

An Assessment of the Gender Responsiveness of Road Infrastructures of the Department of Public Works and Highways

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ABSTRACT

This study assessed the gender responsiveness of roads and related facilities connecting three cities of Northern Mindanao, Philippines and participated by road users. A guide of the Department of Public Works and Highways for gender responsive road, but modified, was used in the conduct of the study. The results showed that women travel the most than men and the working group aged 18-59 often travel. Persons with disability traveled the least among the commuters and only a few adults travel with children. The study found that the three road sections in Region X are highly-gender responsive in terms of the road surface, accessibility of services, and hygiene for women and men. This implies that the commuters often observed the existence of these items along the roads. However, according to the performance governance system scorecard, the other roads features of the guideline did not pass. Hence, recommendations to improve these to meet the performance target were included in this study.

Keywords: commuter, vulnerable sectors, road safety, road features, facilities, safety, gender sensitive

INTRODUCTION

A holistic approach of road infrastructures ensures that the road is beneficial to all road users, not only to the motorists but also to pedestrians like senior citizens, a person with disability, and pregnant women. The planning up to the implementation of road infrastructure is necessary due to the increasing number of road lanes from two to six lanes, road users, vehicles, and non-motorized vehicles. The Department of Public works and Highways (DPWH), as the implementing office, needs to understand the characteristics and demands of the different kinds of road users concerning their travel needs and how the roads affect their living. This study hopes to contribute to the attainment of the government objective and efforts towards gender-responsive roads.

As a civil engineer working for the DPWH, one observed that the design criteria of the roads considered only the Annual Average Daily Traffic (AADT) equivalent to the volume of traffic, the horizontal and vertical alignment, the speed and type of vehicles. However, the criteria of the volume of pedestrians and other road users and their safety are not included in the design. Recently, DPWH GAD focal personnel of the district engineering office used Tool 9 as a guide in the field inspection to assess gender responsiveness roads along the national highway. To this end, after the completion of the roads, people living nearby by the roads still complain due to experienced flooding in the area. There was no provision for drainage in the completed road. The police reports showed some pedestrian accidents because there were no sidewalks or walking lanes provided on the roads (Domingo, 2021).

With the commitment of the Philippine national government to international organizations such as the United Nations (UN) and ASEAN nations, the Department of Public Works and Highways (DPWH) integrated gender actions in the implementation of road infrastructures. In 2011, DPWH developed a toolkit making roads gender-responsive. A guideline used in the assessment of gender responsive road infrastructures and related facilities was Tool 9, one of the tools of DPWH toolkit (Cabral et al., 2011). The Highway Safety Design Standards Manual (2012) where the planning of road projects considers careful planning and provision of public transport facilities to minimize the conflict areas between pedestrians and vehicles. The utmost consideration by providing facilities to pedestrians were given that would separate them from local traffic. The elevated walkways were designed and planned, considering the travel patterns and volume of pedestrians (DPWH DO No. X, 2012). In 2017, Department Order No. 82 adopted the DPWH Performance Governance System (PGS) Strategy

Map and Enterprise Scorecard 2017-2022 as a tool in the strategy formulation, execution, and monitoring results. Measure profile no. 3 in the scorecard mentioned that the proposal bypass/diversion road of at least 4-lanes would have completed features such as drainage, sidewalk, curb and gutter, shoulder, pavement markings, signage, and bike lanes (DPWH, DO no. 82, 2017).

The DPWH wanted to make roads gender-responsive. This will provide other road facilities for both women and men as well as to the disabled persons for safe travel. To advance on its aims, the DPWH needs to look at some important features regarding some data related to the traits of females and males on traveling (Cabral et al., 2011). Allen (2018) informed that women and men differed in their travel needs and patterns according to studies. Men traveled most due to employment and women engage in more trips in a day than men, though they travel mostly for short distances (Heesch, Sahlqvist & Garrard, 2012; Allen, 2018). In developing countries due to both economic and social reasons, a significant number of women have lesser access to either individual or public means of transport and are hence dependent on walking, cycling, and other non-motorized vehicles (Peters, 2011).

In order to eliminate discrimination against women and other marginalized sectors, gender equality becomes a national government policy and a commitment to the international community. Among the national laws and policies for gender equality is Section 14, Article II of the 1987 Philippine Constitution wherein the State recognized the role of women in nation-building and ensured that women and men have equal rights before the law.

Likewise, the Republic Act 7192 or the Women in Development and Nation Building Act considers women as full and equal partners of men in the development and nation-building. Executive Order 273 series of 1995 approved and adopted the Philippine Plan for Gender-Responsive Development, 1995 - 2025 directing all government agencies and local levels to institutionalize GAD programs by incorporating GAD concerns in their planning, programming and budgeting processes (Cabral et al., 2011).

The General Appropriations Act section 32 (Department of Budget and Management, 2010) mandated government institutions to formulate a Gender and Development Plan and programs to address gender issues within their concerned sectors and allocated at least five percent of the agency's budget appropriations for the implementation of their Gender and Development Plan. There is also the Magna Carta of Women or RA 9710 that enjoined all departments, including state universities and colleges, government-owned and controlled corporations, local government units adopting gender mainstreaming as a strategy promoting

women human rights and eliminate gender discrimination in their systems, structures, policies, programs, processes, and procedures.

