

Proposed Development of EGSA (4 Lanes) at City of Balanga, Bataan

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Abstract— The study aims to inspire and empower individuals to proactively embrace the "new normal" lifestyle, fostering healthier living practices through environmentally conscious green design. By doing so, the proposed project will seek advantages for individuals' well-being and for the broader community. By promoting and encouraging healthy living, the project aims to positively impact physical and mental health, thus fortifying resilience during these challenging times of the pandemic and beyond. Also, it endeavors to ensure a safer and more secure transportation environment, benefiting commuters, cyclists, and pedestrians alike. In addition, this undertaking promises to foster a harmonious coexistence between human activities and nature while cultivating a sustainable and health-conscious society.

Index Terms— Healthier living, Mental health, harmonious coexistence.

1. Introduction

The two main problems of the current situation in Bataan, particularly in the City of Balanga, were traffic congestion and a lack of public transportation. Several factors contribute to traffic congestion. The first occurs when the demand for space exceeds the supply. Also, there is a lack of road management design to support pedestrians' and motorists' safety and comfort.

Additionally, because of the pandemic, many individuals are experiencing personal stress, anxiety, depression, feelings of disconnection and isolation, and illness.

Transportation has also been adversely affected. The demands for passenger transport have decreased. COVID-19 has caused people to avoid public transport to avoid crowds and share mobility modes for safety and health protocols.

The proposed development along EGSA (4 lanes) can help encourage people to move forward despite the pandemic. Exposure to nature can make us feel better emotionally.

Also, it can contribute to our physical well-being by reducing blood pressure, regulating heart rate, reducing muscle tension, and increasing the production of stress hormones. Nature walks, jogging, and other outdoor activities build attention and focus. Also, the project will encourage people to take the initiative to support the "new normal of living through healthy living through the involvement of green design. It also seeks to secure the traffic flow between vehicles, cyclists, and pedestrians for the safety and comfort of everyone.

Safe and usable sidewalks offer numerous benefits that can be enhanced by increasing their width, introducing more vegetation, and improving overall accessibility. Sidewalks encourage citizens to actively participate in their communities, create safer pedestrian environments, and contribute to healthier neighborhoods.

A. Review Of Related Literature and Studies

Physical inactivity is an important adjustable behavioral risk factor for non-communicable chronic diseases. Studies have shown that physical inactivity is associated with increased risks of obesity, diabetes, cardiovascular disease, and other chronic diseases. A growing number of studies have focused on the ecological context of physical activity and the influence of the residential built environment on physical activity patterns.

The built environment or the physical form of communities usually consists of 6 dimensions: (1) residential density; (2) street connectivity; (3) accessibility to destinations (land-use mixed) and services; (4) walking and cycling environment; (5) aesthetic quality; and (6) safety. Together, these elements shape access to opportunities for physical activity.

There are three types of data that are typically employed to quantify built environment attributes believed to influence physical activity:

- Perceived (subjective) measures obtained through personal interviews with questionnaires,
- Observational (objective) measures acquired using systematic scans or audits and
- Archival datasets, often layered and analyzed with GIS.

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China is undergoing an unparalleled wave of urbanization, which has been a driving factor in the decline of physical activity and significant transformations in the constructed surroundings. For instance, the expansion of urban development, transportation systems that prioritize driving, and the presence of inconvenient, unsafe, and unappealing public spaces have all contributed to the discouragement of active modes of transportation such as walking and cycling. As a result, it becomes imperative to thoroughly evaluate the characteristics of the built environment before comprehending their correlation with physical activity trends in China.

Although tools for assessing the built environment have transmitted been to developed nations, their application in China remains limited. Moreover, Chinese and other densely populated Asian cities showcase distinctive features within their built environments that may yield diverse associations with physical activities. These features encompass a variety of aspects, including mixed residential housing models, high population density, intricate public transportation networks, a plethora of overpasses, provisions for bike parking, obstructions on sidewalks and bike lanes, as well as unique destinations like historic edifices, tea houses, and open-air food stalls.

Furthermore, it's worth noting that even identical built environment attributes might exhibit different correlations with physical activity in China compared to Western countries. While Western countries generally observe a positive connection between residential density and physical activity, studies have indicated that there's a chance that densely populated Chinese cities could impede leisure-oriented physical activities due to reduced access to activity-promoting resources and heightened concerns about traffic safety.

