Enhancement and Application of the Mode Transfer Quality Index (MTQI): The Case of MRT-3

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Abstract: In the Philippines, the lack of a standardized framework for assessing transfer quality in multimodal public transport hampers effective planning. This study refines the Mode Transfer Quality Index (MTQI) by converting subjective sub-indicators into field-measurable metrics to enhance replicability and streamline data collection. The enhanced MTQI integrates three key indicators—Accessibility and Connectivity, Convenience, and Comfort and Security. It was applied to four MRT-3 stations: Araneta Center–Cubao, Guadalupe, North Avenue, and Taft Avenue, and complemented by a user satisfaction survey. Findings revealed that 16 out of 29 transfer links scored 0.60 or below, indicating widespread transfer quality deficiencies. Common issues included inadequate wayfinding and PWD access, poor biking infrastructure, and temperature-related discomfort. Correlation analysis showed strong alignment between MTQI scores and commuter satisfaction in several sub-indicators, while weaker correlations in physical infrastructure and route directness suggested differing user perceptions. The refined MTQI also reduced survey time by 66.9%, demonstrating practical value.

Keywords: Mode Transfer Quality Index, transfer link, MRT-3, multimodal transfers, user satisfaction

1. INTRODUCTION

Multimodal transport presents a promising solution to pressing transportation challenges such as declining urban accessibility, persistent traffic congestion, and environmental issues like air and noise pollution (Van Nes, 2022; Klug, 2013). In the context of the Philippines, however, this approach is often a necessity due to the fragmented nature of the public transportation system, compelling commuters to make multiple transfers to complete their trips. For instance, Mijares *et al.* (2014) noted that Metro Manila commuters typically make two to three transfers per journey, a process frequently perceived as inconvenient by regular transport users. These transitions significantly influence the overall commuting experience, as they account for a substantial portion of the journey (Fajardo & Gaspay, 2024).

Metro Manila is served by four urban rail lines, with the Metro Rail Transit – Line 3 (MRT-3) being the most critical in terms of ridership due to its strategic location along Epifanio Delos Santos Avenue (EDSA), a key corridor connecting central business districts (Mijares *et al*., 2016). MRT-3 has seen a dramatic increase in ridership, from 32 million passengers in 2020 to 129 million in 2023 (DOTr-MRT3, 2024), far surpassing the Light Rail Transit – Line 2 (LRT-2), which recorded 49 million rides in 2023 (Light Rail Transit Authority, 2024). This surge in ridership is attributed not only to the MRT-3's capacity but also to its strong connectivity with other modes such as buses, jeepneys, and UV Express vehicles. Given this high volume of commuters and the importance of quality transfers, assessing the mode transfer quality between MRT-3 and other connected transport systems becomes increasingly critical.

Despite its significance, the Philippines still lacks a comprehensive framework to systematically evaluate the quality of these mode transfers. This insufficiency limits the understanding of commuter experiences and hinders the formulation of targeted improvements in multimodal transport integration.

Fajardo and Gaspay (2024) made significant strides by developing a Mode Transfer Quality Index (MTQI) for the EDSA Busway. The study involved a thorough literature review and consultation with stakeholders and transportation experts. The MTQI includes five primary indicators, with 19 sub indicators, to evaluate mode transfer quality in urban transit as shown in Table 1-1.

Table 1-1. Mode Transfer Quality Index (Fajardo and Gaspay, 2024)

Indicator	Sub-Indicators	Subjective	Objective
Accessibility	Pedestrian accessibility within a 500-m radius	X	
	Pedestrian congestion in sidewalk		X
	Presence of walkalators or escalators		X
	PWD-accessible		X
Convenience	Directness of route	X	
	Convenient walking path	X	
	Convenience of Station Location	X	
	Comfortability of Physical Infrastructure	X	
Transfer walking	Presence of physical infrastructure	X	
	Transfer time	X	
	Comfort	X	
	Thermal comfort	X	
	Presence of obstruction in sidewalks	X	
	Covered walkways/sidewalks		X
Station Design	Availability of bicycle facilities		X
	Availability of PWD facilities		X
	Presence of wayfinding signages		X
	Covered waiting stops/resting area		X
Proximity	Distance between transfer points	X	

While this framework provided a solid foundation, more than half of its sub-indicators rely heavily on commuter interviews. Such dependence on subjective data introduces practical challenges— most notably, it significantly prolongs the data collection process, as gathering perception-based responses requires extensive surveying and coordination with respondents. This reliance also makes large-scale or repeated assessments impractical due to the time, labor, and resources involved.

Additionally, the original scoring system presents two key issues. First, it lacks uniformity across indicators; some are rated using a binary scale (1 or 5 for absence or presence), while others employ a 1–5 range. This inconsistency may result in disproportionate scoring, as indicators with wider scales contribute more nuance to the overall index than those with only two possible scores. Second, the framework does not account for partial implementation of facilities. For instance, covered walkways or ramps may only be provided along portions of a transfer path, yet the scoring scheme requires assessors to classify them as either present or absent. The absence of partial scoring makes it difficult to represent these intermediate conditions accurately, reducing the precision and consistency of the overall evaluation.

Building on the conceptual foundation established by Fajardo and Gaspay (2024), this study aims to address key limitations of the original MTQI. Specifically, it seeks to resolve the data collection issues that arise from the reliance on subjective measures in Fajardo and Gaspay's MTQI. Additionally, the study aims to assess the mode transfer quality of MRT-3, a critical yet underexplored component of the urban transport network, and to determine commuter satisfaction. The user satisfaction survey is an independent approach, not meant to validate the MTQI but rather to explore commuter preferences.

The study focuses on three main objectives: (1) to enhance the Mode Transfer Quality Index (MTQI) by shifting most indicators to objective, field-measurable metrics; (2) to apply the enhanced MTQI in assessing the transfer quality of MRT-3 with its connected transport modes; and (3) to determine the correlation between the MTQI assessment and commuter satisfaction based on a user survey.

The study focuses only on physical integration for the indicators. Additionally, the enhanced index is to be applied to selected MRT-3 stations namely Araneta Center – Cubao, Guadalupe, North Avenue, and Taft Avenue. All of which were chosen due to their high ridership, number of connected modes, and type of modes available (e.g. jeep, bus, UV, etc.).

2. REVIEW OF RELATED LITERATURE

2.1 Transport Interchange

Efficient multimodal transport systems rely on well-designed interchanges that enable seamless transfers between modes such as trains, buses, jeepneys, bicycles, and walking (Bryniarska & Zakowska, 2017). Edwards (2011) describes interchanges as nodes that manage flows between transport modes, user groups (including PWDs), and information systems like signage and wayfinding tools. Beyond connectivity, interchanges contribute to both user satisfaction and operational efficiency when supported by shared infrastructure and coordinated scheduling (Krogstad *et al*., 2016). Studies in urban India reveal that commuters prioritize comfort, clear visual cues, and facility quality over fare levels (Sadhukhan *et al*., 2014), while Luk and Olszewski (2003) identify five dimensions of integration: institutional, fare, physical, network, and informational. Sil *et al*. (2022) further highlight that physical factors such as accessibility and level changes significantly shape comfort in contexts where infrastructure remains underdeveloped.

While the design of an effective transport interchange involves various dimensions, this paper focuses specifically on physical integration. This scope aligns with the study's goal of enhancing the Mode Transfer Quality Index (MTQI) originally proposed by Fajardo and Gaspay (2024).

2.2 Interchange Physical Integration Indicators

The first approach involves enhancing the sub-indicators in the MTQI to ensure they are measurable through field surveys.

