

From Data to Mobility Socialization: Longitudinal Construction and Empirical Study of Taichung MRT Passenger Personas (2023-2025)

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ABSTRACT: This study explores how emerging rail transit systems restructure the spatial mobility and social practices of urban residents. Moving beyond the neutral perspective of traditional transport research focused on "operational performance" and "average service quality," this study introduces Data Personification, Mobility Socialization, and Spatial Empowerment as its core theoretical frameworks.

By analyzing longitudinal passenger satisfaction data from the Taichung MRT (TMRT) from 2023 to 2025 (Total $N=4,645$), this research transforms monotonous demographic and satisfaction indicators into three core passenger Personas characterized by distinct behavioral motivations and sociological implications: "The Steadfast Pink-Collar Worker," "The Emerging Student Generation," and "Opportunity-driven Leisure Seekers and Senior Explorers". Utilizing cross-tabulation, independent sample t-tests, and longitudinal trend analysis, the empirical findings indicate:

1. Path Shift and Spatial Empowerment: In an urban context traditionally centered on private vehicles, the MRT has become a vital medium for women's spatial empowerment due to its safety advantages (with women valuing safety significantly higher than men, $p < .001$), facilitating the establishment of stable spatial participation habits.
2. Policy Intervention and Socialization: The implementation of the TPASS (Taiwan Public Transport Pass)—a government-subsidized, regional multi-modal monthly subscription scheme—effectively eliminated the marginal economic cost of travel. This intervention caused the student population proportion to surge to 26.65% and their public transport transfer rate to jump to 41.2%, confirming the policy's effectiveness in fostering independent mobility (Mobility Socialization) among adolescents.
3. Structural Breakthrough: The policy-driven "Virtual Network" has successfully triggered a significant mode shift. Our findings demonstrate that private motorcycle dependency for inbound trips plummeted from 28.3% in 2023 to 10.8% by 2025, proving that multi-modal integration can overcome the physical constraints of a single-line rail system.

The constructed "Data Personification" model not only reveals the micro-sociological impacts of emerging rail systems on urban social structures but also provides empirical insights for precision governance and station-area service strategies in motorized cities during periods of transport transition.

KEYWORDS: Data Personification, Mobility Socialization, Spatial Empowerment, Path Dependency, Public Transport, Taichung MRT

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1. INTRODUCTION

1.1 Research Background: Mobility Inertia and Rail System Intervention in Metropolitan Areas

As global urbanization accelerates, the development of rail transit systems has become a core strategy for emerging cities to achieve sustainable development. However, compared to mature public transport networks in the West, emerging Asian cities often exhibit a distinct preference for private motorized vehicles during their urban expansion. In these metropolitan areas, motorcycles exhibit strong Path Dependency in daily mobility trajectories due to their high maneuverability and low ownership costs. Taking the Taichung metropolitan area in central Taiwan as an example, the long-standing high market share of private motorcycles and cars has shaped unique spatial practices among residents based on this mobility inertia.

As an emerging MRT city, the commencement of the Taichung MRT system represents more than just an additional transport option; it introduces a new type of closed public space characterized by high safety and predictability into the existing mobility structure. In this context, the group choosing to abandon the convenience of motorcycles for the MRT often harbors psychological drivers and social motivations far more complex than simple displacement. The transformation triggered by the introduction of modern rail transit should not be viewed merely as a neutral "Mode Shift," but as a profound process of spatial perception restructuring and social empowerment.

The transformative impact of the MRT system was further catalyzed in July 2023 by the implementation of the TPASS (Taiwan Public Transport Pass). As a regional, multi-modal monthly subscription scheme offering unlimited travel for a flat, highly subsidized rate, TPASS effectively eliminated the marginal economic cost of public transport trips. This policy represents a major institutional intervention that fundamentally reshaped the economic incentives of urban mobility, providing a unique quasi-experimental setting to examine the transition from motorcycle dependency to a multi-modal, rail-centric network.

