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Assessment on the Potential Use of Roller Road Barrier at Megadike East Access Road in San Fernando, Pampanga

Ernie G. Manabat*, John Gabriel B. Gran**, Lovell C. Perez Jr.***, Erica A. Santos****, Ricalyn V. Sarmiento*****, Alvin D. Velasco******
*(Civil Engineering Department, Don Honorio Ventura State University, Cabambangan, Villa de Bacolor, Pampanga
Email: erniemanabat4@gmail.com)
**(Civil Engineering Department, Don Honorio Ventura State University, Cabambangan, Villa de Bacolor, Pampanga
Email: granjohngabriel@gmail.com)
***(Civil Engineering Department, Don Honorio Ventura State University, Cabambangan, Villa de Bacolor, Pampanga
Email: lovellperezjr@gmail.com)
****(Civil Engineering Department, Don Honorio Ventura State University, Cabambangan, Villa de Bacolor, Pampanga
Email: santoserica0516@gmail.com)
******(Civil Engineering Department, Don Honorio Ventura State University, Cabambangan, Villa de Bacolor, Pampanga
Email: ricalynsarmiento434@gmail.com)
*******(Civil Engineering Department, Don Honorio Ventura State University, Cabambangan, Villa de Bacolor, Pampanga
Email: alvinvelasco165@gmail.com)

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Abstract:

This study highlights the unpredictable nature of road accidents and the global challenge of reducing their occurrence. Despite disciplined driving, accidents can still happen, particularly in accident-prone areas. The proposed solution is Roller Road Barriers, especially effective on elevated roadways, as they absorb impact energy, convert it to rotational energy, and redirect traffic, preventing vehicles from crashing through immovable barriers. The study, conducted in Megadike Access Road in San Fernando, Pampanga, and with information from Negros Occidental, tests the effectiveness of these barriers. The research includes vehicle classification, driver interviews, and a miniature model demonstration. The implementation of Roller Road Barriers is suggested as a measure to decrease road accidents and enhance safety in the specified areas for drivers, commuters, and the community.

Keywords — **Accident-prone, safety, Megadike Access Road, Roller Road Barriers**

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I. THE PROBLEM AND A REVIEW OF RELATED LITERATURES AND STUDIES

A. Introduction

Car accidents are one of the main reasons for fatalities in humans. Around the world, there are roughly 1.3 million traffic fatalities per year. 3,500 accidents occur each day. It's the eighth most frequent reason for passing away (World Health Organization, 2018). Road traffic accidents are a factor accounted for 23% of all injury-related deaths globally (Ingole et al., 2022).

Two drivers died when the cars they were driving were involved in an accident along the eastern megadike elevated road within the boundaries of Barangay San Isidro in Bacolor, Pampanga, as reported in Sunstar Pampanga on April 28, 2014. According to the police investigation, the SUV was moving north when the motorcyclist moving south suddenly swerved into the opposing lane and struck the SUV. The motorcycle's driver was ejected from the collision location a few meters away due to its strength. The SUV continued to fall on the concrete slope of the dike despite colliding with the concrete barriers along the roadside. The fact that there were casualties proves how powerful the collision's impact was. Due to this, it is necessary to develop new strategies for lowering accident rates and minimizing damage from incidents.

The roller barrier is commonly known as a safety fixture that prevents drivers from an accident because it has shock-absorbing energy and converts into rotational energy. It originated in Korea since they found it effective in their country in preventing accidents and they started to adopt the product to other countries (Hasan et al., 2018). It is now the latest technology in road safety which seems to be attributed to a company called "Evolution in Road Safety Innovation" (ETI). Also, this technology is now used in the Philippines in a municipality in the province of Negros Occidental, Philippines

Conversely, barriers are used to separate oncoming traffic, protect things on the roadside from potential collisions with vehicles, and prevent animals from entering the street. They are classified into two groups based on their function: flexible and stiff systems. Semi-rigid system identification is also encountered in some cases while flexible barriers distort permanently because of car impact. Both the barrier and the car absorb collision energy. The steel or another deformable material is typically used to construct flexible barriers and vehicle collision causes minor deformation in rigid barriers because of their hard and concrete materials. Collision energy is dispersed through vehicle deformation, barrier element movement, and friction between the vehicle and the barrier (Butāns et al., 2015).

With this, the Roller Barrier was created to provide a safe and effective solution to prevent road accident and keep individuals from falling and minimize the damage that it may cause, knowing that the Megadike is very high and deadly if you fall. How does the guardrail function? It is a next-generation guardrail that combines, according to Evolution in Traffic Innovation (ETI), the world's safest roadside and median barrier is built of revolving barrels made of ethylene-vinyl acetate, an energy-absorbing co-polymer, and a patented steel guardrail. Alternatively put a roller barrier is a particular kind of road safety barrier that is made up of a number of cylindrical rollers that are connected and can freely rotate to create a continuous barrier. When a vehicle impacts the barrier, the rollers rotate, absorbing the impact and slowing down the vehicle gradually, reducing the risk of serious injury or damage. Particularly, the idea behind this product is to replace all the hard metal guard rails that can be seen anywhere that once the car would hit the barrier, it would stop the car from crossing the other side but instead it would just slow down.

In terms of its potential in road use in Pampanga, the roller barrier may offer several benefits.

Pampanga is a province in the Philippines known for its busy roads, with a high volume of vehicular traffic, particularly on the major highways and expressways. A roller barrier could potentially provide an effective means of enhancing road safety in the province by reducing the severity of crashes and mitigating the risk of serious injuries and fatalities.

However, it is worth noting that the use of roller barriers on roads may also have some drawbacks or limitations. For instance, they may require more maintenance than other types of barriers due to the rotating rollers, and they may not be suitable for all road configurations or traffic conditions. Therefore, a thorough evaluation of the feasibility and effectiveness of roller barriers in Pampanga would be necessary before considering their implementation.

TABLE I
ROAD INCIDENTS IN MEGADIKE PAMPANGA

FACTORS						
STATIONS	TOTAL ACCIDENTS	LIGHTING	ROAD DESIGN	LACK OF SIGNAGES	BLOCKED VISION DUE TO TALL GRASS AND TREES	OTHERS
BACOLOR MPS	107	Negative	Negative	Negative	Negative	107 (Human Error)
PORAC MPS	436	7	Negative	Negative	Negative	Negative
Total	543	0	0	0	0	107

Source: (Philippine National Police FREEDOM OF INFORMATION, 2022)

Regarding the potential use of roller barriers in the Pampanga Megadike, it is worth noting that roller barriers are primarily designed to enhance road safety by reducing the severity of crashes and mitigating the risk of serious injuries and fatalities on roads. While they may offer some benefits in the context of a megadike, which is designed to protect against flooding and other environmental hazards, roller barriers may not be the most suitable solution for this purpose. A megadike typically requires a different type of engineering design and construction, such as earthen embankments, reinforced concrete walls, or other types of barriers that are specifically designed to withstand the forces of flooding or other natural disasters. While roller barriers may offer some benefits in terms of protecting against vehicular accidents, they may not be the most effective solution for mitigating the risks posed by flooding or other environmental hazards.

Megadike Access Road in San Fernando, Pampanga, Philippines is an important infrastructure that connects different municipalities in Pampanga and serves as a crucial access point for transportation of goods and services. The road is also used by many residents for daily commuting, including school children and employees. However, the road has been identified as a prone area for accidents and collisions, especially on the curves and bends.

