Assessment On the Awareness of Tactile Pavements to Visually Impaired Persons and Its Impact to The Safety of Pedestrians at V. Tiomico St. City of San Fernando, Pampanga

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Abstract: - This research focuses on safety assessment and awareness on tactile pavements in V. Tiomico Street, City of San Fernando. The study aims to assess the sidewalks and also aims to provide recommendations for the awareness of tactile pavement usage, intending to promote pedestrian safety and accessibility in the City of San Fernando, Pampanga. A comprehensive survey and investigation were conducted to gather data on the current road conditions and pedestrian behavior. A total of 200 participants were surveyed using a questionnaire. The results showed that most respondents believe that they have little or no control over their safety while walking in V. Tiomico St. In addition, most respondents reported being unaware of their surroundings while walking in the street. Based on these findings, it is recommended that a tactile pavement be constructed in V. Tiomico St. City of San Fernando, Pampanga. Tactile pavement, as a safety feature, can provide critical feedback to visually impaired individuals and alert pedestrians to potential dangers. The proposed construction of a tactile pavement can reduce accidents, improve pedestrian safety, and make the road more inclusive to vulnerable road users. Overall, the research indicates that the construction of tactile pavement presents a feasible and practical solution to improve road safety in V. Tiomico Street, City of San Fernando.

Key Words: - ***Tactile pavement, visually impaired, safety assessment, tenji blocks.***

I. INTRODUCTION

Tactile paving (also known as *tenji* blocks, truncated domes, detectable cautions, tactile tiles, tactile ground surface indicators, tactile walking exterior markers, or detectable warning surfaces) is a structure of textured ground surface indicators used on stairs and railway station platforms to help visually impaired pedestrians. Tactile warnings are surface patterns of truncated domes, cones, or bars that may be detected with a long cane or underfoot and are designed to advise the vision-impaired of impending roadways and dangerous surface or slope changes. (We Capable, n.d.). The tactile pavement was invented by Seiichi Miyake in Japan in 1965. It first appeared in a crosswalk in Okayama city in 1967 and subsequently spread to other pedestrian crossings around Japan. Tactile pavement, or paving that can be touched, communicates a guidance message to visually impaired walkers. When installed at curb ramps, detectable warning plates identify the transition from the pedestrian path to traffic, or they alert a pedestrian to proceed with caution before a flight of steps.

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Because the most tactile pavement is available in a variety of colors and materials, effective color contrast is simple to accomplish with the right tactile paving.

In two circumstances does the color of a tactile have a special meaning:

- Red is only used with blister tactile to indicate a restricted pedestrian crossing.
- Buff blister tactile is only used in uncontrolled pedestrian crossings.

When installing tactile pavement of a certain color, such as red blister paving, at a controlled crossing, the tactile paving will be of a comparable hue to the surrounding paving.

Around 2 million people in the UK are affected by vision loss, according to the NHS. 340,000 of them are officially blind or partially sighted. A routine walk down the street can become dangerous and stressful for someone who is blind.

With the use of tactile, a unique kind of paving, persons can safely and confidently walk footpaths. Pedestrians can get information and be made aware of dangers through tactile pavement slabs. For instance, it can warn blind people about shared cycleways, platform edges, and crossing locations.

You may see little domes or rounded, slightly raised bars on the ground's surface when crossing the street or getting on a train. These markers are a type of tactile paving that can be touched with the feet or a cane. They are also known as detectable warning plates or ground surface indicators. Attention patterns rows of truncated domes arranged in a grid pattern are a particularly popular design element of detectable warning plates. A guiding pattern, often known as a corduroy pattern, is another well-liked design that makes use of rows of rounded, thin bars or lines as indicators.

For pedestrians who are blind or visually impaired, tactile paving or paving that can be felt conveys a message regarding navigating. When positioned at curb ramps, detectable warning plates indicate the change from a pedestrian route to a roadway. This can be anything from a transition from a sidewalk to a road to a warning to commuters to be cautious when approaching a flight of stairs. To generate color contrast, the designs frequently use hues other than the sidewalk.

Tactile pavement, or paving that can be touched, communicates a guidance message to visually impaired walkers. When installed at curb ramps, detectable warning plates identify the transition from the pedestrian path to traffic, or they alert a pedestrian to proceed with caution before a flight of steps. Tactile pavement is the vividly colored (often yellow and/or red) tiles you find on sidewalks, bus and tram stops, metro stations, and other public locations. Marked with little bumps and ridges, these tiles would be installed in any place that claims to be accessible for persons with visual impairment.

According to the UN Convention on the Rights of Persons with Disabilities, persons with disabilities (PWDs) are people who have long-term physical, mental, intellectual, or sensory impairments that, when combined with other factors, may prevent them from fully and equally participating in society. Disability is defined as "an umbrella phrase covering impairments, activity limitations, and participation constraints" by the International Classification of Functioning, Disability, and Health (ICF). An impairment is an issue with a body's structure or function, an activity restriction is a problem that a person has performing a task or action, and a participation restriction is a problem that a person has participating in everyday activities.

More than 1 billion individuals, or roughly 15% of the world's population, are disabled globally. Between 110 to 190 million adults aged 15 and older struggle significantly to operate. In addition, the increased aging of the population and the expansion of chronic diseases are factors in the rising rates of disability. About 80% of PWDs worldwide reside in low-income nations, the majority of which are impoverished and unable to obtain basic treatments. PWDs require more regard and attention in terms of health needs due to their conditions, without discrimination. However, data indicate that PWDs have less access to health care and more unmet needs (WHO, 2011).

According to the 2010 Census of Population and Housing (CPH, 2010), out of the country's 92,100 thousand households, 1,443 thousand Filipinos, or 1.57%, are disabled. The greatest recorded PWD population among the 17 areas was 193 thousand, while the lowest recorded PWD population was 26 thousand in the Cordillera Administrative Region (CAR). In 2010, there were more men than women with disabilities, with men making up 50.9% of all people with disabilities.

For every five (5) PWD, one (18.9%) was between the ages of 0 and 14 years, three (59.0%) were between the ages of 15 and 64, and one (22.1%) was beyond the age of 65 (PSA, 2013).

