Bicycle Lanes Design for Road User Safety

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Abstract: - This study addresses the use of non-motorized transportation. The global benefits of the bike paths, bike lanes, and other types of bicycle-specific infrastructure consist of a reduction in traffic congestion and a decrease in emissions of greenhouse gasses and other pollutants that commuters face today. Additional indirect benefits, of no less value, demonstrate the benefits and viability of bicycles and non-motorized transport. The aim of this study is to design a bicycle lane north–south road from Commerce Avenue in Metro Manila and determine the characteristics of the bikers in the area and to analyze the treats affecting bicycle riders using descriptive survey. The results of the data analysis show that familiarization of paths & facilities in north-south road was the main treats leading for a protected bike lane. A bicycle safety programs for ecotourism was recommended from the results of data analysis and through purposive sampling, a group of transportation engineers validated the bicycle program as well as the bikeway program.

Key-Words: - Bike, Cycling, Ecotourism, Non-motorized transportation, Transportation engineering

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1 Introduction

Since last year's lockdown limited access to public transportation, more and more people have been switching to biking as an alternative to get around the city. And in response, the government has been adding new bike lanes all over the metropolis. According to The Department of Transportation (2021), has opened the P801.83-million bicycle lane network in Metro Manila, the last portion of the 497-kilometer nationwide bike lane network constructed together with the Department of Public Works and Highways [1,6]. The Metro Manila bike lane network has a length of 313 km, stretching across nine major road sections and 12 cities. With the completion of the bike lanes, cyclists are provided with safe spaces on the road as they pedal to work and to other places. According to Tugade [1,9], the 129-km Metro Cebu bike lanes were inaugurated by the DOTr and DPWH last July 16 while the 54.71-km Metro Davao bike lanes were officially opened on July 20 [1,10]. The development of bike lanes in metropolitan cities aims to increase accessibility to key activity areas and fundamental facilities, significantly lessen carbon emission and promote road safety. The promotion of active transportation was strengthened by the declaration of the bicycle as an additional mode of transportation and the provision of funding to support the establishment of bike lane networks.

According to DPWH [11,12], the agency opens its first protected bike lane along Laguna Lake highway in Bicutan, Taguig City. The 5.8 kilometers long and three-meter-wide bike lane was officially opened on February 7, 2019. Formerly known as the C6 Dike Road, the Laguna Lake Highway, which was completed last November 2018, was a 1.28 billion Peso project that serves as an alternative route to the traffic-packed EDSA and C5-road [2,13]. Aside from the bicycle lane, the highway also features provisions for streetlights and road safety signages. There's also a 1.5-meter-wide sidewalk on both sides, as well as an elevated dike to protect pedestrians against flooding (DPWH, 2019). The MMDA) recorded 3,026 incidents (36 of which were fatal) involving bicycles, e-bikes, and pedicabs [3,6,14]. This

accounts for 2.4% of the total number of incidents for the entire 2020 and significantly from just 1,783 bicycle- and pedicab-related incidents 20 fatal from 2019 [6].The metro is downright un-walkable and un-bikeable in its current state, and the MMARAS numbers from last year are proof. If the end-users want to make the city safer FOR drivers, riders, cyclists, pedestrians, and the government should do their part. There are 26 bike riders were killed in Alabang because of road crashes, and 962 people were also injured in bike-related mishaps [4,15].

It is high time to evaluate the impact of transportation infrastructure on bicycle accidents in Commerce Avenue to analyze the factors involved in bike-related accidents to be able to create a bicycle safety program and design a road plan for bicycle lane. It is believed that further research will surely provide bicycle safety program that apply to bicycle related accidents in Commerce Avenue in Metro Manila

2 Problem Formulation

During the pandemic, more people have turned to alternate modes of transportation, such as bicycles, especially during the first few months of quarantine, when public transportation was scarcer than it is now [5]. With that in consideration, it's obvious to see how, as more cyclists take to the road, the number of bike-related incidents would inevitably rise. In fact, the overall number of bicycle accidents increased to 2,606 for the year 2020, up from 1,759 the year before and this was the first time that the number of bicycle accidents exceeded 2,000 since the MMDA began recording statistics in 2009, when it was 1,111 [6,17].

