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The cover image is a photo of the 1966 flood of the Arno in Florence (Italy).

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The contribution of a tramway to pedestrian vitality

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Abstract
Pedestrian movement in the public environment is important in supporting local public life, commerce and physical activity. Countering the decline in the presence of people on the streets is a major focus of urban planning in a wide variety of urban contexts. This research investigates the contribution of a tramway to local pedestrian movement, using the Hong Kong Tramways (HKT) as a case. Flow counts were collected in a field study of the tram corridor that enabled regression analysis. Pedestrian flow was positively related to the following, in descending order of importance: feeder street pedestrian flow, tram alighting rates and irregular crossing rates. These factors cumulatively account for 41% of pedestrian volume on tram corridor segments. Pedestrian flow is negatively related to the degree of barrier fencing and block size. The tram is also used to transit between walking segments, effectively enlarging the individual walking environment. The findings suggest spatial planning measures associated with higher pedestrian flow.

Keywords
Pedestrians; Tramway; Vitality

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1. Introduction

The choice of the form of mass public transit to serve an urban corridor remains a topic of debate in urban planning and transport planning. Although the faster travel speeds of heavy underground rail are often highlighted in the worldwide efforts to shift urban mobility from private to public modes, slower surface modes are often seen as urban development generators (Olesen and Lassen, 2016). Contemporary light rail projects are typically strategic urban projects, where measured efficiencies may take a second place to the experiential and regenerative properties of the infrastructure. The iconic and representational aspects of new tramway projects have captured the political imagination, supported by strong public preference for the mode over motor alternatives (Hensher et al., 2015). Technological advances in surface rail systems and new awareness of the important issues of comfort and reliability have complicated the choice of mode previously centred on carrying capacity and time (Denant-Boemont & Mills, 1999).

In the contemporary context of a renewed interest in surface rail as well as controversy concerning its contribution to non-motorized transport and local revitalization, we need a longer timeline to see how a tramway system may contribute to land use change and new urban activity structures. While unique in many respects, the Hong Kong tramway provides an interesting case of a century-old system and an extensive network of served streets in areas with variations in land use mix.

Firstly, we consider definitions of vitality and then what is shown to support it, including urban rail. Street vitality is strongly associated with liveability, and according to some authors, to sustainability (Miller et al., 2013). Jacobs (1961) suggested that vitality was represented by the abundance of human activities in space. She prescribed a specific blueprint for fostering street vitality, including diversity of land uses, small blocks and the presence of older building stock. All three were found to be positively associated with walking in Seoul, Korea (Sung & Lee, 2015). The second of these is examined in the present study. The qualities of the urban street, emphasized by Jacobs and others, would appear to have significant sway in how the local street is perceived and used, as in the case of a Polish city (Kotus & Rzeszewski, 2013). Seniors are particularly sensitive to the issues of layout and design of the walking environment (Gaglione et al., 2019), which prompts the inclusion of such factors in the present study.

At the same time street vitality as pedestrian flow is geography-bound because of increasing complexity of movement systems in cities. In this emerging context, it makes sense to expect that land use outcomes would depend on the specific characteristics of the rail system. Underground metro has a different accessibility map than that of tram, because tram stations are more closely spaced and are directly connected at the same level to their surrounding environment. It should follow that pedestrian flows are related to interaction with the transit system and its flow of passengers to and from the street, which is investigated in the present study. The metro station and supportive land use structure is an often-cited example of transit-oriented development (TOD) with its guiding principles of density, a diversity of land uses, station accessibility in support of the metro station, and a central role for public transport in urban mobility (Calthorpe, 1993; Cervero, 2008; Renne, 2009). In theory the concentration of movements at more widely spaced metro stations is supportive of more intensive development in a smaller area where the distance between stations is not walkable for the majority. New public transit systems introduced in an existing city centre have been shown to modify shopping patterns (Davies & Bennison, 1977). In that study, the redistribution of public transit stations led to a redistribution of pedestrian movement and related changes in shop turnover, independently of other changes in land use. It is then expected that the location of public transit stations is relevant to local flow level, part of the focus of the present study. The literature on the overall effects of tramway systems on walking provides some evidence that there is a measurable shift from motorized modes. For example, urban traffic decreased significantly in Zaragoza, Spain following the implementation of a tramway (Ortego et al., 2017). In another before-after study of the implementation of a surface rail system, it was seen that a higher proportion of local residents accessed transit on foot after the line opened (Brown et al., 2016). There was also higher frequency of walking for a wide variety of purposes. The built environment constitutes an important influence on the propensity to walk in the vicinity of a rail corridor. For example, in Minneapolis, USA, it was seen that the presence of commercial uses was strongly associated with walking rates around the rail corridor (Schoner & Cao, 2014), a finding that we consider in the present study. Discontinuities between the surrounding road network and the transit corridor resulted in less walking for all purposes. While Hong Kong does not exhibit this kind of discontinuity, the density of its street network does deserve examination for its contribution to street vitality. In general, studies on contemporary tramway projects support the idea that pedestrianism accompanies surface rail. When such effects are experienced over a long time, we might expect land use change and other signs of street vitality, including the increased presence of pedestrians.