Thus, the Department of Public Works and Highways was mandated to design, plan, construct, and the maintenance of national roads, and bridges, flood control, water resources projects and other public works. Department Order No. 48, series of 2011, mainstreamed gender actions in road infrastructure projects to ensure roads must be gender-responsive. DPWH developed a tool kit using the Gender and Development Guidelines (GAD) for Project Development, Implementation, Monitoring, and Evaluation, or as a guide. This guideline includes the different road features such as road surface, pedestrian areas, lanes for non-motorized vehicles or intermediate modes of transport, accessibility of services, safety and security, hygiene for women and men, and environment-friendly and aesthetic features. This study, thus, provides an assessment of how the roads are gender-responsive to road-users.

FRAMEWORK

The Gender Mainstreaming by the Council of Europe states that the system shall consider the differences between the condition and needs of women and men in all community policies and actions. Gender mainstreaming in the organization means the improvement, development, and evaluation of policy processes toward gender equality perspective and incorporation of these policies at different levels and stages by the authorities. In 2015, the European Institute for Gender Equality (EIGE) mandated to strengthen the promotion of gender equality (Gori E., Romolini A., & Fissi, S., 2018).

The Theory of Gender Sensitive Practices advanced by Poggio in 2006 as cited by Muller and Palmen (2022) stresses to include the process of assessment of implication for women and men for any planned action, which includes the legislation of policies. It is to integrate the needs and experiences of women and men as one dimension of the design, implementation, and evaluation of policies and programs in all political, economic, and societal spheres.

In the Philippines, gender mainstreaming was initiated by the mandate of Executive Order No. 273 to all government agencies to institutionalize the GAD efforts in the government. The DPWH developed a guideline for gender-sensitive roads that leads to gender-responsive infrastructure. Tool 9 serves as a guide for assessing the gender responsiveness of road infrastructures and related facilities or the extent to which current road infrastructures reflect the vision of gender mainstreaming. This will link the gap between road users, monitoring

institutions, private sectors and the DPWH with a goal to embed gender equality and women empowerment. This tool is a guide in the major phase of a road infrastructure implementation such as planning, design, construction, and maintenance (Cabral et al., 2011).

The effort of the Philippine government to adhere to the gender-sensitive practices are in the guidelines. The agency fulfills this operation through certain criteria to follow in the construction of roads. This criterion covers road surface, pedestrian areas, lanes for the intermediate mode of transport, accessibility of services, safety and security, hygiene for both genders, and environmental-friendly and aesthetic features.

The DPWH Department order no. 47, series of 2015 give information about road roughness as an indicator of road condition in terms of road pavement performance as a major determinant in vehicle operating cost. Poor roughness characteristic of pavement will result in the inconvenience of the riding public, increase in vehicle operating cost, increase in accident potential, and reduction in pavement life. Likewise, the DPWH department order no. 41 series of 2016 identifies various road pavement defects such as potholes, cracks, shoving and corrugation, and pumping and depression.

WHO in 2011 suggested that maybe there are now more than a billion people who have some form of disability. The reduction of poverty and participation of people with disabilities can be facilitated by improving their accessibility and mobility. Physical accessibility will not only benefit persons with disabilities but also to people who have limited mobility, including the elderly, children, and pregnant women, and that due to the lower economic status of women, they often use less expensive and less desirable public transit options than men (Babinard et al., 2012; Bickenbach, J., 2011).

Non-motorized transportation includes walking, biking, and small-wheeled transport or a wheelchair. However, research shows that taking public transit will have the same health, environmental, and economically favorable uses as walking and biking (Maghelal, 2011; Litman 2012; Jones, 2012). For a bicycling network to attract the wide population its most fundamental attribute should be low – stress connectivity that provides easy routes (Mekuria et al., 2012).

Common in most landscapes around the world are habitat loss, fragmentation, and degradation. One cause of this is the building of roads and infrastructures. Thus, greening the highways may be a series planting, studying long-term survival and growth of transplanted deciduous trees in urban highway right-of-way environments about species, site, and production techniques. Some landscapes often appear underutilized but may contain valuable space for building the urban

forest and desired green infrastructure (Bigger, 2015; Van Der Ree et al., 2011).

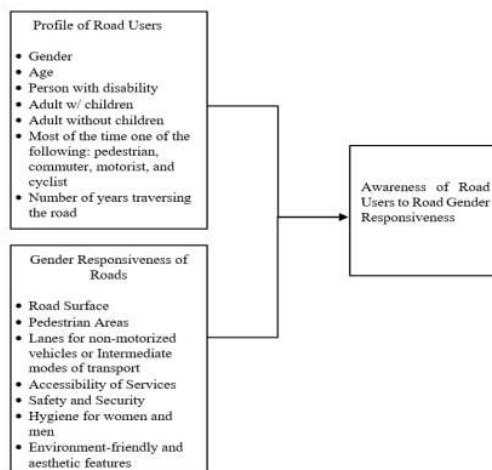
If our pavements and roads allow our movement across the built environment landscapes, then provisions should also be in place to meet the needs of the body in motion. The design of public toilets and rest areas were introduced in studies for the relief of travelers (Ramster et al., 2018; Yunusa, 2015).

The effort of the Philippine government to adhere to the gender sensitive practices are within the guidelines implemented by the DPWH on roads and highways. It is the aim of this study to evaluate the implementation of the guidelines and to determine whether gender-sensitive practices are present among roads and highways according to the perception of road users, as presented in Figure 1.