The Megadike in Pampanga, Philippines is a major infrastructure project aimed to safeguard the region from flooding and other environmental threats. It acts as a large barrier or embankment that runs along the river or along the coast, preventing overflow of water and mitigating flood damage.

The Megadike's main purpose is to protect the surrounding municipalities and villages from the devastation caused by severe rains, typhoons, and other water-related disasters. It serves as a vital line of defense, channeling, or confining floodwater to ensure the safety and well-being of the residents.

The Megadike was built with thorough engineering and design, and it includes a variety of strong structures and materials, such as reinforced concrete walls, earthen embankments, and other appropriate obstacles. These components work together to withstand floodwater forces, offering a dependable defense against probable breaches or breaches.

The Pampanga Megadike is critical to the region's infrastructure because it protects valuable agricultural lands, residential areas, and essential transit links. During times of flooding, it works as a buffer, decreasing the risk of property damage, disruption of livelihoods, and possibly loss of life. Furthermore, the Megadike includes a road that runs the length of it, providing vital connectivity between municipalities in Pampanga. This road is an important transit route for the movement of products and services in the region, enabling trade and economic activity.

However, the Megadike's access road has been classified as a high-risk region for accidents and collisions, particularly on the curves and bends. This is a safety concern for the inhabitants who use the road for traveling on a daily basis, including kids and employees.

In the past, accidents on this road have resulted in injuries, deaths, and significant damage to property, causing a major disruption in the lives of residents and affecting the local economy. One of the contributing factors to these accidents is the lack of proper road barriers in the prone areas, which could have helped prevent or minimize the impact of the collisions.

Improved signs, speed restrictions, traffic management systems, and maybe other suitable obstacles particularly designed for vehicular safety may be implemented to solve this issue and improve road safety. These measures are intended to lessen the severity of crashes and ensure the safety of persons going on the access road, while keeping the Megadike's main role as a protective structure against flooding and environmental dangers.

The Megadike in Pampanga, Philippines, offers advantages and disadvantages that must be evaluated. The Megadike in Pampanga, Philippines, provides significant advantages in terms of flood protection and economic development. It serves as a vital barrier against floodwaters, safeguarding lives and minimizing casualties. The structure also protects properties, infrastructure, and valuable agricultural lands from the damaging effects of floods. Additionally, the inclusion of an access road promotes transportation and trade, contributing to the region's economic stability. While recognizing these benefits, it is important to implement comprehensive flood risk management strategies to ensure holistic resilience and address potential disadvantages associated with the Megadike (Ganiron, 2016).

However, there are a few disadvantages to consider. The Megadike's development may have environmental repercussions, such as altering natural water flow patterns and harming ecosystems. Because of the revolving rollers, they may require more maintenance than other types of barriers, and they may not be suited for all road designs or traffic circumstances. As a result, before considering their adoption, a full assessment of the feasibility and effectiveness of roller barriers in Pampanga would be required. To mitigate these effects, adequate environmental assessments and mitigation strategies are required. Furthermore, the project will incur significant costs for development, maintenance, and prospective repairs, providing financial issues for the authorities in charge. The flood protection provided by the Megadike is confined to its specific area, and surrounding regions may still face flooding dangers. Finally, careful maintenance is required to ensure the Megadike's effectiveness throughout time. Evaluating these benefits and drawbacks is critical for stakeholders and experts to make educated decisions and rectify any flaws in order to maximize the project's benefits while limiting its potential drawbacks.

The use of roller barriers as a safety measure on roadways, particularly on curves and bends, has gained popularity in recent years. These barriers have been shown to be effective in reducing the severity of accidents and minimizing damage to property. However, there has been limited research conducted on the feasibility and economic viability of using these barriers in the context of Megadike Access Road.

The purpose of this study is to assess if installing roller barriers on the vulnerable portions of Megadike Access Road is both feasible and cost-effective. Using a cost-benefit analysis, the study aims to ascertain if the use of roller barriers as a security measure is economically feasible. To evaluate how drivers, feel about using these barriers as a safety measure and to quantify their level of acceptance. The study focuses on the perspective of engineering, with the aim of providing insights that can inform decision-making and policy development in the area of road safety.

B. Review of Related Studies

Highway safety refers to the techniques and precautions taken to keep other road users from dying or suffering major injuries. Road accidents are one of the main reasons why people die. Accidents that result from violating traffic laws, poor road design, collisions between vehicles, or exceeding the speed limit result in immediate death or serious injuries. (Chawan, Mahindrakar, Maurya, Mayekar, 2021).

In their paper, Rao et al. reported that 1,347 accidents and 400 fatalities occurred in 2015. They also claimed that 57 accidents occur every hour. He asserted that roller barriers are the way of the future for managing and improving road safety since they save lives and shield vehicles from harm. Additionally, Reddy et al. (2018) stated that 1.25 million people pass away as a result of traffic accidents, and they recommended that guardrail installation on the road can reduce the number of accidents.

In the meanwhile, road barriers can assist vehicles in staying on the road, lessening the damage done to cars, motorcycles, and even individuals in accidents, according to Hasan's (2018) study on rolling barriers. In order to provide RCC (Reinforced Cement Concrete) barrier and avoid head accidents, strong metal bars, also known as guardrails, run along the side of the road (Zain and Mohammed, 2015). These barriers occasionally are unable to guarantee a driver's safety. Occasionally, it In hilly locations, certain RCC round pillars about 3 feet tall are provided to stop the vehicles from tumbling off hills, however it cannot ensure both the safety of the vehicles and the passengers.

In their study on rolling barriers on horizontal curves, Lodhia and Poojari (2021) noted that the use of rolling barriers is intended to: decrease accident frequency and severity; decrease damage to cars; and decrease injuries to humans, to prevent deaths from accidents.

It was further stated that rolling barriers have the following benefits: they increase the safety of people and vehicles; they have a shock absorbent system that lessens sudden shocks on vehicles; they convert shock energy into rotary rotational energy; they are simple to install and require less maintenance than regular barriers; they also provide good visibility at night with the help of reflective tape; they have a longer serviceable life than regular barriers; and they help to prevent accidents. It may have a high initial cost but will end up costing less in the long run because it requires less maintenance and has a longer lifespan because it is made of recyclable materials.

This was proved for safety reason when Koreans found the use of the rolling barrier as a preventive tool in road safety. One particular style of road barrier is the rolling barrier, which that its growth and innovation are just as crucial to the other's development infrastructures. According to Farrahn, Anas, and Azeem (2018) in their study "Rolling Barriers: Emerging Concept to Reduce Road Accidents: An Indian Perspective," the roller barriers are quite effective, and their use has significantly decreased the number of accidents on flat and curving highways, ramps, and medians. severe curved roadways as in the mountainous terrain, entrance/exit ramps in the parking garage, etc. On the other hand, according to Zahoor and Sharma's (2018) study on rolling barriers, roller barriers are the most widely used barriers in the world because of their strength, excellent crash test performance, and other features.. On the other hand, Zahoor and Sharma (2018) stated in the study of Rolling Barrier that roller barrier is the highly preferred barrier in the world due to its highly applications like strength, high positive results crash test performance etc. RB (Roller Barrier) which does not only absorb the vehicle effect but also diverting the other vehicles moving in wrong direction.

It also helps decrease the traffic jam due to accidents. The roller barrier system plays a crucial role in enhancing road safety by mitigating the severity of vehicle collisions through the absorption and redirection of kinetic energy. This paper provides a step-by-step installation procedure for roller barriers, serving as a valuable guide for researchers and engineers interested in studying and implementing this safety device.

