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Integrated Active Transportation Planning:
Cultures, Trends, and Behaviors in Hong Kong and San Francisco

By
Meiqing Li

A dissertation submitted in partial satisfaction of the
requirements for the degree of
Doctor of Philosophy
in
City and Regional Planning
and the Designated Emphasis
in
Global Metropolitan Studies
in the
Graduate Division
of the
University of California, Berkeley

Committee in Charge:
Professor Daniel A. Rodriguez, Chair
Professor Daniel G. Chatman
Professor Joan Walker

Summer 2024

Integrated Active Transportation Planning:
Cultures, Trends, and Behaviors in Hong Kong and San Francisco

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By

Meiqing Li

Abstract

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Doctor of Philosophy in City and Regional Planning
and the Designated Emphasis in Global Metropolitan Studies

University of California, Berkeley

Professor Daniel A. Rodriguez, Chair

This dissertation consists of three interrelated empirical studies on active transportation planning, the built environment, and pedestrian behaviors in Hong Kong and the San Francisco Bay Area. Through two independent case studies and one comparative study, I examine three overarching research questions: 1) what is the role of social media in facilitating civic urbanism for active transportation? 2) how are active transportation plans associated with the built environment over time? 3) how do pedestrian behaviors differ across cultures? I employ various data and analytical methods to answer these questions.

I first survey the institutional contexts for active transportation planning in Hong Kong and the Bay Area before delving into the three empirical studies in the following three chapters. The active transportation planning process in Hong Kong manifests a complex interplay between the government and civil society, a multifaceted process involving public participation, economic incentives, institutional organization, planning culture and politics. Contrary to the territory-wide strategic plans in Hong Kong, the Bay Area jurisdictions adopt city or county-level master plans for bicycle and pedestrian environment improvements.

The first study examines the use of social media by local placemaking non-governmental organizations (NGOs) in Hong Kong, and its role in facilitating public participation processes in active transportation planning. It utilizes social media texts and in-depth interviews with stakeholders to gauge opinions towards active transportation issues in Hong Kong, as well as how the NGOs employ social media as a tool to engage the public around active transportation agendas especially when formal participation channels exhibit limited capacity. The findings reveal the role of social media as a critical outlet for advocacy and a collaborative decision-making process. The case also demonstrates the opportunities for governmental agencies to

collaborate with civil society organizations for more people-centric active transportation planning. However, to build the trust that supports such collaboration requires substantial work.

The second study sits in the context of the San Francisco Bay Area. It uses a mixed method approach to investigate the trends and implementation pathways of pedestrian infrastructure enhancements around BART and Caltrain stations in the San Francisco Bay Area. It utilizes several novel datasets generated from unstructured data with statistical modeling, to systematically examine the built environment changes and their association with plans at a high spatial-temporal resolution. It demonstrates the potential role of plans in instigating changes in marked crosswalks at station area intersections, as well as the interactive effects contributed by a variety of station area characteristics. The upgrading and addition of high-visibility crosswalks show an overall improvement of pedestrian environment, suggesting the effectiveness of the presence of master plans.

The third empirical chapter presents a comparative study of pedestrian behaviors across Hong Kong and the San Francisco Bay Area. It utilizes a comprehensive dataset on behavior, infrastructure, and environment for the pedestrians collected at 283 heavy rail station areas, to understand the nuances of pedestrian interaction with human scale environment across two seemingly different cultures for walking in the context of contrasting urban form, car-dependency, as well as the perception of walking. The findings highlight the importance of observing the context-specific nuances in human-centric urban design. First, the types of pedestrian infrastructure and ambient environment surrounding transit-access pedestrians present more similarities than differences across cultures. Second, a typical pedestrian in Hong Kong and San Francisco appears to behave in a similar manner given a comparable level of perceived stress and risk from cars. Third, regions differ in their choices of design treatments for a specific road or traffic flow condition. However, I document how this sometimes may lead to counter effective or unintended results.

Altogether, the three studies contribute a comprehensive story about the state-of-the-art practice of active transportation planning in a global context. It shows how different policy contexts shape the roles of prominent stakeholders in the active transportation planning process. The two-case comparison extends findings from single case studies in terms of how urban design transfer or deviate from place to place. In order to achieve active transportation-friendly environment, design strategies should not be taken at face value without examining the human-scale nuances such as walking speed or compliance with traffic rules.

Acknowledgements

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List of Abbreviations

EDA	Electrodermal activity
EMD	Electric Mobility Device
EPA	Environmental Protection Agency
GHG	Greenhouse gas
GSV	Google Street View
NDA	New Development Area
NGO	Non-governmental organization
NLP	Natural language processing
HKIP	Hong Kong Institute of Planners
HKPSI	Hong Kong Public Space Initiative
MTC	Metropolitan Transportation Commission
MPO	Metropolitan Transportation Organization
MTR	Mass Transit Railway
OSM	OpenStreetMap
OZP	Outline Zoning Plan
R+P	Rail + Property
SEM	Structural Equation Model
SFMTA	San Francisco Municipal Transportation Agency
SLD	Smart Location Database
TOD	Transit-Oriented Development
TPB	Town Planning Board

Chapter 1 Introduction

1.1. Introduction

This dissertation investigates the relationship between civic urbanism, plans, the built environment, and active travel behaviors in Hong Kong and San Francisco. It tells three complete and connected stories about active transportation planning in two different geographies across countries. Without specification, Hong Kong generally refers to the whole territory of the Hong Kong Special Administration Region, whereas San Francisco is a loose geographic definition that encompasses the nine-county San Francisco Bay Area.

Despite distinct political, social and economic contexts, active transportation has gained popularity across multiple cultures. With two comparative cases in the United States and Asia, I adopt a mixed-methods approach including archival research, expert interviews, field observations, machine learning, and statistical analysis to examine three primary research questions: 1) what is the role of social media in facilitating civic urbanism for active transportation? 2) how are active transportation plans associated with the built environment over time? 3) how do pedestrian behaviors differ across cultures? These questions bridge across the planning process, built environment outcomes, and behavioral responses pertaining to active transportation planning in different contexts, the answers to which can contribute to a comprehensive understanding of the multilateral planning mechanism and to inform sustainable transportation policy transfers across the globe.

1.2. Motivation: Sustainable Transportation and Global Policy Transfer

Sustainable mobility, or sustainable transport, is an overarching theme that encompasses transportation-related policies and interventions that address a broad range of environmental and social issues, such as climate change, pollution, traffic congestion, and road safety. Because the transportation sector contributes a significant share of global greenhouse gas (GHG) emissions, and has been the greatest source of GHG emissions in the U.S. (US EPA, 2017), significant effort of sustainable transportation planning has been placed on mitigating GHG emissions and its impact on climate change. In order to reduce carbon footprint and provide high-quality access, cities have embraced various climate action plans and sustainable transportation plans that promote active modes of transportation, particularly walking and cycling which are considered green modes with zero emissions.

Both Hong Kong and San Francisco make a case for studying active transportation planning process in a metropolitan setting. Particularly, they share similar sizes of population and rail-backbone transit network as well as an overarching goal for sustainable mobility. However, they contrast in urban form, car-dependency, and planning institutions. They also exemplify the diverse underlying circumstances of the planning process. First, despite the shared goals of

achieving more sustainable and equitable transportation, the objective for planning remains in specific localities. For example, the main objective for sustainable transportation in the U.S. is to reverse the long-persistent trend of auto-dependency, whereas in Hong Kong the priority is to enhance walkability since walking has already served as a ubiquitous mode of access to public transit, accounting for almost 90% of all trips.

Second, individual motivations for active travel vary across countries. For example, in China people use active means of transportation largely due to the economic constraints to choose other modes, but people in the U.S. tend to do so for environmental and health considerations (Kwan et al., 2014). Even among countries of the developed world, the mode share of active transportation varies from as high as 30-40% in Nordic countries to below 10% in Canada, Australia and the U.S., due to urban form and other cultural, political factors (Bassett et al., 2008).

Third, the means of planning differ as policy goals fold out in action as local planning cultures intertwine with the planning process. In Hong Kong, the government's visions for active transportation live in territory-wide strategic plans such as climate action plans and long-range plans to support high-level goals of carbon emission reduction and to enhance the quality of public space. At the same time, civic urbanism emerges as an alternative means of participation in a less democratic planning process. In the Bay Area, where the public contribute more to the planning process than in Hong Kong, local jurisdictions implement active transportation master plans to enhance safety and equitable access. Hong Kong as a "city-state" has a comparable geographic scale with cities in the U.S., whereas it being a westernized Asian society makes it less distant from U.S. cities than other Asian cities from a policy perspective.

