number of people involved in road accidents continues to rise. This accident is the most unpleasant event that may happen to a road user. The objective of this research is to assess the accident-prone areas of Barangay Dolores Junction in City of San Fernando, Pampanga, and to determine the most significant factors causing the road accidents. In this research, 31 factors were considered and they were grouped into 3 categories; human factor, vehicle factor, and environmental factor. Moreover, a survey questionnaire consisting of questions related to the said categories was given to 400 respondents who are apparently road users. The Relative Importance Index was used to find the most significant factors of road accidents at the intersection of Barangay Dolores. The results from the survey revealed that the ten significant factors were all from the group environmental factor. Furthermore, 31 factors were identified as the causes of road accidents but the top ten most significant factors were (1) illegal parking on the road (sidewalk, driveway, street, within a crosswalk, at or inside intersection), (2) lighting deficiencies on roads when it gets dark, (3) poor state of road pavement and maintenance, (4) inadequate design of road shoulders or sidewalks, (5) unnecessary barriers on the road, (6) heavy rainfall and slippery roads, (7) inadequate or badly maintained horizontal and vertical signals (pedestrian lanes, white lines on the road, arrows, stop, give way, etc.), (8) insufficient clearance, (9) small number of restricted speed zones in cities, and (10) dangerous bends (U-turns). To conclude, these findings will help the government and the road users to minimize and prevent the road accidents in Barangay Dolores Intersection.

**Key Words—** Road Accidents, Dolores Junction, Accident-Prone Areas.

## I. INTRODUCTION

People, animals, and wheeled vehicles use roads, highways, and expressways to go from one location to another. It serves as the primary mode of ground transportation, and accidents can happen on the road at any time, both purposefully and inadvertently.

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With the rapid expansion of urban space, the urban traffic has also increased in complexity resulting to drivers having difficulty in navigating the road thus leading to road accidents.

Accident is an unforeseen and unplanned event or circumstance that can happen anywhere and anytime, but the road is among the most common places where it might occur. Road accidents are considered as one of the leading causes of increased accident numbers in emerging countries. Increase in number of accident experiences of a particular location can be due to different road or environmental conditions; these locations are called "accident prone areas" (Krishnan, 2017). Sayed (1997) also added that they are generally defined as places with greater accident rates (both frequency and severity) than the national average. This definition explains how safety improvements are

planned and implemented for the work that will be done in the evaluation of the intersection's safety. All present and future transportation systems must have a high level of driver safety as a primary criterion. In order to prevent and control the accidents at the intersection, it is necessary to analyze the data acquired and presented.

The World Health Organization (WHO) acknowledges the global epidemic of traffic accidents in most regions and expresses worry about the fact that this phenomenon kills 1.2 million individuals between the ages of 20 and 50, in addition to causing non-fatal injuries. According to the most recent WHO data from 2018, road accidents claimed the lives of 10,624 people in the Philippines, accounting for 1.74% of all deaths. The age-adjusted death rate in the Philippines is 11.40 per 100,000 people, placing it 118th in the world. In total, 14,553 people have died or been injured in road accidents involving passengers, drivers, and pedestrians, averaging 40 people each day.

Road accidents may occur in different ways; it may be the driver's fault or sight distance of the object that may be considered obstructions at the intersection. These impediments give drivers less time to see the object and come to a stop. Driving intensity and risk exposure are also key factors in road accidents, with consequences for road safety (Lal & Craig, 2001). According to Chen et al. (2012), driver gender and age, traffic control type, speed zone, crash type, time of day, and seat belt usage are all risk factors proven to be significantly associated with the severity of intersection crashes.

Das et al. (2009) stated that at signalized intersections, slow moving vehicles have been involved in numerous critical injury crashes. For transportation reasons, sight distance is defined as the roadway's length that is readily visible to the motorist. If the intersection is not visible to the driver, this may cause an accident. As a result, clear sight distance is required for safe vehicle maneuvering. In addition to this, according to Maze and Plazak (2000) as the number of lanes and crossings at an intersection increase, the number of conflict points increases, and each conflict point requires the driver to take evasive action to prevent a collision.