To begin, the importance of a well-documented installation procedure cannot be understated. A comprehensive documentation of the installation process ensures that future researchers and engineers have access to valuable insights and best practices for successful implementation.

To gather relevant information, an in-depth literature review is conducted, analyzing research papers, technical reports, and industry standards. This review focuses on roller barrier systems, their design principles, and previous studies on installation methodologies. By understanding the existing body of knowledge, researchers and engineers can make informed decisions during the installation process.

A thorough site assessment is then performed to evaluate the suitability of the location for roller barrier installation. Factors such as traffic volume, road geometry, soil conditions, drainage patterns, and environmental constraints are considered. The findings of this assessment serve as a foundation for subsequent decision-making, ensuring that the installation plan aligns with the specific site requirements.

Using the information gathered from the site assessment, a detailed installation plan is developed. This plan considers the roller barrier system specifications, including dimensions, materials, and required safety features. Collaboration with relevant stakeholders, such as transportation authorities and civil engineers, is essential to ensure compliance with local regulations and guidelines.

A comprehensive procurement plan is prepared to acquire the necessary roller barrier components and installation equipment. Collaboration with suppliers is undertaken, prioritizing cost-effectiveness and quality. Resources, including personnel, tools, and machinery, are allocated to ensure their availability throughout the installation process.

Before commencing the installation, it is crucial to obtain all necessary permits and permissions from the relevant authorities. A project schedule is developed, considering factors such as weather conditions, traffic disruptions, and manpower availability. The installation plan is communicated to the project team, and safety briefings are conducted to address potential hazards.

During site preparation, the designated installation area is cleared of debris, vegetation, and any existing structures that may impede the installation process. If required, ground excavation and leveling are performed to achieve a stable foundation. Safety signage and barricades are installed to notify motorists and pedestrians of the ongoing construction work.

The installation process itself follows a series of steps. The starting point and alignment for the roller barrier are established, with positions for each support post marked and evenly spaced according to the manufacturer's specifications. Holes for the support posts are then dug using appropriate machinery and equipment, ensuring the proper depth and diameter to accommodate the post size and required concrete foundation. The support posts are set in the holes and secured with concrete, allowing sufficient curing time for post stability. The roller barrier components are assembled according to the manufacturer's instructions, securely connected to the support posts, and aligned with proper tension. The functionality of the roller barrier system is tested, including its ability to absorb and redirect impact forces, with necessary adjustments and finetuning made if needed. Additional end treatments, such as crash cushions or terminal ends, are installed to enhance protection and overall system performance. A final inspection is conducted to ensure compliance with design specifications, safety standards, and industry best practices.

Throughout the installation process, it is important to document each step thoroughly. This documentation should include photographs, technical drawings, and any modifications made during the installation. Evaluating the installed roller barrier system and summarizing the outcomes help validate the effectiveness of the installation and provide valuable insights for future research and improvements. And the following are the step by step process in installing the Roller Road Barrier.

Step by step process in installing the Roller Road Barrier:

.Fig 1 Main Post Installation

Fig. 2 W Rail Installation (Lower Side)

Fig. 3 Sub-Post Installation

Fig. 4 Impact Absorbing Roller Installation

Fig. 5 W Rail Installation (Upper side)

Fig. 6 Bolting by Using the Impact Drill

Fig. 7 Post Cap Assembly

Fig. 8 Round Rail Assembly

In conclusion, the step-by-step installation procedure presented in this paper emphasizes the significance of roller barriers in enhancing road safety. By following a systematic approach, researchers and engineers can ensure a successful implementation of roller barriers while considering factors such as site assessment and design.

In addition, it has shown to lower maintenance and repair costs. By its presence alone, the barrier appears to be deterring and reducing the frequency of impacts. The rolling barriers systems are the future technology in Transportation Engineering. Furthermore, people will always value their lives and their vehicles as well in line with that on the Road Safety Using Rolling Barrier System (Sanjay et al., 2018), "Eventually life is more precious than vehicles but when it comes to rolling barrier system operation, it saves life and prevents maximum damage to the vehicles."

C. Conceptual Framework

The IPO model depicted in Figure 9 serves as the study's framework. In this framework, the independent variable was the use of Roller Road Barriers in Megadike area, which was measured in terms of drivers' level of agreeability. The dependent variable was the economic viability of the deployment of roller barriers, specifically on the prone regions in Megadike which were the curves.

Using a survey form given to drivers, the study collected data in San Fernando, Pampanga, respondents. Statistical analysis was done on the responses using tools like as well as mean, percentage, and frequency distribution.

The cost-benefit analysis was carried out to ascertain the deployment's economic viability. Roller road barriers are placed in Megadike's vulnerable areas. The analysis focused on the curves of the access road. The cost analysis included the cost of purchasing and installing the roller road barriers, while the benefit analysis considered the potential reduction in road accidents and damages.

It was noted that no production of roller road barriers will be conducted during the implementation of this study.

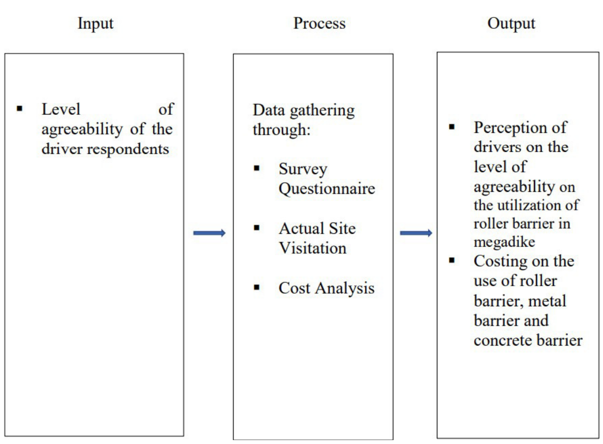

Fig. 9 Conceptual Model of the Study

D. Objectives of the Study

1) General Objective: The main objective of the study was to ascertain whether roller road barriers could be used along the Megadike Access Road in San Fernando, Pampanga.

2) Specific Objective: The specific objectives of the study are the following:

- Describe the drivers' respondents' level of satisfaction with using rollers. be described as a megadike barrier.
- Show the cost analysis on the use of roller barriers in comparison with the metal and concrete barriers.

E. Statement of the Problem

The purpose of the study to determine the potential use of roller road barriers at Megadike Access Road in San Fernando, Pampanga. It specifically answers the following questions:

- How is the level of agreeability of the driver respondents on the utilization of roller barrier in megadike be described?
- What is the cost analysis for the installation of concrete, metal, and roller barriers along the Megadike Access Road?

F. Significance of the Study

To inform the public about the possible benefits of using roller barriers, it was important to perform this study. The following could benefit from this especially:

DPWH**.** In the Philippines, public infrastructure, including roads and highways, is planned, built, and maintained by the Department of Public Works and Highways (DPWH). The DPWH may use the results of this study on the prospective usage of roller road barriers to decide how best to implement them on Philippine roads, thereby enhancing road safety and lowering the rate of accidents and fatalities. This may provide valuable insights into the design, construction, and maintenance of road safety barriers.

This may also inform the DPWH's infrastructure planning and design processes, ensuring that road safety barriers are properly installed and maintained.

Highway Patrol. This research may help highway patrol understand how effective they are in reducing the severity of accidents and injuries, and whether they should be installed on highways. By conducting a study and research on their durability, highway patrols could determine whether they are a long-term solution for improving highway safety. This may further provide them evidence that roller barriers are an effective safety measure, which could increase public confidence in them.