The Public Transport Interchange Design Guidelines (Auckland Transport, 2013) emphasize critical design attributes for transport interchanges. These include (1) visibility, (2) wayfinding, (3) shelter, (4) security, (5) accessibility, (6) service information, (7) passenger facilities, and (8) bus operations.

Similarly, Desiderio (2000) offers insights into the design and operational requirements of intermodal interchanges, focusing on user-centered design principles that can guide the enhancement process.

Moodley and Venter (2022) propose objective and quantifiable indicators by establishing a range of values and employing a scoring system to evaluate the presence and fulfillment of these indicators.

A study by Olszewski and Krukowski (2012) highlights eight quantitative indicators that address the following issues: (1) quality of basic infrastructure, (2) spatial integration of the interchange, (3) accessibility for the elderly and disabled persons, (4) ease of orientation, (5) personal security, (6) traffic safety, (7) passenger information, and (8) availability of additional facilities.

Adamos and Nathanail (2021) investigate user perceptions and satisfaction levels for a comparative evaluation of interchange quality at two terminals. They utilized 36 indicators categorized into eight quality factors.

2.3 Scoring and Weighting Systems

The scoring and weighting systems in the MTQI developed by Fajardo and Gaspay (2024) could also be recalibrated using other approaches from related literature.

In the 2022 study of Moodley and Venter, a scoring system normalized to a 0-1 range was used, incorporating partial scores (e.g. 0.25, 0.50, 0.75) to assess the degree of fulfillment of each indicator, rather than treating them as entirely present or absent. Moreover, the weighting of indicators reflects the calculated perceived importance of each factor based on commuter input.

Conticelli *et al.* (2021) incorporate in their study a weighting system that is determined by rating the key factors (indicators) based on their impact, using a scale ranging from 1 to 3 (3 being the most impactful). Additionally, the scoring utilized is in the scale of 1-5 and is based on the perceived quality of each factor, where 1 represents absence, while 5 means high quality.

Alternatively, Krambeck's Global Walkability Index (2006) suggests equal weighting for all indicators, addressing the variability of significance across different user groups. This approach simplifies the methodology by avoiding subjective determinations of importance.

3. METHODOLOGY

The methodology was divided into three phases: MTQI enhancement, MTQI application, and data analysis. The first phase focused on refining the Mode Transfer Quality Index by shifting subjective sub-indicators to objective, field-measurable metrics. The second phase involved applying the enhanced MTQI to assess transfer quality at selected MRT-3 stations. Finally, the data analysis phase examined the results, with emphasis on determining the correlation between MTQI scores and user satisfaction ratings, among other insights.

3.1 MTQI Enhancement

The enhancement of the MTQI started with identifying the subjective sub-indicators in the existing MTQI. This is followed by a review of candidate sub-indicators. This study retained certain indicators from the existing tool, and introduced new sub-indicators derived from relevant literature and guidelines, including Auckland Transport (2013), Desiderio (2000), and Moodley and Venter (2022), etc.

3.2 MTQI Application

Four MRT-3 stations were selected for this study based on projected ridership, connected routes, and transport modes available, namely Araneta Center – Cubao, Guadalupe, North Avenue, and Taft Avenue.

The sample size for this study was determined using Cochran's Sample Size. Based on this, the required sample size was calculated to be at least 384. Random sampling was employed by randomly approaching individuals exiting or entering the station during non-peak hours, as recommended by the DOTr – MRT-3, to ensure a diverse and unbiased sample.

3.2.1 Questionnaire Survey

The face-to-face questionnaire survey consisted of three required sections and one optional section. Section 1 gathered demographic data (e.g., age, gender, occupation), travel characteristics (e.g., MRT-3 usage frequency, travel purpose, typical times), and trip-specific details (e.g., prior or subsequent modes used). Section 2 covered subjective assessments for both the original and enhanced MTQI, focusing on sub-indicators not measurable through field observation. Section 3 measured commuter satisfaction using a 5-point Likert scale (very dissatisfied to very satisfied). An optional Section 4 invited open-ended responses to capture additional qualitative insights.

3.2.2 Field Survey

After collecting responses from respondents, the relevant transfer links at each station were identified. The objective part of the tool—field-measurable sub indicators—was then assessed for these transfer links. These sub-indicators were observed and recorded on-site to evaluate physical aspects of the transfer environment.

3.3 Data Analysis

Pearson's correlation coefficient was used to measure the strength and direction of the relationship between MTQI scores and commuter satisfaction, offering insights into their alignment. Additionally, t-tests were conducted to assess significant differences in satisfaction between male and female respondents, as well as to validate whether the enhanced MTQI produced significantly different scores compared to the original tool.

4. RESULTS AND DISCUSSION

4.1 MTQI Enhancement

4.1.1 Indicators and Sub-indicators Refinement

To streamline data collection and enhance replicability, the aim is to minimize subjective sub-indicators in Fajardo's MTQI by transforming them into objective measures wherever possible.

1. *Pedestrian accessibility within a 500-m radius*
This sub-indicator is inherently quantifiable but has been refined for greater flexibility. Instead of a binary Yes/No response (as in Fajardo's study), walking distances are categorized based on Moodley and Venter's framework: short (≤400 m), medium (400–800 m), and long (>800 m). Additionally, since item 11 (distance between transfer points) measures a similar aspect, these have been combined into a single sub-indicator: *proximity to the next transport option.*

2. *Directness of route*
Given the challenges in objectively measuring route directness due to random variations (Stangl, 2017) and the complexity of Stangl's modified route directness method, this sub-indicator instead incorporates more practical objective measures: the number of level changes and the types of crossings required to reach the next mode. These metrics similarly capture the directness and continuity of a transfer.

3. *Convenient walking path*
In Fajardo's MTQI, this sub-indicator captures walking path convenience based on user satisfaction ratings. To enhance its objectivity, the *presence of obstructions on sidewalks* and *sheltered walkways* has been incorporated here and is assessed objectively based on presence, absence, or partial availability.

4. *Convenience of station location*
This sub-indicator was excluded as it does not directly influence the quality of the mode transfer process itself. The author believes that it pertains more to broader network planning than physical transfer paths.

5. *Presence of physical infrastructure*
This sub-indicator has been made objective by assessing the presence, absence, or partial availability of key infrastructure elements such as ramps, lifts, railings, and tactile surfaces (Olszewski and Krukowski, 2012; Desiderio, 2000). This is divided into two components: (1) presence of escalators or lifts; and (2) presence of other PWD-accessible facilities (such as ramps, railings, tactile surfaces, and similar features).

6. *Transfer time*
Transfer time is inherently subjective, as it depends on an individual's walking speed and external factors such as crowd density and personal urgency. As such, it remains a subjective sub-indicator. However, for the purposes of standardized rating, the average walking speed in Metro Manila, estimated at 70.62 meters per minute (Gerilla *et al.*, 1995,

as cited in Tolentino and Sigua, 2022)—has been adopted. Based on this, transfer time is categorized as follows: excellent (0–6 minutes), fair (6–12 minutes), and poor (over 12 minutes), providing a consistent reference for evaluating transfer efficiency.

7. Comfort

In Fajardo's study, comfort was treated as a sub-indicator. However, in this paper, it has been elevated to an indicator to better capture its role in the transfer experience. *Comfort and Security* jointly reflect both the physical and psychological ease of movement within transfer areas. This indicator is evaluated based on the presence, absence, or partial availability of key features such as adequate lighting and CCTV surveillance. The inclusion of CCTV is particularly important, as it enhances commuters' sense of safety during the transfer and deters potential incidents such as theft or harassment, thereby improving perceived security and overall transfer quality. Additionally, pedestrian overcrowding, which directly affects both comfort and perceived safety, is evaluated through visual inspection and categorized using the Level of Service (LOS) framework from the Highway Capacity Manual (2010).