Table.1. shows Household Population and Persons with Disabilities by Region in the Philippines in 2010 (PSA, 2013).

Table 1. Household Population and Persons with Disability by Region: Philippines, 2010

Region	Household Population (in 1,000)	Household Population with Disability (in 1,000)	Proportion of Persons with Disability to the Household Population (in percent)
Philippines	92,098	1,443	1.57
National Capital Region (NCR)	11,797	167	1.41
Cordillera Administrative Region (CAR)	1,612	26	1.63
Region I - Ilocos	4,743	78	1.64
Region II - Cagayan Valley	3,226	56	1.72
Region III - Central Luzon	10,118	139	1.38
Region IV-A - CALABARZON	12,583	193	1.53
Region IV-B - MIMAROPA	2,732	50	1.85
Region V - Bicol	5,412	100	1.85
Region VI - Western Visayas	7,090	138	1.95
Region VII - Central Visayas	6,785	109	1.6
Region VIII - Eastern Visayas	4,090	72	1.75
Region IX - Zamboanga Peninsula	3,398	46	1.35
Region X - Northern Mindanao	4,285	67	1.56
Region XI - Davao	4,453	71	1.6
Region XII - SOCCSKSARGEN	4,103	59	1.43
Autonomous Region in Muslim Mindanao (ARMM)	3,249	35	1.07
Region XIII - Caraga	2,425	38	1.58

Source: National Statistics Office, *2010 Census of Population and Housing*

Males made up 50.9 percent of all PWD in 2010, while females made up 49.1 percent. According to these numbers, there are 104 male disabled individuals for every 100 female disabled individuals. In the age ranges of 0 to 64 years, there were more disabled men than women. With a sex ratio of 121 men for every 100 females, the age group 0 to 14 years had the biggest excess of males. In contrast, there were more women than men with disabilities in the 65 and older age group.

One PWD (18.9%) was 0 to 14 years old, three (59.0%) were in the working age range (aged 15 to 64), and one (22.1%) was 65 years of age or more for every five PWD.

People with disabilities were more likely to be between the ages of 5 and 19 and 45 and 64. Children aged 10 to 14 were most of the home population with disabilities, by five-year age group (7.2 percent). Then came those between the ages of 5 and 9 (6.7%), 50 to 54 years (6.9%), and those between the ages of 15 and 19 (6.7%). (6.6 percent) (PSA, 2013).

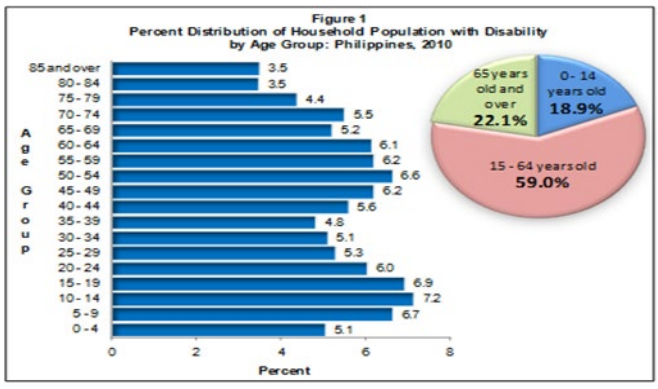


Fig.1. shows the Percent Distribution of Household Population with Disability by Age group in the Philippines in the year 2010.

According to the Department of Health (DOH), over two million (2,000,000) people nationwide in the Philippines are blind or have poor eyesight. According to the DOH, an estimated 332,150 people in the country are bilaterally blind, while the current number of people with bilateral poor vision is 2,179,733. Cataracts were responsible for 33% of the total number of bilaterally blind people, or around 109,609 instances, whereas an error in refraction (EOR) was responsible for 25%. Glaucoma was responsible for 14% of the cases. EOR caused 937, 285, or 43 percent of people with bilateral impaired vision, cataracts caused 34 percent, or 741,109, and glaucoma and other eye illnesses caused the remainder. According to the World Health Organization (WHO), there are roughly 285 million visually impaired persons worldwide, with 39 million blind and 246 million with poor vision. (Jaymalin, 2017).

According to the statistics of the Person with Disability Affairs Office (PDAO) as of 2022, four hundred ninety-five (495) residents of the City of San Fernando Pampanga are visually impaired, forty-eight (48) are totally blind, while the remaining four hundred forty-seven are partially blind.

Visual impairment (vision impairment, vision disability) is characterized as a reduced ability to see to such an extent that it causes problems that are not fixable with conventional means such as glasses or medication. Visual impairment can be caused by disease, trauma, congenital or degenerative conditions, or a combination of these. Schools, colleges, and other educational institutions in the United States use the terms "partially sighted," "low vision," "legally blind," and "totally blind" to describe students with visual impairments (Disabled World, 2022).

Retinal degeneration, albinism, cataracts, glaucoma, muscular issues that cause visual disturbances, corneal disorders, diabetic retinopathy, congenital disorders, and infection are all examples of eye disorders that can cause visual impairments. Cortical visual impairment is a term used to describe visual impairment caused by brain and nerve disorders (CVI). Various conditions only necessitate the use of eyeglasses or contact lenses to correct a person's vision. Other medical conditions may necessitate surgery.

For so long, Civil Engineers have found innovative ways to make our communities advanced and have a less-hassle way of living. By putting all together brilliant minds Civil Engineers found ways to incorporate comfort and reliance for the betterment of society. These handworks may be seen within our

community through buildings, roads, and other infrastructures we see in our community.

Because of everyone's diversity and complexity of needs in life, there are still situations where our means of civilization may still need to expand further. To provide solutions to our societies' needs, we found that not only innovation is our foremost priority but also inclusion. We want our civilized community to not only be seen to have beautiful and stable infrastructures but also to be able to navigate them with overall safety and efficiency. Creating a community where everyone is having the same opportunities and benefits as our Civil Engineered projects should be one of our priorities.

II. Review of Related Literature

2.1 Foreign

Raised lines, domes, and other textures are used in the tactile pavement to help those who are blind, have low vision, or have another visual impairment understand safety information. Large domes or lines are intended to serve as stop signs, whereas softer lines denote a path that is safe for walking. In various locations around the world, both indoor and outdoor spaces have tactile pavement (Grossman, 2017).