Drivers. In the case of a collision, roller barriers are intended to lower the danger of injury or death.By conducting a study and research on roller barriers, drivers may have a better understanding of how they work and how effective they are at improving highway safety. Roller barriers are an example of an innovative safety technology. With this, drivers may stay informed about the latest safety technologies and potentially identify other new safety measures that could benefit them on the road.

Private Vehicle Owners. The private vehicle owners may have a better understanding of how these barriers can help protect them and their passengers on the road. If roller barriers are proved to be successful in lowering accident, severity insurance companies may consider reducing their premiums for vehicles equipped with these barriers. They who install roller barriers could potentially benefit from lower insurance costs as a result.

The Researchers. Being a novice for this kind of topic is challenging. This will serve as a tool to direct and navigate the researchers as they find credible, trustworthy aspects that are known as important facts for deeper comprehension of the topic. Indeed, this research will provide the illumination that will undoubtedly be required in the not too distant future. Researcher networks will have the chance to expand as a result of the study's findings.

Professors. They will use this information to help them in their discussions of relevant teachings. They will find it simpler to discuss connected issues involving the Roller Road Barriers.

Future Researchers. The future researcher or researchers who will carry out the study pertinent to the Roller Road Barriers may use this study as a guide and a reference.

G. Scope and Limitation

This study was conducted to show the drivers' level of agreeability on the use of Roller Road Barriers in Megadike Access Road in San Fernando, Pampanga. The main source ofdata would be on the responses of the respondents on the survey questionnaire on the agreeability of the driver respondents on the use of Roller Road Barriers in Megadike area.

Lastly, the data on cost-analysis for the deployment of roller barriers was the cost-benefit analysis in economic viability concentrating exclusively on the prone region in Megadike which were the curves. No production of the roller road barriers was conducted during the implementation of the study.

H. Definition of Terms

For a better understanding of the study, the following terms were defined in the context of this research:

Access roads - refers to roads or highways that provide entry or exit to a specific location, such as a residential area, a commercial establishment, or a public facility.

Accident - refers to an unexpected event that results in property damage, injury, or loss of life. In the context of road safety, an accident usually involves a collision between one or more vehicles.

Collision - refers to a situation in which two or more objects, such as vehicles, collide with each other, resulting in damage, injury, or loss of life.

Concrete barrier - refers to a type of road barrier made of concrete that is designed to provide protection to vehicles and motorists from potential collisions.

Cost - refers to the amount of money or resources required to implement a specific project or activity.

Cost-benefit analysis - refers to a technique used to determine the economic viability of a project or activity by comparing the costs involved with the expected benefits.

Curve roads - refers to roads that have a curved or winding shape, making it more difficult for motorists to navigate and increasing the risk of accidents.

Economic viability - refers to the ability of a project or activity to generate sufficient economic benefits to justify the costs involved.

Metal barrier - refers to a type of road barrier made of metal that is designed to provide protection to vehicles and motorists from potential collisions.

Prone areas - refers to areas that are more susceptible to accidents or collisions, such as curve roads or areas with high traffic volume.

Road barriers - refers to structures or devices installed along roads or highways to provide protection to vehicles and motorists from potential collisions.

Road safety- refers to the methods and tactics used to stop accidents and encourage highway and road safety.

Roller barriers- refers to a kind of roller-made road barrier that is intended to absorb a collision's force and reroute the car back onto the road, lowering the chance of harm and damage.

Vehicles - refers to motorized or non-motorized modes of transportation used to travel on roads or highways, such as cars, trucks, buses, and bicycles.

II. METHODOLOGY

A. Research Design

The descriptive survey method was used by the researchers to carry out this investigation. Descriptive research is the ideal choice when the objective of the study is to identify characteristics, frequency, trends, and classifications. (McCombes, 2019).

Data were acquired using a survey for the descriptive research. Descriptive research, in the opinion of Shona McCombes (2019), tries to precisely and methodically characterize a population, circumstance, or phenomena. It can respond to questions about what, when, where, when, or how. The definition of a descriptive study design is this type of research, as described by Martyn Shuttleworth in 2008 and later cited in (2021), involves observing and recording a subject's behavior without in any way changing it. It is a respectable method for learning more about specific subjects and acting as a starting point for more quantitative investigations. This type of design makes it possible to explain and justify differences in critical study parameters.

Descriptive survey research design was used in this study for it will describe the level of agreeability of the driver respondents on the use of roller road barriers in megadike access road in San Fernando, Pampanga. Also, it described quantitatively the cost analysis on the use of roller barriers in comparison with the metal and concrete barriers.

B. Site Analysis

This research project on the use of roller barrier was located at Megadike East, San Fernando Access Road in the province of Pampanga. The Megadike map and a section of its road are shown in Figure 2. It is a public road that has 15 km long connecting Jose Abad Santos Ave. Bacolor road to Angeles - Porac - Floridablanca - Dinalupihan Road. Both sides of the road have a deep elevation which is dangerous to thepublic who are passing through due to the lack of barriers on both sides. Most vehicles passing through this dike are private vehicles, motorcycles, and Carmex. The cost analysis would only be focusing on megadike on the portion of curves which are the accident-prone area. When researching traffic incidents in the area, the eastern placement of the Pampanga Megadike is an interesting factor to examine. Here are some items to consider considering the Pampanga Megadike's east location:

Geographical aspects: Understanding the geographical aspects of the Pampanga Megadike's eastern location is critical. This location may include distinctive features such as geography, height fluctuations, closeness to bodies of water, or the existence of natural or manmade structures. These characteristics can have an impact on road conditions and driver behavior, potentially affecting road safety.

Traffic Patterns: Due to its geographical location and proximity to specific destinations or routes, the east location of the Pampanga Megadike may encounter specific traffic patterns. This could lead to increased traffic volume, congestion, or the use of different types of cars on the roadways. It is critical to analyze traffic patterns in order to detect potential danger factors and design appropriate road safety measures.

Environmental Factors: The environment in the Pampanga Megadike's east position may have an impact on road safety. Weather conditions, such as severe rain or flooding, high gusts, or poor visibility due to fog, can all have an impact on driving conditions and raise the chance of an accident. It is critical to investigate the association between these environmental elements and traffic accidents in order to design appropriate safety tactics.

Road Infrastructure: The state and quality of road infrastructure in the Pampanga Megadike's eastern location should be assessed. This involves inspecting the road surface, signage, lighting, lane markings, and any other characteristics that are important. Identifying any flaws or maintenance issues can aid in determining whether inadequate infrastructure leads to traffic accidents.

Understanding Driver Behavior and Awareness: Understanding the behavior and awareness of drivers in the Pampanga Megadike's east position is critical. Speed, adherence to traffic laws, usage of safety equipment, and driver education and training should all be considered. Surveys, interviews, and observational studies can provide insights about driver behavior and point up areas for improvement.

As part of a road safety analysis, researching the east location of the Pampanga Megadike provides an opportunity to analyze the interplay between geographical features, traffic patterns, environmental conditions, road infrastructure, driver behavior, and community engagement. Understanding these elements allows for the identification and implementation of relevant initiatives to improve road safety in the specific location under consideration.

Fig. 10 Megadike Map and road (Google Earth)

C. Respondents of the Study

The study's participants were drivers who are using the Megadike access in San Fernando, Pampanga. The respondents would compose of both public and private vehicle owners, DPWH staff, PNP Highway patrol group who are assigned in the area and experts and professionals who are using the Megadike East Access Road. The convenience sampling method was used to choose the respondents. This indicates that people are picked depending on availability (Wilson, 2010). This sampling method is recommended because it is the most practical, economical, and expedient (Wilson, 2010).

