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PROMOTION OF INCLUSIVITY IN PEDESTRIAN INFRASTRUCTURES: AN ASSESSMENT TOOL

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Abstract:

Inclusive public pedestrian infrastructures are essential to the development of a community. This study sought to develop a validated assessment tool in which its parameters are based on the standards of a legislation, which is the Batas Pambansa (BP) 344 or Accessibility Law and the Design Manual for a Barrier Free Environment, an international design manual. The assessment tool and its parameters were validated by the heads of the Office of the Senior Citizens Affairs (OSCA) and the Persons with Disability Affairs Office (PDAO), and a civil engineer from the Department of Public Works and Highways (DPWH) and was rated highly valid. Using the tool, an evaluation was done to thirteen public pedestrian infrastructures in Plaza Burgos, Guagua, Pampanga by three external and five internal evaluators, wherein the inclusivity level of the infrastructures was measured. All eight independent results arrived with the same verbal interpretation, proving that the tool is objective and reliable. The tool and the results in the conducted assessment were presented and discussed to concerned government agencies such as the Department of Public Works and Highways (DPWH) and the Department of Interior and Local Government (DILG) through a focus group discussion to seek commitment in promoting inclusivity to pedestrian infrastructures, wherein consideration for adoption into standard policy of a government agency was conferred.

Keywords **—public pedestrian infrastructures, assessment tool, inclusivity, persons with disability, senior citizens.**

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I. INTRODUCTION

Public spaces are where mass human interactions are being done; it is crucial and essential in stimulating socio-cultural and recreational activity within a society [1]. They are vital in the wellness of its citizens [2] and their usability is determined by its influence on the wellbeing of an individual as well as their interaction with their environment [3]. Public spaces should be inclusive and be designed to cater not just the mass volume of people that will be using them but also all types of people. In 2015, the United Nations (UN) launched the Sustainable Development Goals (SDG), the eleventh of which is to make cities and human settlements inclusive, safe, resilient, and sustainable [4]. Furthermore, the Philippine Government passed the Batas Pambansa (BP) Blg. 344, commonly known as the Accessibility Law, where section 1 states: "In order to promote the realization of the rights of disabled persons to participate fully in the social life and the development of the societies in which they live and the enjoyment of the opportunities available to other citizens". The provisions of Accessibility Law present the specifications and regulations on how public infrastructures are to be built, which includes the installation of ramps, railings, and other facilities, to allow easy access and mobility and in order to be fully utilized by the persons with disabilities (PWDs), as well as by the other vulnerable sectors such as the elderly [5]. Additionally, Republic Act No. 7277 (RA 7277), also known as the Magna Carta for Disabled Persons, was passed wherein Chapter 6 Section 25 states: "The national and local government shall allocate funds for the provision of architectural or structural features for disabled persons in government buildings and facilities" [6].

Correspondingly, to provide a barrier-free environment and as an initiative for a broader effort toward accessibility, in the United Nations, a design manual (Accessibility for the Disabled: A Design Manual for a Barrier Free Environment) was crafted by the Urban Management Department of the Lebanese Company SOLIDERE in partnership with the United Nations Economic and Social Commission for Western Asia (ESCWA) [7].

Pedestrian and transport infrastructure systems are essential public infrastructures, and access to public transport facilities does not only benefit the persons with disabilities but the general population as a whole [8].

The World Health Organization [9] states that approximately 1 billion individuals live with significant disabilities, constituting about 15% of the global population, which translates to roughly one out of every six people. Meanwhile, according to the National Council on Disability Affairs [10], as of April 2024, 1.526 million individuals in the Philippines are registered with disabilities. As per the results of the Philippine Statistics Authority's 2020 Census of Population and Housing, the elderly population in the Philippines, which is defined as individuals 60 years of age and above, accounted for 8.5% or 9.22 million of all household population [11].