The profile of the road users identifies the gender, age, a person with a disability, an adult with children, adult without children, and most of the time road user is one of the following: pedestrian, commuter, motorist, and cyclist, and the number of years traversing the road. The gender responsiveness of roads is described by the following: road surface, pedestrian area, lanes for non-motorized vehicles, and intermediate mode of transportation, accessibility of services, safety and security, hygiene for women and men, and environment-friendly and aesthetic features. The perception of the road user is used to assess the gender responsiveness of the roads.

Figure 1

The Research Scheme



OBJECTIVE OF THE STUDY

The study aimed to assess the gender responsiveness of national roads implemented by DPWH Region 10. It identified the road users according to gender, age, a person with a disability, adult with children, adult without children, and most of the time road user is one of the following: pedestrian, commuter, motorist, and cyclist, and the number of years traversing the road. It also described the extent of the gender responsiveness of the roads according to the road users in terms of the following: road surface, pedestrian area, lanes for non-motorized vehicles, and intermediate mode of transportation, accessibility of services, safety, and security, hygiene for women and men, and environment-friendly and aesthetic features; their perception assessed the gender responsiveness of the roads.

METHODOLOGY

This study was conducted in Region X in the Philippines, specifically, in the center of Malaybalay City, Gingoog City and Iligan City, where the national highway traversed meeting in Cagayan de Oro City. These are major cities of Region X and growth centers for economics having international seaport and container terminals and has vast agricultural lands and rich in natural resources. The highways were constructed and maintained by the DPWH Region X. With a high mobility rate, 402 road users participated equally distributed using convenience sampling from the three cities.

A researcher-modified questionnaire of DPWH was used as a guide for the assessment of gender-responsive road infrastructures and related facilities survey instrument questionnaire (DPWH, 2011). The modification was the addition of indicators and at the end of each a 5-point Likert scale was used; 5 being Strongly Aware, 4 being Highly Aware, 3 for Moderately Aware, 2 for Less Aware and 1 for Not Aware. This questionnaire was found to be reliable having a Cronbach's alpha of .921 by the Liceo de Cagayan University Research and Publication office. With anonymity of their names and answers held confidential, data from the road users was gathered and analyzed using frequency and percentage, mean, Pearson product moment correlation and multiple regression.

RESULTS AND DISCUSSION

It must be noted that the road users' rating may reflect the performance of DPWH towards its vision that is to improve the life of every Filipino through quality infrastructure. To achieve its goals through DO No. 082 series 2017, the agency adopted the performance governance system scorecard (PGS) as a tool of the management to measure the performance of the operations. In the scorecard, it must give at least Very Satisfactory rating as to conformity with design standards, and in the annual scorecard, audit of the District Engineering Office. It also must give a Very Satisfactory rating as to compliance with maintenance policy guidelines on the maintenance of roads. Widened roads and by-pass roads can be measured to at least four lanes with the following features such as drainage, sidewalk, curb, and gutter, shoulder, pavement markings, signage, and bike lanes.

On Road User Profile

Results show that women are the predominant (59.4%) participants. Women usually prefer jobs or self-employment and are stationed near their areas of residence for reduced travel time and distance between home and the workplace. For this reason, women depend on the available pedestrian footpath network, although a number of them opt for public buses if the travel involves reaching out to the city center or upcountry. Men, in search of paid employment and the related aspects of family provisioning travel longer and make fewer trips.

Travel patterns showed that most commuters and road users are from 18 to 59 years old (85.7%), the working group, and can travel at far distances from home. There were 82% commuters who are adults without children. This majority may also be the working group. Only 17% are with children. They maybe those going to and from schools and those going to the market or other places with no one to leave their child behind at home. Those aged 60 and above (14.4%) though with high income but could no longer often travel farther because of their physical condition. Only 1.49 percent are persons with disability who travel but travel less due to the absence of facilities for disabled persons in bus terminals and bus transits. A paper assessed the travel characteristics and mobility of the elderly and the handicapped in Nigeria. Vehicle designs, access, and waiting time as well as poor facilities at road terminals hampered the effective mobility of the elderly and the handicapped (Tiwari, 2014). Most of the time, 88.1% signified to be commuters and preferred to commute rather than to drive any vehicles, 11% were cyclist riding bicycles and motorcycles.

On the Extent of Road Gender Responsiveness

Road Surface. Road users rated the road surfaces according to smoothness and safety for travel of pregnant women and sick persons. They gave a mean of 3.90, which has an interpretation of often, with a descriptive qualification of highly aware.

Table 1

Gender Responsiveness of Road Surface, n = 402

A. Road Surface	Mean	Description
1. Road surface are smooth.	3.96	Highly aware
2. Road surface are safe for travel of pregnant women and sick persons.	3.85	Highly aware
Total Mean	3.90	Highly aware

This result shows that the road users often observed that the roads are in good condition. This implies that they feel comfortable as they travel and that the national roads are highly gender responsive in terms of the road surface. A study by Wang (2013) found that pavement roughness influences driving behavior; the smoother the road surface the faster is the free-flow speed on freeways. According to Weiss et al. (2020), 8.9% or 646 million people do not have access to transport and 43.3% or 3.16 billion people travel on foot towards healthcare facilities. This is a clear indication that the sick or pregnant must have access to better roads where they will not be put at risk of mortality. Even the study of Blanford et al. (2012) made a comparison between the travel of public health workers by vehicle carrying with them vaccination items and other activities for health care. Bezerra (2020) wrote and emphasized the essential importance of the safety of roads that carry pregnant women to and from health facilities monthly and the critically sick persons carried by ambulances to hospitals on roads.