Tenji blocks, as they were initially called, are a type of tactile block that was created in Japan in 1965 by Seiichi Miyake. Their uneven surfaces serve a different purpose than what you might expect—they serve to alert the blind to impending danger, such as a curb that slopes into the road. Two years later, Tenji blocks were first installed in Okayama City, and ten years later, they were made a requirement for the Japanese National Railways (Veronica, 2019).

The term "anma," which designates a massage technique as well as the practitioners who use it, was first used by blind acupuncturist Sugiyama Waichi in the 17th century. Sugiyama also established 45 medical schools for the blind that provided massage training. People with visual impairments were able to support themselves financially on their own as soon as they entered the field. During the Tokugawa era, it was forbidden for people to become anma if they were blind (1603–1867). Many blind people are still in great demand today, working as massage therapists, acupuncturists, and moxibustion practitioners. They spend three years in specialty schools to become qualified for these jobs. In Japan, young people with visual impairments enjoy fair access to education, for example at the Special Needs Education School for the Visually Impaired at Tsukuba University. The fact that students from other nations can receive financial aid from the International Association for the Visually Impaired to study in Japan is also noteworthy.

As a result, historically speaking, visually impaired people in Japan have a slightly different social structure than in other nations. They frequently lead independent lives filled with activity, which may be why Braille blocks were developed and installed relatively early in Japan (Geeraert, 2021).

2.2 Local

Marikina had the first tactile tile installed in the Philippines. Marikina's city government is installing Braille tiles on ramps located along the city's sidewalks to ensure the safety of people with disabilities (PWDs). The first batch of Braille tile installations can be found on the sidewalks of the Marikina Sports Center, City Health Center, Marikina Public Market, and the Marikina City Hall compound (The Philippine Star, 2014).

Based on (Baguio City Guide, 2020), the city of Baguio City has put tactile tiles on the pavement along Upper Bonifacio Street in response to the COVID-19 outbreak. Making textured ground surfaces for blind or visually impaired walkers is the goal of tactile tiles and tactile pavements. Different tactile tile patterns could convey various messages or cautions. The Baguio City local administration is making an inclusive effort for the locals who may use the help that these tactile tiles could offer. The City of Pines is walkable, so exploring it on foot could be the best option. People with disabilities living in our neighborhood will be able to navigate the City of Pines more easily with the help of tactile tiles.

2.3 Blind or Visual-Impaired Individuals

According to the World Health Organization (World Health Organization, 2022), there are at least 2.2 billion people who have near/distant visual impairment or blindness. To be blind or visually impaired is categorized according to how it is prevalent. unaddressed refractive error (88.4 million), cataract (94 million), age-related macular degeneration (8 million), glaucoma (7.7 million), diabetic retinopathy (3.9 million) as well as near vision impairment caused by unaddressed presbyopia (826 million). Dr. S. Pakrasi (2019), spending too much time on digital screens and exerting eyes may develop a condition called myopia, or near-sightedness. These conditions along with others can lead to blindness if not early attended and prevented, which means anyone who has excessive exposure to

blue light from digital devices can be Blind or Visually Impaired Individuals.

2.4 Tools Assistance for Mobility

People with no visual impairment can roam or travel independently anywhere without hazards according to capacity and means. Whilst people who are blind and visually impaired are limited to accessing and navigating on their own alone, to gait in liberty, blind and visually impaired individuals may use conventional navigating tools such as canes, guide dogs, and audio-guided technologies. Nevertheless, because of the non-environmental hazards, they may stumble upon and regarding the safety of walking alone outdoors, it weakens and slows their mobility thus it requires them to rely upon someone such as trained nurses or volunteer assistance. To be blind and Visually Impaired cannot take away a person's independence, so through some tools and assistance, a person that is blind or visually impaired can gait on their own. The trending use of Tactile paving can provide massive infrastructure support for navigation in cities or any public areas for people who are blind and visually impaired. Installed Tactile Paving is usually seen and commonly used effectively near public transport stations, pedestrians, and crossroads. Tactile Paving should be embossed on the road to know precisely where they are located. With proper signs and warnings that indicate it is for the infrastructure assistance to blind and visually impaired individuals who need assistance, to navigate freely can be now achieved.

2.5 Technological Assistive Travel Aids

(2017) Chanana et al., there can be an evolution of assistance provided by technological advancement that can assist a blind and visually impaired individual to provide precise details by performing obstacle detection ahead. This new technology can be advantageous in utilizing design locations which serve as maps for blind and visually impaired individuals to access and navigate.

B.-S. Lin, C.-C. Lee, and P.-Y. Chiang, 2017, proposes 3 categories of technological help: electronic orientation aids (EOAs), position locator devices (PLDs), and electronic travel aids (ETAs). These 3 use sensing inputs which are a general camera (or a mobile phone camera), depth camera, Radio Frequency Identification (RFID), Bluetooth beacon, ultrasonic sensor, and infrared sensor, these electronics can use for the advancement of navigating the measurement of walks, distance, or obstacle that may come ahead.

As the ETA's are using technological sensory units to detect possible stagger to a blind or visually impaired individuals' gait, it can still miss the mark to achieve full independence of navigating on their own. Whilst the tactile, using natural sensory units such as foot, hand, arm, fingers, or any body parts where the sense of pressure can be experienced, allows having a directional cue to avoid obstacles by intensifying the feeling sensation naturally.

2.6 Types of Tactile Paving

The fundamental factor of tactile pavement is that varied surface profiles are meant to signal different risks, and they are explained below. (Joomla, n.d.).

Fig.2. Shows the Tactile Types available in the Market.

There are two forms of Blister paving: the most popular type contains 6mm high 'blisters' in a square pattern and they are used to signal pedestrian crossings with lowered kerbs. Normally, the red-colored units are used for light-controlled crosswalks and buff for those crossings with no stoplights. The Offset Blister units, also known as off-street applications, are used to mark the boundary of the platform at rail and tram stations.