The demographics that have the highest pedestrian related death or injury rate are pedestrians over the age of 65 [12]. It is essential to design pedestrian infrastructures based on the specifications and necessity of older people in order to ensure their safety and improve road and pedestrian mobility [13]. In the same way, the lack of inclusive public infrastructures and the existence of different physical and social barriers contribute massively to PWDs feeling secluded from society; which is why inclusive public spaces are necessary to alleviate this seclusion; and rather promote social inclusion [14].

Several studies have been conducted to assess the level of inclusivity of infrastructures globally and locally.

The study of Tennakoon et al. [15] revealed that barriers such as pavement obstruction, pavement irregularity, and pavement restriction are some of the factors that indicate pedestrian inconvenience and inaccessibility among aged and disabled people in Colombo district, Sri Lanka. Additionally, pedestrian infrastructures such as walkways and sidewalks are perceived user-unfriendly by both the older and disabled folks. Furthermore, their study proposes that a national policy or action plan, which is inclusive, needs to be established in order to improve pedestrian safety and accessibility.

Similarly, the study of Damastuti and Dhafiya [16] revealed that infrastructures such as pedestrian walkways, stairs, and ramps in Pelambuan, Banjarmasin City, Indonesia are lacking in terms of accessibility and inclusivity, most specifically to people with physical disabilities. The results in their study highlighted that even though there are available and existing infrastructures, several factors such as damaged and steeply designed stairs indicate that they do not meet the standards for accessibility. Their study also suggests that there is a need to improve pedestrian infrastructures to make them more accessible and inclusive.

In the Philippines, the study of Sales [17] assessed the compliance of selected buildings and street facilities in the University of the Philippines Los Baños (UPLB) with the requirements of BP 344. It was found out that specific passing percentages for compliance with certain locations achieved notable levels of accessibility. The assessment results in their study conveyed that the lower campus of UPLB falls within the 26%-50% compliance category, indicating the need for further construction and renovations to enhance accessibility for differently abled individuals on campus. This underscores the importance of addressing accessibility concerns to ensure inclusivity.

On the other hand, in the study conducted by Gay et al. [18], it was indicated that a significant number of restaurant facilities in Bulacan are currently accessible to disabled individuals and can be considered PWD-inclusive. Though the study presented a positive outlook on accessibility for PWDs, there is still emphasis on the need for further research in order to know the specific needs of the PWDs.

The aforementioned studies emphasize the necessity for inclusive public pedestrian infrastructures; its importance and role to a society

that aims for sustainable development, as well as the shortcomings of the existing systems and infrastructures. Moreover, there are also legislations and initiatives from the government to build inclusive pedestrian infrastructures. Some of the studies used quantitative methods to assess and evaluate the existing infrastructures in question; particularly, the study of Sales, which concluded with the level or percentage of compliance of the assessed buildings. However, the study did not further provide solutions based on the results of the conducted assessment to actively improve the shortcomings found in the study. Hence, this proposed study aims to offer suggestions and recommendations for the improvement of the existing public pedestrian infrastructures that will be based on the results of the evaluation conducted on them. In this manner, the inclusivity of the existing public pedestrian infrastructures may be enhanced, and the difficulties that the vulnerable sectors, most especially the PWDs and the elderly, are experiencing in using the infrastructures may be diminished.

II. METHODOLOGY

Relevant provisions from Accessibility Law [19], as well as relevant design requirements from the Design Manual for a Barrier Free Environment [20, 21, 22, 23] were used in determining the criteria and the criteria descriptions in the assessment tool.

For the provisions of Accessibility Law, the Minimum Requirements for Accessibility of Dropped Curbs, Minimum Requirements for Accessibility of Walkways and Passageways, and Minimum Requirements for Accessibility of Signages, together with their corresponding illustrations, were used in the development of the tool. Similarly, design requirements for signages, pathways, and curb ramps from the Design Manual for a Barrier Free Environment were also used.

After determining the relevant provisions of Accessibility Law and the relevant design requirements from the Design Manual for a Barrier Free Environment, the assessment tool was developed, which is a rubric. Three components of the assessment tool were formulated – each one was crafted based on the specific pedestrian infrastructure that it means to assess, namely: dropped curbs, sidewalks, and signages. Each of the rubric components consists of three criteria, wherein these criteria are scored using a four-point scale.