In a uniform movement network, with uniform land use and population density distributions, we could expect variations in local pedestrian flow to be small. In theory, a tramline makes a direct contribution to local pedestrian flow by offering individuals the opportunity to substantially enlarge the traversable environment by using the tram to link walking segments. To the extent such a phenomenon occurs, it would directly contribute to local pedestrian flow and overall flow levels. Increased walking rates were observed in smaller urban blocks (Appleyard, 1981; Moran et al., 2016), in facilitating more links among street segments. In theory, higher interaction rates that accompany smaller networks may induce longer walks and a larger traversed environment. While it is widely claimed that a tramline can make a direct contribution to local pedestrian vitality, we lack empirical studies to show how or if it works.

Other explanations for local pedestrian vitality include the claim that qualities and experiences are influential as preferences are acted out in the real environment. It is widely held that fine-scaled urban design is highly relevant in the pedestrian experience (Sternberg, 2000), and qualities may also impact on who elects to be in particular urban spaces (Ozuduru et al, 2014). The positive effects of space design alone are thought to be associated with social vitality (Jones et al., 2016), the response to a new opportunity for experience and encounter offered by the environment of focus. In the present study we do not investigate the effect of urban spatial qualities of tram streets on pedestrian preferences, although it is clear that the tram streets are distinctly different from streets for motorized modes.

The vitality of local streets may be supported variously by bottom-up initiatives from entrepreneurs and local organizations (Ozuduru et al, 2014), but may also respond positively to an array of policy initiatives on the part of local government, particularly in support of a liveable and pleasant walking setting. In Hong Kong, the transport authority has been concerned with safety and security for pedestrians and efficiency for motor traffic. The implementation of fences on pavements started in the 1970s and accelerated in recent years to an estimated 1,500 km of fences today. According to the Transport Department that identifies the need for such facilities, they are intended to keep pedestrians off the traffic lanes in places with high pedestrian flows (DeWolf, 2018). They are thought to reduce irregular street crossing although this effect, alongside other effects of street fencing, remains to be confirmed.

Pedestrian circulation and the associated commercial activities are highly sensitive to minor features of the walking environment. Shopping linkage, or the series of temporally linked stops made in a shopping itinerary, are also sensitive to network arrangements. The efficiencies in shopping linkage, uncovered in shopping centre designs and implemented in the shopping centre development era, had negative impacts on traditional commercial streets in cities throughout the developed world (Bromley & Thomas, 1989; Thomas & Bromley, 2003). Shopping centres offer the efficiencies of bringing many more retailing units close together in space and eliminating the 'dead' zone that often occurs on linear retailing streets as a consequence of an uncontrolled mix of land uses, or the interposition of major barriers and parks (Reimers & Clulow, 2004). Urban motorization led to the introduction of many physical features intended to control pedestrian movement including designated pavements, curbs, signal-controlled intersections and fences. Qualities of these features of the walking environment have been shown to have impact on the number of walking trips in the local environment

(Tian & Ewing, 2017). Stated preference studies also reveal pedestrian preference for wider, uncrowded pavements with trees and the presence of commercial activity (Liu et al., 2020). In spite of these recent findings, empirical study of the specific effects on walking rate of certain street design features remains a gap in the literature.