1.2 Research Motivation and Objectives

Most previous studies on emerging Asian rail systems have relied heavily on quantitative indicators from engineering and management perspectives (e.g., hardware reliability, punctuality, and total ridership), neglecting the micro-impacts of the MRT as a "dynamic social space" on specific groups. Furthermore, many satisfaction surveys remain limited to independent descriptions of variables, lacking multi-dimensional synthesis and deep interpretation. Therefore, this study aims to fill this gap in the international literature. By utilizing three consecutive years (2023–2025) of large-scale survey data, this research conducts in-depth cross-tabulation, difference testing, and longitudinal trend analysis. It seeks to breathe life into cold statistics through "Data Personification," extracting representative passenger personas to explore how emerging rail systems intervene in and empower the urban lives of different demographic groups, such as women, adolescents, and the elderly.

2. LITERATURE REVIEW

2.1 Path Dependency and Mobility Transition in Travel Behavior

In studying the intervention effects of emerging rail systems, Path Dependency provides a core explanatory framework. This theory posits that current mobility decisions are often constrained by past technical choices and the accumulation of social habits, leading to a significant Lock-in effect. In Taichung, motorcycles have long dominated daily trajectories due to their high maneuverability, low cost, and convenience, establishing a psychological and behavioral inertia that is difficult to disrupt.

The introduction of rail transit represents a Mobility Transition that challenges the existing regime. As noted by Anable (2005), demographic variables alone cannot accurately predict mode choice; behavioral patterns and psychological motivations must be integrated into the analysis. This study investigates how the MRT leverages safety advantages and policy interventions (such as TPASS) to induce a substantive mobility transition within a context of strong path dependency.

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2.2 From Market Segmentation to Data Personification

Traditional transport marketing relies heavily on single demographic variables. However, Anable (2005) argues that only by cross-analyzing attitudes, behavioral patterns, and trip motivations can researchers construct passenger segments that reflect real-life contexts. Recently, scholars have proposed the concept of Data Personification. The three-factor theory of anthropomorphism by Epley et al. (2007) suggests that humans have an innate psychological tendency to imbue non-human entities (including abstract statistics) with human characteristics to enhance cognitive connection with complex environments. This study adopts this mechanism to translate massive quantitative data into personified narratives, thereby reducing the cognitive resistance associated with traditional data interpretation.

2.3 Gender, Transport, and Spatial Empowerment

Transport geography has long focused on power imbalances in spatial mobility. Law (1999) pointed out that women's mobility trajectories are shaped by social roles and safety perceptions (fear of crime), leading to fragmented travel chains. Modern rail systems, with high levels of surveillance (CCTV and staff), bright environments, and high predictability, significantly reduce mobility barriers for women at night or in unfamiliar areas. This intervention not only facilitates physical displacement but also expands women's urban activity radius, achieving substantive Spatial Empowerment.

2.4 Mobility Socialization and Social Inclusion

Haustein et al. (2020) emphasize that public transport is a critical site for the Mobility Socialization of adolescents, serving as an initiatory medium for them to gain independence from family reliance (e.g., being chauffeured by parents) and build peer networks. Conversely, for the elderly, Lucas (2012) warns that a lack of transport resources can easily lead to Social Exclusion. Through policy subsidies and accessible design, public transport can prevent spatial isolation among seniors, facilitating Active Aging by connecting them to nature and society.

3. METHODOLOGY AND DATA SOURCES

This study utilizes a secondary data analysis approach, with the data derived from the "Passenger Satisfaction Survey Result Reports" published by the TMRT Corporation from 2023 to 2025. The survey adopted a systematic sampling design, conducting face-to-face interviews with actual passengers at various MRT stations. After excluding invalid responses, the cumulative valid sample size over the three-year period reached $N=4,645$, providing a high degree of population representativeness.

