DEVELOPING AN INITIAL FRAMEWORK TO ESTIMATE MINUMUM SIZE REQUIREMENTS OF PUBLIC TRANSPORT FACILITIES FOR MALLS IN URBANIZED AREAS

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Abstract: In the Philippines context, malls have effectively become the modern "community center" with its wide array of shops and amenities. Although majority of their patrons are public transport users, it can be observed that not enough space are provided for public transport facilities within the mall complex. This contributes to the congestion in the vicinity of the mall. Given that there is a lack of space standards for public transport facilities in the local setting, this paper attempts to develop a framework to arrive at some minimum size requirements so that the facilities can function properly. This study tries to identify the different factors which determines the size of the public transport facility and makes an initial proposal on how the space standards would look like.

Keywords: terminals, public transportation, public transport facilities, malls.

1. INTRODUCTION

Malls are one of the major trip generators in an urban area. In the Philippines context, they have effectively become the modern "community center" (Rico and de Leon, 2017). Over the past decade, mall developers have been proactively providing terminal facilities within their premises to attract more pedestrian foot-traffic, especially since majority of their patrons (60-80%) are public transport users (Ortiz, 1996 as cited in Palmiano etal, 1999). There also have been Public-Private Partnership (PPP) efforts by the government to spur terminal facilities development, combining commercial development with terminal facilities [1], including the Paranaque Integrated Terminal Exchange (PITX), the Taguig City Integrated Terminal Exchange and the North Integrated Transport System (ITS) in Caloocan City.

In the case of terminals for stand-alone malls, it can be observed that insufficient space is provided for the terminals within their premises. There are even some malls which do not even provide any facilities at all. Because of the lack of space, queues and waiting areas for the passengers tend to spill-over into the adjacent sidewalks, and sometimes unto the streets themselves. This contributes to congestion both in the pedestrian walkways and the roads (Palmiano etal, 1999).

One contributing factor for the poor condition of public transport terminals can be the lack of capacity or resource materials regarding the planning and design of public transport facilities (SG Architects, 2015). Most of the local laws regarding the regulation of public transport facilities often just cite general statements about space requirements, but provide no quantitative benchmark or guidelines.

In comparison, some laws, like the National Building Code (NBC), specify some

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[1] https://mirror.pco.gov.ph/news_releases/ppps-needed-for-more-integrated-transport-exchanges-in-metro-manila-govt/

standards for other types of transport facilities, like the number of parking slots per building type and the sizes of a parking slot. In the absence of quantitative guidelines for public transport facilities, it is then the private sector themselves who determine how much space is to be provided for public transport facilities. They typically provide less than what is actually needed, in order to cut down on costs and maximize commercial spaces.

Given the importance of public transport facilities to the overall transportation network, it is important that there should be some minimum guidelines on area size requirements, just like how guidelines have been set by the government for other public works. This would help ensure that the public transport facility has enough capacity to accommodate its expected demand. This will also ensure the convenience of the commuters when getting a ride.

Specifically for malls, given that they have become a natural convergence point of many people and are often one of the major trip generators in a city, it is but logical that it should provide sufficient public transport facilities within its premises to serve their customers, as well as their employees.

It is in this light that this research was made to develop a framework for developing minimum size requirements for public transport facilities within mall complexes. This study is envisioned as the first phase in a series of studies that will eventually determine specific numerical values for minimum space standards for different public transport facilities in mall complexes in the Philippines.

As this study is an initial attempt to develop some kind of space standards for terminals, focus is given more to the methodology first and thus simplicity of scope is desired. As such, this study will first focus on malls found in urbanized areas. Eventually, it is envisioned that once a framework has been developed, the guidelines can be expanded to include other types of land uses (e.g. central business districts, industrial estates, residential neighborhoods) and other less urbanized areas.

2. STATEMENT OF THE PROBLEM

The current local guidelines in place regarding the minimum size requirements for public transport facilities requirements for malls in urbanized areas are insufficient, ambiguous or too general. This then leads to inadequate provision of spaces, as private entities provide their own terminal spaces according to their own needs and interpretation.

3. RESEARCH OBJECTIVES AND SCOPE OF STUDY

3.1 Research Objectives

Main objective: Develop an initial methodology to determine the minimum size requirements for public transport facilities requirements for malls in urbanized areas that can serve as a guideline for implementing standards and guidelines.

Specific objectives:

1) Present a compelling argument why there needs to be clear space guidelines for public transport facilities. (Discussed in Section 4)
2) Provide an overview of the different spaces in a terminal and the factors that affect them. (Discussed in Section 5)

3) Identify and comment on the current relevant legal provisions related to the provision of minimum size requirements for public transport facilities. (Discussed in Section 6)
4) Develop an initial framework to estimate minimum size requirements for terminal facilities for malls (Discussed in Section 7)
5) Identify further steps to reinforce the initial framework. (Discussed in Section 8)

3.2 Scope and Delimitations

For this study, the working definition of malls is taken from the definition of shopping center, which is "an integrated group of commercial establishments that is planned, developed, owned and managed as a unit." (Institute of Transportation Engineers, as cited in Palmiano etal. (1999)). Shopping centers with only supermarkets or department stores and no other individual shops within its building will not be part of this study. In terms of location, only malls within urbanized areas will be covered.

The terminals to be studied will only be those that are explicitly part of a mall development, and not in a nearby lot. Terminals which are part of other types of land uses, such as residential neighborhoods and industrial estates, are not part of this scope. For now, mixed-use developments are also not part of this study as it involves more complicated interactions of land uses, and thus have different trip patterns from single-use malls. Stand-alone terminals are also not part of the scope of this study, as it entails a different kind of computation for passenger demand.