Furthermore, American Association of State Highway and Transportation Officials' (AASHTO) The overall scope where two or more highways merge or meet, including the roadway and roadside amenities for the traffic movements in the area, was established in the book Policy on Geometric Design of Highways and Streets. An intersection leg is a roadway that radiates from and forms part of an intersection, and the most

typical intersection where two highways cross has four legs. Through- or cross-traffic movements are common at intersections, as are turning movements between the highways.

The key elements impacting the occurrence of accidents, including intersections, are usually geometric design, measures of traffic control, characteristics of driver, and traffic characteristics. Numerous researches have looked at the influence of traffic and geometric characteristics such as, lane arrangement (Wang & Abdel-Aty, 2006), curvature (Savolainen & Tarko, 2005), signal timing (Wang & Abdel-Aty, 2006; Bonneson & Zimmerman, 2006), and collision type on the frequency of crashes at intersections (Abdel-Aty et al., 2005; Jagannathan et al., 2006). Furthermore, various researches have looked into the impact of these characteristics on the severity of intersection crashes (Abdel-Aty & Keller, 2005; Abdel-Aty, 2003; Jagannathan et al., 2006).

The number of crashes observed is used to identify accident-prone zones. As majority of road accidents mainly occur at intersections, ensuring safety at crossing is vital. The use of the said intersection's data and considerable amount of related literature will be a big help to mitigate the accidents.

In this study, the researchers aim to determine and understand the possible improvements that can be adopted in the given area of interest in order to reduce the number of road accidents and improve the road safety conditions in Barangay Dolores Junction, City of San Fernando, Pampanga.

The purpose of this study is to assess the accident-prone location of Barangay Dolores Junction in City of San Fernando, Pampanga. In contrast to Rifaat and Chin's (2007) study that examined crashes in all locations, this research will focus on collisions that occur at intersection.

## II. METHODOLOGY

The research methodology used in this study was descriptive design which helps the researchers to better understand the factors that will affect and influence the study. It shows the path through which the researchers formulate the problem, objectives and present the data obtained during the study period. This section stated the details of the research process used to identify and analyze the information.

The researchers reviewed the data and information from related literatures. This includes the factors causing road accidents

such as human, vehicle, and environmental factors. The accidents were classified into three categories: damage to property, non-fatal, and fatal. Additionally, the data collection method used by other researchers was reviewed.

The researchers identified the location's profile with the use of applications such as Google Maps and Department of Public Works and Highways (DPWH) Road and Bridge Inventory. One kilometer from the DHL Express Service Point (15.03950, 120.68080) was considered and its endpoints are; Pep & Ronnie (15.04440, 120.67351), NorthWalk 2 (15.04348, 120.68842), Café Rustico (15.03131, 120.67561) and Villa Barosa (15.03344, 120.68725). Through these said applications, the researchers can visualize the road, type of road, volume capacity, and road properties.

The respondents of this study were road users who can access the said intersection. This includes pedestrians, cyclists, horse riders, and motor vehicle drivers. In this study, simple random sampling was used for the data collection from respondents who were willing to complete the survey. The researchers used the Slovin's Formula in identifying the number of respondents.

$$n = \frac{N}{1 + N(e^2)}$$

Where:

n = sample size

N = population size

e = acceptance sample error.

The acceptance sample error was defined as 0.05, and the population size is the total number of populations in City of San Fernando, Pampanga, which was 354,666 (According to the Census of 2020). Using the formula, sample size of 400 road users were used in the study.

The researchers used mixed methods, the survey method and secondary data analysis. These specific procedures were collected and analyzed data by using previously gathered information regarding intersection accidents.