The weight of the criteria in the rubrics was determined through a survey. The survey questions were subdivided into three categories depending on which pedestrian infrastructure was being measured in terms of the level of importance of its criteria.

The developed assessment tool was pilot tested to Plaza Burgos, Guagua, Pampanga in order to check its reliability. Afterwards, software validation procedures were performed on the gathered data from the test using IBM SPSS Statistics software.

A four-point Likert scale was used in the numerical scoring of the tool, wherein higher values of scale indicate higher level of inclusivity.

TABLE I
LIKERT SCALE LEVEL OF INCLUSIVITY

SCALE	DESCRIPTOR
4	Highly Inclusive
3	Inclusive
2	Barely Inclusive
1	Non-Inclusive

The assessment of the inclusivity level of the existing public pedestrian infrastructures was done through the use of a checklist which was based on the developed and validated assessment tool. Using the tool, a total of 13 public pedestrian infrastructures in the vicinity of Plaza Burgos, Guagua, Pampanga were evaluated by three external evaluators who are civil engineers as well as by the researchers who served as internal evaluators. The 13 public pedestrian infrastructures assessed are composed of 8 sidewalks, 3 signages, and 2 dropped curbs.

A. Existing Public Pedestrian Infrastructures Assessed in Plaza Burgos, Guagua, Pampanga

Fig. 2. Sidewalk 1

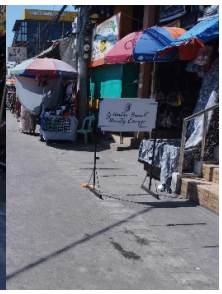
Fig. 3. Sidewalk 2


Fig. 4. Sidewalk 3


Fig. 5. Sidewalk 4

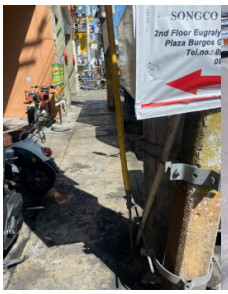

Fig. 6. Sidewalk 5


Fig. 7. Sidewalk 6

Fig. 8. Sidewalk 7

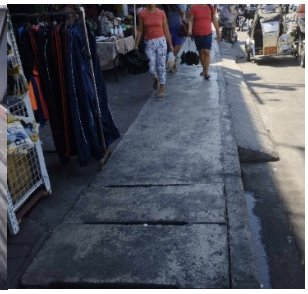
Fig. 9. Sidewalk 8


Fig. 10. Signage 1

Fig. 11. Signage 2


Fig. 12. Signage 3


Fig. 13. Dropped Curb 1


Fig. 14. Dropped Curb 2

The following formula was used in the calculation of the averages of the pedestrian infrastructures in the assessment:

Average = Σ (Weight x Score) / Total Weight
(Equation 2.1)

Additionally, mean was also used in the computation of the assessment results.

Mean formula:

$$\bar{x} = \Sigma xi / n \text{ (Equation 2.2)}$$

Where:
$\bar{x}$ = mean
Σxi = summation of elements
n = total number of elements

In seeking the commitment of the concerned government agencies regarding the promotion of inclusivity to public pedestrian infrastructures, a set of guide questions were asked to the representatives of the agencies.

The responses of the representatives for each guide question were interpreted using codes in order to identify themes. Then, after the identified themes were analyzed, a general synthesis of the themes was constructed.

III. RESULTS

A. Phase 1: Developed and Validated Assessment Tool for Inclusivity Level of Public Pedestrian Infrastructures

The survey results revealed that each of the criteria was considered very important in terms of their level of importance by the survey participants. Therefore, their respective weights will be treated as equal when reflected in the rubric assessment tool. Each of these criteria will be given a weight value of 33.3333 – their total weight being equivalent to a hundred.