Pedestrian Areas. The commuters coming from the three cities in this study rated the extent of the road according to their observation of pedestrian areas. The researcher prepared five items to describe the extent of the road according to pedestrian areas. These are the following: there are safe lanes for walking; there are pavement markings/signage for crossing streets; there are sidewalks, footpaths, footbridge free from obstruction to pedestrian use; there are ramps for persons with a disability, and there are footbridges sensitive to women’s needs and personal care.

Table 2*Gender Responsiveness of Pedestrian Areas, n = 402*

B. Pedestrian Areas	Mean	Description
1. There are safe lanes for walking.	3.76	Highly aware
2. There are facilities or signages/ pavement marking for crossing streets.	4.00	Highly aware
3. There are walking lanes (sidewalks, footpaths, footbridges) free from any obstruction to pedestrian use (e.g. no parked cars, no structures)	3.23	Moderately aware
4. There are ramps for persons with disabilities and women with handcarts or strollers	2.03	Less aware
5. There are footbridges sensitive to women's needs for security and personal care.	1.78	Not aware
Total Mean	2.96	Moderately aware

Table 2 shows that commuters rated the provision of safe lanes for walking and signages/pavement markings for crossing streets as highly aware. This implies that commuters often observed safe lanes for walking, signages and pavement markings, on the roads. The provision of walking lanes such as sidewalks, footpaths, and the footbridge that are free from obstruction was rated with a total mean of 3.23, and described as moderately aware. This means that commuters, most of the time observed or just enough of the said facilities, are free from obstruction. On the provision of ramps for the person with a disability, it was rated as less aware. The commuters sometimes observed ramps in the roads as they traveled and therefore, the roads are less gender-responsive. They are not aware of footbridges being sensitive to women's needs for security and personal care. The commuters never noticed footbridges that are sensitive to women's needs indicating that the roads are not gender-responsive.

A similar study conducted in Uganda observed that the city road network was characterized by the absence of segregated lanes for pedestrians. This partly explains the prevalence of road accidents among pedestrians and cyclists. It also found a poor rating on ramps for easy movement among persons with disabilities and that women mobility was constrained by narrow sidewalks and the absence of pedestrian precincts (Buyana, Lwasa & Schiebinger, 2014).

Lane for Non-motorized Wheels or Intermediate Modes of Transport. The rating for the presence of exclusive lanes for non-motorized vehicles like bicycles, tricycles, trisikad and other intermediate mode of transport in the roads and if lanes are being used as intended is with a total mean of 1.70 and 1.60, respectively, as shown in Table 3. This means that road users sometimes observed or found few lanes exclusive for non-motorized vehicles or other intermediate mode of transport as they travel towards the cities. It indicates that the national

roads are less gender responsive in terms of the lanes for non-motorized vehicles or intermediate modes of transport. The report of WHO (2015) described the effective measures implemented by both governments and nongovernmental organizations and their progress towards road improvements like safety legislation, weak road traffic laws. It also mandated governments to pay attention to the Decade of Action for Road Safety framework 2011-2020 especially on the continuation of the roads built and designed without paying close attention to the needs of road users who are most vulnerable.

Various studies in other countries showed that roads with lanes for nonmotorized vehicles reduced traffic and accidents. Many study the effects of having these priority lanes, the interaction between motorized and nonmotorized vehicles in mixed traffic, the design of priority lanes, nonmotorized volume, lane crossing behaviors, passing/overtaking behaviors and so on (He, Lin, Liy & Tao, 2020; Hongwei et al., 2011; Purohit, Chattaraj, & Panda, 2014; Pei et al., 2021; Dolatsara, 2014).

Table 3

Gender Responsiveness of Lane for Non-motorized Wheels, n = 402

C. Lane for non-motorized vehicles and other intermediate mode of transport	Mean	Description
1. There are exclusive lanes for bicycles, tricycles, trisikad and other intermediate mode of transport.	1.70	Less aware
2. These lanes are being used as intended.	1.60	Less aware
Total Mean	1.65	Less aware

Accessibility of Service. The road users rated the following as highly aware: roads are accessible to employment; roads are accessible to school; roads are accessible to markets; roads are accessible to health/medical facilities; roads are accessible to public transport terminals, as shown in Table 4. This implies that commuters often experience that the road provides access to employment, schools, markets, hospitals, and public transport facilities, and therefore, the roads are highly gender responsive.

A study by Tiwari, Jain, and Rao (2016) in the cities of India found that mobility is both the ability to travel to destinations of choice and the amount of movement necessary to do so. By definition, the household’s ability to travel is seen as positive mobility from the socio-economic perspective because it indicates that people are traveling for employment, education and other purposes, thus enabling the value addition to the households. Unlike in the study of Chakwizira et al. (2012) where it stated that in the rural areas of many developing countries

there is still the need to improve the roads between homes to farms, water sources, schools, health clinics and markets. However, for roads that are accessible to information facilities, the participants rated it as moderately aware. It means that commuters most of the time observed that there is the presence of information facilities along the roads as they travel.