Additionally, the terminals to be studied are for road-based public transportation (water transport and air transport are not included). In terms of planning aspects, the study will focus in determining the minimum size requirements. The other planning aspects of a terminal, such as locational factors, operational, technological and legal aspects, are not part of this study.

4. ESTABLISHING THE NEED FOR SPACE STANDARDS FOR PUBLIC TRANSPORT FACILITIES FOR MALLS

4.1 The need to ensure minimum level of service

Just like other critical public infrastructure, there should be some standards to ensure minimum level of service to the public. Browsing through the local planning manuals and building codes, one can see that some minimum standards have been set for critical public infrastructure and facilities. (See Table 1).

Table 1: Examples of guidelines for some land uses and facilities in HLURB CLUP Guidebook Vol. 2

Type of hospital	Area
Municipal hospital	1.5 ha
Provincial hospital	1.5 ha
Regional hospital	2.5 ha
Medical center	3.5 ha

Recreational space	Standard
Municipal park	Min. of 500 sqm per 1,000 population
Playfield	Min. of 0.5 ha. per 1,000 population

Source: HLURB CLUP Guidebook Vol. 2 (2014)

However, public transport facilities are rarely or not even mentioned in these guidelines. In instances where they are mentioned, the statements are generic and qualitative in nature and provide no concrete and objective benchmarks.

Because of the lack of guidelines, terminals, or public transport facilities are usually neglected in the plans and programs of a local government unit (LGU). Many PUV terminals tend to use the street or the sidewalks themselves. This causes inconvenience to the commuting public, as they are forced to cram into narrow spaces, or have to use the roads themselves as their queuing or waiting area. Aside from further contributing to traffic congestion, this also poses a danger to the commuters.

Having concrete space standards would help ensure the minimum space standards are provided so that the operations of the terminal do not spill over to the road, and thereby contain or minimize the traffic congestion. The convenience and safety of the commuters are also protected.

4.2 The need to provide sufficient public transport facilities for the mall's customers.

Just like any responsible real estate manager, malls have to provide sufficient spaces to serve their customers to ensure convenience and safety. The National Building Code mentions, among others, minimum requirements for restrooms, parking slots, and number of fire exits. However, there are just token mentions of public transport space requirements. (See Table 2).

Table 2: Transport space requirements for malls and related building types as per National Building Code (NBC)

Building type	Transport Space Requirements
Terminal depots and the like	- one (1) car slot for every 500.00 sqm of gross floor area or for a fraction thereof - one (1) off-RROW (or off-street) passenger loading space that can accommodate two (2) queued jeepney/shuttle slots or two (2) queued bus slots whichever is applicable
Transit stations	- four (4) queued bus slots whichever is applicable
Public market	- for the buyers, one jeepney/shuttle parking slot for every 150 sqm of market floor area - for the vendors, one jeepney/shuttle parking slot for every 300 sqm of floor area - off-street terminal that can accommodate at least two (2) jeepneys and six (6) tricycles for every 1,000 sqm of market space.
Malls	- one parking slot for every 100 sqm of shopping floor area

Source: National Building Code, as amended in 2005

As can be seen in the last row in the above table, there is no mention in the NBC of any legal requirements for terminal spaces for malls. There is no mention of the required number and sizes of loading/unloading bays, passenger waiting areas, etc. As such, mall developers tend to provide as little space for public transport services within their complex as possible, while some do not provide any at all. This is to maximize the area that can be used for commercial purposes. In some cases, the public area outside of the malls have essentially become the default terminal (See Figure 1). This then takes away the circulation space needed by the passing-through pedestrians and motorists. Additionally, the sidewalk space is not enough to accommodate the volume of commuters.

Figure 1. Sidewalk outside Guadalupe Commercial Center being used as a PUJ terminal

According to a study done by Ortiz (1996, as cited in Palmiano etal, 1999), majority (60-80%) of the patrons of malls are public transport users; the other 20-40% are private car users. This results in a ratio ranging from 1:1.5 to 1:4 (private car users vs. public transport users). Using the principle of proportionality, this means that for every space provided for 1 private car user, the size of space to be provided for public transport users should be 1.5 to 4 times bigger.

But a cursory observation of the current practice shows the opposite. More mall area are given for private car users in the form of parking slots, driveways, ramps and lay-bys. Public transport users are given much smaller spaces in terms of waiting area, circulation space and PUV bays. High volumes of commuters are forced to cram into small spaces, with some spilling over to the driveways (See Figure 2). This cannot be considered as good practices by a responsible mall operator. By instituting some minimum standards, the mall developers can be compelled to provide what they should have been providing in the first place—good customer service.

Figure 2. Small space provided for bus passenger concourse at SM North bus bays

4.3 The need to establish transportation equity

Over-provision of private car spaces and under-provision of public transport spaces would naturally push more and more people to use private cars to go to the malls, since commuting has become a hassle. This high volume of private cars going to the malls contribute to the congestion in the vicinity of the mall. Additionally, because public transport spaces are so small, the queues and waiting areas for the passengers tend to spill-over into the streets themselves, further contributing to congestion around the malls.

During peak hours and sale days, travel delays are high. On special occasions or holidays, traffic can even become worse, as the malls would have promos to attract the public. It is one of the reasons why the Metro Manila Development Authority (MMDA) has coordinated with the malls to adjust their mall opening hours during the Christmas season, to minimize traffic congestion.[2]

While malls have been reaping the benefits of revenues brought about by foot traffic to their developments, the surrounding community and the LGU have to bear the costs of the traffic congestion generated by the malls. Aside from congestion, there is also added pollution and noise. The LGU have to deploy additional traffic management personnel or install traffic devices just to contain the traffic around the mall. This isn't an equitable use of public funds, nor is it a good relationship to the community.