2. Aims and hypotheses

This study is intended to uncover the quantitative contribution of a tramway to street-level pedestrian volume, independent of other contributing factors. The contributing factors of local physical planning and land use are also examined for their contribution to pedestrian flow. In general, we would like to know how management of the transport environment, including environmental design, contribute to local street vitality. The tramway contribution to local pedestrian movement is separated from that generated by the immediate local environment by seeking answers to the following questions:

1. Is the presence of a tram station positively related to pedestrian flow at the station location block? There is direct access from the tram station to the target block;
2. Is the alighting rate positively related to pedestrian flow?;
3. What part of the target block pedestrian volume can be explained by the coterminous contribution to pedestrian flow of streets directly connected to the corridor? The tram corridor is a major commercial artery in the local area.

The relatively high ridership volumes on the tram and their short headway allow for the possibility that the tram is a significant contributor to local pedestrian flow, but it is necessary to quantify this relationship to understand the size of the contribution. The proximity of station to footpath, never more than a single traffic lane, would appear to strengthen the link to local pedestrian traffic, while close spacing of stations allows riders to disembark close to intended areas for visit. It is also possible, however, that alighting tram passengers are returning home or accessing locations off the tramway corridor and so making no contribution to pedestrian flow. Several local physical characteristics are considered as well, in keeping with the theory that urban design may be salient in pedestrian flows.

4. Following the literature, is smaller block size positively related to pedestrian flow? Small block size is thought to promote linkage;
5. Is the degree of barriering to cross-movement, through the use of fences, negatively related to pedestrian flow? Limiting the path choice in this way is thought to reduce footpath attractiveness;
6. Is the irregular (non-compliant) crossing rate, which increases the de facto level of choice, positively related to pedestrian movement?

In general, it is suggested that increasing the options available to pedestrians increases their willingness to use that local environment and to access those additional opportunities. Areas of greater internal linkage would then likely attract more visitors by diversifying and expanding the area of pedestrian activity, while external linkages also expand the pedestrian catchment.

3. The Hong Kong Tramways system

The tramway is intimately associated with the urban development of Hong Kong Island, forming the spine of the east-west development of Hong Kong from 1904 when the tramway first opened. In 2017, the year of the present study, the HKT spanned 13 km on Hong Kong Island with a total track length of 30 km. There were 120 stations in use, with approximately 250 m between stations. It is positioned on the centreline of a connected series of wider streets at the lowest elevation where the land is flat. Today, the tramway is paralleled by the Mass Transit Railway (MTR) that runs under the tramway streets for nearly all its length. Buses also travel on the same corridor but typically offer access to distant locations with few intermediate stops. Light buses operate using parts of the corridor, linking more distant housing estates with central locations. In this way, the tramway corridor is a multiple mode system that is also characterized by street-front commercial activity and strong pedestrian movement. In 2013, average daily ridership was 198,000 (Transport Department, 2014) (Fig.1), declining to 180,000 in 2019 after extensions to the MTR.

Fig.1. Tramway-street arrangements involve several channels in a narrow right-of-way

HKT operates within densely built-up districts across Hong Kong Island. The westernmost district is Kennedytown, a moderate-income residential community now undergoing some gentrification (Fig.2). To its east is Sai Ying Pun, with its seafood markets, middle-income residential uses and hotels. Sheung Wan is the western edge of the Central Business District (CBD), a mixed area of shops and services, with serviced and rental apartments. Cross-border bus and ferry services are concentrated here. Central and Admiralty are the CBD, devoted to offices, hotels and high-end shopping. The MTR stations in these two areas are hubs for connections to Kowloon and Island South. They are also directly connected at the underground level to certain shopping centres. Immediately above the CBD is the higher income Mid-Levels residential area, with restaurants, bars and specialized shops. To the east is Wan Chai with the Convention Centre, hotels and public services. HKT then runs through Causeway Bay, the most intensely visited shopping district in Hong Kong, but also a densely inhabited residential area. Further east are North Point, Fortress Hill, Quarry Bay and Sai Wan Shan, all middle-income residential areas with Quarry Bay also housing an office cluster. The entire area served by HKT is built at high density in residential or office blocks. The tramway corridor itself has streetfront commercial uses its entire length except for those short sections where it runs adjacent to public open space. HKT lost its right-of-way in a large proportion of the tramway corridor in 1974, when the company was sold to Wharf Holdings Ltd. The system is operated by RATP Dev Transdev Asia since 2010. The tram now shares road space with motor vehicles and also no longer has priority signalling at intersections. On the other hand, operating speeds have increased in recent years. Passengers can check for tram arrivals in real time with an app. In practical terms, one can usually see approaching trams in the distance because they are double-decked and run in the centre of the street. Headways at peak travel time are about 1.5 minutes.