Table 4

Gender Responsiveness of Road Accessibility of Service, n = 402

D. Accessibility of Services	Mean	Description
1. Roads are accessible to employment/livelihood area of both men and women.	4.32	Highly aware
2. Roads are accessible to school.	4.41	Highly aware
3. Roads are accessible to markets.	4.32	Highly aware
4. Roads are accessible to health/medical facilities.	4.13	Highly aware
5. Roads are accessible to public transport facilities.	4.26	Highly extent
6. Roads are accessible to information facilities.	3.05	Moderately aware
Total Mean	4.08	Highly aware

Safety and Security. Table 5 presents the road user rating for lighting facilities installed, provision of guardrails and barriers, have flood control system, with drainage system to prevent flooding, with refuge facilities, and with police visibility with a total mean of above 3.50 meaning they are highly aware of them. The commuters often observed the said items as they travel which implies that roads are highly gender responsive. Fotios, Unwin and Farrall (2015) stated that reassurance describes the confidence pedestrian gain by walking along the dark. A road where there is the reassurance of lighting provides the confidence to walk with lower fear of crime and violence. Thus, an important public service is nighttime lighting (Murray & Feng, 2016).

Many studies revealed that for added safety, road barriers can be installed to prevent errant vehicles from colliding with dangerous obstacles or traversing steep slopes, and that video surveillance system definitely adds to the commuter's security while using the roads (ZouZou et al., 2014; Firmino et al., 2013). One study gave a synthesis of transport infrastructure for over 60 years on the barrier effects and their assessment. It found that barriers are limited in practice. It found that the increase of placing road barriers in first world countries decreased the road accidents and increased road safety (Van Eldjik, Gil & Marcus, 2022).

Table 5

Gender Responsiveness of Road Safety and Security, n = 402

E. Safety and Security	Mean	Description
1. Lighting facilities installed.	3.64	Highly aware
2. Lighting facilities are functioning.	3.37	Moderately aware
3. There are guardrails and barriers.	3.77	Highly aware
4. Have flood control system.	3.58	Highly aware
5. With drainage system to prevent flooding and minimize slippery roads.	3.61	Highly aware
6. There is gauging instrument or indicator of road safety especially in areas near water.	3.03	Moderately aware
7. There is sufficient geometric design in critical road areas to prevent accidents.	3.40	Moderately aware
8. There is facility for emergency calls.	2.16	Less aware
9. There are surveillance videos.	2.22	Less aware
10. With refuge facilities (for the first aide and rest areas) in times of crisis (accidents, floods, earthquakes, etc).	3.66	Less aware
11. With police visibility of related enforcers.	3.66	Highly aware
Total Mean	3.28	Moderately aware

The participants most of the time observed or just enough of lighting facilities are functioning, presence of gauging instrument or indicator of road safety especially in areas near water, that there is sufficient geometric design in critical road areas found in the roads as they travel and the roads are moderately gender responsive. Wolhuter (2015) in his study stated that the geometric designer is the architect of the road. It follows that designers should be sensitive to the perceptions of people who are using the road, whether drivers or passengers in or outside the vehicles.

The commuters are less aware of the facilities for emergency calls and surveillance videos. It implies that the commuters observed few surveillance videos and facilities for emergency calls and therefore, the roads are less gender responsive. This result suggests that without pedestrian signs and signals, pedestrians, the young and the old, tend to act independently and increase road risks.

Hygiene for Women and Men. The commuters were highly aware of separate public toilet facilities for women and men in terminals. Public restrooms in the three terminals are clean and maintained by the local government unit of Malaybalay, Gingoog, and Iligan City. These rooms are also provided by gasoline stations and convenience stores along the roads. Others are found in stop-over areas. Toilets provided by the restaurants and gasoline stations along the roads are clean and maintained by the private owners of the establishments. However,

contrary to this study, a study by Yalley, Poku, and Adjarko (2013) found that among the three terminals in the three cities of Ghana, they discovered that there were no sanitary facilities in two terminals while the other one terminal has poor sanitary facilities. Almost always, none are found for lactating mothers traveling on the roads.

Table 6

Gender Responsiveness for the Hygiene of Women and Men, n = 402

F. Hygiene for women and men	Mean	Description
1. There are separate safe public toilets for women and men.	4.27	Highly aware
2. Toilets have potable water.	3.92	Highly aware
3. Toilets are clean.	3.90	Highly aware
4. Toilets are accessible to main roads	3.11	Moderately aware
5. Toilets are well maintained in places like bus terminal.	3.85	Highly aware
Total Mean	3.90	Highly aware

Environment-friendly and Aesthetic Features. Table 7 shows the rating on the presence of mechanisms to reduce adverse impact on the environment as moderately aware. It implies that road users or commuters most of the time observed mechanisms that lessen the impact of air pollution in the roads leading to Cagayan de Oro City. They are highly aware of clean streets and the presence of plants in roadway corridors and are moderately aware of landscaped edges and grass shoulders, and vegetated median.