Even though malls have provided the LGU with revenues and job opportunities, the mall developers still have to shoulder their fair share of the costs associated with the intensity of their development. This is in line with the principle of transportation equity (Litman, 2024),

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2 https://mmda.gov.ph/92-news/news-2023/6843-october-26-2023-mmda-s-traffic-management-measures-for-the-holiday-season-get-mall-operators-support.html

wherein it posits that individuals or groups should receive a fair share of resources, such as funding, road space or planning priority. Also, costs that travel activities impose on other people, such as delay, risks and pollution, are unfair, and should be minimized or compensated to achieve fairness.

In line with this principle of transportation equity, malls have to provide sufficient public transport spaces in proportion to the number of commuters going to their malls. They have to see to it that their terminal space requirements are provided within their property and do not use public space. Their operations should also not spill over to the surroundings.

4.4 The need to attract more people to use public transport

In the 2022 Urban Mobility Readiness Index Study, Metro Manila ranked 58th out of the 60 cities studied with the worst public transport systems. Specifically for public transport, it ranked 56th.[3] Given the overall poor quality of service of the public transport system is poor, this pushes more people to choose private vehicles for their trips,[4] which further contributes to congestion.

Significant improvements to the public transport system can attract more people to use public transport mode and reduce private car usage.[5] Aside from the public transport mode itself, these improvements include public transport facilities as they serve as the links between different modes. They need to be located properly to minimize walking times and maximize integration with other modes. They need to have wide enough spaces to avoid overcrowding.

5. AN OVERVIEW OF PUBLIC TRANSPORT FACILITIES

5.1 Types of public transport facilities

Land Transportation Franchising and Regulatory Board (LTFRB) Memorandum Circular (MC) no. 2017-030 under DOTR Department Order (DO) No. 2017-011 have categorized public transport facilities into three (3) types in terms of the types or the number of modes that use them. They are:

- Integrated Terminal Exchange (ITX): an intermodal transport terminal which can simultaneously accommodate at least four (4) modes of transportation (e.g. public utility buses, mini-buses, PUJ, UVE, taxis).
- Bus terminal: a facility which hosts less than four (4) modes of transportation, one of which is a bus.
- PUJ/UVE terminal or any terminal not under the first two classifications.

5.2 An overview of the spaces in a terminal

Generally-speaking, the space inside the terminal can be divided into vehicle spaces, passenger spaces and terminal administration spaces (See Figure 3).

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3 https://www.philstar.com/headlines/2022/11/25/2226400/metro-manila-public-transportation-among-worst-world-study

4 https://changing-transport.org/modernizing-public-transport-in-the-philippines/

5 https://www.centreforcities.org/reader/gear-shift/how-to-increase-public-transport-use/

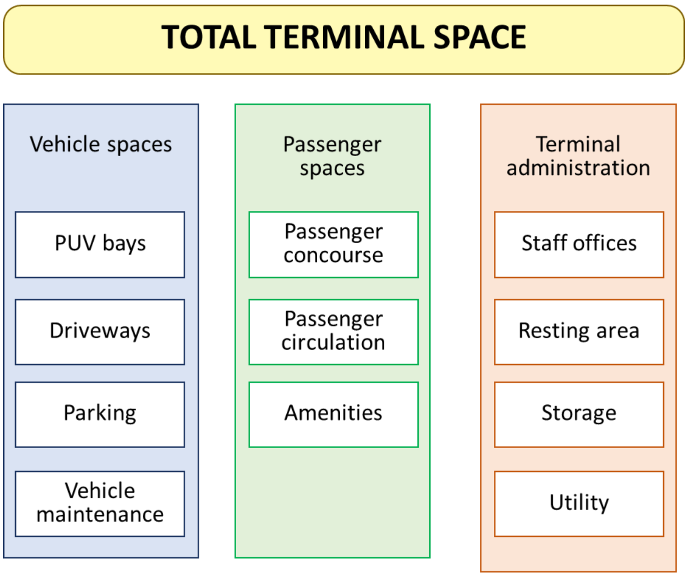

Figure 3: Division of the different spaces in a typical terminal

Vehicle spaces include the PUV loading/unloading bays, driveways, parking (for all modes) and vehicle maintenance facilities (if present).

Passenger spaces can be further divided into passenger concourse, circulation areas and passenger amenities. Passenger concourse refer to the passenger space directly adjacent to the PUV loading/unloading bays where people queue and wait for the ride. Passenger circulation areas include spaces such as walkways, stairs, escalators and elevators. Passenger amenities refer to the different facilities that help make the trip more convenient or pleasant. This includes comfort rooms, ticketing offices, information counter/booth, shops, stalls, dining/eating area, etc.

Administration spaces include offices for the terminal staff, resting area (or locker rooms) for PUV operators and drivers, storage space, utility room, etc.

For this study, the focus will be on the vehicle spaces and passenger spaces.

5.3 The different factors affecting the size of the different spaces in a terminal

The factors affecting the size of terminal facilities can be generally classified into two: passenger-side factors and vehicle-side factors. Passenger-side factors refer to the volume of people expected to use the terminal. Vehicle-side factors refer to the capacity of the vehicles and the vehicle space. The higher the capacity, the more vehicles and passengers that can be processed or carry, the lesser the space needed.

On top of all of this, another factor affecting the sizes of the terminal is the level-of-service (LOS) or performance standard. The higher the standard or LOS rating that is to be desired, the more space allocation will be needed.