In this study, the researchers used questionnaire and documentary sources in gathering data. The questionnaire was a Likert-scale that was drafted by the researchers and its drafting was based on studies, articles, published and unpublished theses that are related to the study, and will be validated by experts. In addition, the documentary sources were used in this study as indicator that will consider on the

questionnaire. The researchers gathered information from the Philippine National Police (PNP) for the accident records in Barangay Dolores Junction, City of San Fernando, Pampanga.

Prior to the actual data gathering, the researchers' objective is to get permission from the police station to collect data regarding accidents that mainly happened at the intersection. Upon collecting, the researchers sorted the gathered data to classify the different factors that cause road accidents.

Weighted Mean was used in this study in interpreting the assessment of the respondents to the factors causing the road accidents on the intersection, such as (a) human factors, (b) vehicle factors, and (c) environmental factors.

Weighted Mean Formula:

$$\text{Weighted Mean} = \frac{\sum w \times n}{N}$$

Where:

w = weights applied to x values

n = no. of votes

N = total no. of responses

The researchers used basic spreadsheet software to further analyze and interpret the data collected to give recommendations and suggestions on how to solve and/or minimize the occurrence of accidents.

The Relative Importance Index (RII) is a method of determining the most influential factors in an object of the study. In addition, the results of the questionnaire were used as input for statistical calculations, which are then converted into influencing factors. The most influential elements were determined by RII using a ranking system based on the weight of the scores provided by respondents after completing the questionnaire. To find the most significant factors of the road accidents in the intersection of Barangay Dolores, the RII tool was used through the following equation:

$$\text{RII} = \frac{\sum W}{(A \times N)}$$

Where:

RII = Relative Importance Index

W = Weight (Weights ranging from 1 to 5)

A = Highest Weight

N = Total respondent

RII values have a range between 0 and 1 (0 values are not included). The highest RII score was the most influential factor in the research, then the RII makes a ranking for each of the sub-factors. The calculation of the average value of RII was used as the RII value for each main factor contained in the sub-factor.

The RII was computed for each cause to identify the most significant causes. The researchers used Microsoft Excel for the application of the RII formula and to organize the data. To add, the causes were ranked based on RII values. From the ranking assigned to each cause of the accidents, it will be possible to identify the most important factors or causes of road accidents in Barangay Dolores Junction.

Based on the mean RIIs and the ranking of all groups, the 10 most significant factors that cause road accidents in Dolores Junction were selected.

### III. RESULTS AND DISCUSSION

The responses of the respondents gathered through the survey method are the content of this section. The respondents were able to cover the set of questions unconsciously through online and in-person surveys. The findings are presented in a systematic manner in order to address the research aims and objectives, and to answer the research questions.

In this study, the excel software was used to weigh and interpret all the gathered data to assess the factors causing the road accidents on the intersection, such as (a) human factors, (b) vehicle factors, and (c) environmental factors.

Table.1. Distribution of Victim According to Age and Gender

Age Group	Gender				Total	
	Male		Female			
	No.	%	No.	%	No.	%
1 to 9	10	0.79	5	1.74	15	0.97
10 to 19	26	2.06	10	3.47	36	2.32
20-29	301	23.83	111	38.54	412	26.56
30-39	344	27.24	84	29.17	428	27.6
40-49	286	22.64	43	14.93	329	21.21
50-59	172	13.62	24	8.33	196	12.64
60-81	123	9.74	11	3.82	134	8.64
82-100	1	0.08	0	0	1	0.06
<b>Total</b>	<b>1,263</b>	<b>100</b>	<b>288</b>	<b>100</b>	<b>1,551</b>	<b>100</b>

Mean  $\pm$  SD: 38.89  $\pm$  1.32 years

Source: Philippine National Police (2016-2020)

Based on the results there were 1,551 total number of victims whose mean age was 38.89  $\pm$  1.32 years, ranging from 1-100 years old. The top 5 most affected age groups were 30-39 (27.6%), followed by 20-29 (26.56%), 40-49 (21.21%), 50-59 (12.64%), and 60-81 (8.64%) (see Table 1).