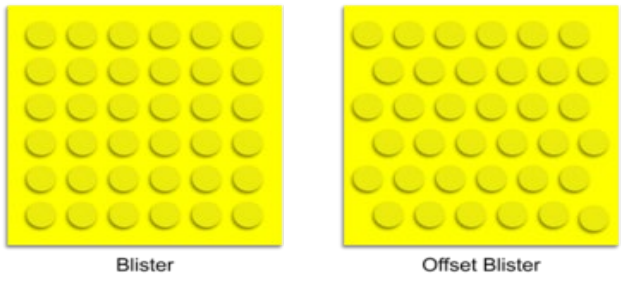
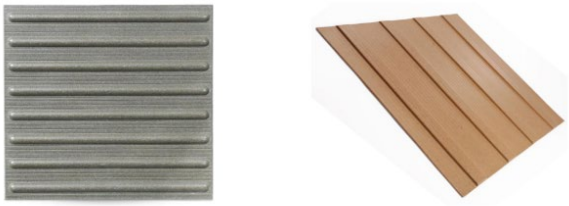


Fig.3. shows what Bister and Offset Blister tactile looks like.

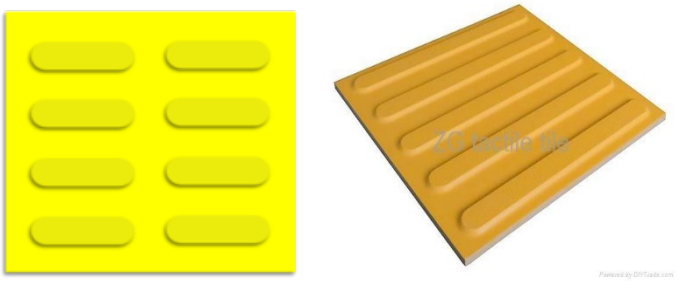
Continuous half-rods that are elevated 6 mm above the level of the pavement are used by Hazard Warning devices to indicate hazards, such as the top and bottom of a flight of stairs. Continuous flat bars are used in cycleway paving to denote a cycle lane. The bars run parallel to the direction of motion so as not to obstruct cycles. This paving may also be used for the pedestrian section where a cycleway and a footpath are close together.



Hazard or Corduroy **Cycleway**

Fig.4. shows Hazard warnings and Cycleway tactile

For the visually impaired, directional or guidance paving is used to indicate the safest path of travel. The raised flat bars have rounded ends. Lozenge paving serves as a platform side warning for on-street uses. As cities rediscover the benefits of trams and light rail transportation (LRT).



Lozenge **Directional**

Fig.5. shows Directional and Lozenge tactile.

2.7 Background of the Study

It focuses on V. Tiomico St. in the City of San Fernando Pampanga. The proposed tactile pavement construction on V. Tiomico St. in San Fernando, Pampanga is intended to address the issue of pedestrian safety in the area. The tactile pavement, a type of ground surface indicator comprised of raised dots or bars, will provide a visual and tactile cue for pedestrians, especially those who are visually impaired, to easily identify the edges of sidewalks and other walkways. The purpose of this research is to evaluate the current safety conditions on V. Tiomico St. and the potential effectiveness of the proposed tactile pavement in improving pedestrian safety. The study's findings will be used to inform the decision-making process for the tactile pavement's construction. If the proposed construction of tactile pavement will be approved, it will help visually impaired persons to prevent possible hazards like falling out from the edges of walkways and sliding by knowing the indicators of tactile pavement such as dots and bars to navigate their way.

2.8 Study Area

Figure 6 shows the road map of the sidewalk of V. Tiomico St. in the City of San Fernando Pampanga.

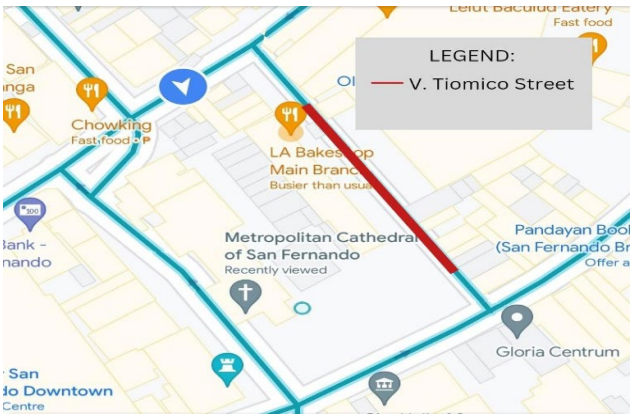


Fig.6. shows the road map of the sidewalk of V. Tiomico St. in the City of San Fernando Pampanga.

Fig.7. shows the bird's eye view of V. Tiomico Street in the City of San Fernando Pampanga.

2.9 Statement of the Problem

People who are blind or visually impaired face unique risks and hazards on the road. This is referring to the involvement of drivers, cyclists, and pedestrians.

"Navigating around an unfamiliar area is always a bit scary, to be honest. Obviously, traditional visual clues, landmarks, etc., aren't there. It helps a lot if clues are consistent, so confusion can certainly occur when that isn't the case. It's very, very important that these adaptations are there to help us and are there in the way that we expect to see them." (Holmes, 2017).

A tactile pavement system was originally implemented in Japan at pedestrian crossings and other dangerous traffic situations. The standard was adopted by the United Kingdom, Australia, and the United States in the early 1990s. Canada began adopting them into transportation in the 1990s, followed by other parts of the built environment in the early 2000s. Most countries in Asia such as Hongkong, Korea, India, Japan, and China wherein most of their cities have already installed tactile pavements on their sidewalks, pathways, pedestrians, and subways. But here in the Philippines, only two (2) cities installed tactile pavements. So, the researchers proposed the construction of a tactile pavement to help the visually impaired. Visual impairment has many underlying reasons for becoming one and it's not what a person could wish for. For the drastic change from being normal to being visually impaired, he/she is still adapting to the new system of life that he/she will do, especially on the road, when walking, and when he/she hits the road. That's where the tactile pavement will come in because he/she will be able to better navigate what he is going through if he/she is close to danger such as the edge of the sidewalks. This is the reason why the researchers propose this study on the construction of tactile pavement in the City of San Fernando Pampanga which is the capital of Pampanga. Moreover, according to the statistical data in Table 1 Region III or Central Luzon, this city has the 3rd most population with disability. Furthermore, researchers choose ages 15-64 to become the respondents in the interviews and surveys because in Figure 1, these ages have the highest population of disabilities in the Philippines.