Transportation generates a high level of greenhouse gasses emissions which primarily results from carbon dioxide emitted from the fossil fuel combustion in motor vehicles. A study by Limsawasd (2016), focused on the reduction in total energy consumption and Carbon dioxide emissions of highway transportation networks by improving the current practices in highway transportation with an integration of environmental sustainability into programming and planning efforts. Liang and Li (2020) revealed that the integration of road landscapes into the city design created in a humanistic and historical landscapes characterize regional cultures and spirit of the age. The study also emphasized the integration of resilience and the United Nations sustainable development goals in dealing with fast urbanization.

Table 7

Gender Responsiveness of Road if Environment-friendly and with Aesthetic Features, n = 402

G. Environment friendly and aesthetic features	Mean	Descripti
1. There are mechanisms to reduce adverse impact on environment. (e.g. climate change, pollution).	2.75	Moderately aware
2. Road infrastructures and related facilities are aesthetically designed.	3.33	Moderately aware
2.1 There is landscaped edges and grass shoulders.	2.99	Moderately aware
2.2 There is vegetated median.	3.82	Highly aware
2.3 There are clean and quiet streets	3.76	Highly aware
2.4 There are plants in roadway corridor	3.11	Moderately aware
Total Mean	3.11	Moderately aware

On the Awareness of Road Users to Road Gender Responsiveness

The preceding tables showed that Road Surface, Accessibility of Services, and Hygiene for men and women were rated by the commuters as highly aware. It implies that the road surface, accessibility of services and toilets are often observed in the roads as they travel going to Cagayan de Oro City from the three cities. The rating with a description of highly aware reflects the good performance of DPWH thereby achieving the target of their performance to attain a very satisfactory rating of the planning and design, construction, and maintenance sections of the department.

However, ratings for pedestrian areas and for safety and security, and environment friendly and aesthetic features, environment friendly and aesthetics features, and safety and security were given as moderately aware. They are also less aware of lanes for a non-motorized vehicle or intermediate mode of transport were rated as less aware.

Overall, the road user awareness of the gender responsiveness of the road infrastructure of DPWH was found to be moderately aware. This study found that the three road sections in Region X are highly gender responsive in terms of the road surface, accessibility of services, and hygiene for women and men. This implies that the commuters often observed the existence of these in and on the roads. However, the other roads features did not pass the performance governance system scorecard.

On the Relationship of Awareness of Road Gender Responsiveness and Profile

The Pearson correlation coefficient showed that gender, a person with disability and most of the time pedestrian, commuter, motorist, or cyclist were found to

be not statistically significant to road gender responsiveness. Multiple regression also showed an R-square equal to 100% indicating that the model explains all the variability of the response data around its mean and the residual plot showed no pattern at all. User Road awareness on road gender responsiveness is attributed to Age, Most of the time pedestrian, commuter, motorist, or cyclist, road surface, pedestrian, lanes for non-motorized vehicles or intermediate modes of transport, Accessibility of Services, Safety and Security, Hygiene for women and men, and Environment-friendly and Aesthetic features.

CONCLUSION

The study found that the national roads in Region X are highly gender responsive in terms of the 3 items: road surface, accessibility of services, and hygiene for women and men. However, the roads are moderately gender responsive in terms of the pedestrian areas, safety, and security, environment friendly and aesthetic features. Moreover, the road is less gender responsive in terms of lanes for non-motorized vehicles or other intermediate modes of transportation. These four features did not pass the DPWH Performance Governance System Scorecard. Thus, these four road features need improvement in terms of their gender responsiveness.

The Philippines, being a member of the ASEAN countries, is upgrading her national roads to conform to the Asian road network. Hence, the Asian highway (AH 26) needs to conform to the set ASEAN standards.

RECOMMENDATIONS

Based on the findings, it is suggested to improve and provide more facilities for commuters who are senior citizens and disabled persons for their easy access as per BP 344, the plans and design of facilities for the disabled persons. This may result in the increase of the number of senior citizens and disabled persons to travel. The safety of persons with children may also be considered in the design of national roads. Circular foot bridges may be designed instead of overpasses with stairways. Stairways are difficult for the PWDs to climb, a small park on it for people to sit and rest, and placing CCTVs for added protection, etc. may encourage pedestrians and the PWDs to use the circular foot bridges.

Strengthen the collaboration between government agencies that have jurisdiction like DPWH, Local Government Unit (LGU), Land Transportation Office (LTO), and Department of Environment and Natural Resources (DENR)

to attain truly gender responsive roads. Coordination between DPWH District Engineering Office (DEO) and LTO be for the implementation of rules and regulations on the segregation of lanes for roads having width of 4 to 6 lanes and provide lanes for non-motorized vehicles or intermediate modes of transportation. This may include completed features such as drainage, ramps, sidewalk, curb and gutter, shoulder, pavement markings, signage, and bike lanes, as well as comfort facilities like toilets and rest areas. In like manner, the budget allocations for the additional needs towards a highly gender responsive roads are suggested.

It is suggested to form an audit team to ensure the compliance of the measure Profile No. 3 in the plans and design, and in the implementation of the project. It is suggested that the management of DPWH Region X issue a memorandum to all district maintenance engineers in the region to provide good landscape and grass shoulders at the roadside and vegetated median along the roads. This road feature may be coordinated with the LGU for their maintenance sustainability, as well regulation and enforcement of policies to prevent obstruction of sidewalks from illegal vendors, roadside parking, etc.

Future researchers may continue to conduct assessments of the gender responsiveness of roads and other infrastructures like school buildings, bridges, parks, and walkways, to name a few.