In terms of analytical methods, this research extends and applies the following three statistical approaches:

1. Longitudinal Trend Analysis: To compare the structural evolution of key passenger segments (e.g., students and females) and their transfer behaviors between 2023 and 2025.
2. Cross-tabulation Analysis: To examine the joint distributions among variables including age, occupation, ticket type, travel purpose, and transfer modes.
3. Independent Sample t-test: To conduct significance testing on the mean differences across genders regarding the "reasons for choosing the MRT."

CHAPTER 4: DATA ANALYSIS RESULTS

This chapter objectively presents the structural characteristics of TMRT passengers across temporal trends, travel motivations, ticket usage, service evaluations, and spatial mobility through five sets of quantitative indicators and longitudinal trend tracking.

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4.1 Correlation Analysis of Occupational Categories and Travel Purposes

Table 1 reveals significant differences in the mobility trajectories across various occupations. "Students" and "Government, Military, and Public School Employees" demonstrate highly rigid commuting characteristics (with school/work commuting ratios reaching 92.1% and 85.2%, respectively). Among "Private Sector Employees," who constitute the largest segment of the sample (37.4%), 78.5% fall under regular commuting. In contrast, the "Service/Freelance" group exhibits highly mixed characteristics; in addition to commuting (45.6%), leisure (32.8%) and business (18.5%) also account for significant proportions.

Table 1: Cross-analysis of Occupation and Primary Travel Purpose (2024-2025 Aggregated Data)

Occupational Category	Sample Share	Commuting	Leisure/Shopping	Business
Private Sector Employee	37.40%	78.50%	15.20%	4.30%
Student	21.80%	92.10%	6.50%	0.40%
Service / Freelance	24.30%	45.60%	32.80%	18.50%
Government/Military/Public School	5.20%	85.20%	8.30%	5.10%
Retired / Homemaker / Unemployed	11.30%	2.10%	81.50%	0.80%

4.2 Age Groups and Ticket Usage Structure

Table 2 shows an extreme differentiation in ticket usage across age groups. Adolescents aged 15-19 exhibit absolute dependence on the "TPASS Monthly Pass" (85.3%). The labor force aged 30 and above primarily relies on standard electronic tickets, while seniors aged 65 and over depend almost entirely on the "Senior Citizen Card" (91.8%). This reflects that public subsidy policies accurately target both the "low-income/high-mobility demand" and the "elderly social demand" segments.

Table 2: Cross-analysis of Age and Ticket Type (2025 Survey Data)

Age Group	Standard Electronic Ticket	TPASS Monthly Pass	Senior Citizen Card
15-19 years old	12.40%	85.30%	1.10%
20-29 years old	35.60%	61.20%	0.50%
30-39 years old	58.90%	38.40%	0.80%
40-49 years old	62.10%	34.50%	1.20%
65 years old and above	4.20%	2.50%	91.80%

4.3 Gender Differences in Motivation and Service Evaluation

To further explore the impact of gender on mobility decisions and service perception, this section conducts independent sample t-tests across different genders (Table 3). The study found several significant differences in motivations and satisfaction evaluations between male and female passengers.

Regarding travel motivations, although "Punctuality/Time Controllability" is the primary consideration for both genders, the proportion of women (75.4%) remains significantly higher than that of men (68.2%, $p < .05$). The most stark difference is found in "High Safety," where women's prioritization (38.6%) exceeds men's (25.4%) by 13.2 percentage points, representing a highly significant difference ($p < .001$).

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In actual service satisfaction ratings (on a scale of 1 to 5), women demonstrated high levels of approval for the "soft care" and safety protection provided by the MRT system. Data shows that women gave an exceptionally high score of 4.82 for "Safety Measures," significantly higher than the 4.51 given by men ($p < .001$). Furthermore, for "Friendly Service Facilities" (e.g., sanitary pad provision, pregnancy stickers), women's ratings (4.72) also exhibited a highly significant advantage ($p < .001$). This confirms that the operational characteristics of the TMRT accurately meet the deep-seated needs of female passengers for spatial safety and sensory detail.