This study aims to answer the following questions:

- How safe are the sidewalks in V. Tiomico Street to be used as pathways for people who have disabilities?
- How well do the people who travel in the City of San Fernando know about the tactile pavement or tactile paving?
- How many and how often do people experience or witness accidents such as stumbling, or falling outside the sidewalks while using V. Tiomico Street as their pathway?
- How likely are the people who pass V. Tiomico Street will approve of the local government installing tactile paving?
- What material/s are best to use in Tactile pavement?

2.10 Objective of the Study

2.10.1 General Objective

The general objective of this study is the following.

- To evaluate the effectiveness of the existing pavement in V. Tiomico St. in providing safe navigation for visually impaired individuals
- To assess the level of awareness and understanding of visually impaired individuals regarding the tactile pavement in V. Tiomico St.

2.10.2 Specific Objective

This study aims to address the following specificities.

- Conduct a comprehensive assessment of the pavement infrastructure in V. Tiomico St.
- Analyze the physical characteristics of the pavement and their impact on the navigation experience of visually impaired individuals.
- Identify potential hazards and deficiencies in the pavement infrastructure that may pose risks or hinder the safety of visually impaired pedestrians.
- Conduct surveys and interviews with visually impaired individuals to gauge their awareness and knowledge about the tactile pavement.
- Evaluate the perception and understanding of visually impaired individuals regarding the purpose and significance of tactile pavement in facilitating safe navigation.
- Identify potential gaps in knowledge or misconceptions among visually impaired individuals regarding the use and interpretation of tactile pavement indicators.

2.11. SIGNIFICANCE OF THE STUDY

The aim of this study is to make V. Tiomico St. safer for visually impaired people by identifying potential hazards and providing recommendations on how to improve the street. Additionally, the study seeks to increase awareness of tactile pavement and its benefits for visually impaired people.

2.11.1 Education:

The study of the safety assessment and awareness on tactile pavements for visually impaired persons in V. Tiomico St. can provide valuable insights into the role of tactile pavements in creating a more inclusive environment for visually impaired students.

2.11.2 People:

Visually impaired persons can feel more comfortable and less vulnerable while traveling throughout the neighborhood. This can contribute to their overall quality of life, allowing them to engage more in the local community while also improving their safety.

2.11.3 Economy:

The study of the safety assessment and awareness of tactile pavement for visually impaired persons in V. Tiomico St. can have a positive impact on the local economy. With the proper installation and maintenance of tactile pavements, businesses in the area may see an increase in foot traffic and an increase in sales as it is easier for visually impaired people to navigate the streets safely. Additionally, as the area becomes safer and more inclusive, it may become more attractive to investors looking to establish their business in an environment that values accessibility and inclusivity, contributing to overall economic growth in the area.

2.11.4 Future Researchers.

This research will be important in this investigation. It may serve as the researchers' data in the evaluation and design of building materials, as well as partial content adjustments. The study's findings may provide fresh information and interpretation for future and further research on related themes.

2.12 SCOPE AND LIMITATIONS

The study focuses on the importance and safety of using tactile pavement on sidewalks for individuals with visual impairments. Still, it does not address the potential benefits or effectiveness of such systems for other groups, such as individuals with mobility and speech impairment.

Additionally, the study may be limited to a specific geographic location. To be specific the study was conducted by the researchers at V. Tiomico St., in the City of San Fernando near the Old Public Market and Metropolitan Cathedral of San Fernando.

The scope of this study is limited to the assessment of safety and the proposed construction of tactile pavement on V. Tiomico St. in San Fernando, Pampanga. The study will not take into account other potential factors that may affect pedestrian safety on the street, such as traffic flow or the presence of other obstacles. Furthermore, the study will not evaluate the proposed tactile pavement's long-term effectiveness or maintenance. As a result, the findings of this study should be interpreted within these constraints.

2.13 CONCEPTUAL FRAMEWORK

The illustration below depicts the framework for the conceptual underpinning of the proposed investigation. The framework employs the IPO format, which allows users to traverse the entirety of the study. It provides a glimpse of the input, methods involved, and results of the specified study.

INPUT	PROCESS	OUTPUT
Identify the problem. -need to improve for safety and accessibility	*Collection of Data -Survey Questionnaires *Data Analysis -SPSS Software *Results and Conclusions *Recommendation	Proposal of implementation of Tactile pavement in V. Tiomico Street.

III. METHODOLOGY

The study's Methodological Framework is divided into three phases. The Research Design, Research Locale, Respondents Sampling, and Research Instrument are all part of Phase 1. The second phase is Data Collection, which entails acquiring information and evaluating responders. Finally, Phase 3 is dedicated to data analysis and assessment. This phase

addressed the obtained data's results and discussion, as well as the conclusion and recommendations.

Phase 1	Methodological Framework
	● Research Design ● Respondents ● Determination of Sample Size ● Sampling Technique ● Research Instrument
Phase 2	● Data Collection ● Statistical Treatment ● Criteria For Data Analysis ● Ethical Consideration
Phase 3	Data Analysis and Evaluation

3.1 Research Design

The researchers used a mixed-method design, which is a blend of qualitative and quantitative research strategies that best specifies the study's aim. The qualitative technique was used to acquire information regarding the Safety assessment and Proposed Construction of Tactile Pavement. For the quantitative approach particularly descriptive survey. Hence, the researchers conducted in the respondent's natural setting with no variables being manipulated.

3.2 Respondents

The target respondents of the Study are citizens of San Fernando Pampanga and neighboring barangays who are traveling to San Fernando Pampanga and using V. Tiomico Street as one of their pathways. The respondents are aged 15 to 64, male and female.

3.3 Determination of Sample Size

The proposed number received from Raosoft Software, a program that assists in determining the minimum suitable sample size, served as the criterion for the sample size of the survey respondents. Although the software recommended 195 as an acceptable sample size (with a 95% confidence level, a 7% margin of error, and with a 50% response distribution), the researchers chose 200 so that the reported percentage could be easily visualized.