According to the researchers' actual survey, 393 vehicles passed the megadike road in an hour. Based on this, 195 samples were calculated with a 5% margin of error using the Raosoft calculator.

To calculate the appropriate sample size for a given population size, Slovin's formula is utilized. In statistical surveys, it is frequently used to determine the ideal sample size.

The equation reads as follows:

$$n = N / (1 + N * e^2)$$

Where:
n = Sample size
N = Population size
e = Desired margin of error

In this case, the population size is not explicitly mentioned, so we will assume it to be the number of vehicles passing the megadike road in an hour, which is 393. The desired margin of error is specified as 5% or 0.05. Plugging in these values into the formula, we can calculate the sample size.

$$n = 393 / (1 + 393 * (0.05)^2)$$
$$n = 393 / (1 + 393 * 0.0025)$$
$$n = 393 / (1 + 0.9825)$$
$$n = 393 / 1.9825$$
$$n \approx 197.91$$

Based on the Slovin's formula, the calculated sample size is approximately 197.91. Since we cannot have a fraction of a sample, we would round it up to the nearest whole number. Therefore, the recommended sample size for this survey would be 198.

According to the population size and required margin of error, Slovin's formula determines the sample size. However, in this case, the researchers have arrived at a sample size of 195 using a different approach, considering other factors or statistical considerations specific to their study.

The Raosoft calculator uses a similar concept as Slovin's formula, considering the desired margin of error. However, it also incorporates the confidence level, which represents the level of certainty desired in the survey results. The Raosoft calculator offers a more accurate and precise assessment of the necessary sample size by taking the margin of error and confidence level into account.

The researchers have determined a recommended sample size of 195 with a 5% margin of error using the Raosoft calculator, it indicates that they have used an alternative method or calculation to determine the sample size. It is important to note that Slovin's formula is just one of several methods available for calculating sample sizes in surveys.

The cost per meter in concrete barrier and metal barrier were provided by the DPWH 1st District Engineering Office (DEO) Sindalan, City of San Fernando, Pampanga.

TABLE 2
COST PER METER IN CONCRETE BARRIER

	Item No. Description:	405(1)a3	Structural Concrete , 28 Days		
	Unit of Measurement:		cu.m		
	Output per Hour:		1.4		
	DESIGNATION	NO.OF PERSON	NO.OF HOURS	HOURLY RATE	AMOUNT
A	Labor				
	a. Construction Foreman	1	1.00	115.98	115.98
	b. Skilled Laborer	4	1.00	83.81	335.24
	c. Unskilled Laborer	8	1.00	64.68	517.44
	Installation and Removal of Formoworks				
	b. Skilled Laborer	4	1.00	83.81	335.24
	c. Unskilled Laborer	8	1.00	64.68	517.44
	Sub-total for A				1,821.34
	NAME AND CAPACITY	NO.OF UNITS	NO.OF HOURS	HOURLY RATE	AMOUNT
B.	Equipment				
	a. One Bagger Mixer (4-6 cu-ft)	1	1.00	215.50	215.50
	b.Concrete Vibrator	1	1.00	79.30	79.30
	c. Water Truck/Pump (16000L)	1	0.10	3,023.25	302.33
	Minor Tools (5% labor cost)				91.07
	Sub-total for B				688.19
C D E	Total (A + B)				2509.53
	Output per Hour = 1.40 cu m				
	Direct Unit Cost (C + D)				1,792.52
	NAME AND SPECIFICATIONS	UNIT	QUANTITY	UNIT COST	AMOUNT
F	Materials				
	a. Lumber, Good- 4 Uses	bd.ft.	70.00	45.00	785.50
	b. Plywood , 1/2 tck x 4' x 8 - 4 uses	pc.	1.60	735.00	294.00
	c. Assorted CWN (1kg/100 bd.ft. of Lumber)	Kg.	0.70	60.00	42.00
	d. Cement	bag	9.50	240.00	2,280.00
	e. Sand	cu.m.	0.50	325.00	162.50
	f. Gravel	cu.m.	1.00	725.00	725.00
	Sub-total for E				4,291.00
G	Direct Unit Cost (E + F)				4,979.19
H	Overhead, Contingencies and Miscellaneous (OCM)		10% of G		497.92
I	Contractor's Profit (CP)		8% of G		398.34
J	Value Aded Tax (VAT)		5% of (G + H + I)		293.77
K	Total Unit Cost		(G + H + I + J)		6,169.22

TABLE 3
COST PER METER IN METAL BARRIER

	Item No. Description:	603(3)a	Metal guardrail (Metal Beam) Including Concrete Post)		
	Unit of Measurement:		m.		
	Output per Hour:		4.2		
	DESIGNATION	NO.OF PERSON	NO.OF HOURS	HOURLY RATE	AMOUNT
A	Labor				
	a. Construction Foreman	1	1.00	115.00	115.00
	b. Skilled Laborer	2	1.00	82.50	165.00
	c. Unskilled Laborer	4	1.0	63.00	252.00
	Sub-total for A				532
	NAME AND CAPACITY	NO.OF UNITS	NO.OF HOURS	HOURLY RATE	AMOUNT
B.	Equipment				
	a. One Bagger MIxer	1	0.50	200.00	100.00
	b.Concrete Vibrator	1	0.50	70.00	35.00
	c. Water Truck/Pump (16000L)	1	0.05	3,00.00	150.00
	d. Cargo Truck (9-10ml)	1	0.25	1,600.00	400.00
	Minor Tools (5% labor cost)				26.60
	Sub-total for B				711.6
C	Total (A + B)				1243.6
	Output per Hour = 4.20 m				
	Dirct Unit Cost (C + D)				296.1
	NAME AND SPECIFICATIONS	UNIT	QUANTITY	UNIT COST	AMOUNT
F	Materials				
	a. Sement	bag	0.33	235.00	77.55
	b.Sand	cu.m.	0.02	325.00	5.85
	c. Gravel	cu.m.	0.04	700.00	25.20
	d. Metal Beam Guardrail	m.	1.00	1,950.00	1,950.00
	e. Plywood Marine, 1/2 tck x 4' x 8 - 4 uses	pc.	0.25	730.00	45.63
	f. Lumber - 4-uses	bd.ft	8.00	45.00	90.00
	g. Reinforcing Steel Bars, Grade 40	kg.	4.00	60.00	240.00
	h. The Wire (2% RSB)	kg.	0.08	47.00	3.76
	i. Assorted CWN (1kg/100 bd.ft. of Lumber	kg.	0.08	75.00	6.00
	j.Bolt, Nut and Washer 5/8" dia.x 9"	pc.	0.50	68.00	34.00
	k.Bolt, Nut and Washer 5/8" dia.x 1"	pc.	2.00	28.00	56.0
	Sub-total for F				2,533.99
G	Direct Unit Cost (E + F)				2,830.09
H	Overhead, Contingencies and Miscellaneous (OCM)		10% of G		283.01
I	Contractor's Profit (CP)		8% of G		226.41
J	Value Aded Tax (VAT)		5% of (G + H + I)		166.98
K	Total Unit Cost		(G + H + I + J)		3,506.49

D. Instruments of the Study

Data on the drivers' level of satisfaction with the use of roller road barriers were collected using a self-made survey questionnaire in megadike access road in San Fernando City, Pampanga. The questionnaire was developed using extant literatures in research. This underwent professional content evaluation. This tool has 14 statements that pertain roller road barriers' purposes and advantages based on literatures in research. Strongly Agree, Agree, Disagree, and Strongly Disagree were the categories used to categorize levels of agreeability. On the other hand, with the support of renowned construction companies, data regarding the cost comparison of using roller barriers vs. metal and concrete barriers was studied.