As cities adopt similar goals, much is yet to understand about the cultural and historical specificities in shaping the outcomes of similar policies. Understanding sustainable transport policies and practices across cultures, as well as individual behaviors can inform context-sensitive planning as cities move towards more sustainable living. So far, there has been a lack of international comparison in the way planning systems work in practice, especially for transportation planning, though the influence of wider societal and cultural context on planning, as well as individual perceptions is widely recognized (Nadin, 2012; Ni et al., 2020).

The COVID-19 pandemic even highlighted the relevance of cultural norms as an important factor that shapes individual behaviors. Hong Kong as a quintessential example of high-density living, and the Bay Area as the forefront of sustainable transportation policy in a car-dependent country, can both have significant implications for a global policy learning and practice.

1.3. Overview

This dissertation consists of five chapters, with Chapter 1 and Chapter 6 being the introduction and conclusions and Chapter 2 introducing the planning contexts of the two case studies. Chapter 3, 4 and 5 are self-contained research chapters organized around a primary research question,

containing background and literature, methodology, findings, and discussion sections. Among the research chapters, Chapter 3 focuses on the active transportation planning process in Hong Kong, Chapter 4 associates the planning process with built environment changes around rail stations in the San Francisco Bay Area, and Chapter 5 centers around the behavioral response to human scale designs in the contrasting settings of Hong Kong and San Francisco.

In the chapters, I also investigate the different actors and scales of planning. Chapter 3 examines the grassroots organizations and citizen participations in the virtual space; Chapter 4 studies formal planning in physical space at a municipal or regional scale; Chapter 5 delves into individual pedestrian behaviors at the intersection scale. Figure 1.1 outlines the interrelations among the stakeholders and elements of the planning process.

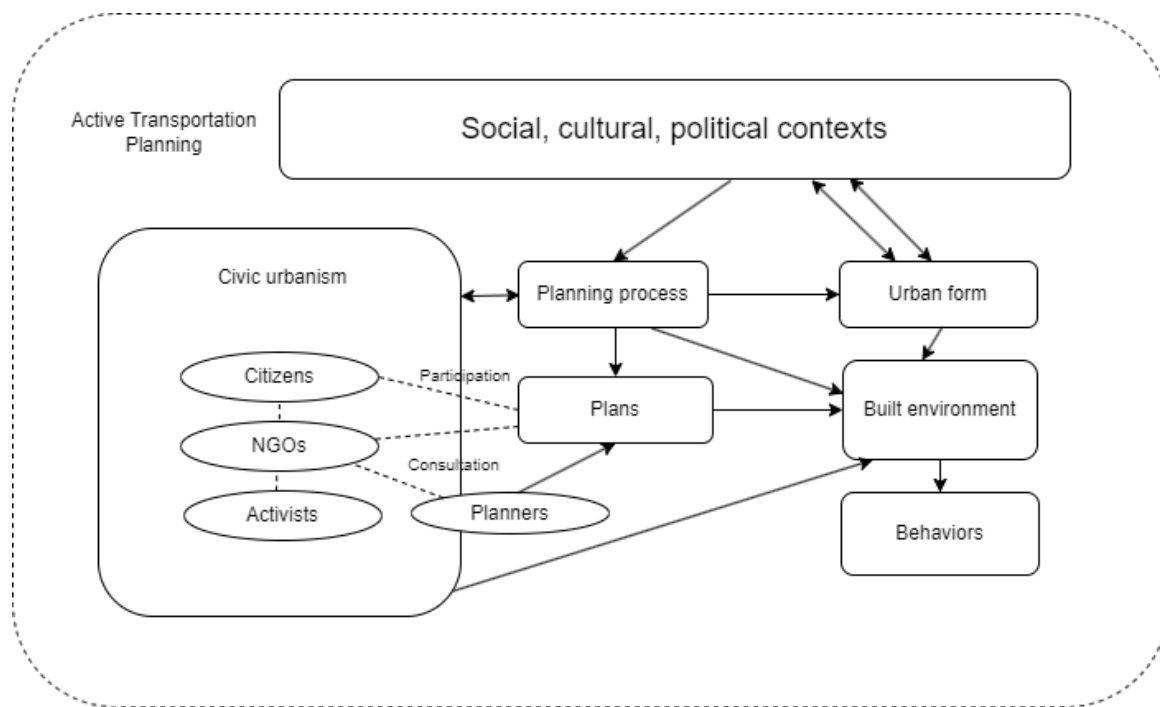


Figure 1.1 Conceptual framework of the dissertation

Chapter 2 Active Transportation Planning in Hong Kong and San Francisco

Hong Kong and the San Francisco Bay Area share some commonalities such as metropolitan scale, regional transit network, and overall goals and strategies for active transportation planning, which forms the basis for comparison, but differ in planning institutions that lead to unique processes for stakeholder participation and plan implementation. Table 2.1 summarizes and compares the basic geographic and travel characteristics underlying the different active transportation planning processes introduced in this chapter, which form the basis for comparison.

Table 2.1 Key characteristics of Hong Kong and the San Francisco Bay Area

	Hong Kong	San Francisco Bay Area
Area	2,755 km ²	18,040 km ²
Population	7.36 million	7.76 million
Travel characteristics	Predominately walking and public transit, cycling for leisure only (88% trips by transit) ¹	Mostly car-dependent, few walking and cycling (3.5% transit commute mode share) ²
Regional rail transit system	MTR	BART, Caltrain
Road safety ³	204 per 100k population	369 per 100k population
Existing active transportation infrastructure	Sidewalks, at-grade and grade-separated crossings, trails and cycle paths	Sidewalks, at-grade crossings, cycle lanes, trails and cycle paths
Active transportation plans	Territory-wide strategic plans	Regional, county or city-wide active transportation plans
Active transportation planning agencies	Town Planning Board, Transport Department	MTC, various county or city transportation authorities

¹ From the 2011 Hong Kong Travel Characteristics Survey, the most recent available data.

² From American Community Survey 1-year estimate for the San Francisco Bay Area, 2021.

³ Estimated from the number of traffic accidents and population, in Hong Kong (2020), and the Bay Area (2022).

2.1. Active Transportation Planning in Hong Kong

In Hong Kong (Figure 2.1), the active transportation planning scene has featured tensions between civil society and planning institutions. While grassroots groups advocate for a street

reform that prioritizes pedestrians and cyclists, transportation planning practices center around car-centric engineering tactics. On this front, some scholarly articles criticize the government's climate action and sustainability transportation policy agenda as “window dressing” and with a lack of public participation during the consultation (Mottershead, 2004; Ng, 2012).