8. Thermal comfort

Thermal comfort is inherently subjective, as it depends on individual preferences and environmental factors such as temperature, humidity, and airflow. Therefore, it will remain a subjective sub-indicator.

The table below summarizes the MTQI refinement.

Table 4-1. Summary of MTQI Refinement

Original Sub-indicator (Fajardo & Gaspay)	Identified Issue	Refined Sub-indicator (Current Study)	Justification/ Reference
1. Pedestrian accessibility within a 500-m radius	Subjectively rated, though objectively measurable in practice	*Proximity to next transport option/s* categorized as: ≤400 m (short), 400-800 m (medium), > 800 m (long)	Moodley & Venter (2022)
2. Distance between transfer points	Duplicate with "Pedestrian accessibility within a 500-m radius"	Merged into *proximity to next transport option/s*	-
3. Directness of route	Subjectively rated; Can be decomposed into field-measurable components	Split into: *number of level changes* and *crossing requirements*	Olszewski and Krukowski (2012), Desiderio (2000)
4. Convenient walking path	Subjectively rated	Assessed via presence/absence/partial *sidewalk encroachment* and *sheltered walkways*	Adamos and Nathanail (2021), Auckland Transport (2013), Olszewski and Krukowski (2012)
5. Presence of obstruction in sidewalks	Subjectively rated	Merged to *convenient walking path* (under *sidewalk encroachment*)	-
6. Convenience of station location	Not directly related to transfer quality	Removed from index	Conceptual assessment
7. Presence of physical infrastructure	Too broad	Assessed via presence/absence/partial *escalators/lifts* and *PWD-*	Olszewski and Krukowski (2012),

		accessible facilities (ramps, railings, tactile paving)	Desiderio (2000)
8. Transfer time	Highly variable; Subjectively rated	Retained subjective; Standardized using walking speed with categories: 0-6 mins (excellent), 6-12 mins (fair), >12 mins (poor)	Gerilla et al. (1995) as cited in Tolentino & Sigua (2022)
9. Comfort	Too broad	Elevated to Indicator: *Comfort and Security* with newly added sub-indicators: (a) *adequate lighting;* (b) *presence of CCTV monitoring*; (c) *pedestrian congestion*	Moodley & Venter (2022), Adamos & Nathanail (2021), Highway Capacity Manual (2010)
10. Thermal Comfort	Subjectively rated	Retained as subjective	Environmental factors

To categorize the sub-indicators, we introduce three key indicators:

- *Accessibility and Connectivity* – measures how easily and efficiently users can move between transport modes, considering proximity, directness, and available transport options.
- *Convenience* – evaluates the smoothness and ease of the transfer process, minimizing effort, delays, and physical barriers.
- *Comfort and Security* – assesses the overall comfort, safety, and environmental condition of the transfer experience, including lighting, surveillance, crowding, and infrastructure usability. Comfort and Security were combined because both dimensions fundamentally contribute to the traveler's perceived sense of ease and well-being within the transfer. For example, well-lit and well-monitored spaces reduce anxiety and deter crime (Welsh & Farrington, 2008), while also contributing to a more comfortable walking experience.

Table 4-1 presents the finalized indicators and their corresponding sub-indicators, categorized based on whether they rely on subjective or objective data.

Table 4-2. Final List of Indicators and Sub-indicators of the Enhanced MTQI

Indicators	Sub-indicator	Subjective	Objective
Accessibility and Connectivity	Proximity to next transport option/s		X
	Presence of directional signage/wayfinding		X
	Presence of biking facilities		X
	Directness of route • Number of level changes • Crossing requirements		X
Convenience	Presence of physical infrastructure • Presence of escalators/lifts • Presence of PWD facilities (e.g., ramps, tactile surfaces, etc.)		X
	Convenient walking path • Sheltered walkways • Sidewalk encroachment		X
	Transfer time	X	
	Adequate Lighting		X

	Presence of CCTV monitoring		X
Comfort and Security	Pedestrian congestion (overcrowding)		X
	Thermal comfort	X	
	Comfortability of physical infrastructures	X	

4.1.2 Scoring and Weighting Systems

The scoring system for this study followed the methodology of Moodley and Venter (2022), utilizing a scale ranging from 0 to 1.

- A full score (1) is given when a criterion is present and in good condition.
- Partial scores are assigned when a criterion is partially provided or exists but is not in good condition.
- A score of zero (0) is given when a criterion is not present or partially provided but is not in good condition.

Some criteria require more than just visual inspection. For instance, proximity to the next transport option is evaluated based on walking distance and follows the scoring system of Moodley and Venter (2022):

- Short distance (≤400 m) → Score: 1
- Medium distance (400–800 m) → Score: 0.5
- Long distance (>800 m) → Score: 0

Moreover, for level changes, moving between different levels should be minimized to ensure a smoother transfer (Desiderio, 2000). Frequent level changes disrupt pedestrian flow and increase transfer time. Therefore, the scoring system is as follows:

- At most one (1) level change required → Score: 1
- Two (2) level changes required → Score: 0.5
- More than two (2) level changes required → Score: 0

As for crossing requirements, Olszewski and Krukowski (2012) identified the degree of safety provided by different types of road crossings. Building on this, the scoring criteria have been adjusted to account for both continuity of transfer and pedestrian safety. Higher scores are given to crossings that facilitate smoother movement with minimal disruptions while ensuring pedestrian safety. The scoring system is structured as follows:

- No crossing needed → Score: 1 (Seamless transfer, no interruption)
- Underground or overhead crossing → Score: 0.75 (Requires additional effort but provides safety)
- Signalized crossing → Score: 0.50 (Stops pedestrian movement but offers regulated safety)
- Unsignalized marked crossing → Score: 0.25 (Requires caution, as safety depends on drivers yielding)
- Unmarked crossing → Score: 0 (Least safe, highest disruption to pedestrian flow)

Pedestrian congestion is evaluated using the Level of Service (LOS) framework for pedestrian walkways, as outlined in the Highway Capacity Manual (2010). Under this system, LOS A (free movement along the desired path) and LOS B (occasional path adjustments to avoid conflicts) indicate minimal to no overcrowding. LOS C (frequent path adjustments to avoid conflicts) and LOS D (restricted movement, with limited ability to overtake slower pedestrians) represent moderate congestion, while LOS E (walking speed is constrained, and passing slower pedestrians is difficult) and LOS F (walking speed is severely restricted, with frequent contact with other pedestrians) signify severe overcrowding. This classification aligns with the approach used in Moodley and Venter's (2022) study:

- Minimal to no overcrowding → Score: 1
- Moderate congestion → Score: 0.50
- Severe overcrowding → Score: 0

For the weighting, the approach from Fajardo and Gaspay's study is retained, which aligns with the equal-weighting methodology of the Global Walkability Index (Krambeck, 2006).

4.1.3 Improvement in Data Collection

During data collection, the time it took to collect answers from respondents was recorded. This was done for both the existing (original) and enhanced tool. The average time required to collect data for the subjective sub-indicator in the original MTQI was 58.632 seconds (approximately 1 minute). In comparison, the enhanced MTQI reduced this average to 19.412 seconds (approximately 20 seconds). This reflected a reduction of about 66.9% in data collection time for the subjective component, highlighting the enhanced MTQI's improved practicality and efficiency.