Accordingly, this study proposes to discuss the characteristics of bicycle accidents and issues in Commerce Avenue in Metro Manila, where there is a high daily volume of vehicles and yet bike lanes are not implemented [7]. This will determine the factors involved in bike-related accidents in Commerce Avenue through a descriptive survey on bicycle users in the area including the effect of multi-lane roadway on bicycles when a separated cycle track is included in the design through simulation and provide safety guidelines for bicycle commuters in Commerce Avenue [8,18].

3 Results & Discussion

Two survey questionnaires were disseminated to obtain the data needed to propose a bicycle lane in Commerce Avenue. The first survey was intended for bike users in Commerce Avenue and the second survey was distributed to transportation experts to gain their insights in designing a bicycle lane in a certain area. The number of respondents for the study was determined using purposive and convenience sampling in the chosen area of study. In the first survey, a total of one hundred one respondents answered the questionnaire survey on bike users in Commerce Avenue The data from one hundred one (101) sampled surveys were tallied and tabulated to show the approval of a bicycle lane in Commerce Avenue. The questionnaire was divided into three parts namely the: a.) social demographic characteristics of the respondents; b.) The surveys were disseminated online through google forms and were interpreted using Microsoft Excel.

3.1 Reasons for biking in Commerce Avenue

Table 1 shows the respondents' reasons for biking in Commerce Avenue. Based on their responses, about twenty-seven-point seventy two percent (27.72%) of the respondents answered for fitness, for nature and for leisure. Thirteen-point eighty six percent (13.8%) answered for fitness, for transportation and for leisure. Nine-point-ninety percent (9.90%) answered for transportation, fitness, leisure. While other respondents answered for their own purposes like for racing and long rides, for delivery.

Table 1. Reasons for biking in Commerce Avenue

Reasons for biking	Respondents	Percentage (%)
All of the selections	2	1.98%
Doesn't ride.	1	0.99%
For fitness	14	13.86%
For fitness, Delivery	1	0.99%
For fitness, For leisure	6	5.94%
For fitness, For nature	3	2.97%
For fitness, For nature, For leisure	28	27.72%
For fitness, For nature, Fun	1	0.99%
For leisure	6	5.94%
For nature	3	2.97%
For nature, For leisure	2	1.98%
For nature, For leisure, For my dad	1	0.99%
For transportation	3	2.97%

For transportation, For fitness	1	0.99%
For transportation, For fitness, For leisure	10	9.90%
For transportation, For fitness, For nature	14	13.86%
For transportation, For leisure	2	1.98%
For transportation, For nature, For leisure	2	1.98%
Racing and Long Rides	1	0.99%
Grand Total	101	100.00%

3.2 Average Distance Travelled on Bicycling Trip

Table 1 shows the respondents' reasons for biking in Commerce Avenue. Based on their responses, about twenty-seven-point seventy two percent (27.72%) of the respondents answered for fitness, for nature and for leisure. Thirteen-point eighty six percent (13.8%) answered for fitness, for transportation and for leisure. Nine-point-ninety percent (9.90%) answered for transportation, fitness, leisure. While other respondents answered for their own purposes like for racing and long rides, for delivery.