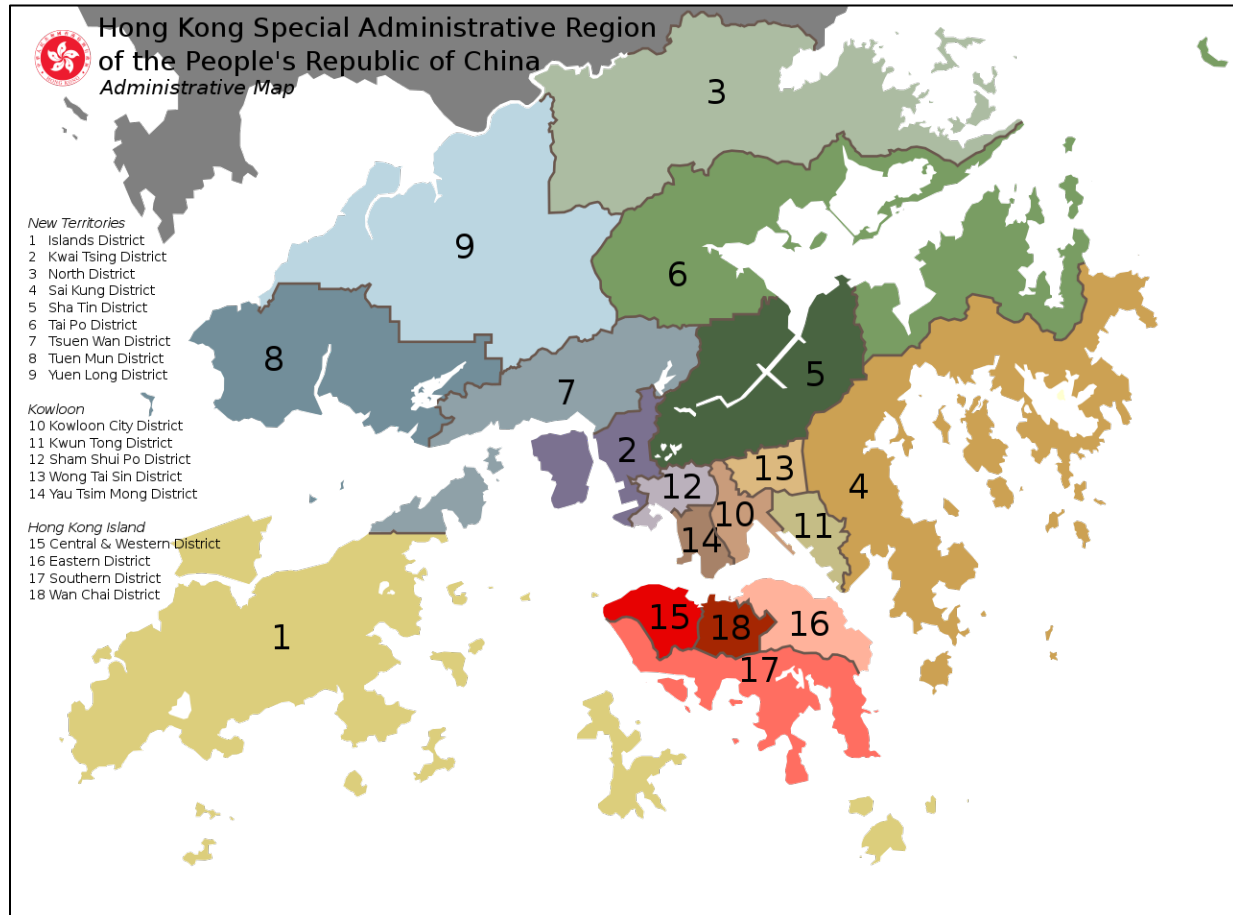


Figure 2.1 The Hong Kong Special Administration Region

Although public transportation development has been one of Hong Kong government's policy priorities since its first White Paper was published in 1979, active transportation in Hong Kong, as part of the city's sustainable transportation policy, did not take stage until the 2000s. Before then, each territorial transport policy white paper followed a decennial Comprehensive Transport Study (CTS) (Figure 2.2). The Comprehensive Transport Study is a transportation study document that aims to develop a territory-wide strategy for transportation in Hong Kong.

The first and second Comprehensive Transport Study (CTS-1 and 2) were followed by the first and second White Papers in 1979 and 1990 aspiring to build an efficient road system. There was no major update in the Second White Paper in terms of policy goals. According to a policy review at that time, “[t]he transport policy of Hong Kong is clearly designed to restrict to a maximum extent individual modes of transportation (bicycles, motorcycles, passenger cars) or

small collective ones (rickshaw, motor rickshaw, minibuses). The aim is to optimize the use of public road infrastructure and to improve traffic safety and management” (*Keep a City Moving*, 1993). The policy put public transit in competition with other alternative modes of transportation. In this context, motorized transit became the sole priority over other road users including bicycles and pedestrians.

The successive transport strategy paper *Hong Kong Moving Ahead* (1999) following CTS-3, was the first and foremost plan that set out sustainable transportation policy strategies, including land-use transport integration, railway back-bone, and environment protection strategies pertaining to active transportation. Based on these strategies, the government laid out initiatives to promote green transport and support the rail-backbone system by pedestrianizing selected roads and providing walkways to rail stations. These initiatives started to consider active transportation as an integral part of the city’s railway back-bone transit system. During this period, the government implemented a few pilot schemes such as the planning of Wan Chai Bypass, pedestrian schemes in Causeway Bay, Central, Mong Kok, and Stanley, along with the first attempt to conduct public consultation (Cheng, 2007). Apart from comprehensive transport studies, the government has managed two large scale Travel Characteristics Surveys (TCS-2002 and TCS-2011), and the ongoing TCS-2022.

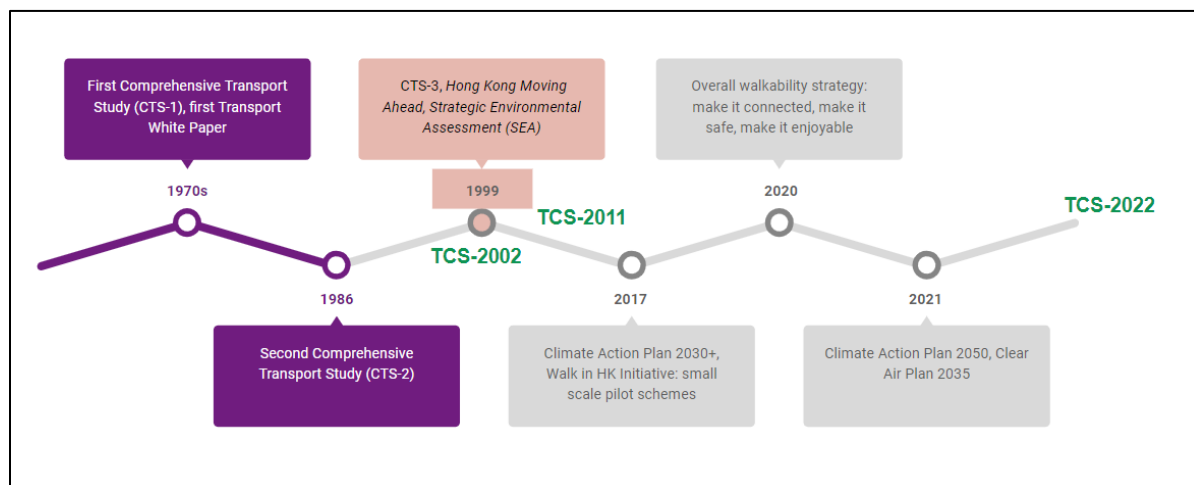


Figure 2.2 The government’s sustainable transportation development timeline

Hong Kong’s sustainable transportation policy took a climate turn in the late 2010s, when the government carried out the 2017 Climate Action Plan 2030+, Climate Action Plan 2050 (2021), and Clear Air Plan 2035 (2021). Active transportation, including walking and cycling, had higher priority to achieve the green mobility goals. At the same time, the Transport Department commenced the “Walk in HK Initiative” (Ockenden, 2020) in 2017 to test out small-scale pedestrianizing schemes while another policy document in 2020 put forward an overall walkability strategy: “make it connected”, “make it safer”, and “make it enjoyable” (LCQ22, n.d.). The government proposed new walkability enhancement measures and incorporated the

Walkability Project Management Office into the Regional Offices of the Highways Department for better coordination.

Active transportation in Hong Kong generally includes walking and cycling. The use of Electric Mobility Devices (EMDs) is banned on roads (Figure 2.3), although regulatory measures and legislative process for legal use of EMDs have been underway (Transport Department - Electric Mobility Devices, n.d.). Although they share the active mobility theme, walking and cycling behaviors have distinct characteristics in Hong Kong. Walking is a ubiquitous mode. The 2011 Travel Characteristics survey estimated a total of 88% of the trips were by public transport, with almost all trips connecting to a walking leg. Cycling, on the other hand, is less common, with only 0.5% of daily commute by bike (Luko, 2019), especially in the metro areas of Hong Kong Island and Kowloon Peninsula (10-18 in Figure 2.4). Most cycling facilities are in the New Territories and serve recreational purposes rather than utilitarian travel (Figure 2.4). While the government strives to promote a bicycle friendly environment in the New Territories and new development, cycling as a commuting mode in the metro area is not encouraged due to road safety concerns. So far, there has been a total of about 250-kilometers of cycle tracks in the whole territory (Interviewee 5, 2022).



Figure 2.3 EMDs are banned from the street (2022)



Figure 2.4 Major cycle tracks and bicycle parking sites in Hong Kong, map from Cycling Information Centre, Transport Department)

Several governmental organizations are involved in the active transportation planning process, primarily the Transport Department, Highways Department, Civil Engineering and Development Department and Planning Department. Planning for new walking and cycling infrastructure shares a similar multi-departmental statutory procedure, where the Outline Zoning Plan (OZP) prepared by the Town Planning Board (TPB) serves as the blueprint for what should be allowed to build and where.

In general, active transportation infrastructure is built through either development projects or road improvements. Most development projects, regardless of scale, have to go through a TPB review by board members who represent a wide range of professional expertise relevant to each case. Though the Transport Department provides general guidelines for the design of walking and cycling infrastructure, project approval is eventually under the control of TPB members who consider walking and cycling access as part of a broader development project package. For infrastructure projects such as the New Territories Cycle Track Network or other road improvement projects, the Civil Engineering and Development Department is responsible for the implementation by coordinating with other departments like the Transport Department for professional advice based on design manuals or the district specific situations. In either case, transportation planning decisions rely heavily on professional judgement by the Transport Department staff who sit on the TPB committees (Figure 2.5).