5.3.1 Vehicle spaces

One basic factor affecting the size of the vehicle spaces is the size of the vehicle itself. This would determine the space allocation for the PUV bays, as well as the driveways and parking slot. The size of the vehicle itself also would affect how much maneuvering space would be needed. Bigger vehicles would need bigger turning radius, and thus bigger spaces. Another factor affecting the PUV bays is the design type or orientation of the PUV bay that will be used (See Figure 4). The type of PUV bay that will be chosen is dependent on the expected

PUV volumes and the target performance standard, as well as space availability. On the average, angle bays take up the least amount of space, while sawtooth and drive-through bays take up the most amount of space.

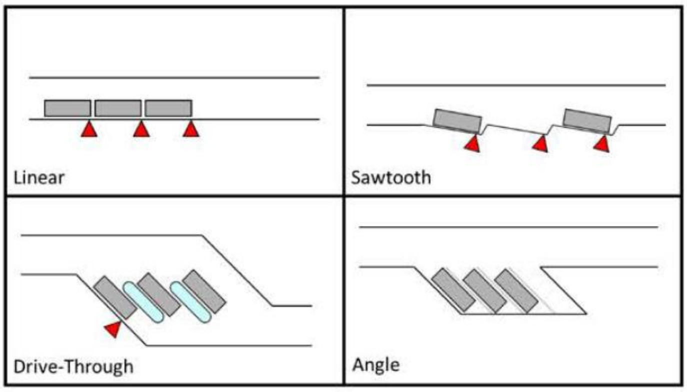

Figure 4: Design types of PUV bays
Source: TCQSM (2013)

Another critical vehicle-side factor is the capacity, which is the ideal or maximum number of people or vehicles that a facility can carry. For PUV bays, the Transit Capacity and Quality of Service Manual (TCQSM) has provided a formula for the capacity of a loading bay, as shown in Equation 1 below. From here, it can be seen that the capacity of a loading bay is dependent on the length of the dwell times, clearance times and the green cycle ratios. Longer dwell times and clearance times result in lower capacities, and thus more loading bays will be required for the same passenger demand.

$$\text{Capacity} = \frac{3{,}600(g/C)}{t_d(g/C) + t_c + t_{om}} \quad \text{[Equation 1]}$$

Where,

3,600 = total seconds in an hour

g/c = green cycle ratio (% of time the bus is allowed to enter/leave the bay)

t_d = dwell time on green (secs.)

t_c = clearance time (secs.)

t_{om} = operating margin time, i.e. allowance for long dwells (secs.)

5.3.2 Passenger concourse and circulation

In determining the size of the passenger spaces, a target level-of-service (LOS) rating has first to be defined. Higher LOS equates to higher capacities and subsequently, bigger areas are required. In the absence of local space standards for land-based terminal facilities, the standards for airports will be used as an initial basis, as shown in Table 3 below.

Table 3: IATA Level-of-Service (LOS) space standards (sqm per person)

Area	A	B	C	D	E
Wait/circulate	≥2.7	2.3 – 2.69	1.9 – 2.29	1.5 – 1.89	1.0 – 1.49
Check-in queue	≥1.8	1.6 – 1.79	1.4 – 1.59	1.2 – 1.39	1.0 – 1.19

Source: IATA, as cited in Aghahowa, E. and Enoma, A. (2009)

5.3.3 Spaces for amenities

The different amenities would also take up space in a terminal. The amenities to be provided would depend on the quality of the commuting experience that the terminal operator wishes to give the commuters. The higher the quality, the more amenities to be provided, the bigger the spaces that needs to be provided. To this end, basic amenities checklist as provided by legal guidelines can be used to identify the minimum required amenities per type of terminal. From here, specifications from the National Building Code and architectural design standards can be used to estimate the size requirements of each amenity.

5.3.4 Other non-transport factors

Other non-transport factors refer to the various architectural elements in a terminal. This would include the structural posts or columns, walls, doors, buffer or clearance zones from edges, etc.

6. A REVIEW AND COMMENTARY ON THE CURRENT RELEVANT LEGAL PROVISIONS REGARDING MINIMUM SPACE REQUIREMENTS FOR PUBLIC TRANSPORT FACILITIES

6.1 Current guidelines regarding area requirements for terminals

6.1.1 LTFRB MC 2017-030

In terms of the sizing of the terminals, the LTFRB MC 2017-030 states that the minimum terminal size must be at least 130% of the total space requirement of 50% of the franchised units that will use the terminal. The number of authorized vehicles is just 50% because it is expected that the total fleet size will be divided equally between the two ends of the route. Meanwhile, the additional 30% is to allow the maneuvering of vehicles inside the terminal (i.e. circulation). As for the sizes of the vehicles, they are as follows:

- PUB = 36 m^2
- PUJ/UV/Filcab = 16 m^2

The above provisions are not that ideal for the following reasons:

1) At that time when a terminal is being built, the list of PUV routes which will use the terminal may not yet known or may not yet be its ultimate list, as more routes are added over time after completion of the construction. Similarly, more franchises or units for a route can be granted after the terminal has been built. This would mean that the terminal will not have sufficient space as its commuter market grows.
2) Ideally, in terms of capacity, the terminal should be able to handle the expected volume during peak periods. During peak periods, it is expected that the greater percentage of the fleet of a particular route are on the route end which have the higher demand. Thus, the fleet size of a route should not be divided equally between the two route ends at all times, as indicated in the MC. By just sizing the terminal with just 50% of the franchised units on one end, the terminal would have insufficient capacity to meet the demand during peak periods.
3) The above requirements only takes into consideration the vehicular component of the terminal. It does not mention the spaces to be used by the commuters, like the

queuing or waiting area and the pedestrian circulation space. Restrooms, which is also a National Building Code requirement for all structures, are also not considered in the above LTFRB guideline.

Aside from terminal size provisions, MC no. 2017-030 also identified some facility and amenity requirements for the different categories of public transport facilities, as shown in Table 4 below.