Table.2. Total number of road accidents in year 2016-2020

Year	No.	%
2016	157	19.8
2017	254	32.03
2018	171	21.56
2019	144	18.16
2020	67	8.45
<b>Total</b>	<b>793</b>	<b>100</b>

The total number of road accidents in the year 2016-2020 was 793 according to the Philippine National Police. Table 2 shows that 2017 has the greatest number of RTAs with a record of 254 (32.03%), followed by the year 2018 with 171 RTAs (21.56%), and so on.

Table.3. Accident Outcome/Severity

No Damage		Damage to Property		Non- Fatal		Fatal		Total
No.	%	No.	%	No.	%	No.	%	
19	2.4	689	86.89	77	9.71	8	1.01	793

In addition, table 3 shows the accident outcome or the severity of the total number of accidents. Out of 793 road accidents, 689 (86.89%) resulted to damage to property, 77 (9.71%) for non-fatal, 8 (1.01%) for fatal, and 19 (2.4%) resulted to no damage at all.

Table.4. Distribution for top places in Dolores Intersection of the greatest number of RTAs

Place	No.	Percentage (%)
JBL Hospital	53	6.68
Dolores Flyover	45	5.67
Jollibee Intersection	43	5.42
Holiday Land	40	5.04
Dolores Intersection	37	4.67

As shown in Table 4, the Jose B. Lingad Memorial Regional Hospital (JBLMRH) has the greatest number of RTA which has 53 out of 793 RTAs (6.68%).

Next, is the flyover at the Dolores Intersection, City of San Fernando, Pampanga that has 45 RTAs (5.67%). The Jollibee in the Dolores Intersection has 43 RTAs out of 793 (5.42), while there are 40 RTAs (5.04%) in Holidayland and 37 RTAs (4.67%) in the said intersection. The rest of the number of road accidents came from different parts of the area of interest.

Table.5. Major Causes of Road Accidents

Total	674		11		108
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Table 5 shows the major causes of road accidents, where human factors appear to be the most significant cause of road accidents. 674 RTAs were due to human factors, and the reasons were; reckless driving (617), driver’s fault where he/she accidentally shifted to reverse (24), overtaking (18), and etc. It is followed by environmental factors (108 RTAs) where it includes the insufficient clearance of the road, illegal parking, barriers, slippery roads, and etc. Lastly, vehicle factors (11 RTAs) due to loss of control on the steering wheel, brake loss, and defective light signals.

Table.6. Respondents’ Personal Profile

Category (Road User)	Number	Percentage (%)
Commuter	274	30.08
Pedestrian	191	20.97
Cyclist	77	8.45
Motorcycle Rider	142	15.59
Private Vehicle Driver	127	13.94
Public Utility Driver	52	5.71
Truck Driver	45	4.94
Others	3	0.33
<b>Total</b>	<b>911</b>	<b>100.00</b>
Age Group	Number	Percentage (%)
20 and below	61	15.25
21-30	264	66.00
31-40	29	7.25
41-50	27	6.75
51-60	15	3.75
61 and above	4	1.00
<b>Total</b>	<b>400</b>	<b>100.00</b>

Gender	Number	Percentage (%)
Male	229	57.25
Female	171	42.75
<b>Total</b>	<b>400</b>	<b>100.00</b>

Table 6 presents the results of the respondents' personal profile in terms of road user category, age, and sexual category.

Human Factors			Vehicle Factors			Environmental Factors		
Causes	No.	Rank	Causes	No.	Rank	Causes	No.	Rank
Reckless Driving	617	1	Lost Control on the steering wheel	8	1	Illegal Parking	35	2
Drunk Driving	5	5	Loss of Brake	2	2	Heavy Rain	5	6.5
Driver Fell Asleep	6	4	Defective signal light/s	1	3	Slippery Road	5	6.5
Driver's Fault (Accidentally shifted to reverse)	24	2				Heavy Traffic	2	8.5
Overtaking	18	3				Insufficient Clearance	37	1
Driver's Argument	2	6.5				Avoided a Vehicle	9	3
Sudden Stop	2	6.5				Barrier	7	4
						Elevated Portion of Road (Vehicle moved backwards)	6	5
						Nature	2	8.5
<b>Total</b>	<b>674</b>			<b>11</b>			<b>108</b>	

The population surveyed in this study are the residents of City of San Fernando, Pampanga and the road users passing through the area of interest. Age and profile of 400 respondents of the survey is presented.