These considerations underscore the limitations in utilizing existing assessment tools to evaluate China's urban built environment. Therefore, the imperative remains to tailor an instrument catered to China's urban built environment by making necessary adaptations.

B. Theoretical/Conceptual Framework

1) Theories:

There are several theories as to why traffic congestion occurs.

- People frequently reside a considerable distance from their workplace.

Here in the Philippines and numerous other countries, individuals frequently reside a considerable distance from their workplace.

- Economic Theory

According to Anthony Downs an American economist that rush-hour traffic congestion is unavoidable and it is the direct consequence of having a standard work schedule that we know too well. In addition, he says that roads are like goods in a capitalist economy since they can either be by paying or through a first-come, first-served policy.

- Urban Planning Problems

Failure to anticipate the significant rise in population density.

- Mathematical Theories

As per findings by scholars hailing from the London School of Economics and the University of Toronto, a "core principle of road congestion" emerges, indicating that constructing and expanding road infrastructure leads to a resurgence in traffic volume, ultimately returning to the levels observed before. This conclusion was drawn through an analysis of vehicle kilometers traveled (VKT), which exhibited a proportional increase corresponding to the expansion of lane kilometers on the roadways.

2) Design Concept:

The design concept of this study came from green design based on the idea of the relationship between humans and nature. Humans and nature are interdependent and grow together. Nature provides numerous benefits to humans in physical, emotional, intellectual, and even spiritual well-being. However, humans must take care of nature to maintain balance.

The architectural character of the development should be distinct and harmonious in all its components. As a result, it may be an aesthetic and practical idea to use innovative and sustainable materials to relate their form and function to the environment. The design development must appear to reflect the relationship between humans and nature. The design must be environmentally conscious.

3) Statement Of the Problem

Traffic congestion and the lack of public transportation are the two main problems of the current situation in Bataan, especially in the City of Balanga. Several factors contribute to traffic congestion.

4) Negative effects of traffic congestion:

The regular stop-and-go traffic patterns and the close proximity of vehicles make frequent minor collisions and accidents more common. The idea of opportunity cost is irrelevant due to the lost time that is spent in traffic. As a result, a region's economy is negatively impacted. There are times when secondary roads, many of which are residential, experience the same congestion as primary roads. This not only disturbs the peace in neighborhoods, but it may also have a negative effect on property values. One common repercussion is delays. Deliveries that are late, students who arrive late, and employees who are delayed are all caused by traffic delays. However, the most severe repercussion is observed in the delayed response times of critical services such as firetrucks and ambulances, which, if prolonged, can result in loss of life.

Experiencing traffic congestion also leads to fuel inefficiency, thereby amplifying the release of carbon dioxide emissions. This is because vehicles tend to consume more fuel during acceleration from a standstill.

Road rage is a phenomenon we, as Filipinos, are well-acquainted with. What might begin as seemingly harmless displays of frustration through impolite gestures can escalate into instances of forceful and hazardous driving.

Frequently, individuals affected by road rage find themselves engaged in physical altercations, car accidents, and in extreme cases, even incidents of intentional homicide. Incidents of shootings arising from road rage are prevalent in this context. Also, traffic congestion leads to significant economic losses.

5) *Effects for Pedestrians and Cyclists:*

Most cyclists are aware that bike lanes offer a lack of safety, little physical protection, and no legal protection. One of the main reasons people do not bike is the perceived danger or difficulty associated with cycling for utility, which can be remedied through a combination of education and physical infrastructure. Currently, facility designers and planners cannot agree on the best practices for bicycle facility design.

Some studies show that pedestrians killed while walking along the roadway account for almost eight percent of all pedestrian-related deaths involving motor vehicles.

People are looking for alternative modes of transportation as traffic congestion and air pollution reach dangerous levels around the world.

6) *Scope And Limitations of The Study*

This study will focus on the goal of road access development and how it can impact and affect people's well-being, environment, health, lifestyle, and safety through proper road management design that takes nature and the environment into account.