Table 3: Differences in Motivation and Satisfaction Evaluation by Gender

Items	Male (n=464)	Female (n=736)	Significance (Sig.)
Travel Motivation (Primary Reasons %)			
Punctuality / Time			
Controllability	68.20%	75.40%	*
High Safety	25.40%	38.60%	***
Cleanliness and			
Comfort	28.10%	35.20%	**
No Need to Find			
Parking	42.30%	41.80%	n.s.
Service Satisfaction (Mean 1-5)			
Friendly Service			
Facilities	4.38	4.72	***
Safety Measures and			
Protection	4.51	4.82	***
Staff Performance and			
Service	4.42	4.65	**

(Note: *** $p < .001$, ** $p < .01$, * $p < .05$)

4.4 Longitudinal Evolution of Passenger Structure under Policy Intervention

To examine policy effects, Table 4 presents structural changes from 2023 to 2025. The data reveals that in 2023 (the early stage of TPASS), students accounted for only 13.2%. However, as the policy took effect, the student proportion experienced explosive growth the following year, jumping to approximately 26.65%. Meanwhile, the female passenger share consistently remained between 56% and 66%, serving as the stable core of the TMRT.

Table 4: Longitudinal Evolution of Core Passenger Structure (2023-2025)

Year	Student Share	Female Share	Policy Background
2023	13.20%	66.90%	Early TPASS Implementation
2024	26.65%	56.97%	Full TPASS Policy Impact
2025	24.10%	58.12%	Stabilization of Passenger Structure

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4.5 Longitudinal Evolution of Transfer Modes (Entry/Exit) and Community Characteristics (2023-2025)

To investigate how public transportation policies reshape residents' transfer behaviors over time, this section integrates three years of transfer data (Table 5). By conducting a longitudinal comparison of Inbound (Entry) and Outbound (Exit) data, this study observes structural transformations and situational differences in "Last Mile" choices.

1. Longitudinal Analysis of Entry and Exit Trends

As shown in Table 5, during the early implementation of TPASS (2023-2024), the "Outbound Walking Rate" peaked at 47.2% in 2024. This reflects that before network integration matured, passengers—though attracted by the policy—tended to choose the simplest "MRT + Walking" mode due to a lack of diverse transfer options at their destinations.

By 2025, a deeper structural optimization occurred. The most significant indicator was the precipitous drop in the "Private Motorcycle" inbound transfer rate, falling from 25.1% to 10.8%. Simultaneously, the "Public Transport" inbound transfer rate (35.7%) rose significantly, indicating that passengers had developed the habit of using multi-modal systems (bus and rail). This marks a transition from "motorcycle dependency" to "multi-modal public transportation" among Taichung residents.

Table 5: Longitudinal Evolution of Inbound/Outbound Transfer Modes (2023-2025)

Mode	2023 In / Out	2024 In / Out	2025 In / Out	Longitudinal Observation
Walking	40.7% / 45.6%	42.3% / 47.2%	31.3% / 37.6%	Outbound peak in 2024; declined in 2025 due to diversity.
Public Transport	10.5% / 10.1%	21.3% / 20.3%	35.7% / 28.2%	Inbound growth exceeds outbound; integration is stronger at entry.
Public Bicycle	12.5% / 13.2%	14.2% / 15.3%	11.2% / 13.0%	YouBike consistently functions better for the "last mile" exit.
Private Motorcycle	28.3% / 15.2%	25.1% / 14.8%	10.8% / 10.5%	Core Point: Inbound dependency shifted; balance reached in 2025.
Others	8.0% / 15.9%	7.1% / 2.4%	11.0% / 10.7%	Includes shuttles; exit pickups stabilized as the network matured.

Note: "In" refers to Inbound (Entry) behavior, representing the passenger's choice of transport to reach the MRT station. "Out" refers to Outbound (Exit) behavior, representing the transport mode chosen to reach the final destination after leaving the station.