The HKT has a flat fare of 2.6HKD, a concession fare for seniors of 1.3HKD and a children's fare of 1.2HKD. The fee is relatively low in relation to MTR and especially taxi alternatives. In a parallel study, it was found that the lower price of the HKT had no impact on the choice to use the service (Yang & Zacharias, 2017). In that study it was also found that travel time, waiting time and walking distance to the station are the three aspects of the tramway service that gained the highest scores on an importance scale. These priorities are also revealed as the most important service factors in the rail services of Algiers (Baouini et al., 2018). The tramway service was favoured for somewhat shorter trips than the MTR, with 25% of trips under 5 km. In general, it was seen that the tramway users were somewhat different demographically from MTR users, although not in terms of income.

The tramway system operates on the same network in 2020 as it did in 2017, when this study was conducted. It also operated continuously during the civil unrest of 2019, unlike the MTR, which closed some or all of its operations during street demonstrations. The operator has also proposed a major expansion of the HKT network into new development on the former airport site, but a final decision has yet to be made.

4. Methods and Materials

This study measures the tramway's contribution to pedestrian vitality by relating statistically local pedestrian flow on the tramway corridor to contributions from flows at tram stations and from neighbouring environments. Physical environment characteristics are also included in a regression model as explanatory variables.

The dependent variable is pedestrian volume on the sidewalks, measured in persons per minute at a mid-block cordon on sidewalks parallel with the tramline. Repeated counts were taken for 49 counting cordons. Blocks were coded for the presence of a tram station for either direction or both (1) or none (0).

Simultaneous 5-minute counts of passengers in transit on trams passing the target block were taken, along with the number alighting and boarding on blocks with transit stations. Note that the passenger count is easily accomplished because the double-decked tram car has large windows and is relatively narrow. The contributing pedestrian flows from streets intersecting with the tram corridor are also taken at a mid-block cordon.

Individuals crossing at designated crosswalks and those crossing the street elsewhere were also counted in the same timeframe. The relationship between local pedestrian flow and crossing rate is associational but may reveal the importance of crossing facilities in local pedestrian flow.

Barriers to movement across the corridor are also included for each of the 49 counting positions. The presence of fences along sidewalks to prevent unregulated street crossing were coded as an index representing the proportion of the sidewalk that is fenced, for a maximum of 3.0 when there are continuous fences on both sidewalks and a third one lining the tramway.

Block length was also measured with the hypothesis, based on the literature, that longer blocks would have lesser pedestrian flow.

The tramway system was sampled according to evident physical characteristics and dominant land uses. The areas presumed to have significant differences in terms of travel and local behaviour are the following:

1. des Voeux Road in Sai Wan area characterized by dominant residential and local commercial uses at the street;
2. Sheung Wan area with a mix of employment, residences, central shopping facilities and the Sheung Wan transport hub;
3. Central with offices, hotels and high-end shopping centres;
4. Admiralty area, also with office use, commercial activities and institutional uses;
5. Fortress Hill to North Point residential areas with some employment and traditional street-level commercial activity.

The main tramway corridor and the sub-areas are shown in Fig.2.

These land use segments of the tramway corridor were also used to gauge their impact on pedestrian flow, with the hypothesis that higher intensity land use – essentially high-rise office development and shopping centres – would produce higher pedestrian flow on the tramway corridor.

The total length of the studied tramway corridor has 134 tramway stops, separated for each direction and 49 survey units, defined by major street crossings. There are 31 survey units with at least one tram station in one or both directions. Pedestrian cordon counts are taken 2-5 times with simultaneous boarding and alighting counts when applicable. At the same time, the passenger count on the tram is taken from snapshots of the sideview seen from the footpath.