7) *Significance Of the Study*

The goal and design considerations of the proposed development, are stated as follows:

- a. to promote physical activities that support a healthy lifestyle and well-being;
- b. to reduce the traffic flow within the city through promoting other alternative transport modes;
- c. to provide a healthy environment;
- d. to provide safety features through road management;
- e. to reduce air and noise pollution;
- f. to regulate airflow;
- g. to provide sun shading;
- h. to promote sustainable design with healthy benefits for both humans and nature.

8) *Definition Of Terms*

Traffic congestion - refers to a situation in which traffic is backed up, causing more vehicles to line up in a queue on a particular road.

Traffic flow - an area of mathematics and transportation engineering that examines the interactions between infrastructure such as roads, signs, and traffic control devices and users including drivers, cyclists, pedestrians, and their vehicles. Its goal is to comprehend and create a transportation system that is effective in facilitating smooth traffic movement while minimizing traffic congestion-related problems.

Site development – it involves shaping the human experience through intentional design. In this context, site development pertains to purposeful enhancements or alterations made to the campus environment, excluding utilities and buildings.

Nature – encompasses the entirety of the physical world's phenomena, encompassing plants, animals, landscapes, and various earth-derived elements and creations. This stands in contrast to humans and their handcrafted innovations.

Environment - refers to the surroundings, conditions, and factors that collectively influence and affect the living organisms, systems, and processes within a specific area or on a larger scale. This includes both the natural elements such as air, water, land, and ecosystems, as well as the interactions and impacts of human activities on these elements.

Green design – process of creating products, buildings, systems, and environments that minimize their negative impact on the environment while promoting resource efficiency, energy conservation, and the well-being of both people and the planet. It involves incorporating environmentally responsible practices and materials throughout the design process to reduce waste, conserve energy, and minimize the overall ecological footprint of a project or product.

Well-being - refers to the practice of creating products, buildings, systems, and environments that minimize their negative impact on the environment while promoting resource efficiency, energy conservation, and the well-being of both people and the planet. It involves incorporating environmentally responsible practices and materials throughout the design process to reduce waste, conserve energy, and minimize the overall ecological footprint of a project or product.

Access road – an access road refers to a road or pathway that provides a means of entry to a particular area, location, or property.

Pedestrian - a person who is traveling on foot, usually along sidewalks, pathways, or designated pedestrian areas.

Motorist - a person who drives a motor vehicle, such as a car, truck, motorcycle, or any other type of engine-powered vehicle.

Transportation - refers to the transfer of information, goods, or people between locations.

Transportation facilities - refer to the facilities, services, and amenities that are planned and offered to facilitate the transportation of people, goods, and vehicles between two points.

Cyclist - a person who travels on a bicycle, a two-wheeled human-powered vehicle.

Bike lane - is a designated area of a road intended to give cyclists a safe place to ride alongside motorized traffic, lowering the risk of accidents and increasing general road safety.

Sidewalks - a pavement or footpath in some regions, is a paved pathway or walking area situated alongside a road, street, or other thoroughfare.

Roadway - refers to the part of a thoroughfare or route that is specifically designed and paved for vehicular travel.

Buffer Zone - refers to an area of land, water, or space that is intentionally left undeveloped or used for specific purposes to create a protective barrier or separation between two different zones.

Green buffer wall - refers to a structure or barrier that incorporates vegetation or plantings to create a visual, environmental, or functional separation between different areas.

2. Methods And Procedures

A. Research Design

The research methods used in the study are the following:

- a. The descriptive method uses a survey to identify the specific condition and situation of the site location.
- b. Online Research methods based on related literature from local and international conditions of road management network design and strategies.

B. Population And Locale of The Study

1) Location

The City of Balanga is located in the southwestern region of Central Luzon, within the eastern part of the Province of Bataan. Balanga City shares its borders with Abucay to the north, Manila Bay to the east, the Bagac and Morong mountains to the west, and Pilar to the south. The city is divided by the Talisay River, originating in the Mariveles mountains, and winding its way from the southwest to the northeast.

The City of Balanga is situated within fertile alluvial plains which have significantly contributed to the expansion of its agricultural economy. It is positioned at approximately 14°15' to 15°60' N latitude and 120°45' to 120°10' E longitude.

2) Population

The entire population of the province of Bataan was 853,373 as of May 1, 2020. The household population made up 849,575 or 99.6 percent of the total population. The institutional population, or those who live in communal or institutional living spaces like hospitals, orphanages, and military camps, makes up the remaining 0.4 percent of the Bataan population.