2. In-depth Characteristics of Key Communities

To further clarify the subjects behind these changes, this study conducted a cross-analysis of the "Female (Ms. Taichung)" and "Student (The TPASS Rider)" groups (Table 5-1). The data shows that behavioral shifts were spearheaded by these specific communities under particular policy incentives:

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- **Female Passengers:** Table 5-1 shows a strong preference for walking after exiting. In 2024, the female outbound walking rate reached 48.9%, confirming that the "Safety Capital" of the MRT extends effectively to the surrounding walking sphere. By 2025, the female inbound motorcycle rate dropped to 9.5%, showing a complete decoupling from private transport.
- **Student Population:** This group showed the strongest trend of "Mobility Independence." The student inbound public transport transfer rate exploded from 12.2% in 2023 to 41.2% in 2025. This growth is intrinsically linked to the 38.6% TPASS usage rate among students, proving that removing marginal costs allows youth to transform from "shuttled passengers" to autonomous agents in a multi-modal network.

Table 5-1: Cross-analysis of Key Community Transfer Behaviors (2023-2025)

Key Indicator (Inbound Data)	2023	2024	2025	Longitudinal Academic Finding
Female: Outbound Walking Rate	46.80%	48.90%	39.50%	Confirms MRT as an extension of "Safe Space" for women.
Female: Inbound Motorcycle Rate	25.40%	22.80%	9.50%	Transition from motorcycle dependence is more marked than in men.
Student: Public Transport Transfer	12.20%	28.50%	41.20%	Evidence of "Mobility Socialization" after budget removal.
Student: TPASS Usage Rate	--	18.30%	38.60%	Students have become the core users of the Monthly Pass system.

(Note: Student data refers to the cross-tabulation of "Student Status" and "Inbound Mode"; Public Transport includes bus and rail/HSR).

DISCUSSION

This chapter introduces the theoretical lenses of "Data Personification," "Mobility Socialization," and "Spatial Empowerment" to deconstruct the five sets of quantitative indicators and longitudinal trends presented in Chapter 4. It aims to elucidate how the TMRT acts as a spatial catalyst in reshaping the urban practices of various social communities.

5.1 "Ms. Taichung": Safety Perception as Spatial Capital and Empowerment Practice

Integrating the significance testing from Table 3 with the longitudinal data from Table 5-1 in Section 4.5, this study confirms that female passengers are not only the stable foundation of the TMRT (consistently maintaining a share of over 58%) but also the core beneficiaries of the system's "safety capital."

According to Law's (1999) gendered space theory, women often restrict their spatial paths due to fear (Fear of Crime) within urban mobility. Table 3 shows highly significant differences ($p < .001$) in how women prioritize "high safety" and their satisfaction with "safety measures." Through bright station designs, dense surveillance systems, and the deployment of "friendly service facilities," the TMRT has successfully transformed its stations into "Spatial Safe Havens" within the chaotic urban transportation environment. This sense of safety is not merely psychological comfort but substantially translates into Spatial Empowerment. According to the data drill-down in Table 5-1, female passengers exhibit a significant "situational walking preference": the outbound walking rate for women peaked at 48.9% in 2024. This reflects that when the MRT provides high predictability and sensory safety, "Ms. Taichung" is willing to substitute private motorcycles with walking at the destination (the last mile). Even as transfer options

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diversified in 2025, the outbound walking rate for women (39.5%) remained significantly higher than their inbound walking rate (32.2%). This behavioral shift—from "relying on motorcycles to avoid risk" to "walking comfortably to complete the journey"—demonstrates the core value of rail transit in enhancing mobility quality and expanding the life paths of urban women.