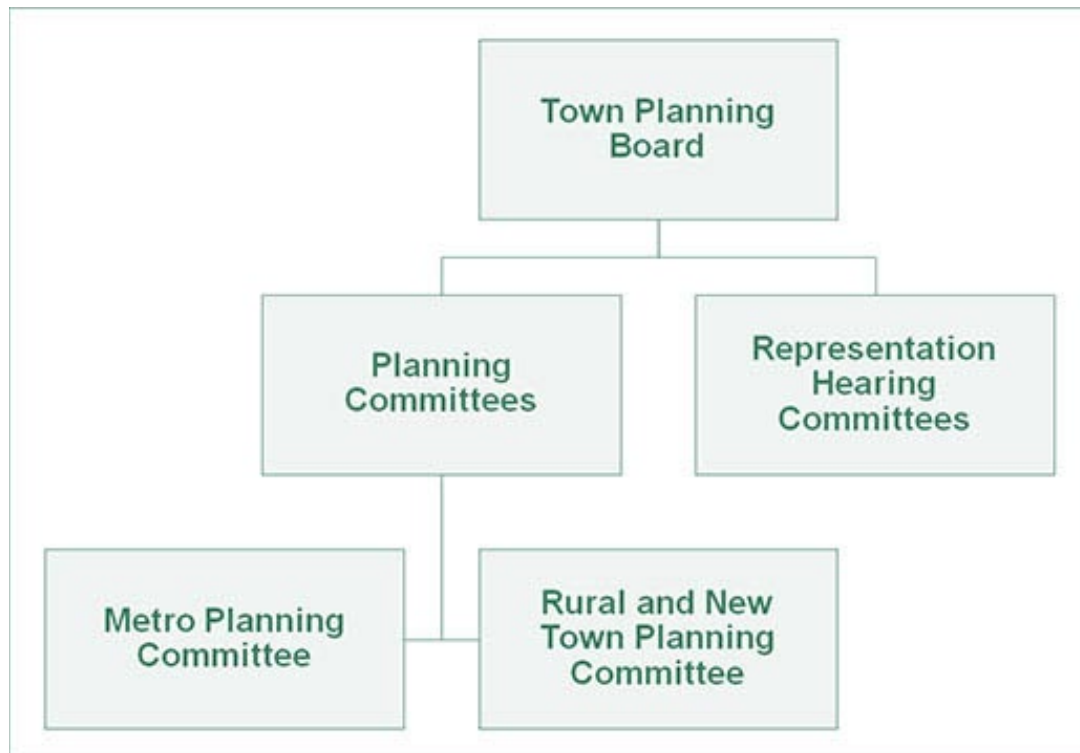


Figure 2.5 Composition of the Town Planning Board (source: Town Planning Board)

Moreover, the Mass Transit Railway (MTR) Corporation is responsible for providing rail station area walkways. The city's historical rail backbone strategy and quintessential Rail + Property (R+P) model grant the MTR Corporation development rights for all passenger connections to stations. It is MTR's economic incentive to provide station area walkways that lead to trains. However, such incentive does not extend beyond the station areas. The civic community shows disappointment that pedestrianization is only confined to rail station areas (Keegan, 2018).

Given the current institutional organization, multiple departments' involvement in the planning process makes inter-departmental coordination a key to the success of active transportation planning projects. So far, however, such coordination seems sporadic. According to a few planning scholars, "the government has generally been on the right track in the policy setting level. How the policies are effectively carried out is the challenge ahead" (Cheng, 2007; Zheng, 2013). More than twenty years since *Hong Kong Moving Ahead*, progress seemed slow on the implementation side. Since there is no territory-wide active transportation plan, public consultation on cycle track or pedestrian planning only happens at the project approval stage when plans are seeking comments from the Town Planning Board. Public officials tend to take a pragmatic approach offering minimal guidelines throughout the project-based approach.

Public participation often takes the form of ex-post consultation, at some degree of tokenism (Arnstein, 1969) in which the public can make comments on planning applications to the TPB. Public comments are assessed by the Board on a case-by-case basis and would be addressed only

if they are planning-related (Town Planning Board, 2023). Recent large-scale new development area planning projects often involve a public engagement program. For example, the North East New Territories New Development Areas (NDAs) Planning and Engineering Study has a three-stage public engagement program where the government published responses to each public comment on the development proposals, to ensure that public views are incorporated into the plan (Civil Engineering and Development Department et al., 2013).

2.2. Active Transportation Planning in the San Francisco Bay Area

The active transportation planning process in the San Francisco Bay Area engages multilevel transportation planning agencies to implement regional, county, or city level active transportation plans. The seven-million-population region has led the innovation in active transportation planning with numerous walking and cycling programs and policies by different levels of jurisdictions including the state, regional MPOs, counties and cities. The Metropolitan Transportation Commission (MTC), the Bay Area's metropolitan planning organization (MPO) adopted its first Regional Bicycle Plan since 2001.

Due to a fragmented transportation governance structure, active transportation enhancements in the Bay Area often rely on local jurisdictions to implement the projects, where plans can serve as an important instrument. The plans take the form of transportation safety plans, stand-alone pedestrian plans, combined pedestrian-bicycle plans, and active transportation plans. In addition to the master plans, local or regional transportation agencies develop other active transportation related policy documents like Complete Streets policies, Vision Zero action plans, and Safe Route to School programs, which target specific policy goals but have less comprehensive place-based treatment proposals than the master plans. The content of these plans by including localized recommendations appears in contrast to the high-level strategic plans for Hong Kong which has a similar size of population (7.35 million in 2022).

Figure 2.6 shows the number of adopted active transportation related plans (bicycle, pedestrian, or combined) in all nine counties and 101 incorporated cities or towns in the Bay Area from 2005 to 2022, based on the California Active Transportation Safety Information Pages (CATSIP). Over the years, active transportation plans have become prominent as more jurisdictions adopted some form of master plans. Among the 110 Bay Area jurisdictions, 65 have proposed at least one type of active transportation plan (a pedestrian, bicycle, or combined active transportation plan), whereas 53 have pedestrian plans, 60 have bicycle plans, and 18 have combined active transportation plans. These plans generally outline existing conditions, vision and goals, and most importantly set priorities and recommendations in terms of projects and programs, as well as cost estimates and funding sources. Based on some recent studies that evaluate the longitudinal changes of the built environment (e.g., Li et al., 2022), the plans seem to associate with positive changes to walking and cycling environment, which in turn promotes safety.

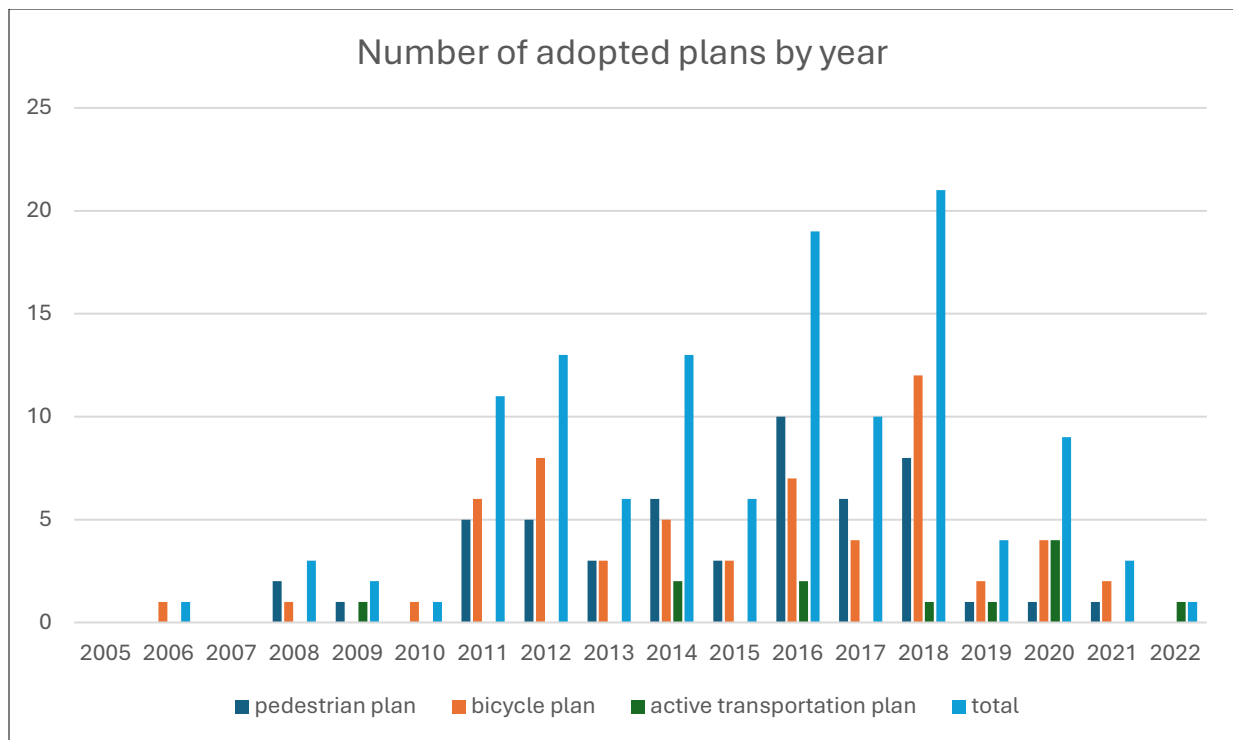


Figure 2.6 Number of adopted plans by each year among all Bay Area counties and cities.
Data source: CATSIP.

