Effects of Transfers on Public Transport Travel Experience and Wellbeing: Evidence from Hong Kong

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SHORT SUMMARY

Public transport transfers impose additional waiting time, physical effort, and uncertainty on passengers, commonly referred to as the "transfer penalty". Despite the importance of transfers in public transport networks, the microscopic transfer environment (including station design, facilities, and service coordination) remains underexamined. This paper investigates how transfer-related factors affect passenger travel experience and subjective wellbeing in Hong Kong, one of the world's most transit-oriented cities. Drawing on an online survey of 119 validated respondents across bus-bus and metro-metro transfer contexts in 2025, regression analysis was used to examine the determinants of travel satisfaction, while discrete choice modelling was applied to analyse passenger preferences for transfer improvements. Results show that perception of facing many barriers and travel delay during transfer and negatively associated with travel satisfaction. Timetable coordination, seat availability, and basic facility provision are the most preferrable improvements. Policy implications for infrastructure design and regulatory frameworks are discussed.

Keywords: public transport; transfer penalty; travel wellbeing; passenger satisfaction; bus; metro

1. INTRODUCTION

Transfers are an essential part of public transport networks. By adopting a hub-and-spoke structure, public transport can extend geographic coverage, maintain operational viability and enhance overall system efficiency without the prohibitive cost of providing direct services to every origin-destination pair (Knoppers and Muller, 1995; Ceder et al., 2013; Chowdhury and Ceder, 2016). Interchange discounts, timetable coordination and integrated ticketing further reinforce the attractiveness of transfer-based routes and support route rationalisation by operators. Yet, the benefits of transfers at the network level do not automatically translate into a positive experience at the passenger level. The additional waiting time, crowded environment, physical effort and uncertainty involved in changing services can impose measurable costs on passengers, which are also known as transfer penalty (Hine and Scott, 2000; Wener et al., 2003, 2005; Guo and Wilson, 2011; Ceder et al., 2013; Moodley and Venter, 2022). Beyond the time cost, the transfer experience is shaped by a wider set of factors spanning service provision, physical environment and station facilities, all of which interact to determine how passengers perceive and respond to the interchange. More broadly, transport-related stress and station design have been shown to significantly affect commuter wellbeing (Tsoi and Loo, 2023; Loo and Tsoi, 2024), suggesting that the physical and service environment at transfer points warrants closer investigation. Moreover, these unpleasant experiences can trigger negative spillover effects extending into work performance, social relationships and health (Tsoi and Loo, 2023; Loo and Tsoi, 2024). Addressing the transfer

penalty is therefore central to promoting transit-oriented development, sustaining public transport ridership and enhancing the subjective wellbeing of urban commuters.

Despite its importance, transfer penalty remains under-examined in the literature. Most studies have focused on macro-level service attributes such as frequency, fare and journey time, while the microscopic transfer environment, including station design, physical facilities, wayfinding and service coordination at the interchange point, has received comparatively little empirical attention (Ceder et al., 2013; Lierop et al., 2018). A further gap concerns the integration of travel experience dimensions: research has tended to address either the affective dimension of travel that captures subjective responses such as stress, comfort and emotional state (Stradling et al., 2007; Hernandez and Monzon, 2016; Lierop et al., 2018), or the cognitive dimension that reflects objective assessments of service quality (Carreira et al., 2013; Drabicki et al., 2021; Moodley and Venter, 2022). These gaps are particularly important given that transfer networks are expanding in many large cities, making it increasingly important to understand what drives passenger experience at the interchange level and how policy can respond.

Hong Kong offers a timely and valuable context to address these gaps. Its public transport system is among the world's most heavily utilised, with over 11 million daily trips and a modal share exceeding 90 percent (Transport Department, 2025). With 39 designated bus-bus interchange points and 28 MTR (metro) intramodal transfer stations together accounting for approximately 77 percent of total public transport patronage, this study aims to (1) characterise the transfer patterns of passengers; (2) identify which transfer-related factors are significantly associated with passenger travel satisfaction and wellbeing; and (3) explore passenger preferences for potential transfer improvements.

2. METHODOLOGY

To achieve the above objectives, a self-administered online survey was conducted between February and June 2025, with separate questionnaire instruments designed for bus-bus and metro-metro transfer contexts to reflect their structural and operational differences. Ethical approval was granted by the Human Research Ethics Committee, The University of Hong Kong, in February 2025. The questionnaire comprised six sections: Parts A and B collected socioeconomic and travel behaviour data; Parts C and D captured specific transfer experience data based on participants' most recent trip, including origin-destination pair, transfer station used, walking and waiting time, number of transfer legs and availability of travel alternatives; Part E applied adapted wellbeing indicators to assess subjective feelings during and after the transfer; and Part F presented a discrete choice experiment to elicit passenger preferences for transfer improvements. QR codes were distributed at seven major bus interchange stations and at major MTR transfer stations, at both peak and off-peak hours on weekdays and weekends. The target sample size, calculated at 95 percent confidence and 5 percent margin of error, was 383 valid responses.