5.2 "The Emerging Student Generation (The TPASS Rider)": Budget Deregulation, Zero Marginal Cost, and Mobility Socialization

The phenomenon of the student population share jumping from 13.2% to 26.65% (Table 4), combined with the student public transport transfer rate doubling from 12.2% to 41.2% (Table 5-1), represents the finding with the highest causal inference value in this study. From the perspective of transportation economics, adolescents aged 15-19 are traditionally "Captive Riders" strictly subject to budget constraints due to a lack of independent income and driver's licenses.

The intervention of the TPASS policy, with its "flat rate/unlimited rides" mechanism, effectively reduces the "marginal cost" of a single trip to zero. The removal of this economic barrier has thoroughly released latent mobility demands previously suppressed by "economic considerations." As described by Haustein (2020) regarding "Mobility Socialization," the MRT has officially replaced the "parental shuttle," allowing this "TPASS generation" to autonomously explore urban spaces and establish peer social networks without financial pressure.

This data (including the doubling of student share and the surge in transfer rates) confirms that public transportation subsidies are not just economic policies but also vital social tools promoting psychological independence and social participation among youth. Behavioral drill-down analysis in Table 5-1 reveals that when student TPASS usage reached 38.6%, their reliance on public transport transitioned from a "forced choice" to an "autonomous practice." This internalization of multi-modal mobility habits early in life has profound policy implications for promoting long-term green transportation and reducing urban carbon emissions.

5.3 "Agile Workers and Silver-Haired Explorers": Social Inclusion, the Gig Economy, and the Rise of "Mobile Offices"

The data in Tables 1 and 2 breaks the traditional stereotype of the MRT as solely a "commuting tool for work and school." Through the lens of data personification, we can observe the social practices of two types of non-atypical movers:

1. **The Agile Local Worker:** Data indicates that the "Service and Freelance" group (24.3%) exhibits a very high proportion of mixed trips—Business (18.5%) and Leisure/Shopping (32.8%). This corroborates Anable's (2005) concept of behavioral segmentation, suggesting that passenger motivations are not singular but overlapping with multiple purposes. Here, the MRT system acts as a mobile office chain within the "Gig Economy." It is worth exploring further that these passengers' demands for MRT stations have transformed from simple "transit nodes" into "stay-in spaces." Since freelancers often need to switch frequently between different meetings or workspaces, providing stations with private and digitally supported spaces (such as micro-work pods) would significantly enhance their mobility efficiency. The continued stability of "non-commuting" trip proportions in the 2025 report reflects that the MRT system in modern cities is not only a transport vehicle but also possesses the potential to become a "decentralized office node," meeting the flexible spatial needs of contemporary atypical workers through micro-sized and mobile working environments.
2. **Social Inclusion for Active Aging:** Table 2 shows a 91.8% reliance on the "Senior Citizen Card" among those aged 65 and above, which, combined with the fact that 81.5% of their trips are for leisure and shopping (Table 1), validates Lucas's (2012) discourse on transport and social inclusion. In a city like Taichung, which is highly dependent on motorcycles, the MRT system prevents the spatial isolation of the elderly, allowing them to connect with urban leisure resources with a very low threshold, essentially transforming "mobility" into "quality of life." The active presence of these "Silver-Haired Explorers" during off-peak hours not only fills capacity gaps but also marks the MRT's success as a social welfare interface in promoting social participation among the elderly.

5.4 Overcoming Structural Challenges: Evolution from a "Single Line" to a "Multi-modal Virtual Network"

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The three-year longitudinal entry and exit data in Table 5 reveals a key turning point in the spatial transfer behavior of the TMRT. Previously, academia largely believed that single-line MRT systems (like the current Green Line) were limited to serving the walking vicinity of stations because the network had not yet formed. However, the data from this study (2023-2025) demonstrates an evolutionary process of achieving a "virtual network" through policy incentives.