Chapter 3 Civic Urbanism and Active Transportation: The Roles of Social Media in Hong Kong

3.1. Introduction

Active transportation planning in post-colonial Hong Kong exhibits a juxtaposition of what Brooks (2002) described as centralized and decentralized paradigms. On the one hand, transportation planning centers around high-level strategic plans and engineering techniques to promote active transportation (Zheng, 2013). On the other hand, local placemaking organizations advocate for a fair share of public space on the backdrop of civic urbanism.

The pre-COVID Hong Kong has seen a flourishing culture of civic urbanism where grassroots placemaking organizations take the scene by organizing public events, knowledge sharing, and mobilizing local communities. Although they sit on a wide spectrum of willingness to cooperate with the government, they often rely on social media platforms to advocate for urbanist ideas and to raise public voices on local planning issues.

Nevertheless, the civil society of Hong Kong has evolved through a series of clashes with the authority in the past decade, from the 2013-2014 Occupy Central and Umbrella Movement, to the remarkable 2019-2020 Protests amid the COVID outbreak, which have significantly transformed the city's political landscape. With such great transformation, active mobility as a subject of planning or advocacy fell to a lower priority among the local communities' agenda.

3.2. Civic Urbanism and the Role of NGOs in Planning

Despite the high-profile presence of an active civil society, academic research on grassroots organizations in Hong Kong is largely absent as studies often focus on the governmental planning side (Cheng, 2007; Mottershead, 2004; Zheng, 2013). On transportation planning, these studies outline the government's general aspirations towards a greener mobility system (Cheng, 2007; Zheng, 2013) with a few critiques on the little connection between policy, practice, and public participation (Cheng, 2007; Mottershead, 2004; Ng, 2012). However, they seem distant from planning practice, and lack opinions from a grassroots and user perspective.

In a global context, literatures discuss the versatile role of NGOs in the planning process as being a mediator or tertiary stakeholder that balance the interest between public and private sectors (Morshed & Asami, 2015), to involve in environmental justice pursuits (Rigolon & Gibson, 2021), to form urban partnership that increases accountability of public programs in limited capacities (Foo, 2018), and to promote and lead empowered participation processes (Cohen-Blankshtain et al., 2013).

Some literature adopts the notion of insurgent urbanism (Hou, 2016) or civic urbanism (I. S. Cho et al., 2022) in the East Asian context, where citizens and communities become increasingly

involved in shaping neighborhoods and cities, departing from state-led or market-driven urban development. Focusing on cases in East Asia including Hong Kong, Seoul, Taipei, and Tokyo, this literature considers grassroots placemaking activities as a counterforce against the institutional practice of citizen participation under neoliberal governance. Specifically, Christ & Tieben (2022) examined citizen-driven placemaking and observed an increasing level of civic urbanism in the context of the Urban Renewal Fund Programme (URF) in Hong Kong, which raised concerns about the “gap between public space design and the aspirations and needs of local communities”, as well as “the lack of meaningful public participation process”. Remarkable cases include the resistance against the demolition of Star Ferry terminal to protect local identity, and an attempt to reclaim public space in the Umbrella Movement and 2019-2020 Protests.

3.3. Social Media for Public Participation in Planning

As social media extends the venue for public participation to the virtual space, it transforms not only the way in which the public interact with planning, but also the role of planners in this process. Some studies observe the social media strategies used by governmental agencies as online participatory tools (Calderon, 2021; Steinmetz et al., 2021; Williamson & Ruming, 2020; Zhao et al., 2018). Sometimes in combination with other online participatory technologies such as interactive mapping, it supports inclusive planning, consensus building, learning from local knowledge, and mobilizing actions and generating support under a communicative rationality framework (Afzalan & Evans-Cowley, 2015; Afzalan & Muller, 2014, 2018; Mergel, 2013). It also has a positive relationship with citizen engagement (Skoric et al., 2016). However, social media could potentially marginalize the dissent voices in the virtual world (Pokharel et al., 2022), and lead to polarization (Trapenberg Frick, 2016). Some argues that it even turns planning professionals into a facilitator of public discourse rather than an expert in the communicative framework (Brown, 2015).

Moreover, data from social media has emerged as a complement to survey data used by policy researchers to gauge public opinions. Compared to traditional methods, this method can collect a large amount of textual data in a short time and at a relatively low cost. As social media becomes more widely used, data generated from online platforms can gradually serve as a better representation of population. At the same time, both public agencies and grassroots organizations utilize online platforms as a public outreach and engagement tool for planning projects, which provides an opportunity to observe institutional or collective behaviors. Recent studies have used social media data such as Twitter (currently known as X) content to observe public discussion on emerging transportation technologies (Duran-Rodas et al., 2020). This line of research often adopts a mixed method approach combining quantitative analysis including topic clustering and sentiment analysis and qualitative analysis or digital ethnography in order to not read the contents at face value.

So far, little has been investigated about the social media use by grassroots organizations in the context of civic urbanism in Asia where social media plays an important role. Fewer studies have

explored the changing dynamics of civic participation in the aftermath of the pandemic and political movements. Public opinions and sentiments retrieved from social media can serve as an instrument to understand the rapidly changing dynamics between stakeholders during the planning process. Additionally, observing the behaviors by grassroots organizations can as well reveal how social media are used to promote a more participatory planning process in an East Asian context.

In this chapter, I focus on civic urbanism for active transportation in Hong Kong to investigate how social media facilitates this process, in the aftermath of the COVID-19 pandemic and the 2019-2020 Protests in Hong Kong. I aim to answer the following question: *what is the role of social media in facilitating civic urbanism for active transportation?* In addressing this question, I also look into the emerging themes in the group discussions, as well as the roles of different stakeholders including planners, activists, governmental officials, and scholars. The next sections introduce the data and method, findings and discussions of the result.

3.4. Methods

I adopt a mixed method approach, particularly a four-steps approach proposed by Andreotta et al. (2019), to analyze social media content made by four major placemaking NGOs (HKPSI, Designing Hong Kong, Walk DVRC, and Street Reset) during the period between 2020 and 2022, post COVID-19 and the social movement. This approach consists of four main steps for analyzing social media data: i) collect text data; ii) quantitative clustering; iii) sample selection (random or relevant); iv) qualitative analysis. In addition to the text data collected from social media, I conduct semi-structured interviews with stakeholders, and collect data from site visits, government websites and archives, to support the qualitative analysis.

Unlike the policy documents published by governmental sources, data on grassroots opinions towards planning issues in Hong Kong has been sparse, partly due to a lack of public participation in the process. Nevertheless, through social media, NGOs have actively shared their voices on public pages or group accounts. According to a survey by GWI, Facebook remains as high as a 77.6% penetration rate among internet users in Hong Kong (Figure 3.1) (We Are Social; Meltwater; DataReportal, 2024). Indeed, almost every grassroots organization in Hong Kong maintains an active Facebook page, a rich complement to official documents about the planning process. Not all organizations have Twitter accounts, and they are not as active as their Facebook accounts.