Table 4: Some space requirements inside the off-street terminals as per LTFRB MC no. 2017-030

	ITX	Bus Terminal	PUJ/UVE Terminal
Separate and sufficient parking slots for each mode of transportation	✓		
Separate departure and arrival bays for each mode of transportation	✓	✓	
Drop-off/pick-up areas for private vehicles	✓		
Installed communication facilities	✓	✓	
Adequate CCTV cameras and monitors	✓	✓	✓
Availability of info and passenger assistance counters and personnel	✓	✓	✓
Detailed schedule of regular trips	✓	✓	✓
Appropriate and adequate signages	✓	✓	✓
Walk-through metal detectors at all entry points	✓		
Adequate and comfortable benches and/or seats with backrests	✓	✓	✓
Separate restrooms for persons with disabilities (PWD) and male and female passengers	✓	✓	✓
Priority lane for senior citizens, PWD and pregnant women	✓	✓	
Elevators and escalators	✓		
Staff facilities such as driver's rooms, canteen and administrative office	✓		

Comments on the above requirements:

1) Although a checklist was provided, there is no mention of quantitative space sizes for each. The lack of specific size requirements would then allow terminal operators to dictate these sizes on their own. As it is, the lack of clear quantifiable standards makes it an ineffective tool to ensure minimum level of service.
2) Some characteristics mentioned above like "sufficient parking slots" and "adequate benches" can be subject to interpretation in the absence of an objective criterion.

6.1.2 National Plumbing Code

Terminals are not specifically mentioned in the National Plumbing Code as a building type. The closest building type that is related to terminals is assembly places. The requirements for such are shown in Table 5.

Table 5: Minimum plumbing requirements for assembly places, as per Revised National Plumbing Code of the Philippines

Type of fixture		Male	Female
Water closet	(for staff)	1-15 pax: 1	1-15 pax: 1
		16-35 pax: 2	16-35 pax: 3
		36-55 pax: 3	36-55 pax: 4
		Over 55, add 1 fixture for each addl. 40 pax	Over 55, add 1 fixture for each addl. 40 pax
	(for public)	1-100 pax: 1	1-50 pax: 3
		101-200 pax: 2	51-100 pax: 4
		201-400 pax: 3	101-200 pax: 8
			201-400 pax: 11
		Over 400, add 1 fixture for each addl. 500 pax	Over 400, add 2 fixtures for each addl. 300 pax
Lavatory	(for staff)	1 per 40	1 per 40
	(for public)	1-200 pax: 1	1-200 pax: 1
		201-400 pax: 2	201-400 pax: 2
		401-750 pax: 3	401-750 pax: 3
		Over 750, add 1 fixture for each addl. 500 pax	Over 750, add 1 fixture for each addl. 500 pax

Comments on the above requirements:

1) Although the minimum number of fixtures are mentioned, there is no equivalent recommendation or guideline regarding the corresponding minimum space needed for each.

6.2 Summary

Based on the above provisions, there are still some gaps in terms of quantitative guidelines for the different spaces in the terminal. Summarized below in Table 6 are the identified gaps. These factors need to be identified so as to able to compute properly the minimum required area for terminals.

Table 6: Some identified gaps in the local space guidelines for terminal facilities

Space	Determining factors	Current legal guidelines	Gaps
PUV bays	- Estimated passenger demand		- No mention of demand basis
	- Size of the PUV	- LTFRB MC 2017-030	-
	- Desired performance standards (target capacity)		- No mention of desired capacity or performance standards
Driveways	- Size of the PUV	- LTFRB MC 2017-030	-
	- Desired level-of-service (LOS) or vehicle flow rate		- No mention of any standard
Parking	- Size of the PUV slot	- LTFRB MC 2017-030 - NBC	
	- Number of slots	- NBC	
Passenger concourse	- Estimated passenger demand		- No mention of demand basis
	- Desired LOS		- No mention of LOS

Space	Determining factors	Current legal guidelines	Gaps
			rating scale or target standard
Passenger circulation	- Estimated passenger demand		- No mention of demand basis
	- Desired LOS		- No mention of LOS rating scale or target standard
Amenities	- Desired quality of service to be offered to the commuters	- LTFRB MC no. 2017-030 provides checklist per types of terminal facility	- Checklist is only provided; no quantitative guidelines
		- NPC mentions minimum number of fixtures for toilets	- No minimum of space equivalent per fixture

7. DEVELOPING AN INITIAL FRAMEWORK TO ESTIMATE MINIMUM SIZE REQUIREMENTS FOR TERMINAL FACILITIES FOR MALLS

7.1 The basic format

Before developing the framework for the estimation of minimum size requirements, it would be good to first envision the desired output of the space guidelines. From there, we can work our way backwards and identify the different steps needed to arrive at that desired output. To help derive an ideal format for the guideline, a review of the current different guidelines regarding space programming was done. From the many examples, one of the most common and clear format for space guidelines is written as a unit value per unit area or population. (See Table 7 for samples)

Table 7: Selected examples of guidelines for space requirements from different references

Reference	Category	Guideline
National Building Code	Parking slot	• For automobiles, 2.50 meters by 5.00 meters per perpendicular parking • For trucks or buses, 3.60 x 12.00 meters per slot
	Parking	• For public colleges or universities, one car slot for every 5 classrooms, and one school bus slot for every 200 students • For shopping center, one parking slot for every 100 sqm of shopping floor area • For terminals, one car slot for every 500 sqm gross floor area
HLURB CLUP Guidebook	Classroom	• 1.5 sqm per child
	School site	• 0.5 hectares for 1-2 classes, with no grade above Grade IV • 1 hectare for central school which has 6 classes • 2 hectares for schools which have 7-9 classes • 3 hectares for schools which has 10-12 classes • 4 hectares for schools which has more than 12 classes

Based on the above, and to be consistent with other local guidelines, the suggested format for the guidelines of minimum size requirements for public transport facilities is to be written as:

XX of terminal space per YY gross floor area (in sqm) of mall space
where XX and YY are numerical values

In the above clause, gross floor area (GFA) of the mall was used over the number of customers/passengers, since the value for the gross floor area is readily known at the planning stages, while the number of customers/passengers is not. Gross floor area is also a fixed value and does not fluctuate over the course of a day or week, unlike the number of customers. Additionally, this is line with one of the basic theories of the traditional four-step demand model. In the first step of trip generation, the estimation of generated trips is a function of the floor area of a structure (See Table 8).