E. Gathering Procedure

The following procedures were the guidelines to access and collect the data needed for the study:

- Permission letter sought for its approval of the conduct of the study.
- Visit and survey the location to determine which part of the road is a curve that needs a barrier for the data needed in cost analysis.
- Ask driver respondents to answer in the survey questionnaire to gather data on the information needed on their level of agreeability on the use of roller road barriers in megadike access.

F. Data Analysis

The data to be gathered by the researchers using the statistical techniques for analysis below:

The driver respondents' degree of agreement with using the Roller Road Barriers was expressed as a mean in Megadike access in San Fernando, Pampanga.

To describe the cost analysis on the use of roller barriers in comparison with the metal and concrete barriers, the frequency was used.

Furthermore, the costing of roller, metal and concrete barrier were gathered from the DPWH 1st

District Engineering Office (DEO) Sindalan, City of San Fernando, Pampanga.

The mean score with the descriptive rating, and point values utilized were as follows:

TABLE 4
DESCRIPTIVE RATING OF MEAN SCORE

Mean Score	Descriptive Rating
3.25 – 4.00	Strongly Agree
2.50 – 3.24	Agree
1.75 – 2.49	Disagree
1.00 – 1.74	Strongly Disagree

To describe the cost analysis on the use of roller barriers in comparison with the metal and concrete barriers, the frequency was used.

III. RESULTS AND DISCUSSION

The study's findings are presented in this chapter along with a discussion of the study that aims to describe the level of agreeability of driver respondents on the utilization of roller barrier in Megadike access road in San Fernando, Pampanga and to show the cost analysis on the use of roller barriers compared to metal and concrete barriers.

The first section presents the results of the survey questionnaire conducted among the driver respondents. The responses were analyzed using descriptive statistics to determine the level of agreeability of the drivers towards the use of roller barriers in the Megadike access road. The section also includes a discussion of the findings, which highlights the drivers' perceptions of the effectiveness and safety of roller barriers compared to metal and concrete barriers.

The cost study of roller barriers in comparison to metal and concrete barriers is presented in the second portion of the chapter. The analysis focuses on the cost-benefit analysis in economic viability, concentrating exclusively on the prone areas in Megadike, particularly the curves. The section includes a discussion of the findings, which presents the advantages and disadvantages of each type of barrier and their cost-effectiveness in terms of installation, maintenance, and repair.

The results and discussion of the study are thoroughly analyzed and discussed in this chapter, which might help stakeholders, engineers, and policymakers in the field of road safety in the development and improvement of road safety measures in Megadike access road and other similar areas.

TABLE 5
DESCRIPTIVE STATISTICS ON THE LEVEL OF AGREEABILITY OF THE RESPONDENTS ON THE UTILIZATION OF ROLLER BARRIER IN MEGADIKE

Statements	Mean	SD	Descriptive Rating
1. It reduces the accident numbers.	3.62	0.57	SA
2. It reduces the severity of accidents.	3.51	0.59	SA
3. It reduces the damage to vehicles.	3.56	0.54	SA
4. It reduces the injury to human body.	3.59	0.57	SA
5. It saves lives from accidents.	3.52	0.59	SA
6. It increases the safety of humans and vehicles.	3.49	0.61	SA
7. It has shock absorbent system, which reduces suddenshocks on vehicles.	3.50	0.60	SA
8. It converts shock energy to rotary rotational energy.	3.43	0.60	SA
9. It is easy to install, and maintenance required is also lessthan normal barriers.	3.42	0.60	SA
10. It gives good visibility at night also, with help of reflective tape.	3.47	0.64	SA
11. It has more serviceable life than normal barriers.	3.46	0.61	SA
12. It prevents sudden stoppage and overthrowing of vehicles after collision.	3.49	0.59	SA
13. It can be made by recyclable materials, thus it's eco-friendly.	3.49	0.60	SA
14. It may have high initial cost, but the final cost is less as maintenance required is less and it has more life.	3.55	0.58	SA
Over-All Mean	**3.50**	0.30	SA

Legend:

Numerical Rating	**Descriptive Rating**
3:25-4.00	Strongly Agree (SD)
2.50-3.24	Agree (A)
1.75-2.49	Disagree (D)
1.00-1.74	Strongly Disagree (SD)

1. The Level of Agreeability of the Respondents on the Utilization of Roller Barrier in Megadike

Table 2 presents the results of a survey that aimed to collect data on the level of agreeability of respondents regarding the utilization of roller barriers in a megadike. The survey consists of 14 statementsthat describe the potential benefits of using roller barriersin terms of reducingaccidents, injuries, and damage to vehicles, among others.

The mean score for each statement ranges from 3.42 to 3.62, with an overall mean of 3.50. All mean scores fall under the descriptive rating of "strongly agree" (SA), indicating that the respondents have a high level of agreement with all the statements presented in the survey.

The results suggest that the respondents perceive roller barriers as an effective safety measure that can reduce the number and severity of accidents, injuries, and damage to vehicles. They also believe that roller barriers are easy to install, require less maintenance, have a longer service life, and are eco-friendly.

In conclusion, the results of the survey indicate that the respondents have a positive attitude towards the utilization of roller barriers in a megadike, and they believe that it can bring significant safety benefits.

The findings back up a study by Zhang et al. (2018) that assessed how well roller barriers work in minimizing the severity of accidents on highways. The results showed that roller barriers can effectively absorb and dissipate the impact energy of a vehicle, reducing the severity of the crash and mitigating the risk of injuries and fatalities.

Also, the study by Wu et al. (2019) investigated the maintenance requirements of different types of barriers, including roller barriers and concrete barriers. The results showed that roller barriers require less maintenance compared to concrete barriers, which can reduce the maintenance costs and improve the overall service life of the barriers.

Additionally, Li et al.'s (2019) comparison of the environmental effects of various barrier types revealed that roller barriers have a lower carbon footprint than concrete barriers.This supports the perception of the respondents in the survey that roller barriers are ecofriendly.

Overall, the cited studies provide empirical evidence to support the positive attitude of respondents towards the utilization of roller barriers in a megadike, and suggest that roller barriers can bring significant safety benefits while being easy to install, requiring less maintenance, having a longer service life, and being eco-friendly.

2. Cost Analysis on the Use of Roller Barriers, Metal Barriers and Concrete Barriers

The cost analysis of the figures provided for the roller and concrete barriers can be further expounded as follows:

Roller Barrier. The cost of the roller barrier is P 14,900.00 per meter as shown in Table 3. This means that if the barrier is to beinstalled along a 100-meter stretch, the total cost would be P 1,490,000.00 (100 meters x P 14,900.00/meter).

The price of the Rolling Barrier was quoted as $250, based on the information provided by Focus Technology Co., Ltd. (2022). It is important to note that prices can vary over time and across different suppliers, so it's always recommended to verify the current prices and obtain accurate quotes directly from the manufacturer or authorized suppliers.