1. **Transformation of Transfer Behavior: Empirical Evidence of Private Mode Shift.** The most notable finding for researchers is the rapid shift in "private motorcycle" transfer proportions. Table 5 shows that inbound motorcycle transfers dropped steadily from 28.3% in 2023 to a new low of 10.8% in 2025. This is more than just a numerical change; it is a significant "Mode Shift" in transportation behavior. After the TPASS policy entered its habit-formation stage, passengers who originally relied on private motorcycles to reach stations successfully converted into green movers using public transport or micro-mobility tools. The near-symmetry of inbound and outbound motorcycle proportions in 2025 (10.8% vs. 10.5%) symbolizes the collapse of motorcycle dependency inertia.
2. **Digital and Policy Solutions for Single-Line Constraints.** This study previously hypothesized that a "single-line network" was the greatest barrier to ridership, but the 2025 data refutes this determinism. Data shows that "public transport transfer (bus/rail)" inbound proportions leaped from 10.5% in 2023 to 35.7% in 2025. This means passengers are overcoming the inherent flaw of a single line's inability to provide door-to-door service through a composite model of "Bus + MRT" or "Rail + MRT." The formation of this "virtual network" is attributed to TPASS eliminating the "Transfer Penalty," leading passengers to perceive Taichung's bus network as a sensory extension of the MRT's hinterland.
3. **Re-evaluating the Centrality of Walking and Friction Costs.** Despite the surge in public transport transfers, "walking" remains central in 2025. Specifically, the outbound walking rate peaked at 47.2% in 2024, and even after transfer options diversified in 2025, outbound walking (37.6%) remained higher than other modes. This aligns with the "low friction cost" principle in behavioral economics: for core groups like "Ms. Taichung" and the "TPASS generation," walking within 500 meters of a station offers the highest directness and lowest psychological burden. Conversely, although public bicycle (YouBike) usage remained stable at 11%–13%, its growth momentum is limited by physical friction costs such as unlocking and finding docking stations. This suggests that as the network expands in the future, the "walkability" of stations and their surrounding pedestrian systems will remain a key factor in determining the core value of rail transit.

In summary, the TMRT is in a transition period from an "isolated line segment" to a "multi-modal integration core." The optimized transfer structure shown in the 2025 data establishes a solid foundation of passenger behavior for the ridership explosion that will follow the formation of the full network.

CONCLUSION AND IMPLICATIONS

6.1 Theoretical Contributions

By adopting the perspective of "Data Personification" and integrating longitudinal data from 2023 to 2025, this study not only constructs multi-dimensional passenger personas but also achieves the following theoretical breakthroughs:

1. **Empirical Validation of the Habit Formation Cycle for Mode Shift:** While past research has primarily focused on the short-term shocks in the initial stages of policy implementation, this study empirically demonstrates that public transportation policies (such as TPASS) require a "habit formation period" of approximately two years to achieve a precipitous shift. This is evidenced by the decline in private motorcycle dependency for inbound transfers from 28.3% to 10.8%, providing clear temporal evidence for transformations in transportation behavior.

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2. **Proposed Integration Effect of the "Virtual Network":** This study challenges the traditional view that single-line MRT networks are inevitably constrained by physical infrastructure. It proves that through "multi-modal connectivity" involving bus and rail systems, the inherent flaws of door-to-door service can be effectively overcome. The high inbound public transport transfer rate of 35.7% in 2025 demonstrates that policy incentives can integrate fragmented transport modes into a perceptually unified network.
3. **Deepening Theories of Spatial Empowerment and Socialization:** The research re-validates the critical value of rail transit in establishing a sense of safety for women (spatial empowerment evidenced by a 48.9% outbound walking rate) and unbinding budget constraints for adolescents (mobility socialization evidenced by a 41.2% student transfer rate).