Table 8: Local trip generation rates for different types of land uses, in person trips per sqm

Land use type	Trip production	Trip attraction	**Total (per sqm)**	**Trips per 10,000 sqm**
Commercial	0.0576	0.0735	**0.1311**	**1,311**
Mixed use	0.0172	0.0243	**0.0415**	**415**

Source: Regidor (2007)

As the gross floor area of a terminal increases, the number of generated trips will also increase. In the modal split step, the number of public transport trips is computed as a percentage of the generated trips. Thus, the number of public transport trips is a function of the mall floor area. (See Figure 5) Extending this further, the required space for the public transport terminal would be a function of the mall floor area.

7.2 Computing for the unit value

Shown in Figure 5 is an initial framework to compute for the average terminal space (in sqm) per mall area (in sqm).

The first step of the whole process is demand estimation. It would start from first computing the public transport demand of the mall using the mall GFA as the main basis. The results of the mall trip generation studies would be used to generate the mall trip rates, which will then be multiplied with the mall GFA and then the modal share of public transport (per mode) to obtain the PT pax demand. From the PT pax demand value, the number of the corresponding PUV trips can then be computed.

The next step in the process is determining the desired LOS rating and/or performance standards. In the case of pedestrian spaces, a LOS rating will be chosen from Table 3, and then the corresponding value for the chosen LOS rating will be determined. This will then be multiplied with the pax demand to get the total area needed for the passenger waiting and circulation areas.

For the performance standards of PUV bays, the values for the different factors mentioned in equation 1 have to be set, which includes dwell time, clearance time and green cycle ratio. As practical as possible, the values to be chosen for these factors be the maximum optimum value so as to maximize the capacity of the vehicle spaces. This is based on the assumption that the terminal has to be operated at its highest capacity.

Once the values have been chosen, the PUV bay capacity can be computed. The computed number of PUV trips required will then be divided by the PUV bay capacity to derive the required number of PUV bays. This value would then be multiplied with the average area per PUV bay to get the total area needed for vehicular bays. This value may include the area for both a loading bay and the driveway.