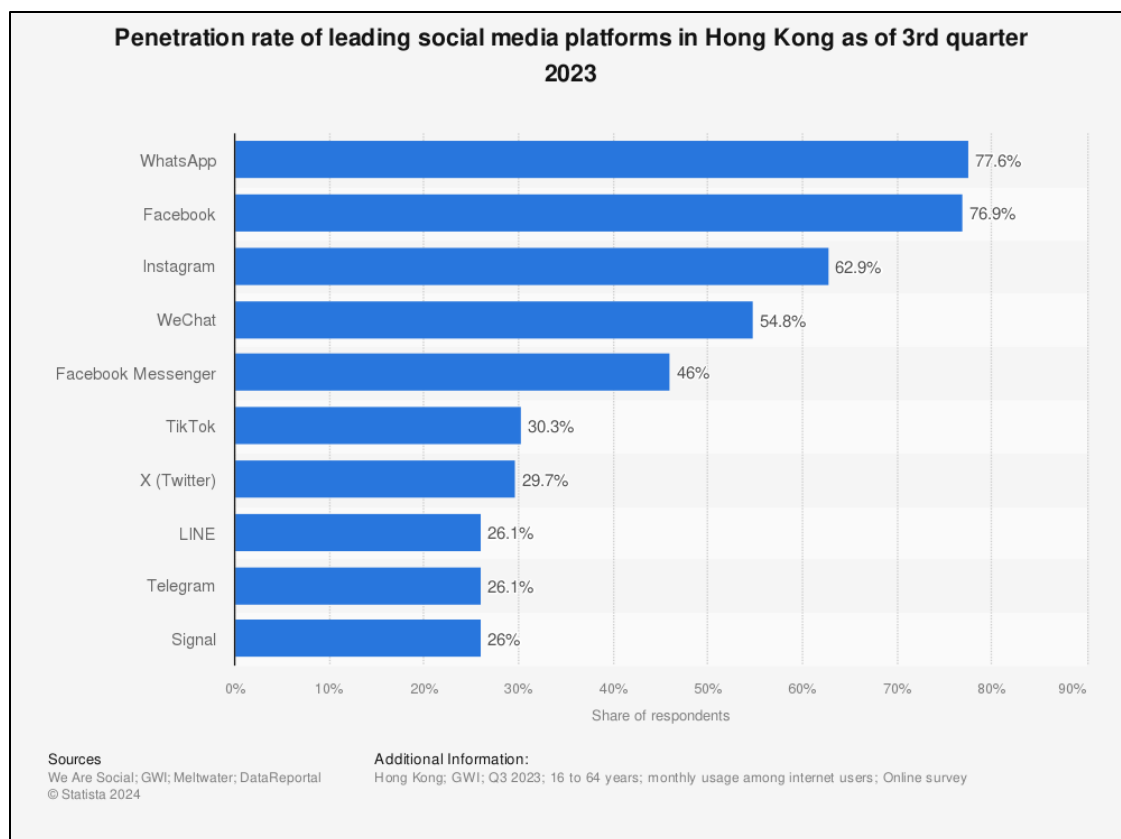


Figure 3.1 Penetration rate of leading social media platforms in Hong Kong as of 3rd quarter 2023

3.4.1 Data collection

I sampled Facebook posts from four major local NGOs (Hong Kong Public Space Initiative, Designing Hong Kong, Walk DVRC, and Street Reset), each with more than 3,000 Facebook followers, a total of more than 30,000 followers¹. I also identified a few other NGOs that work in intersection of urban planning, design, and public engagement, such as Civic Exchange, an influential think tank that does consulting work for the government, neighborhood or district focused concern group pages like Pound Lane Concern Group and Kowloon Greenway, as well as Hong Kong Cycling Alliance, Liber Research Community, Collaborative Hong Kong, Jockey Club Make a Difference Social Lab, but the four organizations' missions are more focused urbanism and placemaking (Table 3.1).

¹ Not unique count. Some of them might follow multiple groups.

Table 3.1 List of placemaking NGOs selected

Organization	Founding year	Mission	Members	Facebook followers (as of March 2023)
Hong Kong Public Space Initiative (HKPSI)	2011	Through research, community engagement and educational events, HKPSI strives to build awareness of public space in Hong Kong.	NGO with part-time young professional members	19,892
Designing Hong Kong	2009	Promote sustainability, quality of life and good design as core values in planning, development and governance	NGO run by full-time staff	5,200
Walk DVRC	2015	Promote walkability and livability in Hong Kong; aim to create a CBD 'for the people'.	Partner to the government, local retailers and the community in pedestrianization and placemaking initiatives	3,500
Street Reset	2020	A collective for human-oriented transport planning and street design	Young professionals	3,074

The mission and member composition of each organization seem largely similar as they mostly stemmed from a group of young built environment professionals across the public and private sectors while striving for improving cycling and improving walkability in Hong Kong.

Founded in 2011, the **Hong Kong Public Space Initiative (HKPSI)** is a charitable non-profit organization that strives to build public awareness of public space in Hong Kong through research, education events, and community engagement programs. It has become one of the most influential organizations among the young planning professional community and has recruited around 300 current and past voluntary executive committee members with backgrounds in the built environment fields. It actively engages stakeholders from government, private sectors, academia and communities with issues related to public space placemaking, by curating a public space directory, holding annual symposiums, organizing Hong Kong Public Space Awards, and education programs. Although not explicitly focusing on the walking and cycling environment, its goals and visions align with those of active transportation planning. The HKPSI Facebook

page has been live and accumulated more than 19,000 members since the founding of the organization in 2011, which serves as an extension of the NGO's public engagement effort. The page shares local news, events and activities, as well as foreign best practices for livable public spaces. Apart from the public-facing page, the organization maintains an internal group for its members to discuss issues on public space.

Designing Hong Kong Limited is a not-for-profit organization promoting sustainable urban planning in Hong Kong. "It promotes collaborations on interventions wherever it sees bad planning and wherever it sees that policies or institutions are not working the way they should" (*Mission – Designing Hong Kong*, n.d.). Unlike other NGOs run by voluntary professionals, it relies on activists and full-time staff to run the company's daily operations. The company grew from a harborfront enhancement project in the early 2000s, then broadened its mission from waste reduction and natural conservation to include issues on sustainable urban development and livable city. Several signature projects in recent years highlight walkability and green commute. The Designing Hong Kong Facebook page mainly posts relevant local news and event announcements. It has about 5,200 followers.

Walk DVRC Limited is an NGO that partners with the government, local retailers and the community in pedestrian and placemaking initiatives, which advocates for fairer sharing of public space between pedestrians and cars across Hong Kong. The organization is named after its initial project on Des Voeux Road Central (DVRC), a major road on the norther shore of Hong Kong, which aims to improve walkability in the busy CBD as a counterproposal to removing the tramway and making way for more traffic. The project idea was first proposed by the Hong Kong Institute of Planners (HKIP) in the 2000s, and then taken over by Walk DVRC in 2017. Since the initiative, Walk DVRC's project scope has extended beyond DVRC by engaging a variety of stakeholders. Compared to the other placemaking NGOs, walk DVRC has a more well-rounded connected supported by a committee of more senior professionals. The Facebook page started in 2015 following the establishment of the DVRC Initiative, which now has more than 3,500 followers. Most posts contain information about activities and best practices as the other NGOs' pages, but with more focus on the pedestrian environment. No small number of posts feature a fashion design event named "Walkable & Workable Fashion".

Street Reset is a relatively young organization founded by voluntary members with professional backgrounds in planning, architecture, or design. The group distinguishes itself from some of the other placemaking NGOs by distancing itself from governmental influence, in which none of the members work for the public sector. It is also the most specialized group on human-oriented transport planning and street design. Its Facebook page has gathered more than 4,200 followers over the three years since its founding in 2020. Projects and posts by Street Reset feature more data-driven advocacy for human-oriented street design. They are also more local focused as the page posts content solely in Chinese.

I collected every Facebook post by HKPSI, Designing Hong Kong, Walk DVRC, and Street Reset between 2020 and 2022, which gave me a total of 656 posts containing 74,897 words in English. Most posts were in both English and Chinese. For bilingual posts, I extracted the English portion, whereas for posts in Chinese only, I extracted English text from Facebook's automatic translation. For comparison, I collected official documents and contents from government websites on cycling and pedestrian planning published during the same period, which includes 14 official documents in English with a total of 17,792 words. For each official document, I include title, year, publishing government department, and source; for each Facebook post, I include date, the number of likes, and posting organization.

I conducted field observation and in-depth semi-structured interviews with key stakeholders including civic activists and NGO leaders, young professionals, planning scholars, independent consultants, and government engineers, during my field work in Hong Kong between March and June 2022, and March 2023. I recruited eight interviewees who have expert knowledge on certain aspects of the topic by email invitation (Appendix B). For each group of stakeholders, I prepare a customized list of questions to guide the interviews (Appendix C). The questions mainly concern the planning process, roles of the stakeholders, and pressing issues in the active transportation realm. Each interview lasted between one and two hours, with four of them conducted in person and the other four via Zoom. Interviews were recorded and transcribed for content analysis to triangulate the findings from text data.

3.4.2 Data analysis

In order to understand the change of social media content posted by NGOs through the period, I first summarize the total number of posts as well as those focusing specifically on active transportation by year and organization. Then, I examine and compare the sentiment of all NGO posts, NGO posts related to active transportation, and government documents related to active transportation. The goal of this analysis is to gauge the opinions and overall attitudes to the NGOs towards active transportation, in comparison with the official aspiration in the planning documents. Finally, I cluster the posts and analyze the content in each topic group, supported by interview data.

I use *spaCy* (Explosion, n.d.), an open-source library for natural language processing (NLP) in Python, to clean up the text and create a list of lemmas in each Facebook post and official document. The data preprocessing follows the NLP processing pipeline: I first tokenized the text by removing special characters (i.e., punctuation, space, digit, line break), then lemmatized the tokens by removing the morphological forms of a word. I created bigram and trigram models, NLP models that generate a two-word and three-word sequence to account for phrases.

For sentiment analysis, I rely on the *vaderSentiment* (Hutto, n.d.) library, the Python implementation of the Valence Aware Dictionary and sEntiment Reasoner (Vader) lexicon and rule-based sentiment analysis tool that is specifically attuned to sentiments expressed in social media. It provides a compound score ranging from -1 to 1 that aggregates the cumulative

sentiment of each post, along with the scores for the positive (compound score > 0.05), negative (compound score < -0.05), and neutral ($-0.05 < \text{compound score} < 0.05$) sentiments of the text. In this way, I was able to identify a list of positive and negative posts.