4.2 MTQI Application

4.2.1 Data Collection

Data collection was conducted from March 26 to April 8, 2025, during non-peak hours (10:00 AM–3:00 PM), following DOTr–MRT-3 approval. A team of at least three surveyors, along with the author, gathered 410 valid commuter responses and simultaneously performed the objective MTQI assessment across four MRT-3 stations and their respective transfer links.

Table 4-3. Key Characteristics of Surveyed Commuters

Number of Respondents	**410**
Percent of Female Respondents	56.34%
Percent of Respondents with Reduced Mobility	13.17%
Percent of Respondents Aged 18-24 Years	35.37%
Percent of Respondents Commuting for School	38.29%
Percent of Respondents Using Jeep Before/After MRT-3	50.98%

Table 4-2 presents the key characteristics of the 410 survey respondents. A majority were female (56.34%), and the most represented age group was 18–24 years (35.37%), followed by 25–34 years (26.59%). Notably, 13.17% of respondents identified as having reduced mobility: 3.90% were persons with disabilities (PWD), 3.66% were senior citizens (aged 60 and above), and 5.61% were pregnant and/or commuting with small children (typically aged 6 or below). In terms of trip purpose, respondents were almost evenly split between commuting for school (38.29%) and commuting for work (30.73%). As for connecting transport modes used before or after riding MRT-3, jeepneys emerged as the most common mode (50.98%), followed by buses (15.12%) and the LRT (12.20%).

Challenges in data collection included commuter reluctance due to time constraints, limited space for engagement, and difficulty initiating surveys without obstructing flow.

Students were generally more receptive, likely due to a shared understanding of academic research efforts.

4.2.2 Transfer Links Determination

Once the data were gathered, transfer links were identified. Transfer links refer to the physical paths that connect modes of transport. A transfer link is not always defined by a single mode-to-mode connection. In some cases, a transfer link may terminate at a terminal or bay where two or more transport modes are available. A total of 29 transfer links were identified in this study. Figures 4-1 to 4-4 show the transfer links across the four stations. Meanwhile, Tables 4-3 to 4-6 summarize the defined transfer links connecting MRT-3 stations with other transport modes.

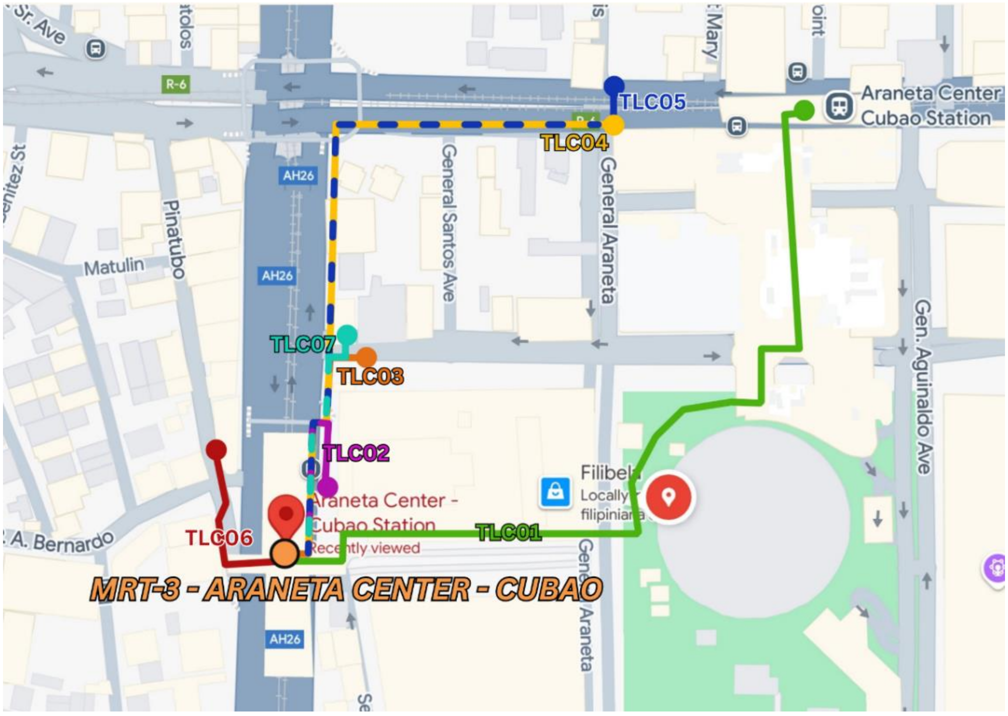

Figure 4-1. MRT-3 Araneta Center-Cubao Station Transfer Links

Table 4-4. MRT-3 Araneta Center-Cubao Station Transfer Links Description

Transfer Link Tag	Description	Mode of Transport Available
TLC01	MRT-3 Cubao ⇌ LRT-2 Cubao (via Gateway Mall)	MRT, LRT
TLC02	MRT-3 Cubao ⇌ Informal Bus Bay (along EDSA Ave. northbound)	MRT, Bus
TLC03	MRT-3 Cubao ⇌ UV Terminal (along Gen. Roxas Ave.)	MRT, UV
TLC04	MRT-3 Cubao ⇌ along Aurora Blvd (eastbound)	MRT, Jeep (modern and traditional)
TLC05	MRT-3 Cubao ⇌ along Aurora Blvd (westbound)	MRT, Jeep (modern and traditional)
TLC06	MRT-3 Cubao ⇌ BAPTODA (along Pinatubo St.)	MRT, Tricycle
TLC07	MRT-3 Cubao ⇌ Ride-hailing (along Gen. Roxas Ave.)	MRT, Taxi, Ride-hailing (Angkas, Grab, MoveIt)