TABLE II
WEIGHT OF EACH CRITERION IN THE RUBRIC ASSESSMENT TOOL FOR DROPPED CURBS

CRITERIA		WEIGHT
1.1	Ramp or slope	**33.3333**
1.2	Surface and color	**33.3333**
1.3	Width	**33.3333**
	Total:	100

TABLE III
WEIGHT OF EACH CRITERION IN THE RUBRIC ASSESSMENT TOOL FOR SIDEWALKS

CRITERIA		WEIGHT
2.1	Surface	**33.3333**
2.2	Guide strips	**33.3333**
2.3	Width	**33.3333**
	Total:	100

TABLE IV
WEIGHT OF EACH CRITERION IN THE RUBRIC ASSESSMENT TOOL FOR SIGNAGES

CRITERIA		WEIGHT
3.1	Color	**33.3333**
3.2	Lettering	**33.3333**
3.3	Placement	**33.3333**
	Total:	100

B. Rubric Assessment Tool for Inclusivity Level of Dropped Curbs

For Dropped Curbs

Weight	Parameters/Criteria	1 Non-Inclusive	2 Barely Inclusive	3 Inclusive	4 Highly Inclusive
33.3333	**Ramp or slope** *- inclined plane that connects two different levels or one level to another*	Too steep for a wheelchair to pass through smoothly	Slightly steep for a wheelchair to pass through smoothly	Positioned out of the usual line of pedestrian flow and has an unobstructed width of not less than 0.90 meters *(※A Design Manual for a Barrier Free Environment)*	Ramped towards adjoining curbs with a gradient not more than 1:12 *(※BP 344)*; sloped towards the road with a maximum cross gradient of 1:20 *(※BP 344)*
33.3333	**Surface and color** *- surface refers to the exterior or upper boundary of the object, while color refers to the range of hues (such as white or yellow) and can be described in terms of lightness and saturation*	Slippery; color does not contrast with the surrounding surface	Has a rough texture or ground pattern to make them detectable and slip-resistant, but color does not contrast with the surrounding surface	Has a rough texture or ground pattern to make them detectable and slip-resistant; and color contrasts with the surrounding surface	Has a rough texture or ground pattern to make them detectable and slip-resistant; color contrasts with the surrounding surfaces; and provided with a guide strip
33.3333	**Width** *- measurement or extent from side to side*	Does not meet the minimum width requirements *(i.e. 0.90 m, ※BP 344, A Design Manual for a Barrier Free Environment)*	Barely meets the minimum width requirements *(i.e. 0.90 m, ※BP 344, A Design Manual for a Barrier Free Environment)* and is obstructed	Meets the minimum width requirements *(i.e. 0.90 m, ※BP 344, A Design Manual for a Barrier Free Environment)* and is unobstructed	Has a width corresponding to the width of the crossing, should it be located at one; otherwise, the minimum width is 0.90 meters *(※BP 344, A Design Manual for a Barrier Free Environment)*
					Average = ∑ (Weight x Score) / Total Weight

C. Rubric Assessment Tool for Inclusivity Level of Sidewalks

For Sidewalks

Weight	Parameters/Criteria	1 Non-Inclusive	2 Barely Inclusive	3 Inclusive	4 Highly Inclusive
33.3333	**Surface** *- surface refers to the exterior or upper boundary of the object*	Rough, uneven, slippery, and obstructed	Slightly rough, with minimal obstructions, but even and non-slip	Smooth, even, non-slip, and unobstructed	Smooth, even, continuous, non-slip, and provided with a different texture and color finish for differentiation
33.3333	**Guide strips** *- a line constructed in or on the road surface to facilitate orientation for pedestrians*	No guide strips provided	Guide strips are provided, but the color is fading and can be hardly seen	Guide strips are provided, the color contrasts with the surrounding surface, and can be clearly seen	Guide strips are provided, the color contrasts with the surrounding surface, can be clearly seen, and is flushed with the top layer of the adjacent road surface
33.3333	**Width** *- measurement or extent from side to side*	Does not meet the minimum width requirements *(i.e. 1.20 m, ※BP 344; 0.90 m, ※A Design Manual for a Barrier Free Environment)*	Barely meets the minimum width requirements *(i.e. 1.20 m, ※BP 344; 0.90 m, ※A Design Manual for a Barrier Free Environment)* and is obstructed	Meets the minimum width requirements *(i.e. 1.20 m, ※BP 344; 0.90 m, ※A Design Manual for a Barrier Free Environment)* and is unobstructed	Meets the minimum width requirements *(i.e. 1.20 m, ※BP 344; 0.90 m, ※A Design Manual for a Barrier Free Environment)*, unobstructed, and provided with space at some point along the route so that a wheelchair may pass another or turn around
					Average = ∑ (Weight x Score) / Total Weight