To characterise transfer patterns and rationale (Objective 1), descriptive and comparative analysis was applied to the responses from Parts A to D, which cover socioeconomic characteristics, travel behaviour and specific transfer experience across bus-bus and metro-metro contexts. To identify the factors associated with travel satisfaction and wellbeing (Objective 2), the questionnaire operationalises six transfer-specific cognitive domains as independent variables: (1) price and discounts; (2) service provision, including alternative routing, seat availability and ability to board immediate departures; (3) journey time and scheduling; (4) physical facilities at the transfer point, including Wi-Fi, charging spots, toilets, customer service points, cover, lighting, ventilation and waiting seats; (5) walking distance and accessibility, including availability of escalators and

moving walkways; and (6) human traffic flow management, wayfinding and sufficiency of waiting lines. These domains were developed through systematic observation of Hong Kong's bus and metro interchange environments and are grounded in the major literature (Lierop et al., 2018; Tsoi and Loo, 2023; Loo and Tsoi, 2024). Part E applied adapted wellbeing indicators drawn from the Warwick-Edinburgh Mental Wellbeing Scale, the WHO-5 Wellbeing Index and the BBC Wellbeing Scale to capture subjective wellbeing states and affective responses during and after the transfer (Ettema et al., 2011; Olsson et al., 2012). Overall travel satisfaction, measured on a 7-point Likert scale and grounded in the Satisfaction with Travel Scale, served as the dependent variable in the regression analysis. Reliability of the Likert scale items was confirmed through Cronbach's Alpha of 0.881. Pearson correlation was first applied to identify variables with a correlation coefficient greater than 0.3 or smaller than -0.3, which were then entered into a multiple linear regression to examine how travel and transfer characteristics, physical encounters and socioeconomic characteristics affect overall travel satisfaction.

To explore passenger preferences for transfer improvements (Objective 3), Part F presented a discrete choice experiment comprising six attributes each with two levels, covering seat availability, convenient stores and vending machines, a service point with toilets, charging and Wi-Fi, timetable coordination, alternative routing availability, and crowd flow indication. A d-efficient experimental design was generated in R to ensure statistical efficiency and minimise multicollinearity. Each respondent was presented with three choice games, each featuring three alternatives, resulting in a total of 357 observed choices. A multinomial logit model was estimated via maximum likelihood estimation using the AlgDesign and nnet packages in R. Given the sample size of 119, these results are interpreted as indicative of preference directions.

3. RESULTS AND DISCUSSION

A total of 235 responses were collected, of which 119 were valid and complete. Table 1 presents the sociodemographic and travel behaviour profile of respondents across the combined sample and by transfer mode. The sample was predominantly young with 61 percent of respondents aged 18 to 29. The gender split was broadly balanced. The majority of respondents had no car ownership and held no frequent-traveller pass, indicating high reliance on public transport across multiple operators. Public transport usage was high with 57 percent travelling 10 to 15 times per week. Most transfer trips were cross-district journeys, with 45 percent crossing two regions and a further 24 percent crossing three regions. This suggests that transfers predominantly serve longer-haul commuting between new towns or remote residential areas and the urban core. Only 26 percent of respondents had transfers involved in their regular work-related trips, and notably 54 percent reported having a direct travel option available yet still opted for the transfer route. Metro-metro respondents were more likely to have work-related trips involving transfer (50 percent versus 13 percent for bus-bus) and less likely to have a direct alternative available (40 percent versus 61 percent), reflecting the more network-dependent nature of rail travel. Despite involving a higher average number of interchange legs, metro-metro transfer was associated with higher overall satisfaction scores than bus-bus transfer, which can largely be attributable to the more controlled and facilitated rail station environment.

Table 1. Sociodemographic and travel behaviour profile of respondents

Characteristic	Combined (*n*=119)	Bus-bus (*n*=77)	Metro-metro (*n*=42)
Gender			
Male	69 (58%)	45 (58%)	24 (57%)

Female	50 (42%)	32 (42%)	18 (43%)
Age group			
18-29	72 (61%)	42 (55%)	30 (71%)
30-39	24 (20%)	17 (22%)	7 (17%)
40-49	13 (11%)	11 (14%)	2 (5%)
50 and above	10 (8%)	7 (9%)	3 (7%)
Car ownership			
None	66 (55%)	42 (55%)	24 (57%)
One or more	53 (45%)	35 (45%)	18 (43%)
Frequent traveller pass			
None	99 (83%)	62 (81%)	37 (88%)
Any pass held	20 (17%)	15 (19%)	5 (12%)
Weekly trip frequency			
1-9 trips	37 (31%)	23 (30%)	14 (33%)
10-15 trips	68 (57%)	44 (57%)	24 (57%)
15+ trips	14 (12%)	10 (13%)	4 (10%)
Work-related trips involving transfer			
Yes	31 (26%)	10 (13%)	21 (50%)
No	88 (74%)	67 (87%)	21 (50%)
Direct travel option available			
Yes	64 (54%)	47 (61%)	17 (40%)
No	55 (46%)	30 (39%)	25 (60%)
Journey reach			
Intra-district	12 (10%)	9 (12%)	3 (7%)
Cross one region	24 (20%)	19 (25%)	5 (12%)
Cross two regions	54 (45%)	34 (44%)	20 (48%)
Cross three regions	29 (24%)	15 (19%)	14 (33%)