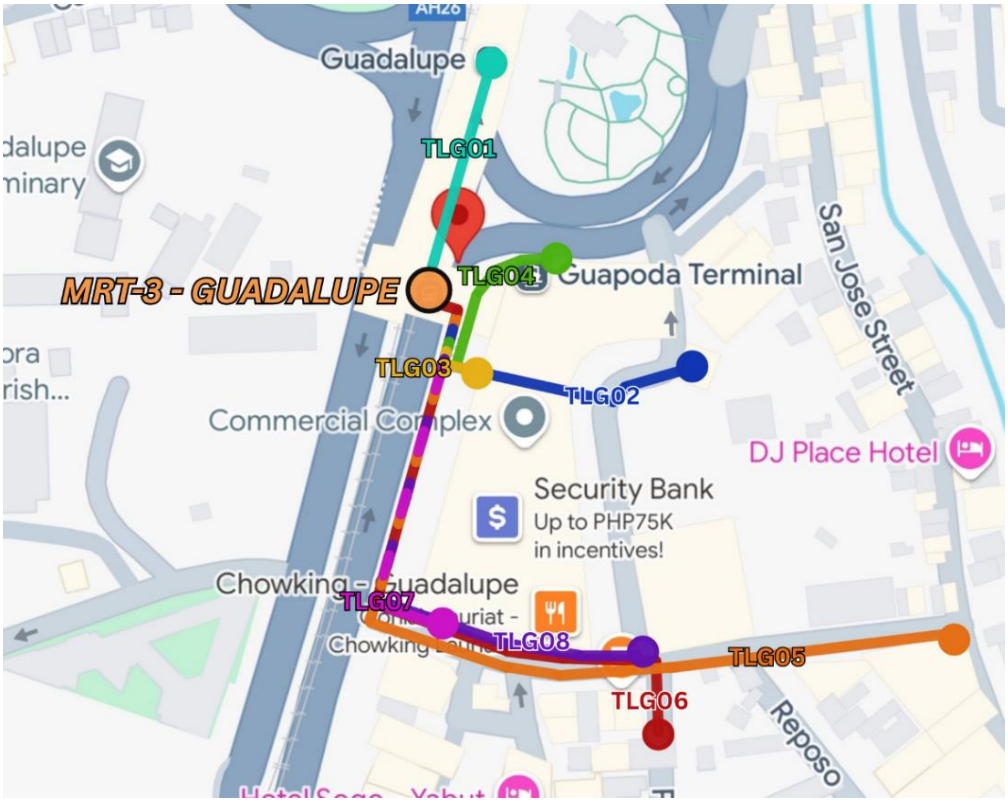

Figure 4-2. MRT-3 Guadalupe Station Transfer Links

Table 4-5. MRT-3 Guadalupe Station Transfer Links Description

Transfer Link Tag	Description	Mode of Transportation Present
TLG01	MRT-3 Guadalupe ⇌ EDSA Carousel	MRT, Bus
TLG02	MRT-3 Guadalupe ⇌ Kimston Terminal (along P. Victor)	MRT, Jeep (modern and traditional)
TLG03	MRT-3 Guadalupe ⇌ Modern Jeep/Ride-hailing (along Maharika Hwy)	MRT, Jeep (modern), Ride-hailing (Angkas, MoveIt, JoyRide)
TLG04	MRT-3 Guadalupe ⇌ Guapoda Terminal	MRT, Jeep (traditional)
TLG05	MRT-3 Guadalupe ⇌ C5/FTI Terminal	MRT, Jeep (traditional)
TLG06	MRT-3 Guadalupe ⇌ Tricycle Terminal (along P. Victor near McDonald's)	MRT, Tricycle
TLG07	MRT-3 Guadalupe ⇌ Modern Jeeps/Taxis (along P. Burgos in front of Jollibee)	MRT, Jeep (modern), Taxi, Ride-hailing
TLG08	MRT-3 Guadalupe ⇌ Informal "Guada-L.Guinto Terminal" (along P. Victor near the Public Market)	MRT, Jeep (traditional)

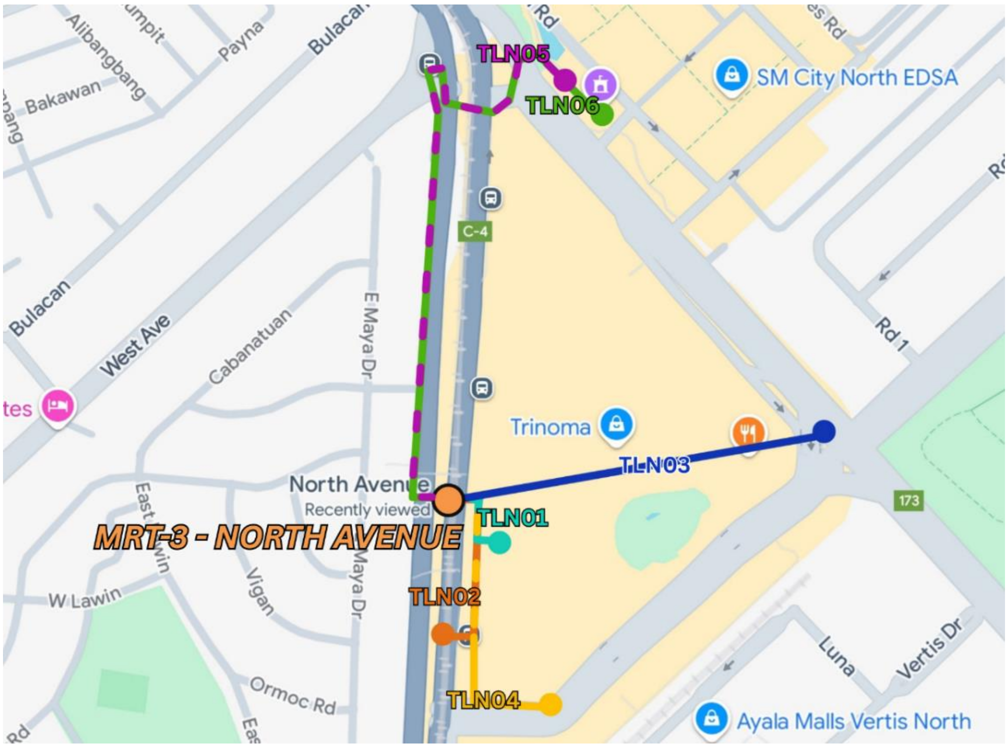

Figure 4-3. MRT-3 North Avenue Station Transfer Links

Table 4-6. MRT-3 North Avenue Station Transfer Links Description

Transfer Link Tag	Description	Mode of Transportation Present
TLN01	MRT-3 North ⇌ UV Terminal (near Landmark)	MRT, UV
TLN02	MRT-3 North ⇌ EDSA Carousel	MRT, Bus
TLN03	MRT-3 North ⇌ along North Ave via Trinoma	MRT, Jeep (modern and traditional)
TLN04	MRT-3 North ⇌ Taxi Terminal (along Mindanao Ave Ext in front of Landmark)	MRT, Taxi, Ride-hailing (Angkas, Grab, MoveIt)
TLN05	MRT-3 North ⇌ Jeep Terminal (near SM North)	MRT, Jeep (traditional)
TLN06	MRT-3 North ⇌ Bus Terminal (near SM North)	MRT, Bus