3.4 Sampling Technique

The researchers used a non-probability sample, individuals are selected based on non-random criteria, and not every individual has a chance of being included. Specifically, the researchers used a convenience sample that simply includes the individuals who happen to be most accessible to the researcher in the chosen study area. Convenience sampling is the most often utilized sample approach since it is extremely quick, simple, and inexpensive.

3.5 Research Instrument

This study used printed questionnaires and Google forms to obtain data from the respondents, who are citizens of the City of San Fernando and neighboring barangays who use V. Tiomico Street as their pathway. The questionnaire of this study consists of three sections. The first section includes demographic background and General Information. The next two sections consist of comprised items in measuring the variables of the study. Before the survey questionnaire is utilized, they are validated and approved by professionals. This study also uses Statistical Package for the Social Science (SPSS) software for the data analysis and assessment of the research variables. The researchers also use interview questions. The interview and survey are documented.

3.6 Questionnaires

To collect data from participants, the following sets of survey questionnaires were delivered face-to-face:

3.6.1 Tactile Pavement

The questions in this section are more about the knowledge of Tactile pavement, and how well the respondent's knowledge is, when it comes to Tactile paving. This study's questionnaire

comprised three items in the locus of control portion, with answers on a 5-point Likert scale ranging from 1 strongly disagree to 5 strongly agree.

3.6.2 Construction of Tactile Pavement

This section's questions are more about how safe the respondents feel, and how likely respondents support and agree with the local government improving the pavement of the sidewalk of the V. Tiomico Street. The scope of the control section of the questionnaire in this study included eight items, with responses on a 5-point Likert scale ranging from 1 strongly disagree to 5 strongly agree.

3.7 Data Collection

The study is to be conducted at V. Tiomico St in the City of San Fernando Pampanga. using the survey forms created for this study. The forms were given to random people between the age of 15 to 64, regardless of whether visually impaired or not. The data was collected from the respondents through questionnaires and interviews that the researchers prepared. It served as the foundation for assessing the safety in the proposed implementation and installation of tactile pavement in V. Tiomico Street in the City of San Fernando Pampanga. Following data collection, the following procedures are tabulated: the response applies statistical treatment to the collected data.

3.8 Statistical Treatment of Data

The researchers conducted a survey among visually impaired individuals who have/haven't experienced using tactile pavements. The survey includes questions about the dimensions of the tactile pavement, the frequency of its use, and any issues encountered while using the tactile pavement.

As soon as the researchers gathered the data, they were compiled, sorted, organized, and tabulated. The average scores were calculated automatedly.

3.9 Criteria for Data Analysis

The scores of the respondents in each questionnaire were presented using the following criteria:

Table 2: Criteria for the Street Encounter

Numerical Rating	Interpretation
5	Very often
4	Often
3	Sometimes
2	Rarely
1	Never

Table.3. Criteria for the Safety Awareness

Numerical Rating	Interpretation
5	Very Safe
4	Safe
3	Neutral
2	Unsafe
1	Very Unsafe

Table.4. Criteria for the Situation Awareness

Numerical Rating	Interpretation
5	Very Helpful
4	Helpful
3	Average
2	Below Average
1	Not at all

Table.5. Criteria for the Usage Encounter

Numerical Rating	Interpretation

5	Very Useful
4	Useful
3	Average
2	Below Average
1	Not at all

Table.6. Criteria for the Accident Situation

Numerical Rating	Interpretation
5	Very often
4	Often
3	Sometimes
2	Rarely
1	Never

Table.7. Criteria for the Support Condition

Numerical Rating	Interpretation
5	Strongly Agree
4	Agree
3	Neither Agree nor Disagree
2	Disagree
1	Strongly Disagree

3.10 Ethical Consideration

The subjects are respected during the research. The participants' voluntary participation in the study is verified by a letter of consent and a questionnaire completed and authorized by them. The letter describes the purpose of the study as well as the requirements for participation. The participants were advised that the study was entirely voluntary and would have no impact on their status. Any language used in the questionnaire, whether written or spoken, is not intended to be offensive. The sources employed in this work are appropriately credited and recognized. The research norms were governed by legal and ethical principles that were centered on the well-being of all nonpublic information in the permitted research study. The data that is given to the researchers is confidential and they will only use the data that has been gathered in the study and duly protected by the Data Privacy Act of 2012 (R.A. 10173).

IV. Result and Discussion

4.1 Profile of the Respondents

This section displayed all the findings from the data collected from the respondents, including their sex profile and whether they were citizens of the City of San Fernando Pampanga or a nearby barangay.

Of the total number of respondents is two hundred (200), one hundred fifteen (115) or about 57.5% are female while the remaining 42.5%, or eighty-five (85) respondents are male.

One hundred forty-three (143) 71.5% of the respondents are from the City of San Fernando Pampanga, while the other fifty-seven (57) or 28.5% are from the nearby barangay of the City of San Fernando Pampanga.

92.5% of the respondents or one hundred eighty-five (185) out of the two hundred (200) population of the respondents use V. Tiomico Street as one of their routes and pathway. The remaining 7.5% or fifteen (15) of the respondents don't use V. Tiomico as their pathway.

4.2 Demographic Background

Table.8. Descriptive Statistics for the Questionnaire for the Demographic Background

Indicator	Mean	Verbal Description
1.How often do you travel in the City of San Fernando Pampanga?	3.82	Sometimes
2.How often do you come or pass V. Tiomico Street beside	3.57	Sometimes

the Metropolitan Cathedral Church?		
GRAND MEAN	3.69	Sometimes

Table 8 shows the demographic background of the respondents measuring *How often you travel in the City of San Fernando Pampanga?* and *how often you come or pass V. Tiomico Street?* Hence it is determined that the first question shows a 3.82 mean with the verbal description of Sometimes. While the second question has a 3.57 mean, with a total of 3.69 mean with a Verbal Description of Sometimes.