The table conveys that 274 or 30.08% of respondents are commuters, accounting for the highest percentage of total respondents, followed by pedestrians with 20.97%, while 3 or 0.33% are other road users accounting for the lowest percentage with a total number of 911. This indicates that the respondents chose more than one in this category.

In terms of ten-year age groups, it appears that the greater percentage of respondents are between the ages of 21 and 30, with a frequency of 264 or 66%, 61 are ages 20 and below with 15.25%, and the least are between the ages of 61 and above, with a frequency of 1.00% of the total population of

respondents. This means that vicenarian or mostly young adult commuters make up the vast majority of road users who travel on a daily basis.

According to the table, males dominated the study accounting for a total number of 229 or 57.25%, while females accounted for only 171 or 42.75% of the total population of this study. This only demonstrates that the vast majority of respondents were male.

Table.7. Influenced the driving behavior and pedestrian behavior

HUMAN FACTORS	WEIGHTED MEAN	RANK
1. Driving at speeds over the established legal limit	2.808	1
2. Using a cellphone while driving or walking	2.565	3
3. Driving without a valid license or with an expired license	2.133	8
4. Driving under the influence of liquor or drugs/medicines	1.948	11
5. Driving with high levels of fatigue or tiredness (sleepiness)	2.213	7
6. Driving without keeping a safe distance from other vehicles	2.258	6
7. Driving without using and not requiring all passengers of the vehicle to wear seat belts	2.333	5
8. Driving or crossing without respecting vertical traffic signs	2.110	9
9. Driving with more than the permitted number of passengers	2.385	4

10. Driving despite of poor eyesight	1.890	12
11. Motorbike riders driving without wearing a helmet	2.578	2
12. Not looking left and right for pedestrians before crossing the road	1.958	10

Table 7 shows the human factors that influenced the driving behavior and pedestrian behavior of road users. The driving at speeds over the established legal limit ranked 1st with weighted mean of 2.808, then the motorbike riders driving without wearing a helmet ranked 2nd with weighted mean of 2.578, using a cellphone while driving or walking ranked 3rd with weighted mean of 2.565, driving with more than the permitted number of passengers ranked 4th with weighted mean of 2.385, driving without using and not requiring all passengers of the vehicle to wear seatbelts ranked 5th with weighted mean of 2.333, driving without keeping a safe distance from other vehicles ranked 6th with weighted mean of 2.258, driving with high levels of fatigue or tiredness (sleepiness) ranked 7th with weighted mean of 2.213, driving without a valid license or with an expired license ranked 8th with weighted mean of 2.133, driving or crossing without respecting vertical traffic signs ranked 9th with weighted mean of 2.110, not looking left and right for pedestrians before crossing the road ranked 10th with weighted mean of 1.958, driving under the influence of liquor or drugs/medicines ranked 11th with weighted mean of 1.948, and driving despite of poor eyesight ranked 12th with weighted mean of 1.890.