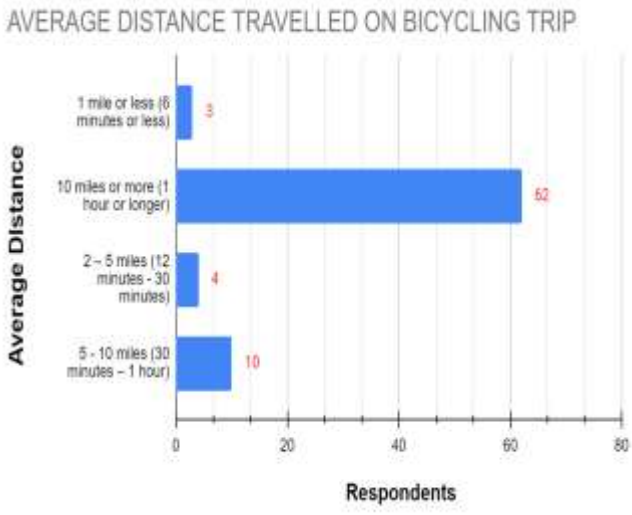

Figure 1. Average Distance Travelled on Bicycling Trip

Figure 1 shows the respondents' average distance travelled on bicycling trip. Three percent (3%) of the respondents can travel one mile or less (six minutes or less), four percent (4%) can travel two to five miles (twelve to thirty minutes), ten percent (10%) can travel five to ten miles (thirty minutes to one hour) and sixty-two (62%) can travel ten miles or more (one hour or longer), respectively.

3.3 Injury or disability that may impact bicycling

Figure 2 showed that ninety seven percent (97%) of the respondents have no injury or disability that may impact their bicycling activities. On the other hand, three percent (3%) answered yes which were specified in the answered forms namely nearsightedness and back pain.

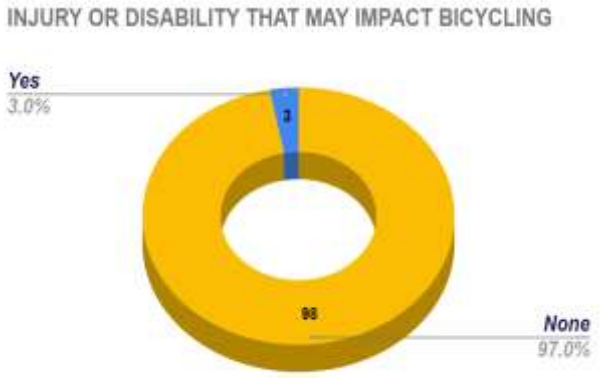

Figure 2. Injury or Disability that may impact Bicycling

3.4 Average Distance Travelled on Bicycling Trip

Figure 3 shows the respondents' frequency of using bicycle as their mode of transportation. According to the graph, the highest used of mode of transportation is categorized for entertainment and for exercise.

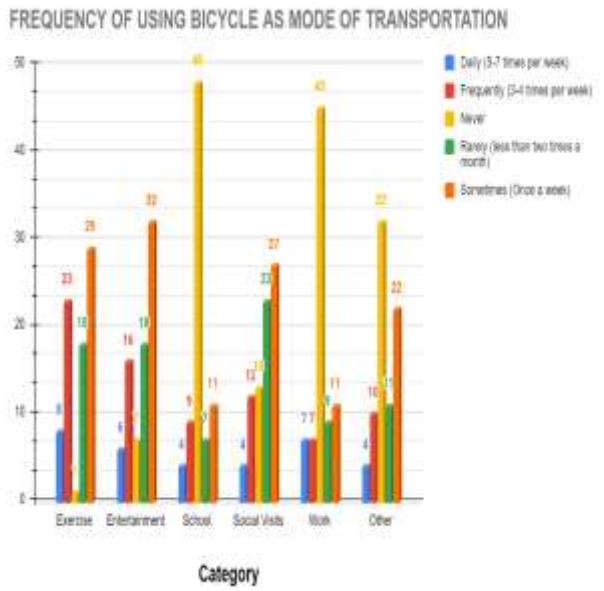

Figure 3. Frequency of Using Bicycle as Mode of Transportation

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4 Findings

Based on the data obtained, the researchers were able to determine the barriers that bike users experience while biking in Commerce Avenue. These responses will be made significant in designing the road design and bicycle safety program development in Commerce Avenue.

4.1 Transportation Expert Survey

To obtain the needed guidelines for bicycle safety program, the researcher conducted a survey intended for engineers who are working in the field of transportation. The respondents were selected through convenience sampling and majority of them work in the Department of Public Works and Highways. The questions aimed to tackle their work experience particularly their history in handling projects related to bicycle lanes. Moreover, the questionnaire was divided into two significant parts consisting of open-ended questions. The first part includes the Respondents' Background on Road Safety Program, and the second part discusses the Respondents' Background on Bicycle Safety Program.