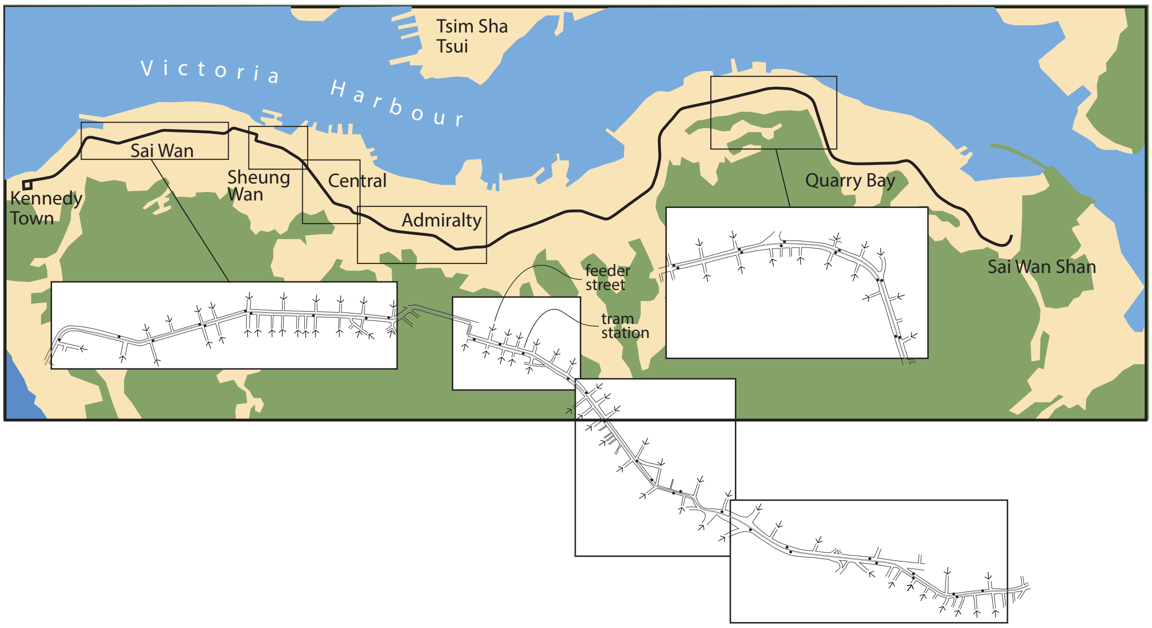

Fig.2 The main tramway corridor on Hong Kong Island with study areas

Five research assistants undertook the field study in June and July 2017. All local censuses were undertaken within a fixed time frame of about one hour so that the various counts could be statistically related. All data were entered in a database and analyzed using SPSS 22. A hierarchical linear regression is performed so that we can observe the specific contribution of each explanatory variable.

4. Results

Tab.1 presents the descriptive results from the field survey. The two sides of the tramway corridor streets were counted separately in this analysis, but the feeder street counts are combined for the two sides of the street.

Variable	Counts [N°]	Mean rate [p/min]	Standard Deviation
Street pedestrian volume (north side)	198	12.1	9.9
Street pedestrian volume (south side)	197	18.5	13.9
Feeder pedestrian volume	708	6.1	6.2
Tram alight	928	2.8	3.3
Tram board	456	2.1	3.0
Passengers in tram	578	22.9	21.8
Pedestrian crossing rate	70	30.9	36.7
Irregular crossing rate	49	3.1	3.4

Tab.1 Street and tram pedestrian counts (n) and rates

Streets of the tram corridor have much higher pedestrian flows overall than do the feeder streets from surrounding local areas (Tab.1), supporting the thesis that arrival in the area for walking is by tram for many individuals. The total numbers of individuals riding, alighting and boarding the tram are also not small in relation to the flows of pedestrians on the streets. We could expect from these figures that if an effect of tram-riding on street vitality does exist, it would be detectable.

The explanatory variables are entered in a combined linear regression model following calculation of possible collinearity using VIF, reported in Tab.2. There is negligeable collinearity. Pedestrian flow is significantly related to disembarking and boarding tram passengers, the flow of pedestrians from the surrounding areas into the tram corridor, the volume of pedestrian crossing traffic at lighted intersections and the irregular crossing rate in the local environment. All of these factors contribute positively to pedestrian volume on the sidewalk. The disembarking rate at a station associated with a street segment contributes some 20% of the variance in pedestrian flow on the sidewalk. Non-compliant street crossing, although constrained by the presence of fences on one or both sides of the street, is also positively associated with pedestrian volume (9%). While it might be thought that jaywalking is simply a by-product of large pedestrian numbers, it makes an independent contribution to the flow on the footpath. For example, the crossing volume at lighted intersections and according to traffic rules, explains only 1% of the variation in pedestrian volume.