Table.8. Influence of the vehicle condition

VEHICLE FACTORS	WEIGHTED MEAN	RANK
1. Not complying with vehicle regulations	1.928	3.5
2. Vehicles do not have seatbelts	1.945	2
3. Vehicles do not have a speed limiter	1.928	3.5



(heavy duty vehicle)		
4. Vehicles do not have technical inspection certificates	2.003	<b>1</b>
5. Vehicle is in bad condition	1.810	<b>5</b>
6. Signal lights/blinkers are in bad condition	1.743	<b>8</b>
7. Tires are not properly inflated	1.753	<b>7</b>
8. Vehicles are not well-maintained	1.788	<b>6</b>

As shown in table 8, these are the factors that influence the performance of the vehicle itself. Vehicles do not have technical inspection certificates ranked 1st with weighted mean of 2.003, vehicles do not have seatbelts ranked 2nd with weighted mean of 1.945, not complying with vehicle regulations and vehicles do not have a speed limiter (heavy duty vehicle) both ranked 3rd and a half with weighted mean of 1.928, vehicle is in bad condition ranked 5th with weighted mean of 1.810, vehicles are not well-maintained ranked 6th with weighted mean of 1.788, tires are not properly inflated ranked 7th with weighted mean of 1.753 and signal lights/blinkers are in bad condition ranked 8th with weighted mean of 1.743.

Table 9 shows the influence of environmental factors in road users. The illegal parking on the road (sidewalk, driveway, street, within a crosswalk, at or inside intersection) ranked 1st with weighted mean of 3.653, lighting deficiencies on roads when it gets dark ranked 2nd with weighted mean of 3.633, poor state of road pavement and maintenance ranked 3rd with weighted mean of 3.555, inadequate design of road shoulders or sidewalks ranked 4th with weighted mean of 3.473, unnecessary barriers on the road placed in ranked 5th with weighted mean of 3.455, heavy rainfall and slippery roads ranked 6th with weighted mean of 3.363, inadequate or badly maintained horizontal and vertical signals

Table.9. Influence of the deficiencies on roads, environment and weather conditions

ENVIRONMENTAL FACTORS	WEIGHTED MEAN	RANK
1. Poor state of road pavement and maintenance	3.555	<b>3</b>
2. Lighting Deficiencies on roads when it gets dark	3.633	<b>2</b>
3. Inadequate design of road shoulders or sidewalks	3.473	<b>4</b>
4. Dangerous bends (U-turns)	3.290	<b>10</b>
5. Inadequate or badly maintained horizontal and vertical signals (pedestrian lanes, white lines on the road, arrows, stop, give way, etc.)	3.338	<b>7</b>
6. Small number of restricted speed zones in cities	3.313	<b>9</b>
7. Illegal parking on the road (sidewalk, driveway, street, within a crosswalk, at or inside intersection)	3.653	<b>1</b>
8. Unnecessary barriers on the road	3.455	<b>5</b>
9. Insufficient clearance	3.338	<b>8</b>
10. Heavy rainfall and slippery roads	3.363	<b>6</b>
11. Animals crossing the road	2.803	<b>11</b>

(Pedestrian lanes, white lines on the road, arrows, stop, give way, etc.) ranked 7th with weighted mean of 3.338, insufficient clearance ranked 8th with weighted mean of 3.338, small number of restricted speed zones in cities ranked 9th with weighted mean of 3.313, dangerous bends (U-turns) ranked 10th with weighted mean of 3.290, and lastly was the animals crossing the road were ranked 11th with weighted mean of 2.803.

Table.10. The Overall Ranking of 31 factors causing the road accidents

Item	Factors	RII %	Rank
1	Illegal parking on the road (sidewalk, driveway, street, within a crosswalk, at or inside intersection)	73.05	1
2	Lighting Deficiencies on roads when it gets dark	72.65	2
3	Poor state of road pavement and maintenance	71.1	3
4	Inadequate design of road shoulders or sidewalks	69.45	4
5	Unnecessary barriers on the road	69.1	5
6	Heavy rainfall and slippery roads	67.25	6
7	Inadequate or badly maintained horizontal and vertical signals (pedestrian lanes, white lines on the road, arrows, stop, give way, etc.)	66.77	7
8	Insufficient clearance	66.75	8
9	Small number of restricted speed zones in cities	66.25	9
10	Dangerous bends (U-turns)	65.8	10
11	Driving at speeds over the established legal limit	56.15	11
12	Animals crossing the road	56.05	12
13	Motorbike riders driving without wearing a helmet	51.55	13
14	Using a cellphone while driving or walking	51.3	14
15	Driving with more than the permitted number of passengers	47.7	15
16	Driving without using and not requiring all passengers of the vehicle to wear seat belts	46.65	16
17	Driving without keeping a safe distance from other vehicles	45.15	17
18	Driving with high levels of fatigue or tiredness (sleepiness)	44.25	18
19	Driving without a valid license or with an expired license	42.65	19
20	Driving or crossing without respecting vertical traffic signs	42.2	20
21	Vehicles do not have technical inspection certificates	40.05	21
22	Not looking left and right for pedestrians before crossing the road	39.15	22