D. Rubric Assessment Tool for Inclusivity Level of Signages

For Signages					
Weight	Parameters/Criteria	1 Non-Inclusive	2 Barely Inclusive	3 Inclusive	4 Highly Inclusive
33.3333	**Color** - *color refers to the range of hues (such as white or yellow) and can be described in terms of lightness and saturation*	Color combination is mistaking for the color-blind	Correct color combination is used, but does not contrast with the surrounding surface	Correct color combination is used and contrasts with the surrounding surface	Correct color combinations are used, contrasts with the surrounding surface, is clearly distinguishable, and prevents glare
33.3333	**Lettering** - *such as inscribing, printing, painting, or engraving*	Too small to be distinguished	Proportion to the reading distance, but not raised at least 1 mm from the background *(※BP 344, A Design Manual for a Barrier Free Environment)*	Proportion to the reading distance and raised at least 1 mm from the background *(※BP 344, A Design Manual for a Barrier Free Environment)*	Proportion to the reading distance and raised at least 1 mm from the background, with the smallest letter type not measuring less than 15 millimeters; braille symbols are included *(※A Design Manual for a Barrier Free Environment)*
33.3333	**Placement** - *placing or positioning*	Placed at a location not clearly seen	Placed at a location that can be clearly seen but may be considered as an obstruction	Located at a minimum height of 1.40 meters and a maximum height of 1.60 meters *(※BP 344)*	Located at a minimum height of 1.40 meters and a maximum height of 1.60 meters and has a minimum headroom of 2.0 meters, should it protrude into a walkway or route *(※BP 344)*
		Average = ∑ (Weight x Score) / Total Weight			

The parameters used in developing the assessment tool are the relevant provisions of the Batas Pambansa (BP) 344 or the Accessibility Law, and the design requirements from the Design Manual for a Barrier Free Environment. The tool was validated by experts from concerned sectoral groups such as the Persons with Disability Affairs Office (PDAO), which represents the persons with disability sector; the Office of the Senior Citizen Affairs (OSCA), which represents the senior citizen sector; as well as an Engineer II from the Department of Public Works and Highways (DPWH).

In determining the weight of each criterion in the tool, a survey was conducted which was participated in by 377 respondents. All parameters were considered "very important" by the majority of the respondents, hence, producing an equal weight of all criteria upon computing their averages. After the assessment tool was developed and expertly validated, a pilot test was done in Plaza Burgos, Guagua, Pampanga to check the reliability of the tool. It was revealed that the assessment tool is reliable and objective after the collected data from the test was subjected to software validation procedures using the IBM SPSS Statistics software.

E. Phase 2: Level of Inclusivity of Existing Public Pedestrian Infrastructures in Plaza Burgos, Guagua, Pampanga

A total of 13 existing public pedestrian infrastructures were assessed around Plaza Burgos, Guagua, Pampanga consisting of 8 sidewalks, 3 signages, and 2 dropped curbs.

Of the eight sidewalks assessed, Sidewalk 6, which is located at the town plaza, was evaluated "highly inclusive", while the rest were evaluated "barely inclusive". It was observed in the case of the sidewalks that their width dimensions were within the minimum and ideal standards. However, the obstructions present within the pathways were such reasons and conditions that contributed to the infrastructures being evaluated as "barely inclusive".