In all, these six independent variables explain about 41% of the variance in pedestrian volume on the sidewalks. This might be considered large in relation to other possible explanatory variables, such as the presence of major shopping facilities or office towers, instead of residential blocks and local retailing uses.

Variable	B	SEE	Stand. B	R^2	F	VIF
I: Alighting rate	3.636**	0.411	0.407	0.165	78.085**	1.35
II: I, Boarding rate	0.083	0.205	0.019	0.166	39.041**	1.02
III: II, Feeder ped. vol.	1.683**	0.159	0.456	0.350	70.472**	1.21
IV: III, Crosswalk vol.	0.060	0.039	0.072	0.354	53.645**	1.39
V: IV, Jaywalk vol.	2.127	0.434**	0.205	0.392	50.238**	1.14
VI: V, Barrier fence level	-3.700	1.085	-0.142**	0.409	44.946**	1.15

Note: *<.05; **<.01

Tab.2 Hierarchical regression model for street pedestrian vitality with 6 explanatory variables

When the tramway corridor is segmented according to land use mix, as indicated above in Methods and Materials, it is found that these categories make no contribution to pedestrian flow. In other words, land use defined in broad categories is not significant in its contribution to street vitality in this case. In particular, areas with a higher concentration of workplaces do not generate higher use of the tram.

The question of whether block length is a factor in street pedestrian vitality is examined. Short blocks provide more frequent opportunities to access the target street. For each of the count segments, block length was measured as the distance between intersection midpoints. With 396 counts on the 49 corridor segments, the correlation between block length and pedestrian flow is r=–0.287 (p<.01; two-sided). As expected, in keeping with the literature, shorter blocks are associated with stronger pedestrian flow.

The flows of pedestrians from MTR station exits at or adjacent to the tramway corridor could be used to compare with tram-disembarking passengers. Over the same study segments of the tramway, 5-minute counts were also taken of pedestrians exiting MTR exits and moving in the direction or directly into the tramway corridor streets (figure 3). It will be seen that the egress rate from MTR stations is much more variable than from tram stations. The 24 MTR exits contribute 344 persons/minute to the corridor while the tramway contributes 244/minute. The contributions of pedestrians from the MTR are at a very limited number of points

– 25% of exiting passengers are at a single exit in Central, while 49% are at 4 of the 24 exits. This people flow suggests a more nodal form of development, with integrated high-density, mixed use development above stations (Zacharias & He, 2018). The MTR also generates pedestrian movement into the local street environment although a certain proportion of pedestrians exiting the station remain in the connected centre above, before returning to the MTR. Point generators may be much larger in the MTR system with a different distribution in the street environment than seen in the tram streets. These distinctions suggest the largely autonomous roles of each of the transport systems, with their different purposes and with little linkage between them.

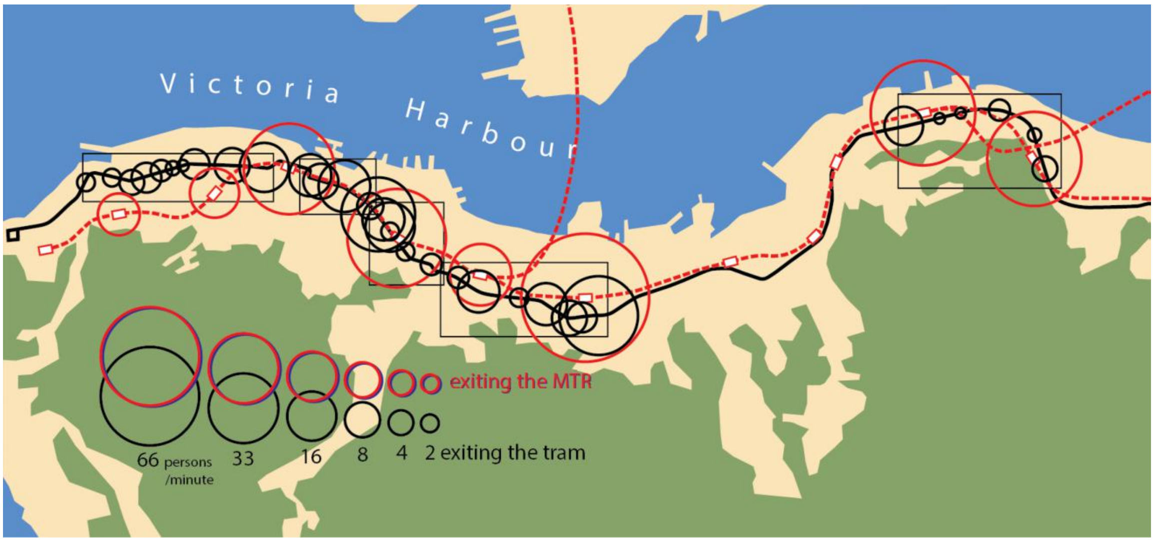

Fig.3. Disembarking tram rates sampled across store operating hours and metro station exit rates in the same time frame