I applied a Latent Dirichlet Allocation (LDA) model as well as content analysis to derive topic clustering of contents from social media and official documents. The LDA model belongs to a family of topic modeling techniques in NLP and machine learning for analyzing the underlying thematic structure in text data (Blei et al., 2003), in which topics are clustered based on the distribution of words. Finally, I sampled representative posts and compared them with qualitative data from the interviews and site visits.

3.5. Findings

3.5.1 Social media posts by placemaking NGOs

Between 2020 and 2022, the four NGOs have contributed a total of 656 unique Facebook posts (73,726 words in English), which yields 12,062 likes, an average of 18 likes per post. The number of posts from HKPSI and Designing Hong Kong has dropped over time, while that of Street Reset and Walk DVRC stayed relatively constant (Figure 3.2). Since Street Reset's Facebook page had not posted content until October 2020, there were much fewer posts from its page than the other three NGOs' pages. Prior to 2021, HKPSI and Designing Hong Kong's pages had more frequent posts on news and public engagement activities. The numbers dropped in the following years as COVID-19 social distancing orders came into place, which limited the number of in-person activities. At the same time, the National Security Law was enacted in 2020, and the groups likely became more cognizant in the content posted on their public outlets. Notably, the internal group of HKPSI has retained regular updates with similar but less selective contents.

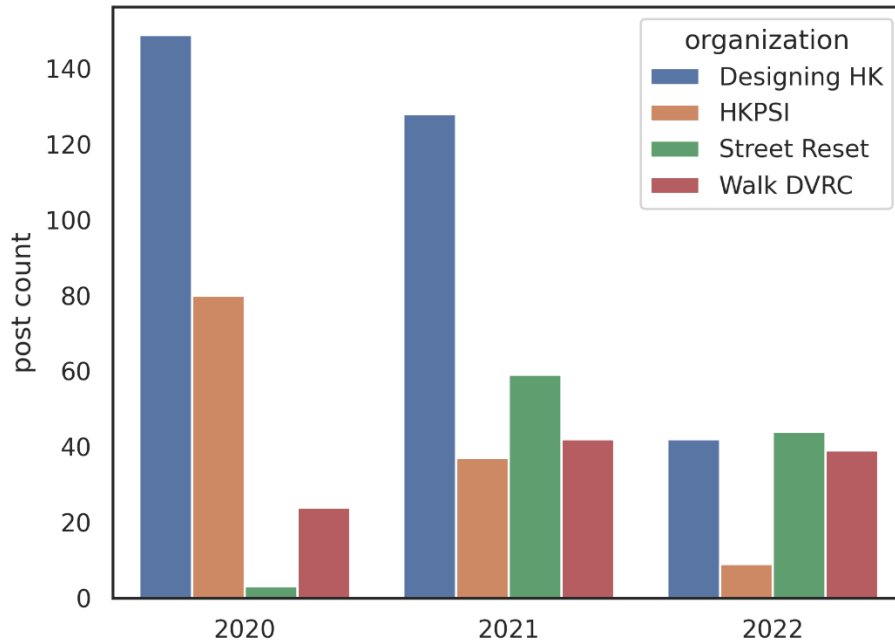


Figure 3.2 Total number of posts by year and organization

I filtered the sample to only include posts that contain active transportation related keywords: *pedestrian, walk, cycle, bike*, which narrowed down to 121 posts directly related to active mobility, about 18% of all posts. Figure 3.3 shows the changes across years and organizations, highlighting a growing trend on active mobility related content. Compared with the other posts, the number of active mobility related posts stayed relatively constant or growing.

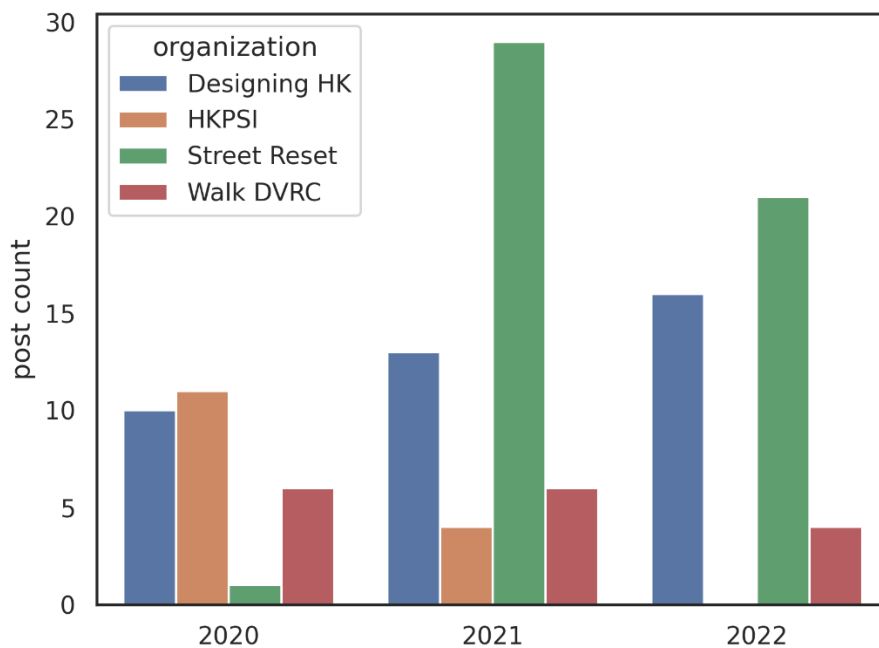


Figure 3.3 Total number of posts related to active mobility by year and organization

A majority of active mobility related posts come from Street Reset, the young grassroots organization that stresses its independence from the government. It has also gained the greatest popularity among the groups reflected by the number of likes to posts by followers (Figure 3.4, Figure 3.5).