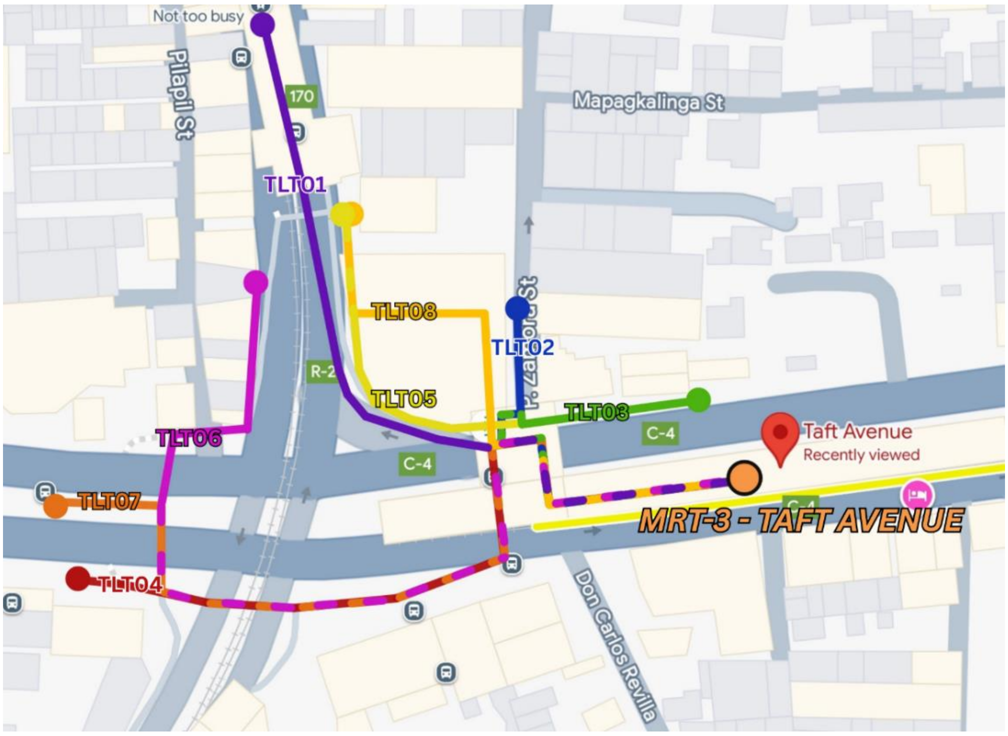

Figure 4-4. MRT-3 Taft Avenue Station Transfer Links

Table 4-7. MRT-3 Taft Avenue Station Transfer Links Description

Transfer Link Tag	**Description**	**Mode of Transportation Present**
TLT01	MRT-3 Taft ⇌ LRT-1 EDSA Taft	MRT, LRT
TLT02	MRT-3 Taft ⇌ ZET Coop Terminal (along P. Zamora)	MRT, Tricycle
TLT03	MRT-3 Taft ⇌ along EDSA Ave westbound (near Kabayan Hotel)	MRT, Jeep (traditional)
TLT04	MRT-3 Taft ⇌ along EDSA Ave eastbound (in front of EDSA Carousel)	MRT, Jeep (traditional)
TLT05	MRT-3 Taft ⇌ Jeep Loading Area (along Taft Ave. northbound)	MRT, Jeep (traditional), Tricycle
TLT06	MRT-3 Taft ⇌ Van Terminal (along Taft Ave. southbound)	MRT, Van
TLT07	MRT-3 Taft ⇌ EDSA Carousel	MRT, Bus
TLT08	MRT-3 Taft ⇌ Jeep Loading Area (via Metro Mall)	MRT, Jeep (traditional), Tricycle

4.2.3 Index Computation Results

The MTQI scores were interpreted using the scale shown below, where each range corresponds to a qualitative description of transfer quality.

Table 4-8. MTQI Score Interpretation

Range Values	Transfer Quality
0.801 – 1	Very High
0.601 – 0.8	High
0.401 – 0.6	Moderate
0.201 – 0.4	Low
0 – 0.200	Very Low

Following the computation, the MTQI scores for each station are summarized in the table below.

Table 4-9. MTQI Scores per Station

Station	MTQI Score	Transfer Quality
Araneta Center - Cubao	0.539	Moderate
Guadalupe	0.614	High
North Avenue	0.583	Moderate
Taft Avenue	0.537	Moderate

To provide a deeper understanding of the results, the following sections present the MTQI findings through two perspectives:

- Per Transfer Link – to examine the quality of individual connections within each station.
- By Sub-Indicator – to evaluate station performance across specific dimensions of transfer quality.

4.2.3.1 MTQI Scores per Transfer Link

The table below displays the MTQI scores for each transfer link, including both the individual indicator scores and the overall score.

Table 4-10. MTQI Scores of Transfer Links

Stations	*Transfer Links*	*Accessibility and Connectivity*	*Convenience*	*Comfort and Security*	**MTQI Score**
Araneta Center – Cubao	TLC01	0.500	0.736	0.885	**0.707**
	TLC02	0.438	0.736	0.646	**0.606**
	TLC03	0.438	0.667	0.606	**0.570**
	TLC04	0.203	0.422	0.517	**0.381**
	TLC05	0.208	0.417	0.500	**0.375**
	TLC06	0.469	0.595	0.736	**0.600**
	TLC07	0.344	0.633	0.620	**0.532**
Guadalupe	TLG01	0.594	0.833	0.650	**0.692**
	TLG02	0.500	0.500	0.521	**0.507**
	TLG03	0.750	0.833	0.863	**0.815**
	TLG04	0.625	0.667	0.670	**0.654**
	TLG05	0.531	0.375	0.725	**0.544**
	TLG06	0.531	0.383	0.510	**0.475**
	TLG07	0.625	0.500	0.700	**0.608**
	TLG08	0.625	0.500	0.725	**0.617**
North Avenue	TLN01	0.750	0.578	0.807	**0.712**
	TLN02	0.719	0.583	0.756	**0.686**
	TLN03	0.469	0.717	0.785	**0.657**
	TLN04	0.531	0.600	0.810	**0.647**
	TLN05	0.344	0.333	0.594	**0.424**
	TLN06	0.219	0.317	0.590	**0.375**
Taft Avenue	TLT01	0.750	0.833	0.648	**0.744**
	TLT02	0.438	0.500	0.422	**0.453**
	TLT03	0.563	0.579	0.600	**0.580**
	TLT04	0.531	0.519	0.369	**0.473**
	TLT05	0.438	0.583	0.481	**0.501**
	TLT06	0.281	0.450	0.420	**0.384**
	TLT07	0.531	0.429	0.392	**0.451**
	TLT08	0.438	0.833	0.850	**0.707**

Scores highlighted in orange indicate transfer links with MTQI values below 0.60, corresponding to moderate or lower transfer quality. To aid interpretation, the scatter plot in the next chart visualizes MTQI scores across all 29 evaluated links. In this study, a score above 0.60 signifies high-quality transfer. However, 16 of the 29 links fell at or below this threshold, indicating widespread issues in transfer quality within the system.

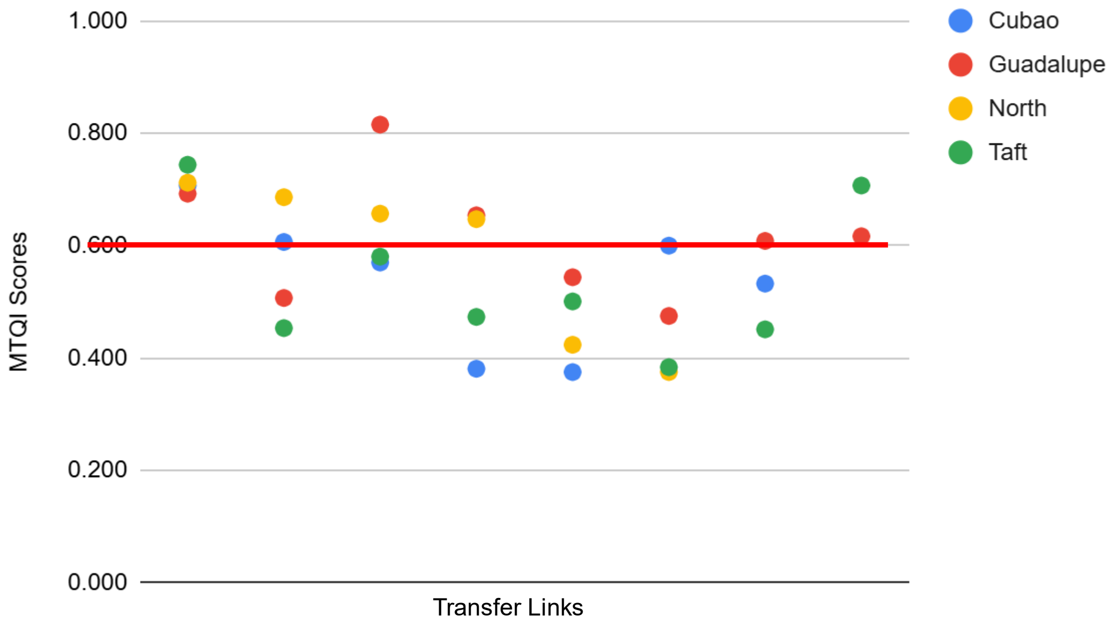

Figure 4-5. Distribution of MTQI Scores Across 29 Transfer Links

It is important to note that a transfer link classified as high quality does not imply a flawless experience or the absence of needed improvements. Targeted interventions may still be required, as lower sub-indicator scores can reveal specific deficiencies within otherwise high-scoring links.