5. Discussion

The 198,000 average daily riders on 30 km of track amount to 6,600 boardings per kilometre. For order of magnitude, the most heavily used urban surface rail systems in the U.S. are the Massachusetts Bay Transportation Association regional line (3,310 km) and the Muni Metro of San Francisco (2,760 km) (APTA, 2018). The building and population densities are much greater in Hong Kong than in those American systems, but a state-of-the-art underground metro follows the alignment of the HKT, which could be expected to take a high proportion of travellers on the corridor. The tramline streets also carry buses, light buses and taxis although these modes carry far fewer passengers than do the HKT or MTR. The tram corridor is a multi-modal transport corridor with a relatively stable distribution of users across modes. While destination and distance are undoubtedly important factors in the distribution of users, the tram is most integrated with local street functions and at the scale of blocks. Station spacing is at smaller intervals than in most urban surface rail systems but this spacing has a role in sustaining continuity in urban streetlife.

This connection between tram and street is demonstrated in the relationship among people flows. The contribution of local area population and activities to pedestrian flow on the tramway corridor streets is about 27%. Without any motorized transport, that figure should approach 100%, largely because of the severe constraint of typical walking distance. The contribution of the tramway to street pedestrian flow, measured as disembarking passengers, is about 20% of the total. The mean pedestrian flow for all locations and all times within the tramway corridor is 30.6 persons/minute while the tramway carries 22.9 persons/minute. This latter flow is much higher than the combined passenger flow in taxis, light buses, buses and private vehicles. Many bus routes use the tram corridor for only part of the route, light buses pass with less frequency and cars carry relatively few individuals.

The physical organization of the tramway corridor is significant in the pedestrian environment. Fences were introduced in Hong Kong by the Transport Department as a measure in favour of traffic separation, a fundamental principle in Hong Kong's urban planning model (Bristow, 1989), that includes overhead walkways and underground pedestrian corridors. The fences are placed at the outer edge of the footpath. Some of the dedicated tramway tracks are also now bound by fences, to discourage pedestrians from accessing the stations at the ground and directing them to bridges with staircases leading down to the station platforms. The bridges are not well used with people preferring to access stations directly from the footpath. For most of the length, the fences are discontinuous, to respect the pre-existing structure of land uses and, in some cases, movement. The fence is clearly negatively related to pedestrian flow ($r=-.289$; $p<.01$). Irregular crossing is positively related to pedestrian flow, although we do not know whether more pedestrians are generating more jaywalkers or whether the practice of jaywalking raises desirability of walking in a particular segment of the corridor. On the other hand, irregular crossing is negatively related to fences ($r=-.272$; $p<.01$), such that there is a latent desire to jaywalk. Accessing the tram station almost always involves crossing one or more traffic lanes without a pedestrian signal, while crossing the entire width of the street is mandated at signalled intersections only. For the pedestrian using the tram, the regulatory environment could be considered somewhat ambiguous at least in the real environment of small dimensions and close, physical relations. Street space has been more clearly demarcated in an apparent attempt to separate movement streams. The original operating concept of the tramway was to allow free movement of individuals from the spaces near buildings to the tramway.

The tramway extends the walking environment by offering an accessible means to go at faster than walking pace to a distant locale, which is evidently what is occurring. Numbers alighting (average=2.1; sd=3.0) and boarding (2.8; sd=3.3) at a station are a small proportion of passengers on the tram (22.9; sd=21.8). At these rates, the majority of passengers are travelling several stations in their use of the tram corridor. Passengers board from origins in the local environment but are typically travelling beyond walking distance to access other parts of the tram corridor. Without the tram, these passengers would have little option but to walk or detour to the MTR, which will also typically involve a much longer walk within underground corridors and via stairs, escalators and lift to the station platform. Such complex travel involving vertical movement is a major disincentive to walk among the elderly (Gaglione et al., 2019). Alternatively, they might restrict their walks to a very local area, as suggested by the much lower pedestrian flow on blocks without a tram station. The apparent hop-on-hop-off nature of the tram deserves further investigation as an indication of the role of such transport systems in an urban corridor. In the Hong Kong environment, the tram is an extension of the walking network because of the density of stations, ease of access and opportunities offered. The significance of network characteristics at the very local scale in walking rates that is revealed in other studies (Zecca et al., 2020) is also salient here. These studies suggest more attention should be devoted to localized conditions of walking, in addition to the traditional study of citywide walking networks.