6.2 Managerial and Policy Implications

Based on the trends of "transfer diversification" and "motorcycle decoupling" revealed by the latest 2025 data, this study proposes the following four strategic recommendations:

1. **Shifting from "Station Management" to "Regional Network Guidance":** Given that the proportion of inbound public transport transfers significantly surpassed private motorcycles in 2025, operators should not limit their focus to optimizing station facilities. It is recommended to develop a "Multi-modal Intelligent Transfer Guidance System" that integrates real-time bus arrivals and TMR/HSR connection information via apps or station displays. This aims to minimize the "transfer penalty" and consolidate the established habits within the virtual network.
2. **Enhancing "Walkability" within Station Pedestrian Systems:** Data shows that "walking" remained central in 2025, with female passengers exhibiting a particularly strong walking preference. It is suggested that the city government promote a "Last-Mile Safe Walking Environment Program" in conjunction with MRT stations. Specifically, efforts should focus on strengthening night-time lighting and the continuity of barrier-free ramps to maintain the MRT system's core ridership and deepen spatial empowerment.
3. **Positioning TPASS and Senior Citizen Cards as an "Environmental and Social Welfare Package":** The data confirms that price incentives successfully prompted motorcycle users to shift to the MRT and released mobility demands for both the student generation and the elderly. Policy-makers are encouraged to institutionalize these subsidies and incorporate their environmental contributions (carbon reduction) and social value (spatial participation rights for budget-constrained groups) into annual performance evaluations to ensure the policy's sustainability.
4. **Innovating Station Space Utilization: Constructing "Mobile Office Nodes":** In response to the "stay-in" demand and mixed-trip characteristics exhibited by agile workers, it is recommended to pilot "micro-office pods" or "digital coworking spaces" at pivotal stations. This would not only reduce secondary transfer friction for passengers seeking external workspaces but also attract business clientele during off-peak hours, creating new value for station facilities.

6.3 Limitations and Future Research

1. **Lack of Qualitative Turning Point Insights:** While this study observed a significant decline in motorcycle dependency, the specific psychological thresholds that prompt passengers to abandon motorcycles remain unknown. Future research should conduct in-depth interviews with "mode shifters" to provide details on behavioral motivations.
2. **Dynamic Observation of Network Expansion:** Following the commencement of the Taichung MRT Blue Line construction, the research framework can be extended to study behavior during the "network formation stage." This would allow for a comparison of the intensity of behavioral changes between a "single-line virtual network" and a "dual-line physical network."

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3. External Validity Verification: The model constructed in this study can be applied to other emerging Asian cities with similar "high motorcycle dependency" backgrounds (e.g., cities in Vietnam or Thailand) for cross-national comparison, thereby validating the universal applicability of this theoretical framework.

REFERENCES

Chinese Literature and Official Reports

- 1) Taichung MRT Corp. (2024). 2023 Taichung MRT Passenger Satisfaction Survey Result Report. Taichung: Taichung MRT Corp.
- 2) Taichung MRT Corp. (2025a). 2024 Taichung MRT Passenger Satisfaction Survey Result Report. Taichung: Taichung MRT Corp.
- 3) Taichung MRT Corp. (2025b). 2025 Taichung MRT Passenger Satisfaction Survey Result Report. Taichung: Taichung MRT Corp.

English Literature

- 4) Anable, J. (2005). 'Complacent Car Addicts' or 'Aspiring Environmentalists'? Identifying travel behaviour segments using attitude theory. *Transport Policy*, 12(1), 65-78.
- 5) Epley, N., Waytz, A., & Cacioppo, J. T. (2007). On seeing human: a three-factor theory of anthropomorphism. *Psychological Review*, 114(4), 864-886.
- 6) Haustein, S., Kroesen, M., & Mulalic, I. (2020). Mobility socialization of the young: A life course perspective on travel mode choice. *Transportation Research Part F: Traffic Psychology and Behaviour*, 75, 234-245.
- 7) Law, R. (1999). Beyond 'women and transport': towards new geographies of gender and daily mobility. *Progress in Human Geography*, 23(4), 567-588.
- 8) Lucas, K. (2012). Transport and social exclusion: Where are we now?. *Transport Policy*, 20, 105-113.