4.2.3.2 Sub-indicators Scores per Station

The table below presents the scores of each station for every sub-indicator. A summary of these results, grouped by indicator, is shown in the bar graph that follows.

Table 4-11. Sub-indicator Scores per Station

Indicators	Sub-indicators	Araneta Center–Cubao	Guadalupe	North Avenue	Taft Avenue
Accessibility and Connectivity	Proximity to the next transport option/s	0.786	1.000	0.750	0.875
	Presence of wayfinding	0.143	0.125	0.250	0.250
	Presence of biking facilities	0.071	0.500	0.750	0.125
	Directness of route	0.485	0.766	0.521	0.734
Convenience	Presence of physical infrastructure	0.357	0.344	0.292	0.313
	Convenience of Walking Path	0.714	0.406	0.625	0.594
	Transfer time	0.731	0.972	0.648	0.866
Comfort and Security	Presence of adequate lighting	0.857	0.688	0.833	0.688
	Presence of CCTV monitoring	0.571	0.750	0.833	0.563
	Pedestrian congestion in sidewalk	0.643	0.750	0.750	0.313
	Thermal comfort	0.448	0.444	0.523	0.395
	Usability of physical infrastructure	0.701	0.721	0.678	0.657

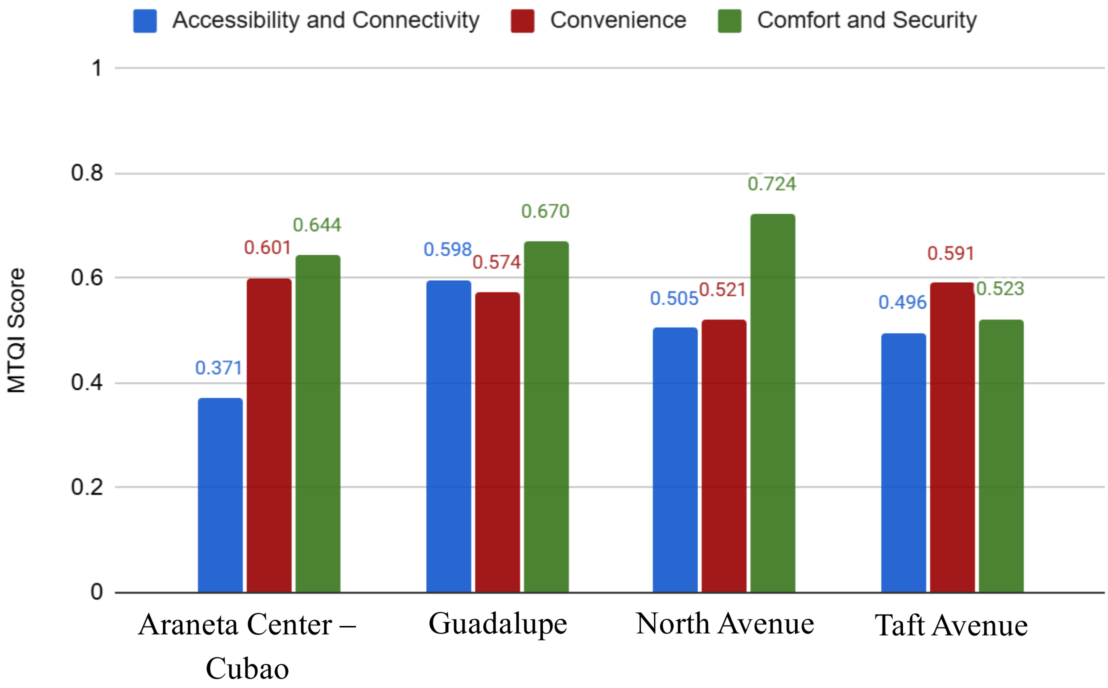

Figure 4-6. Indicator Scores by Station

4.2.4 User Satisfaction Survey Result

To understand how users perceive transfer quality, a satisfaction survey was included in the questionnaire. The questions were designed to reflect each sub-indicator, allowing users to rate their satisfaction with specific aspects of their transfer experience. The results are shown in the table below.

Table 4-12. Mean User Satisfaction per Sub-Indicator for Each Station

Sub-indicators	Araneta Center-Cubao	Guadalupe	North Avenue	Taft Avenue
Proximity to the next transport option/s	0.609	0.744	0.585	0.689
Presence of directional signages/wayfinding	0.444	0.445	0.416	0.401
Presence of biking facilities	0.252	0.495	0.543	0.282
Directness of route	0.597	0.692	0.514	0.607
Presence of physical infrastructure	0.590	0.513	0.490	0.465
Convenience of walking path	0.605	0.522	0.615	0.410
Transfer time	0.584	0.717	0.543	0.634
Presence of adequate lighting	0.738	0.663	0.684	0.604
Presence of CCTV monitoring	0.626	0.660	0.589	0.530
Pedestrian congestion in sidewalk	0.536	0.589	0.611	0.326
Thermal comfort	0.441	0.446	0.487	0.373
Usability of physical infrastructure	0.714	0.690	0.669	0.637

Satisfaction survey results showed that respondents were most dissatisfied with wayfinding, biking facilities, physical infrastructure, walking paths, overcrowding, and thermal conditions.

In addition to rating their satisfaction, users also provided valuable feedback and suggestions through the survey. Many emphasized the need for coordination between transport planners and local government units (LGUs) to allocate proper spaces for street vendors, thereby preventing obstruction of sidewalks. Several respondents called for improved ventilation in transfer areas, recommending the installation of electric fans in enclosed or congested segments where applicable. Users also raised concerns about sidewalk design, noting that poor layout and unclear boundaries often make it difficult to identify pedestrian paths. A recurring concern was the lack of adequate PWD-accessible facilities, with some expressing that the current state reflects a disregard for the needs of persons with disabilities in transport planning. Lastly, there were calls to improve the aesthetics of transfer facilities to make them more appealing and comparable to international standards. These suggestions highlight the users' desire for a more inclusive, functional, and dignified commuting environment, reinforcing the need for responsive and user-centered transport interventions.

4.3 Data Analysis

4.3.1 MTQI Scores Validation

In the absence of stakeholder consultation, the evaluation of the selected MRT-3 stations was carried out using the existing MTQI developed by Fajardo and Gaspay (2024) to generate baseline sub-indicator scores. A paired t-test was then conducted to compare these scores with those derived from the enhanced version of the MTQI. The resulting p-values, which ranged from 0.14 to 0.88, indicate no statistically significant differences between the two sets of scores. This implies that the enhancements did not significantly alter the scoring outcomes, thereby maintaining consistency with the original framework despite the modifications introduced.