A major question for Hong Kong concerns the vitality of its street environment, particularly in light of new developments that emphasize linkage between the MTR and concentrated facilities attached to the stations. This form of nodal development is an innovation that should be assessed for its impact on the traditional, street-oriented public environment of Hong Kong. To encourage the development of the north side of the tramway corridor, more pedestrian crossings would clearly help, based on the present study. The fences removed for constructing street barricades during street demonstrations were temporarily replaced with poles strung with plastic chain that was removed by activists almost immediately, presumably to maintain free crossing movement. The design and management of the tramway corridor clearly deserves re-examination, to balance local community needs, street vitality, access to public transport, pedestrian safety and an efficient, road-based transport system. The present study could serve as a source for gauging the effects of a new street design.

It is almost a convention in public transport planning to simplify systems and concentrate resources on the most efficient carriers, when efficiency is measured as throughput and time. Underground rail systems are planned in consideration of walking distance, where it is almost always more time-efficient to walk when the destination is within the distance between a station and a third one on the same line. Thus, it is unlikely that the metro will be used to expand the walking environment by linking two areas distant from each other. The effects on local street vitality of the MTR require further study. In the present work, the contributions of the MTR to movement within the major tramway corridor are much less than the contribution of the tram itself. It may be, however, that the large pedestrian volumes generated by certain metro stations also contribute to a different pattern of street-oriented public activity. These effects need to be understood as part of a plan to integrate public transport with local land use. This study also suggests further investigation of combined transport corridors – heavy underground rail paralleled by bus, tram, bicycling and walking systems – so we can better understand the synergies between these systems and their complementary implementation.

This study concerned the iconic Hong Kong tramway, but the methods are adaptable to other tramway systems. In the contemporary city, we are much concerned with the integration of areas with sharply different social and economic profiles. How the tram serves to link such areas and create a common public environment for everyone in the city seems an important extension of the present effort on measuring the tram effect on street vitality.

6. Conclusion

In Hong Kong, the tramway is an integral part of the local commercial street network. Blocks supported by tram stops have significantly higher pedestrian flow than blocks without. The tram contribution to street vitality, measured in terms of pedestrian presence in the tramway corridor, is about 20% of the total, while the ability to cross the street, facilitated to some extent by the tram station at the middle of the street, contributes an additional 10%. Together, tramway-related factors account for more in street vitality than the flow of pedestrian traffic emanating from surrounding areas into the tramway corridor. In all, the five variables of the model – passengers alighting and boarding the tram, pedestrian volume on feeder streets, crossing rates – collectively account for 41% of the variance in pedestrian volume.

The pedestrian flow on the south side of the corridor is about 30% higher than on the north side. Most of the inhabited areas surrounding the tram corridor are to the south. It is also clear that disincentives to crossing, including fences, reduce street vitality on the north side of the tramway streets. Local improvement in crossing conditions, in particular providing more crosswalks, removing fences or allowing jaywalking would have a positive effect on north side vitality.

Although there has been discussion about the long-term viability of the Hong Kong tramway, it should now be clear that the question is not only a matter of the operations of this historic system. The character and liveliness of the vicinity of the tramway corridor are supported by the tramway operations by facilitating movement between local areas and extending walking distance. In this way, the tramway makes a direct contribution to active transport.

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Image Sources

Fig.1: Photos taken by the author

Fig.2 and 3: Figures prepared by the author

Author's Profile

John Zacharias

The author's interests lie in the space between the planned environment and human behaviours. How plans and designs condition behaviours but also how behaviours transform space are central investigations in the research. Environmental perception is a second strain of research, which interfaces with behaviour when we examine the study concerns cognitions relating to actions. The studies on these topics published in international journals are typically conducted in real environments at a variety of urban scales.