Regarding the signages, Signage 1, which is located at the town plaza, was evaluated "non-inclusive" due to the reason that only its metal framing was visibly left, making it ineffective and of no use. Signage 2, which is located at the Municipal Hall, on the other hand, was evaluated "highly inclusive" because the signage is well placed and can be easily seen from a significant distance; it is well maintained in both its condition and readability. Signage 3, which is also located at the town plaza, was evaluated as "barely inclusive". Its height dimension is on a level with the prescribed standard dimensions; however, the signage itself was vandalized, its purpose is drastically lowered as its rating in the assessment.

Lastly, of the two dropped curbs assessed, Dropped Curb 1, which is located in front of the Municipal Hall, was evaluated as "inclusive". However, it requires repainting and maintenance. Dropped Curb 2, which is located at the town plaza, was assessed "highly inclusive", making the dropped curb infrastructure in the vicinity of the town plaza inclusive.

After all the involved infrastructures were assessed, the evaluation reports of the external and internal evaluators were reflected in order to observe consistency in the results, as well as to check the objectivity of the assessment tool. The computed averages from the results had negligible differences, while the interpretation of the general averages was consistently similar, therefore making

the assessment tool objective and reliable in terms of consistency in its results.

TABLE V
INCLUSIVITY LEVEL OF SIDEWALKS AROUND PLAZA BURGOS, GUAGUA, PAMPANGA BASED ON THE EVALUATION OF THE EXTERNAL AND INTERNAL EVALUATORS

PEDESTRIAN INFRASTRUCTURE	GENERAL AVERAGES BASED ON THE ASSESSMENT OF THE EXTERNAL EVALUATORS (CIVIL ENGINEERS)	GENERAL AVERAGES BASED ON THE ASSESSMENT OF THE INTERNAL EVALUATORS (RESEARCHERS)	VERBAL INTERPRETATION
Sidewalk 1	2.2222	2.3333	Barely Inclusive
Sidewalk 2	2.2222	2.1999	Barely Inclusive
Sidewalk 3	2.2222	2.3333	Barely Inclusive
Sidewalk 4	2.4444	2.4667	Barely Inclusive
Sidewalk 5	2.1110	2.1333	Barely Inclusive
Sidewalk 6	3.9999	3.9999	Highly Inclusive
Sidewalk 7	2.4444	2.3333	Barely Inclusive
Sidewalk 8	2.3333	2.3333	Barely Inclusive

TABLE VI
INCLUSIVITY LEVEL OF SIGNAGES AROUND PLAZA BURGOS, GUAGUA, PAMPANGA BASED ON THE EVALUATION OF THE EXTERNAL AND INTERNAL EVALUATORS

PEDESTRIAN INFRASTRUCTURE	GENERAL AVERAGES BASED ON THE ASSESSMENT OF THE EXTERNAL EVALUATORS (CIVIL ENGINEERS)	GENERAL AVERAGES BASED ON THE ASSESSMENT OF THE INTERNAL EVALUATORS (RESEARCHERS)	VERBAL INTERPRETATION
Signage 1	1.3333	1.1333	Non-Inclusive
Signage 2	3.9999	3.9999	Highly Inclusive
Signage 3	1.8888	1.9333	Barely Inclusive

TABLE VII
INCLUSIVITY LEVEL OF DROPPED CURBS AROUND PLAZA BURGOS, GUAGUA, PAMPANGA BASED ON THE EVALUATION OF THE EXTERNAL AND INTERNAL EVALUATORS

PEDESTRIAN INFRASTRUCTURE	GENERAL AVERAGES BASED ON THE ASSESSMENT OF THE EXTERNAL EVALUATORS (CIVIL ENGINEERS)	GENERAL AVERAGES BASED ON THE ASSESSMENT OF THE INTERNAL EVALUATORS (RESEARCHERS)	VERBAL INTERPRETATION
Dropped Curb 1	3.0000	2.7999	Inclusive
Dropped Curb 2	3.9999	3.7333	Highly Inclusive