Table 4-13. Comparison of Sub-Indicator Scores Between Existing and Enhanced MTQI with Paired t-Test Results

Sub-indicator	Araneta Center - Cubao		Guadalupe		North Avenue		Taft Avenue	
	Enhanced MTQI	Existing MTQI	Enhanced MTQI	Existing MTQI	Enhanced MTQI	Existing MTQI	Enhanced MTQI	Existing MTQI
Q1	0.786	0.600	1.000	0.862	0.750	0.673	0.875	0.828
Q2	0.143	0.143	0.125	0.857	0.167	1.000	0.250	0.375
Q3	0.071	0.143	0.500	0.143	0.583	0.167	0.125	0.250
Q4	0.485	0.143	0.766	0.500	0.521	0.500	0.734	0.313
Q5	0.357	0.214	0.344	0.310	0.292	0.222	0.313	0.250
Q6	0.714	0.585	0.406	0.529	0.625	0.666	0.594	0.448
Q7	0.731	0.873	0.972	0.978	0.648	0.839	0.866	0.931
Q8	0.857	0.675	0.688	0.603	0.833	0.500	0.688	0.604
Q9	0.571	0.442	0.750	0.442	0.833	0.500	0.563	0.370
Q10	0.643	0.432	0.750	0.434	0.750	0.833	0.313	0.161
Q11	0.448	0.714	0.444	0.571	0.523	0.503	0.395	0.750
Q12	0.701	0.606	0.721	0.588	0.678	0.620	0.657	0.553

p-value	0.138	0.542	0.875	0.443
Remarks	*Not Significant*	*Not Significant*	*Not Significant*	*Not Significant*

4.3.2 Correlation Analysis

Pearson correlation coefficient revealed that there is a strong alignment between MTQI scores and user satisfaction ratings. Only two sub-indicators showed weak relationships – directness of route and presence of physical infrastructure.

Table 4-14. Correlation Analysis

Sub-Indicators	Pearson-r
Proximity to the next transport option/s	0.868
Presence of wayfinding	0.775
Presence of biking facilities	0.882
Directness of route	0.580
Presence of physical infrastructure	0.324
Convenience of Walking Path	0.778
Transfer time	0.935
Presence of adequate lighting	0.777
Presence of CCTV monitoring	0.683
Pedestrian congestion in sidewalk	0.772
Thermal comfort	0.915
Usability of physical infrastructure	0.700

The majority of the respondents were regular users without mobility impairments, which may account for their reported satisfaction with existing infrastructures, even if it was objectively lacking. Furthermore, users reported that level changes and road crossings are a regular part of their commute. Their responses may indicate adaptive behavior (Mijares *et al.*, 2016).

4.3.3 Gender-disaggregated Analysis

An independent t-test revealed significant differences in satisfaction between male and female users for 5 out of 12 sub-indicators.

Table 4-15. Significant Gender Differences in User Satisfaction Across Sub-Indicators

Sub-indicators	p-value	Remarks	Mean, male	Mean, female
Proximity to the next transport option/s	0.224	Not Significant	0.718	0.689
Presence of directional signages/wayfinding	0.382	Not Significant	0.451	0.429
Presence of biking facilities	0.029	Significant	0.363	0.420
Directness of route	0.632	Not Significant	0.617	0.628
Presence of physical infrastructure	0.703	Not Significant	0.511	0.519
Convenience of Walking Path	0.561	Not Significant	0.510	0.525
Transfer time	0.043	Significant	0.666	0.617
Presence of adequate lighting	0.647	Not Significant	0.683	0.674
Presence of CCTV monitoring	0.031	Significant	0.635	0.589
Pedestrian congestion in sidewalk	0.022	Significant	0.508	0.459
Thermal comfort	0.017	Significant	0.466	0.415
Usability of physical infrastructure	0.929	Not Significant	0.666	0.665

As shown in the table, females were more dissatisfied with CCTV monitoring, transfer time, overcrowding, and thermal conditions. Meanwhile, males showed more dissatisfaction with biking facilities.

5. CONCLUSION

This study enhanced the existing Mode Transfer Quality Index (MTQI) originally developed by Fajardo and Gaspay (2024) to address inefficiencies in data collection and replicability across sites. Drawing from relevant literature, the enhancement aimed to streamline the tool by shifting several perception-based indicators toward objective, field-measurable metrics. Incorporating both the original and enhanced MTQI versions during the data collection phase allowed for a direct comparison of efficiency. Results show that the enhanced tool reduced the average data collection time for the subjective indicators by approximately 66.9% (from 58.6 to 19.4 seconds). Moreover, a paired t-test revealed no statistically significant difference between the scores generated by the two versions, demonstrating that the improved efficiency and replicability were achieved without compromising scoring validity, even in the absence of stakeholder consultation.

Using the enhanced MTQI, 29 transfer links across selected MRT-3 stations were evaluated. Of these, 16 scored 0.60 or below, indicating that more than half of the observed links have moderate or low transfer quality. This suggests systemic issues in transfer environments, emphasizing the need for targeted improvements.

Notably, transfer links integrated with the MRT–LRT and MRT–EDSA Carousel corridors generally exhibited favorable conditions, often scoring higher due to features such as clear wayfinding, covered walkways, and smoother transitions. Transfers traversing commercial establishments also performed well, benefiting from air-conditioned, well-lit, and sheltered pathways. Meanwhile, links leading to more "informal" transport modes, such as jeepneys and tricycles, often lacked basic transfer infrastructure—frequently obstructed designated walkways, missing signages, little to no protection to the weather, etc. resulting in lower MTQI scores. A critical and consistent issue across poorly scoring links was sidewalk obstruction caused by informal vendors. Interestingly, this was also a top concern raised by users, who suggested designating proper vending areas to preserve walkability.

Sub-indicator analysis revealed consistent problem areas across stations: poor wayfinding, lack of PWD- and bike-friendly facilities, encroached or exposed walking paths, congestion, and insufficient thermal comfort. These observations were validated by the user satisfaction survey, where similar elements received low ratings. Gender-based analysis further uncovered that female commuters reported greater dissatisfaction with safety, comfort, and crowding conditions, while male users were more concerned with biking infrastructure.

Among all the stations studied, only Guadalupe achieved a high MTQI score. Other major transfer hubs like Araneta Center–Cubao, North Avenue, and Taft Avenue hovered at moderate levels, highlighting that even prominent nodes in Metro Manila's transit network fall short of delivering high-quality transfers.

Overall, the strong correlation between MTQI scores and commuter satisfaction highlights the practical value of the tool in assessing transfer environments. Since the results reflect the physical realities on the ground and align with user sentiment, the MTQI, especially in its enhanced form, can serve as a reliable guide for identifying where interventions are most needed. Improving wayfinding, biking facilities, accessibility for persons with reduced mobility through the presence of physical infrastructures, shelter from weather, and managing sidewalk obstructions are clear priorities. These are not just technical issues but daily frustrations experienced by commuters. As urban mobility in Metro Manila continues to evolve, improving the quality of mode transfers, particularly in informal and underserved areas, should be treated not as a side issue but as a key part of transport planning. Making these spaces safer, clearer, and more comfortable will go a long way in improving the overall commuter experience.

6. RECOMMENDATIONS

To build upon the findings of this study, several recommendations are proposed for future research and practical implementation. First, future studies are encouraged to integrate user-defined weightings for MTQI sub-indicators. The current framework assumes equal importance across all factors, but this may not align with commuter priorities. Allowing users to assign relative importance to indicators could help better capture perceived transfer quality and improve the alignment between objective scores and subjective satisfaction.

Second, it is recommended that data collection be conducted across varied timeframes, especially during peak hours. High-demand scenarios often reveal latent issues such as severe congestion, heightened thermal discomfort, and longer transfer times, which may not be apparent during off-peak periods.

Third, future research should consider expanding the dimensions of integration captured by the MTQI. Beyond physical infrastructure, aspects such as operational efficiency and cost-related factors may also strengthen the tool's comprehensiveness.

Lastly, researchers are encouraged to replicate and apply the enhanced MTQI across different transit corridors in Metro Manila and other urban settings. Doing so in diverse environments will help reveal whether user priorities shift across contexts, such as between central business districts and more peripheral neighborhoods, which in turn strengthens the case for incorporating user-defined weightings in the tool.

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