The cost of installation, labor, and other necessary materials should also be factored in to arrive at the total cost. Figure 3 illustrates the roller barriers' true appearance. Rolling Barriers are a safety fixture that prevent drivers and passengers from fatal accidents by: absorbing shock energy and converted shock energy into rotational energy. Safety road roller are also being used as a barrier for safety of the road users in certain countries like Malaysia Road Accessory prevents driver and passenger from fatal and destructive accident by not only absorbing shock energy but also converting shock energy into rotational energy. Safety roller can be recycled and eco-friendly. Safety roller barriers are easily adjustable by adding or removing a roller.

Figure 12 shows various megadike vertical drives that should have barriers built at distances of 75 and 108 meters.

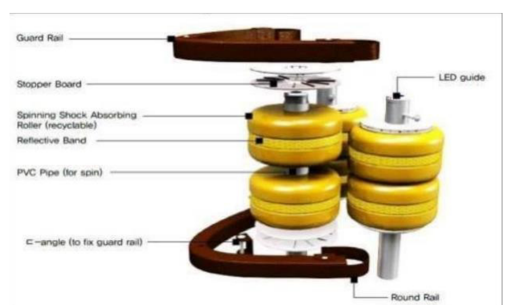

Fig. 11 Roller Barrier

(a) (b)

Fig. 12 Megadike horizontal curves a)108 m and b) 75

Metal Barrier. The metal barriers' structure is seen in figure 5. Metal barrier is another name for a guard rail. Any protective wall or fence built to keep people from harm is referred to as a guard rail. In addition to loading docks, mezzanines, car parks, warehouses, industries, railroads, and even individual properties, guard rails are frequently found along bridges and cliff roads. Guard rails are available in a variety of forms, materials, and sizes, all of which are especially created to improve safety while also boosting productivity.

The cost of the Metal barrier is P 3,796.71 per meter as shown in Table 2. If the same 100- meter stretch were to be installed with concrete barriers, the total cost would be P 379,671.00.

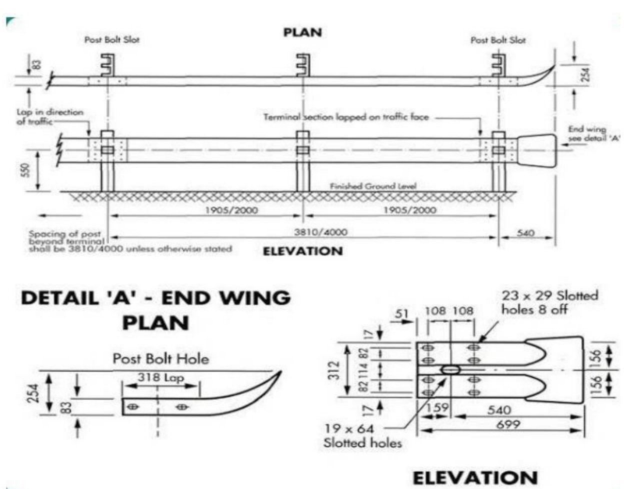

Fig. 13 Metal Barrier Structure

83,487.62 ((100 meters ÷ 4.2meters/hour) x P 3,506.48)

Concrete Barrier. The cost of the concrete barrier is P 6,169.22 per cubic meter as shown in Table 2. If the same 100-meter stretch were to be installed with concrete barriers, the total cost would be P 165,246.97 ((0.375 meters squared dimension of concrete barrier x 100 meters) ÷ 1.4 cubic) meter/hour x P 6,169.22). The cost of installation, labor, and other necessary materials should also be factored in to arrive at the total cost.

The cost analysis shows that the concrete barrier is significantly cheaper than the roller barrier. However, it should also be noted that the initial cost is just one aspect to consider in selecting a barrier type. Other factors such as durability, maintenance, and effectiveness in preventing accidents should also be considered. Figure 6 depicts the concrete barriers' true appearance.

In addition, the cost analysis should also consider the local regulations and requirements for the installation of the barriers. For example, some locations may require specific barrier types or materials for safety reasons. Therefore, a comprehensive cost analysis should be conducted to consider all these factors and determine the most suitable barrier type for the specific application.

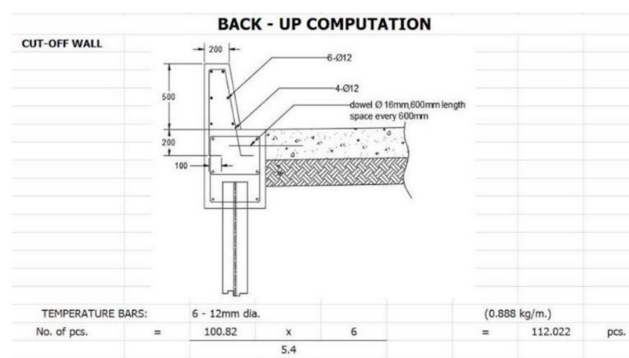

Fig. 14 Concrete Continuous Barrier

The findings are similar with the studies on the cost-effectiveness of different types of barriers for road safety, such as the research by Chen and Qu (2019) on the evaluation of the effectiveness and cost-effectiveness of concrete barriers for motorcycle safety. Other studies, such as the one by Yang et al. (2018), discuss the need for considering the life-cycle cost of infrastructure projects, including the maintenance and replacement costs, in addition to the initial construction cost.

TABLE 4
Cost of concrete, metal and roller barrier

Barrier	Quantity	Measurement (meters)	Cost
Concrete	1	1	₱ 4,500.00
Metal	1	1	₱ 3,796.71
Roller	1	1	₱ 14,900.00

Cost of Roller and Concrete Barrier in Megadike horizontal Curves

Table 4.1 presents the cost analysis report that aims to compare the cost of using roller barriers, metal barriers and concrete barriers in Megadike horizontal curves. The cost analysis was conducted basedon the cost of the barriers per meter and the total length of the horizontal curves. The results of the analysis will be used to determine which barrier type is more costeffective for this specific application. Table 2.1 presents the cost analysis report that aims to compare the cost of using roller barriers, metal barriers and concrete barriers in Megadike horizontal curves. The cost analysis was conducted basedon the cost of the barriers per meter and the total length of the horizontal curves. The results of the analysis will be used to determine which barrier type is more cost effective for this specific application.

Horizontal curves are critical sections of roadways where changes in grade occur. These sections of roadway require proper safety measures to prevent accidents and ensure the safety of road users. Barrier systems are commonly used to improve safety in these areas. However, the selection of barrier types can have a significant impact on the project's cost. This cost analysis report will compare the cost of using roller barriers and concrete barriers in Megadike horizontal curves.

The cost analysis was conducted based on the cost of the barriers per meter and the total length of the horizontal curves. The cost of installation, labor, and other necessary materials were notincluded in the analysis as they were assumed to be the same for both barrier types.

The cost of installing 75 meters of roller barriers is P 1,117,500.00, while the cost of current metal barrier with the same length is P 284,753.25. The cost of installing 108 meters ofroller barriers is P 1,609,200.00, while the cost of the existing same length of metal barrier is P 410,044.68.

The cost analysis results show that using concrete barriers and metal barriers is more costeffective than using roller barriers in Megadike horizontal curves. The cost of using concrete barriers is significantly lower than the cost of using roller barriers for both the 75-meter and 108- meter horizontal curves. Therefore,based on cost alone, concrete barriers are a more suitable option for this specific application.

The cost analysis results show that concrete barriers and metal barriers are a more cost effective option than roller barriers for Megadike horizontal curves. However, it should be noted that other factors such asdurability, maintenance, and effectiveness in preventing accidents should also be considered in selecting the most suitable barrier type for a specific application. Therefore, a comprehensive analysis that considers all these factors should be conducted before making the final decision on which barrier type to use.