LITERATURE CITED

Allen, H. (2018). *Approaches for Gender responsive Urban Mobility, Module 7a. Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities*. The Deutsche Gesellschaft für Internationale Zusammenarbeit.

Babinard., J., Wang, W., Bennett, CR, & Mehndiratta, S. (2012). Accessibility of urban transport for people with disabilities and limited mobility: Lesson from East Asia and the Pacific. *Transport Note*, 44(2012) 1-9.

Bezerra, B. S. (2020). Road Safety and Sustainable Development. *Good Health and Well-Being*, 617-628.

Bigger, M. (2015). *Greening the highways: Out-plant survival and growth of deciduous trees in stressful environments* (Order No. 3732288). Available from ProQuest Dissertations & Theses Global. (1733330483). <https://searchproquest.com/docview/1733330483?accountid=139409>

Bickenbach, J. (2011). The world report on disability. *Disability & Society*, 26(5), 655-658.

Blanford, J. I., Kumar, S., Luo, W., & MacEachren, A. M. (2012). It's a long, long walk: accessibility to hospitals, maternity and integrated health centers in Niger. *International journal of health geographics*, 11(1), 1-15.

Buyana, K., Lwasa, S., & Schiengbinger (2014). Closing Africa's Infrastructure Deficit: The Role of Gender Responsiveness in Urban Planning. World Academy of Science, Engineering and Technology, *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, 8(3), 878-886.

Cabral, M.C., Yap, B.E., Navida, C., Pablo, C., Padua, M., Antonio Jr, J., et. al. (2011). *Toolkit for making road infrastructure projects gender responsive*. Manila, Philippines: DPWH. <https://www.dpwh.gov.ph/dpwh/sites/default/files/GAD/home/attachments/toolkit%201.pdf>

Chakwizira, J. & Nhemachena, C. (2012). *Linking indigenous knowledge systems, transport and rural development in South Africa*. In Abstracts of the 31st Southern Africa Transport Conference (SATC 2012) (Vol. 9, p. 12).

Department of Budget and Management. (2010). *General Appropriations Act of 2010*. <https://www.dbm.gov.ph/wp-content/uploads/GAA/GAA2010/GP-2010.pdf>

Dolatsara, H. A. (2014). *Development of safety performance functions for non-motorized traffic safety* [Masters Thesis, Western Michigan University]. Western Michigan University Scholarly Works. https://scholarworks.wmich.edu/masters_theses/502/

Domingo, K. (2021). *57,000 pedestrians hurt in PH road accidents in a decade: DOH*. ABS-CBN News. <https://news.abs-cbn.com/spotlight/05/04/21/57000-pedestrians-hurt-in-ph-road-accidents-in-a-decade-doh>

Department of Public Works and Highways. (2011). *DPWH DO no. 48 s. 2011*. https://www.dpwh.gov.ph/DPWH/sites/default/files/GAD/dept_order/DO_048_S2011.pdf

Department of Public Works and Highways. (2012). *Highway Safety Design Standards Manuals: Part 1 – Road Safety Design Manual and Part 2 – Road Signs and Pavement Markings*. https://www.dpwh.gov.ph/DPWH/references/guidelines_manuals/highway_safety_design_standards_manual

Department of Public Works and Highways.(2012). *DPWH DO no. X s. 2012*. https://www.dpwh.gov.ph/dpwh/references/issuances/departament_order

Department of Public Works and Highways. (2017). *DPWH DO no. 82 s. 2017*. https://www.dpwh.gov.ph/dpwh/references/issuances/departament_order

Firmino, R. J., Kanashiro, M., Bruno, F., Evangelista, R., & da Costa Nascimento, L. (2013). Fear, security, and the spread of CCTV in Brazilian cities: legislation, debate, and the market. *Journal of urban technology*, 20(3), 65-84.

Fotios, S., Unwin, J., & Farrall, S. (2015). Road lighting and pedestrian reassurance after dark: A review. *Lighting Research & Technology*, 47(4), 449-469.

Gori E., Romolini A., & Fissi, S. (2018). Local authorities' policies for disseminating gender equality. Evidence from Italy. *Transylvanian review of administrative sciences*, 53(2018) 38-53. DOI: <http://10.24193/tras.53E.3><http://infotrac.galegroup.com/itweb/phgrc62a>

He, L., Lin, X., Liu, Q., & Tao, J. X. (2020). A numerical model for impacts of left-turn non-motorized vehicles on through lane capacity metrics. *Archives of transport*, 55(3), 7-16.

Heesch, K. C., Sahlqvist, S., & Garrard, J. (2012). Gender differences in recreational and transport cycling: a cross-sectional mixed-methods comparison of cycling patterns, motivators, and constraints. *International Journal of Behavioral Nutrition and Physical Activity*, 9(1), 1-12.

Hongwei, G. U. O., Ziyoun, G. A. O., Xiaomei, Z. H. A. O., & Xiaobao, Y. A. N. G. (2011). Traffic behavior analysis of non-motorized vehicle under influence of curb parking. *Journal of Transportation Systems Engineering and Information Technology*, 11(1), 79-84.