23	Driving under the influence of liquor or drugs/medicines	38.95	23
24	Vehicles do not have seatbelts	38.9	24
25	Not complying with vehicle regulations	38.55	25.5
26	Vehicles do not have a speed limiter (heavy duty vehicle)	38.55	25.5
27	Driving despite of poor eyesight	37.8	27
28	Vehicle is in bad condition	36.2	28
29	Vehicles are not well-maintained	35.75	29
30	Tires are not properly inflated	35.05	30
31	Signal lights/blinkers are in bad condition	34.85	31

Table 10 presents the results of the most significant causes of the road accidents in the intersection of Barangay Dolores through the results of the survey. It is found that the highest factor causing road accidents is the "illegal parking on the road" and the value of its Relative Importance Index (RII) is 73.05%, while the factor that occupies the 10th position in the ranking is the dangerous bends (U-turns) and its RII value is 65.8%.

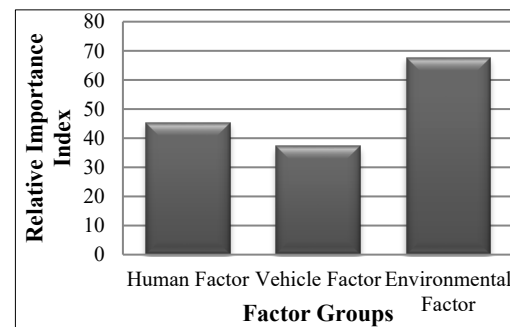


Fig.2. Factor Group Ranking

The 31 factors are grouped into 3 groups namely human factors, vehicle factor, and environmental factor. The ranking of these groups is associated with importance as assessed by the road users in the Dolores Junction. Figure 1 indicates that the top group causing the road accidents in the intersection of Barangay Dolores is the Environmental Factor.

Relative Importance Index and ranking of all investigated 31 factors are listed in Table 11. The analysis clarifies the followings: (1) there are 3 factors with relative importance index higher than 70%, and (2) the minimum importance index is 34.85%. These indicate that the identified factors are highly relevant to the road accidents in the Barangay Dolores Junction. Table 11 shows that the top ten significant factors of road



accidents in the intersection of Barangay Dolores, City of San Fernando, Pampanga. They are ordered as follows: (1) illegal parking on the road, (2) lighting deficiencies on roads when it gets dark, (3) poor state of road pavement and maintenance, (4) inadequate design of road shoulders or sidewalks, (5) unnecessary barriers on the road, (6) heavy rainfall and slippery roads, (7) inadequate or badly maintained horizontal and vertical signals, (8) insufficient clearance, (9) small number of restricted speed zones in cities, and (10) dangerous bends (U-turns).

#### IV. SUMMARY OF FINDINGS

The primary purpose of this study is to evaluate the accident-prone locations in Barangay Dolores Junction in San Fernando, Pampanga, and to identify the most significant factors that cause road accidents. Surveys were done among road users at Barangay Dolores Junction. Since face-to-face interaction is strictly limited, respondents were asked to complete out survey questionnaires via Google Forms and face-to-face. In order to supplement the researcher's gathered data and information, a thorough online research was conducted.