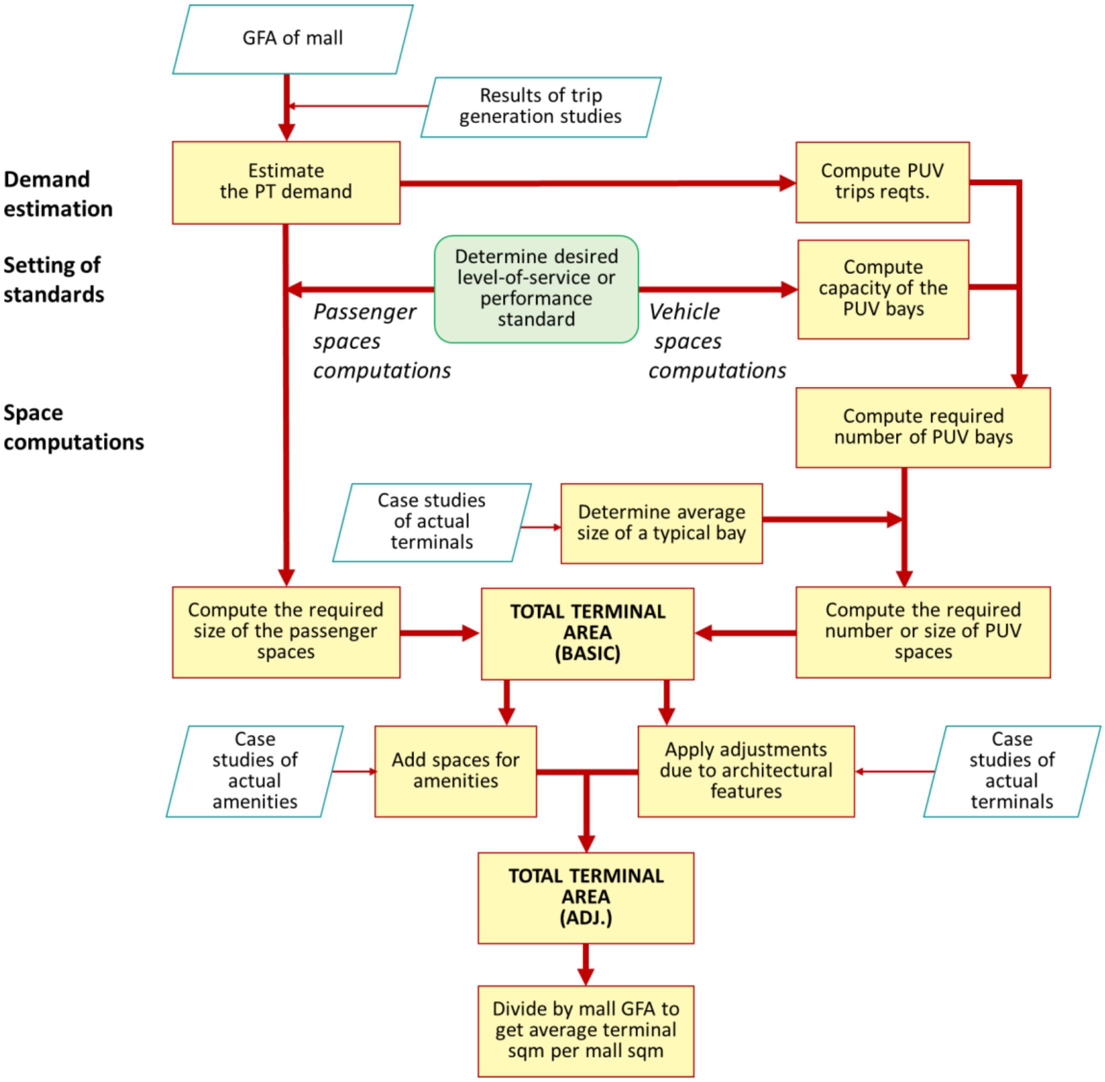

Figure 5. Initial framework to compute the average terminal space per mall space

The total values for pedestrian spaces and vehicle spaces will then be added to arrive at the basic total terminal area. From here, adjustments due to amenities and architectural features will be added to arrive at the total adjusted terminal area. Finally, the mall GFA will then be divided this adjusted terminal area to get the ratio of mall space to terminal space.

The above process would be applied for different types of malls in different settings to check differences, if any. After sufficient samples have been collected, various statistical analysis can be applied to determine similarities or variances in the values. This would determine if there is a need to further provide more nuanced guidelines.

7.3 Adding possible variations to the basic format to adopt to different local settings

Different localities in the Philippines would show different trip patterns depending on their specific location and the transport options already available. These different trip patterns and mode choices would then mean that there could be varying size requirements for the public transport facilities. Discussed below are some of the main identified factors.

7.3.1 Income classes

Many studies have shown that one of the key indicators of a person's decision to use public transport is a person's car ownership. (Tao et al, 2019). The higher the car ownership, the lesser the probability of them using public transport. Subsequently, one of the key predictors of car ownership is household income or per-capita income (Dargay and Gately, 1999; Rubite and Tiglao, 2004). Thus, it can be surmised that the higher the car ownership levels of the catchment area around the malls, the lesser the chances they will use public transport, and subsequently the lesser the required terminal space would be.

Additionally, the type of malls that developers would build in an area is reflective of the income levels of its catchment area. Krugell in Rasool (2010) states that the tenants of a shopping center should meet the needs of the income group that will be frequenting the center. In catchment areas where the dominant class group are the low income group, typically the shops would be more for the general public ("pang-masa") to fit within the budget expenditure of the people. Such shops can be value-for-money and discount stores (Rasool, 2020). In catchment areas where there are significant higher-income groups, the malls would have more luxury brand, hobby, recreational and specialty stores (Rasool, 2020).

Thus, there is a need to differentiate the terminal space requirements of the malls according to the major income group of their catchment area. Malls with the same gross floor area size may need different terminal sizes, depending on the location of the mall. To this end, the income classification of the LGU will be used as an indicator of the income catchment group. The reasoning here is that the combined values of the household or per-capita income contributes to the LGU's income, which in turn, is the basis for their income classification.

Shown in Table 6 below are the income classifications used by Republic Act (RA) No. 11964, or the "Automatic Income Classification of Local Government Units Act" in 2023. It classifies cities and municipalities into five (5) classes each according to their income ranges, based on the average annual regular income for three fiscal years preceding a general income reclassification. (See Table 9). These same classifications can be used as a way to differentiate different space standards for public transport facilities for the malls in different LGU's.

Table 9: Average annual income of different classes of cities and municipalities (in Philippine Pesos)

Class	Cities	Municipalities
First	> 1,300,000,000	> 200,000,000
Second	1,000,000,000 - 1,300,000,000	160,000,000 – 200,000,000
Third	800,000,000 - 1,000,000,000	130,000,000 – 160,000,000
Fourth	500,000,000 - 800,000,000	90,000,000 – 130,000,000
Fifth	< 500,000,000	< 90,000,000

Source: Republic Act (RA) No. 11964

7.3.2 Presence/absence of rail

Another variation that needs to be included is the presence/absence of a nearby rail station to the mall, since its presence can potentially significantly change the modal split of the mall. With the presence of a rail station, some commuters may opt to use the rail instead,

instead of road-based modes, whether public transport or private modes. This can drastically reduce the size requirements for a public transport facility in the mall. Additionally, the scale of the rail station may also be a factor that affects the size of the nearby terminal in the mall. Thus, it is important to note these distinctions in the guideline. As an initial parameter, 500 meters as the distance from the mall since it is generally considered the catchment radius of a station (Korea Development Institute (2011) in Eom etal. (2019)).

7.3.3 The proposed format of the guideline for the minimum size requirements for public transport facilities

Given the above nuances, the proposed guideline for terminal size requirements would look similar to the recommended parks and open spaces guidelines prepared by The Alliance for Safe, Sustainable and Resilient Environments (ASSURE), as shown in Table 10 below.