These results support the importance of safety measures in horizontal curves is highlighted. This is according to a study by Abhijith and Kumar (2017), that horizontal curves are considered to be the most important transition element in the geometric design of highways and their safety performance is critical to avoid accidents.

More so, the use of barrier systems in horizontal curves for safety improvement is mentioned. According to a report by the National Cooperative Highway Research Program, "Barrier systems are used to protect motorists from obstacles such as bridge piers, retaining walls, and steep slopes, and to contain errant vehicles within their intended travel path" (National Cooperative Highway Research Program, 2016).

It was discussed also the impact of barrier type selection on project cost. According to a study by A. M. Reza et al., "The type of barrier is an important factor in determining the cost of safety measures" (Reza et al., 2018).

Lastly, the importance of conducting a comprehensive analysis that considers all factors in barrier selection is emphasized. According to a report by the Federal Highway Administration, "Barrier selection should be based on a comprehensive analysis that considers not only cost but also safety, durability, and maintenance factors" (Federal Highway Administration, 2008).

TABLE 4.1
Descriptive statistics of Cost of existing Metal and concrete barrier in Megadike horizontal curves

Barrier	Quantity	Measurement(meters)	Cost
Metal	61.5	61.5	₱ 233,497.67
Metal	108	108	₱ 410,044.68
Metal	75	75	₱ 284,753.25
Metal	187.5	187.5	₱ 711,883.13
Metal	274.5	274.5	₱ 1,042,196.90
Concrete	274.5	274.5	₱ 1,235,250.00
		Total	**₱ 3,917,625.62**

The Google map of the Megadike from Porac to Bacolor, Pampanga, is depicted in Figure 7. Table 4.2 reflects the cost of the roller barriers based on the existing concrete barriers in the different location of the Megadike. Based on the researchers' survey that there are 28, 296 vehicles per day passing by the Megadike road. The cost analysis results show that the cost of roller barriers is P 14,900 per meter. In addition, the cost of roller barriers ranges from P 916,350 to P 4,090,050 per segment, depending on the length of the segment. The total cost of roller barriers based on the existing concrete barriers on the different location of the Megadike is at P 14,616,900.00. The cost analysis results show that the use of roller barriers is not significantly cheaper than the use of metal or concrete barriers. But based on research study of Farhan et.al. 2018, conducted to illustrate the need for "Rolling Barriers", which have decreased the accident rate in the aforementioned nations, from the standpoint of India. Rolling barriers provide performance characteristics that reduce injuries to humans and damage to vehicles, including cushioning effects during collisions, lowering the high-speed effect, combining material resilience with stiffness, and others. The number of accidents on level roads, curved road sections, ramps, medians, and other locations has decreased thanks to the usage of roller barriers, which are highly effective. Ramps for entry and departure on steeply curved roadways and in mountainous terrain.

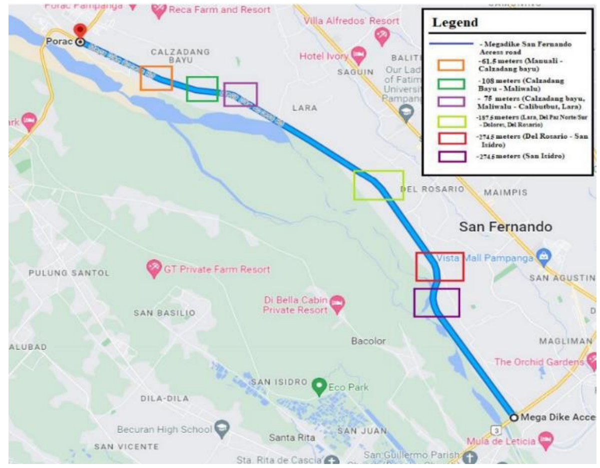

Fig. 15 Megadike Map

TABLE 4.2
Descriptive statistics of cost of roller barrier in the existing barriers of the Megadike roads

Location	Existing	Distance/Post (1.5 meters)	Manual Costing of Post	Roller Barrier Cost (14,900)
Manuali-Calzadang Bayu	Metal Barrier	1.5	61.5	916,350.00
Calzadang Bayu - Maliwalu	Metal Barrier	1.5	108	1,609,200.00
Calzadang Bayu, Maliwalu - Calibutbut, Lara	Metal Barrier	1.5	75	1,117,500.00
Lara, Dela Paz Norte/Sur - Dolores, Del Rosario	Metal Barrier	1.5	187.5	2,793,750.00
Del Rosario - San Isidro	Metal Barrier	1.5	274.5	4,090,050.00
San Isidro	Concrete Barrier	1.5	274.5	4,090,050.00
			Total	14,616,900.00

IV. CONCLUSION AND RECOMMENDATIONS

This chapter presents the summary of findings, conclusions, and recommendations.

A. Summary of Findings

The findings of the study were the following:

1. The Level of Agreeability of the Respondents on the Utilization of Roller Barrier in Megadike. The over-all mean score for all statements is 3.50 with a range of 3.42 to 3.62. All mean scores come under the descriptor "strongly agree" (SA), demonstrating that the respondents strongly agree with all of the survey's assertions

2. Costing of Roller Barrier, Metal Barrier and Concrete Barrier. Concrete barriers cost 4,500 pesos per meter, metal barriers cost 3,796 pesos per meter, and roller barriers cost 14,900 pesos per meter.

The cost of installing 75 meters of roller barriers is P 1,117,500.00, while the cost of current metal barrier with the same length is P 284,753.25. The cost of installing 108 meters ofroller barriers is P 1,609,200.00 while the cost of the existing same length of metal barrier is P 410,044.68.

The cost of roller barriers ranges from P 916,350 to P 4,090,050 per segment, depending on the length of the segment. The total cost of roller barriers based on the existing concrete barriers on the different location of the Megadike is at P 14,616,900.00.

B. Conclusion

According to the study's results, the following are drawn conclusions:

1. The respondents' level of agreement indicates that they have a favorable opinion of using roller barriers in a Megadike.
2. The cheapestbarrier is the metal and concrete barrier but roller barrieris a more effective option to use as barrier based on its durability, maintenance, and effectiveness in preventing accident.

C. Recommendation

Following are the study's findings and conclusions, which are, hereby suggested:

1. Roller barriers should be considered as a potential safety measure in the construction of megadikes. However, it is important to note that the cost of roller barriers is higher than that of concrete barriers, which may be a limiting factor in their adoption. Further research and cost-benefit analysis should be conducted to determine the feasibility and costeffectiveness of using roller barriers in megadikes, taking into consideration the potential safety benefits and long-term savings in maintenance costs.
2. Based on the results of the survey and the cost analysis, it is recommended to utilize roller barriers in the megadike. The survey results indicate that the respondents have a high level of agreement regarding the effectiveness of roller barriers in reducing accidents, injuries, and damage to vehicles. The roller barrier is also significantly cheaper than the concrete barrier, which can provide cost savings in the long run. However, it is important to note that the selection of a barrier type should not be based solely on cost. Other factors such as durability, maintenance requirements, and effectivenessinpreventing accidents should also be considered. It is also essential to comply with local regulations and requirements for the installation of barriers.
3. A comprehensive analysis should be conducted to evaluate all factors and determine the mostsuitable barrier type for the specific application. Nevertheless, based on thesurvey and cost analysis, roller barriers appear to be a viable option for the megadike. 4. Future researchers should think about simulating the speeds of the various vehicles to estimate the accident damage and healthcare costs.

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