- Four-hundred (400) respondents were asked, using simple random sampling, to complete the proposed questionnaires via face-to-face surveys and Google forms.
- According to Philippine National Police data, there were a total of 793 road traffic accidents in Dolores Junction, City of San Fernando Pampanga, and within our study area. There were 689 traffic accidents out of 793 RTAs that resulted in property damage. The Jose B. Lingad Memorial Regional Hospital (JBLMRH) is one of the most accident-prone regions, with a total of 53 RTAs. Furthermore, research demonstrates that human errors, such as irresponsible driving, unintentionally shifting into reverse, overtaking, and so on, are the most common causes of road accidents.
- The researchers presented recommendations based on the findings, which will aid people in avoiding and minimizing road traffic accidents in Dolores Junction, San Fernando, Pampanga. The proposals focused mostly on the road itself, as well as horizontal and vertical signage such as pedestrian lanes, arrows, stop,

give way, and the implementation of speed limit zones, among other things.

#### V. CONCLUSION

Accidents can be avoided or minimized when the causes are identified. The aim of the research was to evaluate the accident-prone areas in Barangay Dolores Junction in City of San Fernando, Pampanga, and to identify the most significant factors that cause road accidents.

- The researchers drew and evaluated data from 400 respondents, and we utilized the Relative Importance Index (RII) to determine the relative importance of the quality elements involved. According to the findings, the ten significant factors were all from the group environmental factor. Furthermore, the 31 factors were grouped into three categories and ranked according to their Relative Importance Index: (1) human factor, (2) vehicle factor, and (3) environmental factor. In addition, 31 factors were identified as the causes of road accidents but the top ten most significant factors were (1) illegal parking on the road (sidewalk, driveway, street, within a crosswalk, at or inside intersection) (RII% = 73.05), (2) lighting deficiencies on roads when it gets dark (RII% = 72.65), (3) poor state of road pavement and maintenance (RII% = 71.1), (4) inadequate design of road shoulders or sidewalks (RII% = 69.45), (5) unnecessary barriers on the road (RII% = 69.1), (6) heavy rainfall and slippery roads (RII% = 67.25), (7) inadequate or badly maintained horizontal and vertical signals (pedestrian lanes, white lines on the road, arrows, stop, give way, etc.) (RII% = 66.77), (8) insufficient clearance (RII% = 66.75), (9) small number of restricted speed zones in cities (RII% = 66.25), and (10) dangerous bends (U-turns) (RII% = 65.8).
- Among the 31 factors, illegal parking occupied the first spot. This refers to vehicles parked in areas where parking is prohibited by law or ordinance, or in areas specified as "no parking zone" by the authority and/or local government units (LGUs). This factor was ranked second under the environmental factor group based on the data that were collected from the Philippine National Police. Moreover, even on busy

highways and roads vehicle owners park on the streets which creates accidents. When the on-street parking is correctly designed, regulated, and properly implemented, road crashes could be reduced or minimized.

Based on the results of this study, the researchers proposed the following recommendations; (1) the City Engineer's Office of City of San Fernando should inspect the roads to maintain the good state of the road pavement, (2) the horizontal and vertical signages such as pedestrian lanes, arrows, stop, give way, etc. should be repainted and visible to the road users, (3) the Traffic Management Office should strictly implement the speed limit in the city and the drivers of illegally parked vehicles should be penalized for their violations. (4) the sidewalk and street vendors should follow zoning ordinances that are convenient and safe for the vendors, customers, and road users, lastly (5) schools and colleges should have drop-off and pick-up lanes. In addition, signages should have proper implementation of regulations along with policies for private vehicles, as well as public vehicles' loading and unloading zones.

#### RECOMMENDATIONS:

The researchers of this study proposed the following recommendations for future references:

- Future researchers should conduct interviews with professionals who work in the field which deals with road accidents and of road planning.
- Future researchers are recommended to go out in the field to collect data.
- Future researchers are recommended to use latest data from officials, since the authors used the year 2020 data.
- Future researchers are suggested to widen the area of interest or to choose a different location.

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