Based on their collective responses, the researchers found that all of them worked in a company that has a safety management plan. All of them worked in slope protection which means measures installed on the slopes or pertinent surrounding areas of the CCR unit that protect the slope against wave action, erosion, or adverse. effects of rapid drawdown. One of the significant findings include the considerations to be made in designing a bicycle lane. It was discussed that Average Daily Traffic (ADT) must be considered. This will be considered useful in line segmentation for the bicycle lane implementation as this will improve traffic flow on urban streets.

Additionally, they also included the barriers encountered in road safety management. This includes landslides and weather changes. To monitor their safety plans, a weekly inspection is a must [18]. According to Francisco (2016), urban planners and transport experts also have lamented on the dependency of the people on public transportation since less than two percent of the Filipinos have their own cars [19,20]. This challenges the government agencies to prioritize opening pavements for transportation infrastructures that will promote cycling and walking for its numerous advantages.

The researchers interviewed engineers from the Department of Public Works and Highways and it showed how important it is for government agencies to be involved in projects such as this. The Philippines' national strategy in improving transportation issues has opted the Department of Transportation and Communications (DOTC) to layout plans in promoting alternative mobility options and cleaner transport through alternative fuels and green vehicles.

These agencies however cannot work alone but it can set guidelines for the creation of bike lanes. The LGUs also play an important role in implementing those innovations and plans by drilling down to the specifics from providing the actual road infrastructure, making sure that these lanes are kept for the exclusive use of pedestrians and cyclists.

4.2 Bicycle Safety Program

The significant information gathered from the related literatures on successful bicycle lanes both in local and foreign countries including the data from the respondents had led the researchers to come up with a road design proposal in Commerce Avenue.

Figure 4. Commerce Avenue.

This will be made useful by pedestrians and cyclists in the said area considering their commentaries in the surveys they answered.

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Figure 5. Protected Bicycle Lane General Design Proposal

This also includes the standards guided by the Department of Public Works and Highways (DPWH). The sequence of images shows the comparison of pictures of the road path in Commerce Avenue followed by the figures shown that were designed by the researchers and were drawn using AutoDESK Revit2020.

In figure 5,the design features as follows: Design Features: a). One-directional separated bicycle lane. b).Preferred width is 2.44m and absolute minimum width of 1.22m following the DPWH established standards and c). Curb protected bicycle lane.

Figure 6. Protected Bicycle Lane Design for T-intersection Areas Proposal

In figure 6, the design features as follows: a). Designated shared Bicycle Crossing Lane for the bicycle users who wish to make a U-Turn and b). Installment of stop lights to provide safety crossing for the road users and for orderly traffic flow.

Figure 7. Protected Bicycle Lane Design for Intersection Area Proposal

In figure 7, the design features as follows: a).Provided Bicycle Stop box or Red light Box for those bicycle users who wish to make a left turn and exit Commerce Avenue. b).Provided Bicycle Crossing Lane. and c).Implementation of Stop light for coordinated traffic flow.

5 Conclusion

The study concludes that Commerce Avenue is a well-used route for biker users from Las Piñas, Alabang, Muntinlupa and Cavite and users are

looking forward for a bicycle lane in the area. Although men are the dominant bike users in Commerce Avenue., using the comment section of the questionnaire, users still wish to have a protected bicycle lane in the area considering the Female Bi molestations cases in the area and for all the bike users to be protected from fast cars and cars that drives too close to them.

The study also revealed that Commerce Avenue is being used by the bicycle users all day and night just like the automobile users who use the road 24/7 that makes the Personal Safety, Hazardous Conditions such as Darkness and Uneven surfaces, and Difficulties in intersection & Traffic Patterns reasonable for being the top 3 Barriers in Bicycling in Commerce Avenue but despite the three mentioned barriers, Commerce Avenue. remains to have a good environment for bicycling.

Most of the engineers that answered the questions were aged 21 – 26 and are a public or civil workers. The researchers concluded that the common barriers being encountered when achieving bicycle lane projects are the availability of the lane in the area and the budget provided for the project. However, it was also said that the bicycle lane projects on the public road are funded by the government.

The researchers also concluded that for a bicycle project lane to be considered safe, standards and protocols established by the DPWH should be strictly abided when implementing the project.

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Conflict of Interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

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