4.3 Safetiness of Sidewalk in V. Tiomico Street

4.3.1 How safe are the sidewalks in V. Tiomico Street to use as a pathway for people who have a disability?

Table.9. Descriptive Statistics for the Questionnaire for the Safetiness of the Sidewalks in V. Tiomico Street.

Indicator	Mean	Std. Dev	Verbal Description
1. Have you observed or seen a visually impaired individual who used V. Tiomico Street as a pedestrian route?	4.10	0.79	Agree
2. Do you feel safe when you're passing or walking at V. Tiomico Street in the City of San Fernando Pampanga?	3.11	1.21	Neither agree nor disagree
3. Do you think that the current pavement in V. Tiomico Street is safe for people with disabilities, the visually impaired, and blurred vision?	2.54	1.05	Disagree
GRAND MEAN	**3.25**	**0.67**	**Neither agree nor disagree**

Table 9 demonstrates how safe the sidewalks on V. Tiomico Street are as a pathway for individuals with disabilities. In the preceding question, 4.10 means that you have seen or have seen a visually challenged individual who used V. Tiomico Street as a pedestrian path. While 3.11 indicates that respondents neither agree nor disagree with the verbal description, they do not know if they feel safe when passing or walking down V. Tiomico Street. 2.54, on the other hand, refers to the linguistic description of a dissenting belief that the present pavement on V. Tiomico Street is unsafe for individuals with impairments. With a total score of 3.25 and a verbal description of neither agreeing nor disapproving.

4.4 Knowledge of Tactile Pavement

4.4.1 How well do the people who travel in the City of San Fernando know about the tactile pavement or tactile paving?

Table.10. Descriptive Statistics for the Questionnaire for the Familiarity of the Tactile Pavement of Respondents

Indicator	Mean	Std. Dev	Verbal Description
1. Are you familiar with Tactile Pavement	3.79	0.96	Sometimes
2. Have you ever encountered or seen tactile pavement around the City of San Fernando?	3.35	1.12	Rarely
GRAND MEAN	**3.57**	**0.91**	**Sometimes**

Table 10 demonstrates how well individuals who commute in the City of San Fernando understand tactile pavement or tactile paving based on the first question, how familiar are the respondents with tactile pavement? As a result, the statement with the highest mean score, *'Are you familiar with tactile pavement?" (M = 3.79, SD = 0.96)*, is associated with the verbal description of "sometimes." The statement with the lowest mean score is *'Have you ever encountered or seen tactile pavement around the City of San Fernando?" (M = 3.35, SD = 1.12)* with a verbal statement of "rarely, it is shown that with all of the respondents they have rarely encountered tactile pavement, which leads to them being rarely familiarized with the tactile pavement.

4.4.2 How often do people experience or witness accidents such as stumbling or falling outside the sidewalks while using V. Tiomico Street as their pathway?

Table.11. Descriptive Statistics for the Questionnaire for the Experience of Respondents in the safeness of the Sidewalk

Indicator	Mean	Std. Dev	Verbal Description
1. Did you stumble, trip, and fall outside the sidewalk while you are passing V. Tiomico Street in the City of San Fernando Pampanga?	3.63	1.10	Sometimes
GRAND MEAN	**3.63**	**1.10**	**Sometimes**

Based on the question above, Table 11 indicates how frequently respondents experience or see accidents on V. Tiomico Street (M = 3.63, SD = 1.10), with a verbal description of occasionally or sometimes. When utilizing V. Tiomico Street, the responders occasionally slip, trip, and fall outside the sidewalk.

According to (Perkins School For The Blind, 2019), Tactile pavement has been utilized in Japan since the late 1960s, but it wasn't until the 1990s that it became popular in other nations. Tactile pavement became more widespread in the United States with the passage of the Americans with Disabilities Act of 1990, a piece of legislation aimed to increase public space accessibility. Around the same period, countries like Canada, the United Kingdom, and Australia began adding tactile pavement to their paths. The four types of tactile indicators are ceramics, cement, stainless steel, and plastic. Depending on the substance, blind materials can be utilized in a variety of ways. Sidewalks are made of cement.

4.5 Construction and Installation of Tactile Pavement

4.5.1 How likely are the people who pass V. Tiomico Street will approve of the local government installing tactile paving?

Table.12. Descriptive Statistics for the Questionnaire for the Respondent's Approval of the Proposal of Construction and Installation of Tactile Pavement.

Indicator	Mean	Std. Dev	Verbal Description
1. Do you think that it is important to improve the pavement for the safety of the pedestrians of V. Tiomico Street in the City of San Fernando Pampanga?	4.57	0.61	Strongly Agree
2. Do you agree with the local government in installing tactile paving on V. Tiomico Street in the City of San Fernando Pampanga?	4.62	0.53	Strongly Agree
3. Will you support the local government in installing the tactile pavement around V.	4.60	0.55	Strongly Agree

Tiomico Street in the City of San Fernando Pampanga?			
4. Are you confident in the benefits and effectiveness of tactile pavement in improving the safety of pedestrians will outweigh the potential risks and problems?	4.39	0.76	Strongly Agree
GRAND MEAN	**4.54**	**0.61**	**Strongly Agree**

Table 12 shows the descriptive statistics of the responses for the Construction and Installation of Tactile Pavement. To evaluate the supplied variable, all the given elements were used. As a result, the statement with the greatest mean score was chosen as *'Do you agree with the local government in installing the Tactile Pavement around V. Tiomico Street'* (*M = 4.62, SD = 0.53).* Whereas the lowest mean score is '*Are you confident in the benefits and effectiveness of tactile pavement in improving the safety of pedestrians will outweigh the potential risks and problems'* (*M = 4.39, SD = 0.76).* Indicates how probable it is that people who pass by V. Tiomico Street will support the installation of tactile pavement by the local authority. According to the 4.57 mean with the verbal description of strongly agree, the research respondents highly agree that it is vital to upgrade the pavement for pedestrian safety. 4.62 means highly agree with the verbal description, the respondents strongly agree with the government in putting tactile pavement on V Tiomico Street. On the other hand, the mean of 4.60 indicates that the research respondents highly agree with supporting the local government in implementing tactile pavement near V. Tiomico Street. 4.39 means that the respondents strongly agree with the verbal description of being confident in the benefits and efficacy of tactile pavement in boosting pedestrian safety. With a total score of 4.54, I highly agree with the verbal description.