Compared to the 760,650 total population in 2015, Bataan's population expanded by 92,723, for an annual population growth rate (PGR) of 2.45 percent. In contrast, the population growth rate in the Province of Bataan between 2010 and 2015 was greater at 1.94 percent.

The City of Balanga spans 11,163 ha in total land area and comprises a sum of 25 barangays.

According to projections made in December 2010 using data from the 2000-2007 National Census Statistics Report, Balanga had 91,059 inhabitants overall and experienced an average growth rate of percent.

C. Data Gathering Instruments, Technique, And Procedures

The researchers used different data-gathering methods, procedures, and techniques to gain further knowledge on the content of the proposed study. Data collection from the site's actual condition to demonstrate the feasibility of the proposed site development plan.



Fig.1. Location Map



Fig.2. Existing Site Condition- Site Inspection/ Ocular Site Visit

3. Presentation, Analysis, And Interpretation

The road development plan under consideration incorporates safety elements and involves making available a set of road layers intended for maintenance management and transportation planning processes within a public works agency. This study aims to enhance road management design, which in turn can contribute to the safety of all individuals, leading to an improved human index for the province and fostering a stronger connection between humans and nature.

A. Project Development:

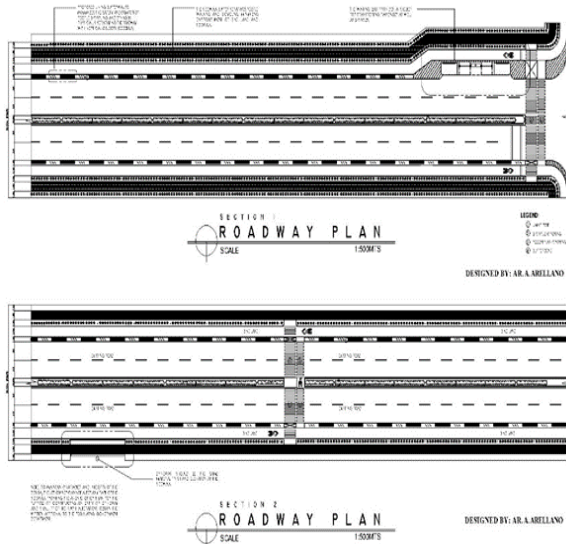


Fig.3. Proposed Site Development Plan

B. Design:

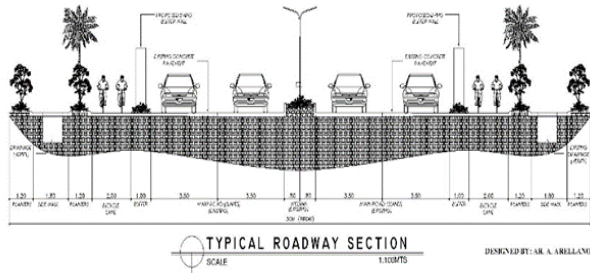


Fig.4. Proposed Roadway section

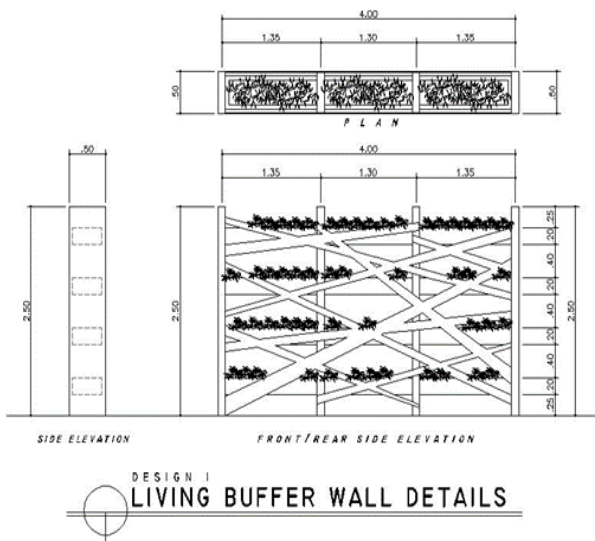


Fig.5. Living Buffer Wall Design and Details 1

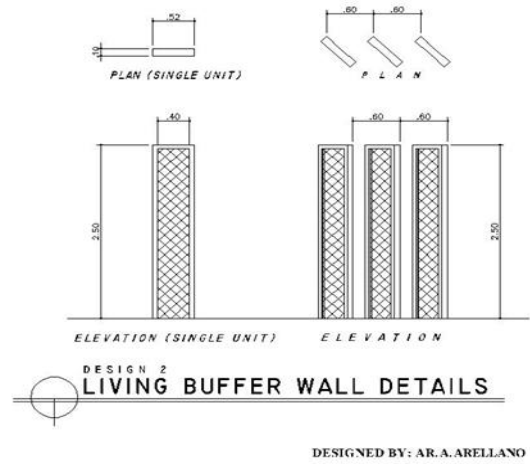


Fig.6. Living Buffer Wall Design and Details 2



Fig.7. Lanes Roadway Perspective



Fig.8. Aerial Perspective



Fig.9. Bike Lane Perspective



Fig.10. Sidewalk Perspective



Fig.11. Sidewalk and Bike Lane Perspective



Fig.12. Two Lanes Roadway Perspective

4. Summary, Conclusions, And Recommendations

A. Summary Of Findings

Safe and usable sidewalks and bike lanes provide numerous benefits, all of which are enhanced by increasing their width, vegetation, and overall accessibility. Sidewalks encourage citizens to participate in their communities, make pedestrian environments safer, and result in healthier neighborhoods. Increased sidewalk width may not only provide a safer and more comfortable environment for pedestrians, but it may also increase the number of pedestrians walking. Citizens will be more likely to walk if they believe it is a safe option.

Proper illumination and clear signage along sidewalks, bike lanes, and roadways can enhance pedestrian mobility by amplifying their sense of safety. This heightened feeling of security stems from improved visibility. As pedestrian activity rises and vehicular traffic decreases, traffic congestion