- Jones, M. (2012). *The creation of a model to estimate the change in non-motorized transportation use after a land use change* (Order No. 1511791). Available from Proquest Dissertations & Theses Global. (1021726515). <https://search.proquest.com/DocView/1021726515?accountid=139409>
- Liang, J., & Li, Y. (2020). Resilience and sustainable development goals based social-ecological indicators and assessment of coastal urban areas - A case study of Dapeng, New District, Shenzhen, China. *Watershed Ecology and the Environment*, 2, 6-15.
- Limsawasd, C. (2016). *Maximizing Environmental Sustainability and Public Benefits of Highway Construction Programs*. FIU Electronic Theses and Dissertations. 2488. <https://digitalcommons.fiu.edu/etd/2488>
- Litman, T. A. (2012). *Evaluating public transit benefits and costs*. (A report) Victoria Transport Policy Institute, U.S. <http://scholar.google.com> dated May 26, 2019
- Maghelal, P.K., P.H.D. (2011). Walking to transit: Influence of built environment at varying distances. *Institute of Transportation Engineers ITE Journal*, 81(2), 38-43.
- Mekuria, M. C., Furth, P. G., & Nixon, H. (2012). *Low-stress bicycling and network connectivity*. https://scholarworks.sjsu.edu/mti_publications/74/
- Muller, J & Palmen, R. (2022). Introduction: Reflecting on a Community of Practice approach to institutional change for a greater gender equality in R&I and HE – Policy and practice. In book: *A Community of Practice Approach to Improving Gender Equality in Research*. Publisher: Routledge. DOI: 10.4324/9781003225546-1
- Murray, A. T., & Feng, X. (2016). Public street lighting service standard assessment and achievement. *Socio-Economic Planning Sciences*, 53, 14-22.
- Pei, Y., He, Y., Kang, J., Ran, B., & Song, Y. (2021). Non-motor vehicle priority lane design and simulation study-take Harbin as an example. *Physica A: Statistical Mechanics and its Applications*, 570, 125803.

Peters, D. (2011). *Gender and Sustainable Urban Mobilit*. <https://dspace.ceid.org.tr/xmlui/handle/1/104>

Poggio, B. (2006). Outline of a Theory of Gender Practices. *Gender, Work and Organizations*, 13 (3), 225-233. <https://doi.org/10.1111/j.1468-0432.2006.00305.x>

Purohit, S., Chattaraj, U., & Panda, M. (2014). Experimental study of non-motorized vehicle characteristics and its effect on mixed traffic. *International Journal for Traffic and Transport Engineering*, 4(4), 425-436.

Ramster, G., Greed, C., & Bichard, J. (2018) How inclusion can exclude: The case of public toilet provision for women. *Built Environment*, 44(1) 52-76. DOI: <https://doi.org/10.2148/benv.44.1.52>

Magna Carta for Women Republic Act 9710. (2009). <https://www.officialgazette.gov.ph/2009/08/14/republic-act-no-9710/>

Tiwari, G. (2014). *Planning and designing transport systems to ensure safe travel for women*. International Transport Forum Discussion Paper, No. 2014-04, Organization for Economic Co-operation and Development (OECD), International Transport Forum, Paris

Tiwari, G., Jain, D., & Rao, K. R. (2016). Impact of public transport and non-motorized transport infrastructure on travel mode shares, energy, emissions and safety: Case of Indian cities. *Transportation research part D: transport and environment*, 44, 277-291.

Van der Ree, R., Jaeger, J., Van der Grift, E., & Clavenger, A. (2011). Effects of roads and traffic on wildlife populations and landscape function: Road ecologies moving larger scales. *Ecology and society*, 16(1) 48

Van Eldijk, J., Gil, J., & Marcus, L. (2022). Disentangling barrier effects of transport infrastructure: Synthesising research for the practice of impact assessment. *European transport research review*, 14(1), 1-19.

Wang, T. (2013). *Reducing greenhouse gas emissions and energy consumption using pavement Maintenance and rehabilitation: Refinement and application of life cycle assessment approach*. University of California, Davis.

Weiss, D. J., Nelson, A., Vargas-Ruiz, C. A., Gligorić, K., Bavadekar, S., Gabrilovich, E., ... & Gething, P. W. (2020). Global maps of travel time to healthcare facilities. *Nature medicine*, 26(12), 1835-1838.

World Health Organization (2015). *Global Status report on Road Safety 2015*. https://books.google.com.ph/books?hl=en&lr=&id=wV40DgAAQBAJ&oi=fnd&pg=PP1&dq=related:oZfATMAbd0QJ:scholar.google.com/&ots=DLQDuTbSrp&sig=qUquckpsEEInqCDqAjQQCED3Lhg&redir_esc=y#v=onepage&q&f=false

Wolhuter, K. (2015). *Geometric design of roads handbook*. CRC Press.

Yalley, P., Poku, G., & Adjarko, H. (2013). Sanitary, Health and Safety Management of Intra-City Transport Terminals of Ghana. *International Refereed Journal of Engineering and Science (IRJES)*, 56-62.

Yunusa, M. (2015). Physical planning and the development of Dankande rest stop area in Kaduna, Nigeria. *City, Culture and Society*, 6(1)5361. doi: <https://doi.org/10.1016/j.ccs.2015.01.002>

Zou, Y., Tarko, A. P., Chen, E., & Romero, A. (2014). Effectiveness of cable barriers, guardrails, and concrete barrier walls in reducing the risk injury. *Accident Analysis and Prevention*, 72, 55-65.