The multiple regression model for overall travel satisfaction achieved a satisfactory fit ($R^2 = 0.59$), with no multicollinearity among independent variables. Table 2 presents the statistically significant predictors. Frequently encountering unclear instructions ($B = -0.129$, $p = 0.023$) and unavailability of Wi-Fi at the transfer point ($B = -0.103$, $p = 0.047$) were both negatively associated with satisfaction. This highlights the importance of information provision and basic connectivity in the interchange environment. Among the transfer-related affective states, perception of facing many difficulties and barriers during the transfer process ($B = -0.187$, $p = 0.026$) and the sense that the journey was unreasonably prolonged due to transfer ($B = -0.155$, $p = 0.018$) were also negatively associated. Conversely, the availability of a direct travel option ($B = 0.421$, $p = 0.028$) and the sense of living out the desired way of travel ($B = 0.272$, $p < 0.001$) were positive predictors. Socioeconomic variables and gross journey parameters were not statistically significant, which suggests that service provision and arrangement plus facilities at the transfer point can largely affect travel satisfaction.

Table 2: Regression results for overall travel satisfaction

Factor	*B*	*p*
Frequently encounters unclear instructions	-0.129	0.023*
Wi-Fi unavailable at transfer point	-0.103	0.047*
Perceived excessive obstacles during transfer	-0.187	0.026*

Journey felt unreasonably prolonged due to transfer	-0.155	0.018*
Availability of a direct travel option (no transfer required)	0.421	0.028*
Journey aligned with preferred travel patterns	0.272	<0.001***

Note: * p < 0.05; *** p < 0.001.

Table 3 presents the exploratory discrete choice results based on 357 observed choices across three choice games per respondent each featuring three alternatives. Timetable coordination, representing schedules of different routes synchronised for passengers to transfer seamlessly, was the most strongly valued improvement across both transfer modes ($\beta = 1.622$, $p < 0.001$), which indicates that reducing waiting time at the transfer point is an important strategy to promote transfer while maintaining travel satisfaction. It was followed by seat availability after transfer ($\beta = 0.902$, $p < 0.001$) and the provision of a service point with toilets, charging and Wi-Fi ($\beta = 0.692$, $p < 0.001$), all of which relate to service provision and facilities that may improve passenger experience while waiting for the next service. These findings are consistent with prior literature on system integration and station environment (Hernandez and Monzon, 2016; Tsoi and Loo, 2023). The negative coefficients for convenient stores and crowd flow signage may reflect passenger concerns about corridor congestion rather than a rejection of those attributes per se. Additional routing alternatives were not significant. Taken together, the results provide evidence for the measures and interventions that can be implemented to improve passenger travel experience and wellbeing at the interchange level.

Table 3: Discrete choice modelling results for transfer improvement preferences

Attribute	Coeff.	t-ratio	*p*
Timetable coordination (immediate connection)	1.622	10.79	<0.001***
Seat availability after transfer	0.902	5.98	<0.001***
Service point with toilets, charging and Wi-Fi	0.692	4.45	<0.001***
Clear indication of waiting lines and traffic flow	-0.345	-2.27	0.023*
Convenient stores or vending machines	-0.460	-2.87	0.004**
More alternative routing available	-0.094	-0.64	0.525 (ns)

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; ns = not significant. Results are interpreted as indicative of preference directions given the sample size.

4. CONCLUSIONS

This paper presents empirical evidence on the determinants of public transport transfer experience in Hong Kong, addressing two research gaps in the literature: the underexplored microscopic transfer environment, and the separation of affective and cognitive dimensions of travel experience in prior work. Regression analysis on 119 validated respondents across bus-bus and metro-metro transfer contexts shows that the quality of the transfer environment, particularly service coordination, information clarity and basic amenity provision, is a more significant driver of satisfaction and wellbeing than the structural characteristics of the trip. Exploratory discrete choice

modelling further indicates that timetable alignment, seat availability and accessible service points are the most highly preferred improvements among passengers.

The findings carry direct policy implications. Timetable alignment, baseline facility standards and system-level wayfinding should be embedded as planning requirements from the earliest design stage of new interchange infrastructure, rather than treated as discretionary matters at the operational level. Benchmarking against international best practice, including Singapore's Integrated Transport Hubs and Transport for London's interchange guidelines, alongside wider adoption of smart mobility tools integrating real-time service data, offer practical pathways for improving transfer quality and travel satisfaction. The study contributes new local-context evidence to the international transfer penalty literature and provides a replicable methodological framework for comparable investigations in other cities. Future work should target larger samples, extend the analysis to intermodal transfer contexts, and explore the integration of smart card data with stated preference methods to further strengthen the evidence base for transfer policy.

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