Table 10: Minimum recommended sizes of parks or open spaces

Type of open space	Description	Minimum size	Min. width of any side
Small or local parks	Serving a small walking catchment area of 150 – 300 meters	0.50 hectares	30 m
Neighborhood parks	Open space serving a walking catchment area of 400 to 500 meters	0.75 to 1 hectare	50 m
Sub-district parks	Open space serving three neighborhoods	5 to 6 hectares	NA
District parks	Open space serving six neighborhoods or population catchment of 15,000 to 20,000 people	10 hectares	NA
Municipal parks	Open space serving the whole city or municipality	3 hectares	NA
Regional parks	Open space serving the municipality/ city and neighboring LGUs	10 to 30 hectares	NA
National parks	Open space serving intra-region catchment or the entire country	NA	NA

Source: Public Parks and Open Spaces: A Planning and Development Guide

The good features of the above guidelines are:

1) Different classifications/tiers: The different classifications/tiers taken into account that different catchment areas would require different sizes of the facilities. For the terminal space requirements, a similar tier system could be developed.
2) Clear descriptions for each tier: The clear descriptions ensures that there is clear basis what kind of catchment area belongs to what tier. Such clear descriptions for each tier could also be developed for the terminal catchment area.
3) Explicit size requirements: The explicit size requirements shows the specific area requirement for each tier. This leaves little room for subjective interpretation. Such explicit quantitative requirements can be used for the terminal space guidelines.
4) Minimum width requirement: The minimum width requirement ensures that the shape of the facility allows for the different spaces to be fitted within it properly and maneuvering of the vehicles.

Shown in Table 11 below is a preliminary sample of how the guideline would look like, following the example in Table 10 above. There would be unit values for each income classification of the LGU, with clear definitions of the income classes provided. There are two sets of minimum size requirements: one for those with a nearby rail station, and one without. A recommended minimum width of any side of the terminal is also provided.

Table 11: Preliminary format of the guidelines for minimum size requirements for public transport facilities in malls or shopping centers

Area Type	Income Class	Annual Income Range	Minimum recommended size per 100 sqm of mall GFA		Minimum width of any side of the terminal
			With rail station within 500 meters	No rail station within 500 meters	
City	Income class 1	> 1,300,000,000	XX sqm	XX sqm	YY meters
	Income class 2	1,000,000,000 - 1,300,000,000	XX sqm	XX sqm	YY meters
	Income class 3	800,000,000 - 1,000,000,000	XX sqm	XX sqm	YY meters
	Income class 4	500,000,000 - 800,000,000	XX sqm	XX sqm	YY meters
	Income class 5	< 500,000,000	XX sqm	XX sqm	YY meters
Municipality	Income class 1	> 200,000,000	XX sqm	XX sqm	YY meters
	Income class 2	160,000,000 – 200,000,000	XX sqm	XX sqm	YY meters
	Income class 3	130,000,000 – 160,000,000	XX sqm	XX sqm	YY meters
	Income class 4	90,000,000 – 130,000,000	XX sqm	XX sqm	YY meters
	Income class 5	< 90,000,000	XX sqm	XX sqm	YY meters

8. IDENTIFYING FURTHER STUDIES NEEDED

The previous sections outlined a general framework on how space size guidelines for terminals can be determined. As this is just an initial attempt to develop a framework for recommending minimum size requirements for public transport facilities in malls, there are still many areas which needs further verification and research before the recommendations can be accepted for broader application. Discussed below are some of the actions that need to be done.

8.1 Trip generation study of different malls

One of the primary data needed to arrive at an appropriate unit value for the size of the public transport facility is the scale and typical percentage (modal split) of mall users that use public transport to access it. This information can be done through a trip generation study of malls, complimented by user interviews and occupancy study at the terminal (if there is already an existing terminal at the mall).

As there are also different types of malls, there is a need to further check the typical modal splits for different mall types (e.g. with/without supermarket, department store, etc.) and scale of malls (e.g. local, regional mall) in different types of settings (e.g. mall within central business district, mall in commercial area, mall near dominantly residential neighborhood). Yet another set of modal split that needs to the studied is the difference between a mall is nearby a rail station and not.

More samples are needed to come up with a more definitive modal split that can be used for benchmarking purposes. Statistical methods can be applied to see whether there are significant variances between these different categories. If there are little variances observed across the categories, then the table shown in Table 8 above can be further simplified.

Another thing to be checked in the trip generation study is the extent of the external commuter demand. External commuter demand refers to users of the facility who do not have the mall as their trip origin or destination, and just use it to get a ride. At this stage, it is unclear how much of these commuters are in proportion to actual users, and whether they have a significant impact on the overall size requirements.

8.2 Terminal facilities and operations study

The terminal facilities and operations study has many aspects. First is documentation. The involves documenting existing terminals in malls, through measuring and drawing the terminal layout. From here, the layout would be digitized and then the area of each type of space in the terminal would be computed. These values would serve as a comparison basis whether the results of the computations are more or less in the same range, or too high or too few. The different architectural elements and amenities will likewise be noted and measured.

Second aspect is evaluation. This involves determining the current level-of-service (LOS) and performance indicator values at the terminals. These performance indicators include dwell times and clearance times. These would serve as baseline data to compare with the future improvements.

Third aspect is scenario-testing. This involves developing experimental setups to test the most optimum values for dwell times and clearance times. This also serves to check whether the actual real-world values for dwell times and clearance times are already optimum, or whether it can be improved.

Fourth aspect is schematic layout testing. Once some initial values for the minimum space requirements have been computed, some terminal layout schemes will be made to test whether the required spaces can actually fit within the computed terminal sizes.

9. CONCLUSION

Coming up with guidelines that can serve as a standard reference for practitioners is a long process that involves many review of previous studies, surveys, analysis, experts discussions and peer review before it can be actually used on a broader scale. In the case of terminal facilities, given the current lack of guidelines in terms of size requirements, this paper presents an initial attempt at a methodology on how to go about creating such guidelines for terminals, specifically for malls. This was based on a review of other existing guidelines and an understanding of the different factors affecting terminal sizes. It also identifies some critical studies to be done to be able to arrive at a more robust result.

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