F. Design Recommendations based on the Provisions of Accessibility Law

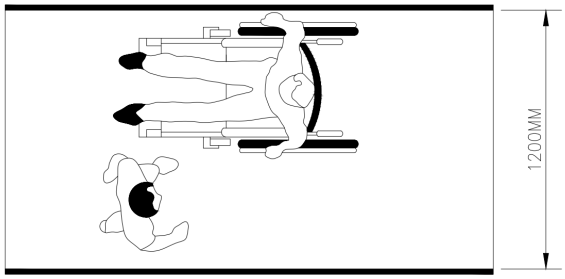

Fig. 1. Accessible sidewalk

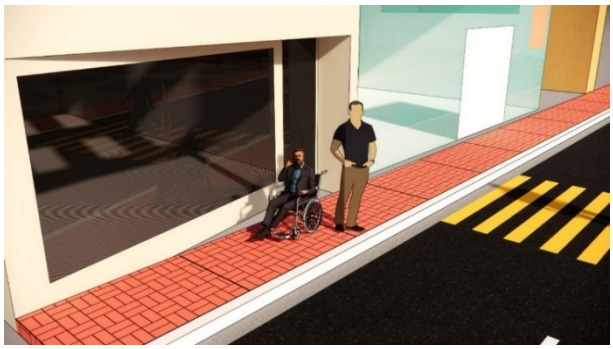

Fig. 2. Accessible and inclusive sidewalk

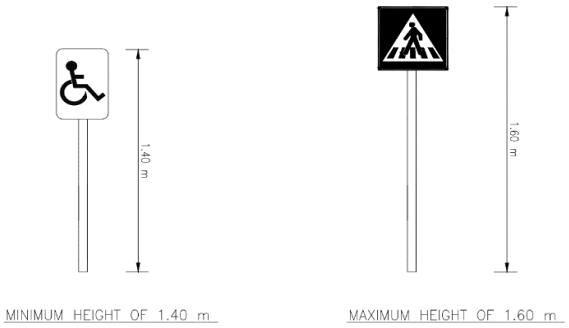

Fig. 3. Accessible signage

Fig. 4. Accessible and inclusive signage

G. Phase 3: Promotion of Inclusivity in Public Pedestrian Infrastructures

After the assessment phase, the study and its findings were presented and discussed to two government agencies, specifically the Department of Public Works and Highways (DPWH) and the Department of Interior and Local Government (DILG) through a focus group discussion.

The focus group discussions were done to promote not only the developed and validated assessment tool, but also inclusivity in public pedestrian infrastructures and in general. The representatives from both concerned government agencies shared insights, discussed the governing policies regarding pedestrian infrastructures, as well

as conveyed the efforts of their respective departments with regards to inclusivity. The gaps between existing policies in addressing inclusivity were also tackled in the discussion. In line with this, the representatives also expressed their openness towards new policies, programs, and means to improve the level of inclusivity of the pedestrian infrastructures in their mandate and agency.

Furthermore, the study received positive feedback from both representatives, wherein it was explicitly stated in the discussion that it has potential and that it can be introduced to the right authorities and departments.

IV. CONCLUSIONS

The developed assessment tool was rated "highly valid" with averages of 4.70, 4.90, and 4.70, respectively, by the validators from the Persons with Disability Affairs Office (PDAO) and Office of the Senior Citizens Affairs (OSCA) in the municipality of Guagua, Pampanga, as well as a civil engineer validator from the 1st District Engineering Office of Pampanga. The reliability test revealed that the assessment tool is reliable after the collected data from the test was subjected to software validation procedures, thus making the parameters and criteria in the tool relevant and effective in determining the level of inclusivity of a particular pedestrian infrastructure.

Similarities in the results of all the individual ratings of the evaluated pedestrian infrastructures show that the assessment tool is objective with its results and output.

The consideration of other means and alternatives in improving and promoting inclusivity in the infrastructures shows that there is a scarcity and necessity on the new means of measuring and improving it, which the tool can provide. The commendations and the good reception of the assessment tool, as well as the openness to new policies, are evidence of a renewed commitment to inclusivity.

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