diminishes along with greenhouse gas emissions and other pollutants. Enlarging the width of sidewalks and bike lanes, as well as enhancing their accessibility, presents citizens with diversified transportation choices while simultaneously alleviating congestion on public thoroughfares.

Walking and cycling confer health benefits that set them apart from other modes of transportation. These activities can contribute to weight management, blood pressure regulation, and the prevention of heart diseases and strokes. Moreover, incorporating vegetative buffers serves multiple purposes. Not only do they purify and regulate airflow and capture greenhouse gases, but they also foster biodiversity. Additionally, they play a crucial role in long-term stormwater management, leading to cost savings.

The increased mobility facilitated by broader sidewalks also yields positive effects on local economies. The surge in pedestrian traffic can significantly bolster sales for local businesses, all the while reducing citizens' expenditures on transportation and parking fees.

B. Conclusions

The research combines best practices in design and construction with evidence-based health and wellness interventions. It uses the built environment as a vehicle to support human health, well-being, and comfort. Proper design, spaces, and developments can result in a built environment that benefits nutrition, fitness, mood, and well-being. End users' sleep, comfort, and performance are all improved. This is accomplished in part by implementing strategies, programs, and technologies aimed at encouraging healthier, more active lifestyles and reducing occupant exposure to hazardous chemicals and pollutants.

Proper and correct design and implementation of an ordinance on road network management can have an impact on everyone's lives, comfort, and safety. A safe and usable public transportation system, road networks, pedestrian walkways, bike lanes, and roadways, as well as other road management accessories, can benefit both humans and nature.

With the support of local governments, we can reduce the number of vehicle miles traveled, thus reducing greenhouse gas (GHG) emissions. Additionally, different modes of transportation (walking, biking, etc.) become more feasible, and traffic is reduced. Creating compact, walkable environments can encourage healthier levels of activity and social interaction.

Sidewalks and bike lanes give pedestrians space to travel within the public right-of-way, separate from vehicles on the road. This ability to connect with the community through sidewalks and bike lanes also significantly reduces the number of pedestrian conflicts with motor vehicles.

C. Recommendations

Local governments should consider the following factors when drafting an ordinance to address sidewalk width, bike lanes, roadways, and buffer zones: street type, adjacent land use, adjacent building height, and roadway characteristics. Greater pedestrian traffic areas, such as large shopping malls,

schools, or tourist attractions, may necessitate broader minimum requirements, which may encourage pedestrian mobility.

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