4.5.2 What material/s are best to use in Tactile pavement?

Table 13 Descriptive Statistics for the Questionnaire for the Materials suitable to use for the Construction of Tactile Pavement

Material	**N**	**%**
Concrete	85	42.50
Rubber	84	42.00
Metal	31	15.50
Total	200	100.00

Table 13 presents the percentages of suitable materials to be used in the construction of tactile pavement to improve the sidewalk in the V. Tiomico. The highest percentage of material is concrete 42.50% answered by eighty-five (85) respondents out of two hundred (200). It is followed by rubber with a percentage of 42% answered by eighty-four (84) respondents. Lasty metal, it has 15.50% all-in-all a 100%.

In one of our interviews with the respondents, we asked why he chose concrete as an appropriate material to be used in Tactile, He answered that *"Dahil pag concrete ang ginamit ay hindi na kailangan kada-buwan ay magpapalit, matagal din bago masira."*

(Because when concrete is used, it is no longer necessary to change every month, it also takes a long time before it breaks.)

Based on (Wuyi Xiongchang Hardware Manufacturing Co., n.d.) Ceramics, Cement, Stainless steel, and plastic are the four types of tactile indicators. Blind materials may be used in a variety of ways, depending on the material. Sidewalks are built with cement.

V. Summary, Conclusions and Recommendation

5.1 Summary of Findings

The research looked at safety and suggested the building of tactile pavements for visually challenged people in San Fernando, Pampanga. The researchers employed a mixed-approach strategy that included both qualitative and quantitative research methods. The data was collected from

visually impaired respondents using a descriptive survey technique, and the study discovered that while portions of the sidewalks on V. Tiomico Street were relatively safe, respondents faced challenges such as steep curbs, a lack of tactile pavement, and objects on the sidewalk.
The study looked at safety and proposed the construction of tactile pavement for visually impaired individuals in San Fernando, Pampanga. The researchers used a mixed-approach approach that included qualitative and quantitative research methods. The study discovered that while portions of the sidewalks on V. Tiomico Street were relatively safe, respondents still encountered challenges such as steep curbs, a lack of tactile pavement, and objects on the sidewalk.
Based on the findings, the research advised that tactile pavements be installed on sidewalks in San Fernando, Pampanga, to improve safety and mobility for visually impaired people. The experts also suggested more studies to discover the best design and placement of tactile pavements for maximum benefit.

Throughout the study, ethical issues were taken into account, and subjects were given a letter of agreement before taking part. The study's sources were properly attributed and acknowledged, and the prevailing legal and ethical research rules were followed.
The researchers used a non-random sample, convenience sample approach to collect 200 respondents ranging in age from 15 to 64 years old, including 115 females and 85 males.

The researchers discovered that the respondents are divided on whether the sidewalk on V. Tiomico Street is safe to use as a walkway for individuals with disabilities or not, with a grand mean of 3.25. They also discovered that respondents' understanding of tactile pavement is not particularly great, with a grand mean of 3.57 or such. They also have experiences or have witnessed incidents such as stumbling or falling off from the sidewalks when utilizing V. Tiomico Street as their pathway, which has a mean of 3.63. The grand mean of the responders who strongly agreed or approved of the local government adopting tactile pavement was 4.54. Most respondents (42%, or 85 respondents) believe that concrete is the best material to utilize Tactile pavement.

5.2 Conclusion

The study on the safety assessment and proposed construction of tactile pavement in V. Tiomico St. in the city of San Fernando, Pampanga aimed to identify safety issues and propose a design for tactile pavement that could enhance the safety of pedestrians, particularly those with visual impairments. A mixed-methods approach was employed to gather data, including site inspections, surveys, and interviews with relevant stakeholders.

The results of the study indicate that the current safety conditions of V. Tiomico St. need to be improved, particularly for visually impaired pedestrians. The proposed design for tactile pavement was effective in improving all pedestrians' safety conditions. The installation of tactile pavement in V. Tiomico St. is essential to ensuring the safety and accessibility of the street for all pedestrians, especially those with disabilities.

The thesis concludes that the installation of tactile pavement is crucial for the safety and accessibility of V. Tiomico St. The proposed design for tactile pavement can enhance safety conditions for all pedestrians, particularly those with visual impairments, and ensure the street's compliance with accessibility standards. The findings of this study could also serve as a basis for the development of similar projects in other areas, particularly in ensuring the safety and accessibility of public spaces for persons with disabilities. The implementation of the proposed design could promote inclusivity and improve the quality of life for individuals with disabilities in San Fernando, Pampanga.

5.3 Recommendation

For future studies, we recommend the future researchers on the following:

- Coordinate with the City Engineer to assess the areas in which the tactile pavement can potentially be installed.
- Spreading awareness about Tactile is important for the residents in the City of San Fernando; for them to understand the use of Tactile Paving it will help by Organizing a seminar or training program for residents and stakeholders to further explain and augment their knowledge about the tactile pavement.
- Conduct additional assessments focusing on the busy sidewalks and pedestrian areas within and around the vicinity of the research study to identify other potential areas that could benefit from the tactile pavement.

- Consider the specific needs of different groups of pedestrians, such as people with disabilities, elderly individuals, and children. Tactile pavement should be designed to be accessible and usable for all pedestrians, regardless of their physical abilities.
- Evaluate the costs and benefits of the proposed construction of tactile pavement, including the materials, labor, and ongoing maintenance costs. This can help determine the feasibility of the project and ensure that it is a good investment for the city of San Fernando Pampanga.
- The researchers advise future researchers to employ a simple random sampling in gathering their respondents. It is also recommended that future researchers use data from the last 5 years the study is being conducted.
- It is suggested that future researchers get respondents who work in the Civil Engineering field such as Civil Engineers, Structural Engineers, Construction Engineers, Materials Engineering, and COSH officer for credible respondents.

Through these recommendations, it is hoped that greater awareness and consideration for the needs and safety of pedestrians in San Fernando Pampanga will be achieved, particularly for those who may have visual and physical impairments.

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