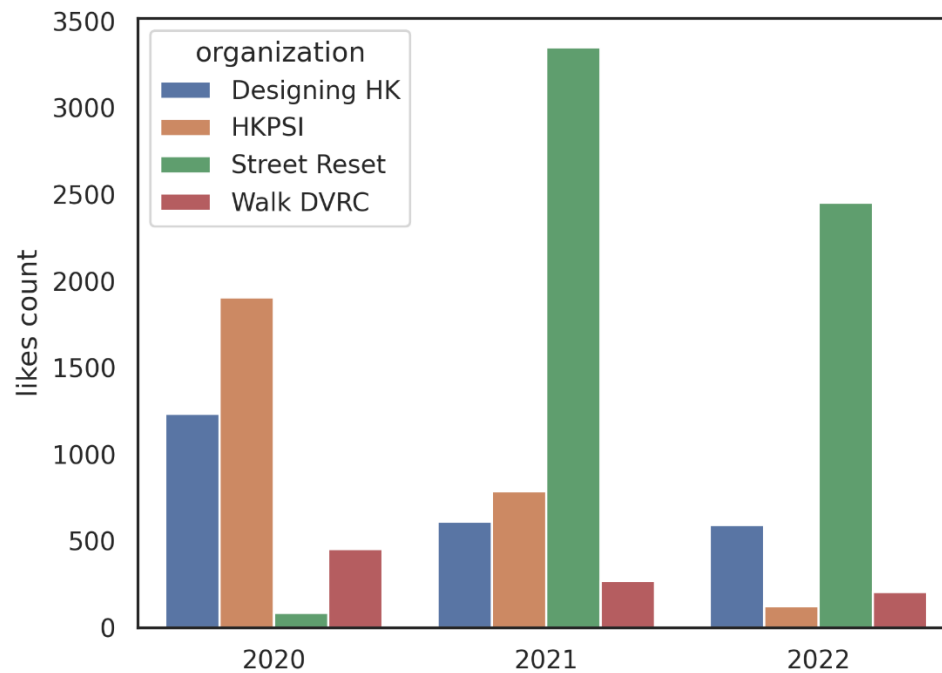


Figure 3.4 Total number of likes to all posts by year and organization

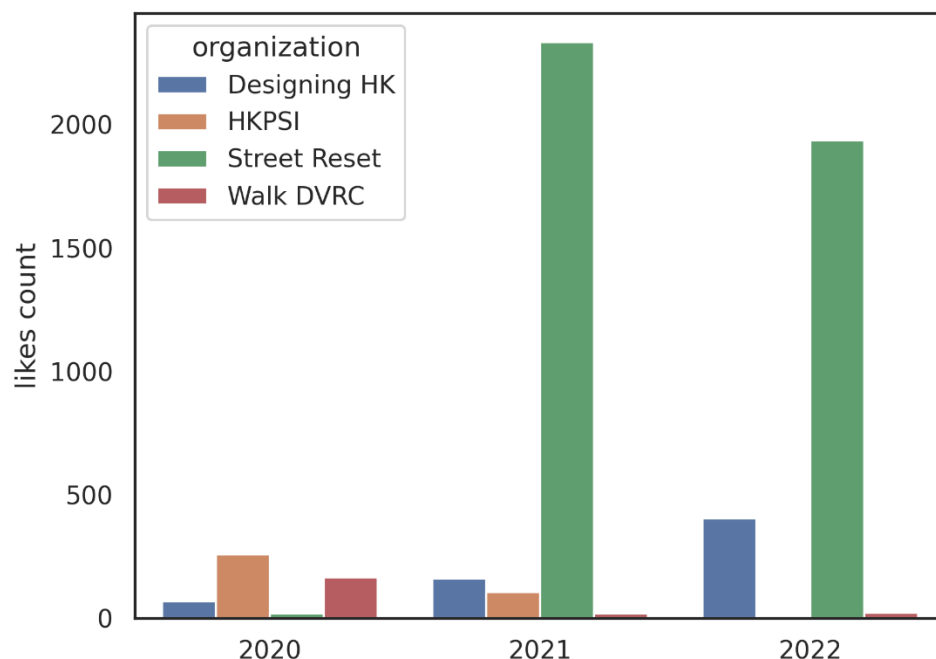


Figure 3.5 Total number of likes to posts related to active mobility by year and organization

The Facebook pages serve as the main channel to engage the public in their missions and activities. The NGOs target contents to the followers who mainly interact through commenting and reacting to the Facebook posts. Most likes come from page followers since new posts appear only on followers' threads. The total number of likes to posts over the years changes along with the number of posts by each organization. Specifically, for active mobility related posts, posts by Street Reset have attracted an overwhelmingly larger number of likes than those by other organizations, reflecting a stronger grassroots basis.

In general, the NGOs representing grassroots voices show a positive attitude towards active mobility, though with less overall positivity compared with governmental documents. The sentiment analysis shows a positive mean score for all Facebook posts made by the NGOs (0.36). Among them, active mobility related posts yield a more positive mean score of 0.44 and are more polarized in terms of distribution (Figure 3.6). The governmental documents on active mobility have the highest mean score of 0.63.

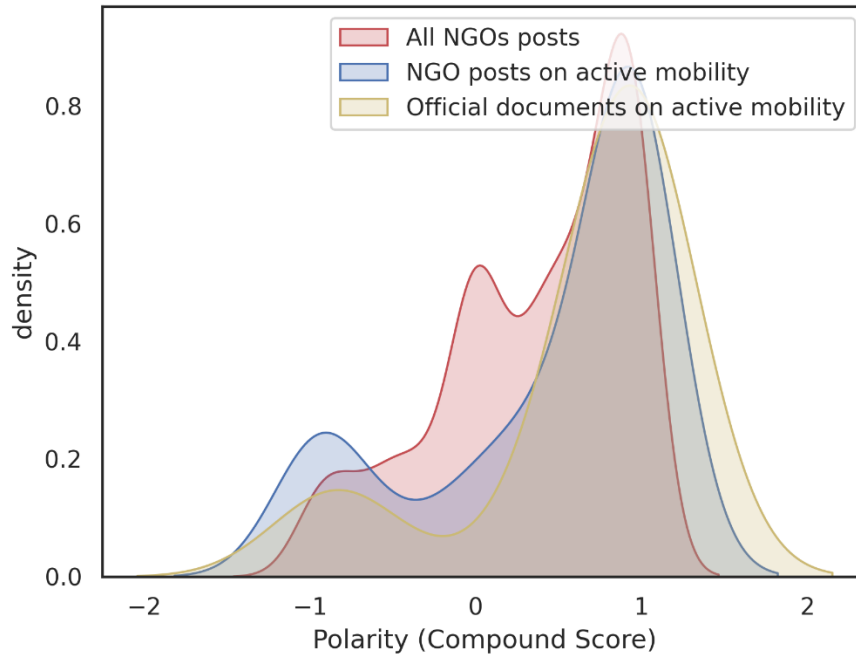


Figure 3.6 Kernel density plots of compound scores for Facebook posts and official documents

I use LDA model to derive a preliminary classification for each of the 656 posts by NGOs, before narrowing down to the 121 posts directly related to active mobility. This gives an overall picture of the contents generated by the placemaking NGOs.

I select the most reasonable number of clusters and classification based on results from a few iterations. The final classification identifies three topic clusters for all NGO posts in the four Facebook groups (Figure 3.7). Figure 3.7 shows the top ten associated words for each topic. Based on the relative frequencies of associated words for each cluster, I code them with intuitive but subjective labels, “conservation”, “urban design”, and “events”. “Conservation” represents posts related to natural conservation such as comments on waterfront development; “urban design” includes most posts about public space design, pedestrian environment and cities amid the pandemic; “events” refers to a variety of online and offline activities organized by NGOs that usually includes an https link for the public to register for the events or activities.

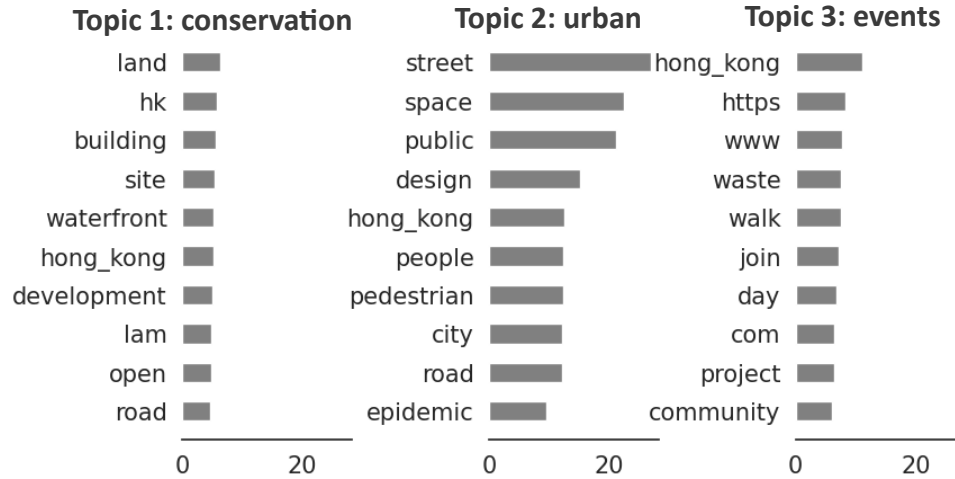


Figure 3.7 Topic clustering for all NGO posts by LDA model (n = 656; cluster = 3)

Then, I classify a narrower sample of 121 active mobility related posts into strongly positive (compound score > 0.5), strongly negative (compound score < -0.5) and others, based on some similar social media studies for transportation related discussions (Duran-Rodas et al., 2020). Among the 121 NGO posts selected, 18% are classified as strongly negative, 62% are classified as strongly positive (Figure 3.8).

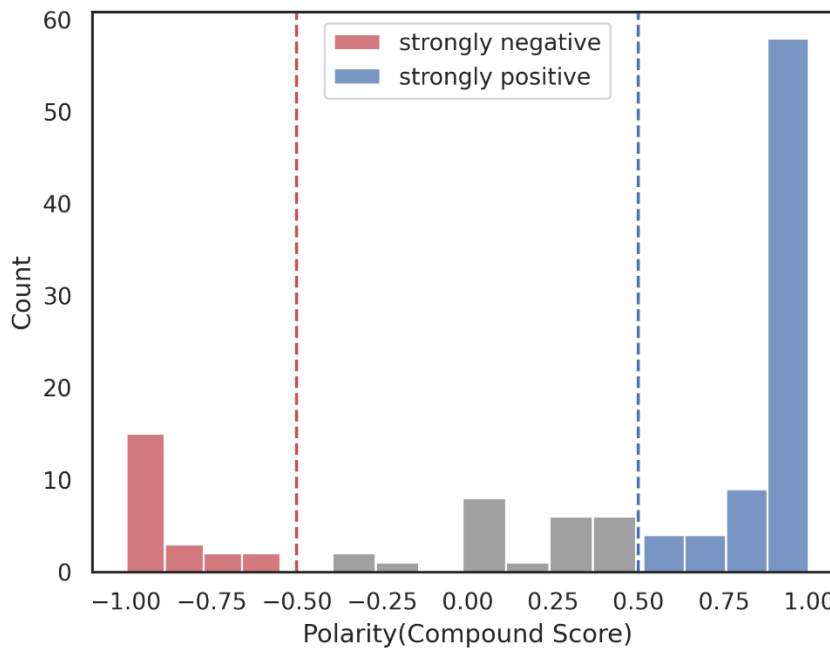


Figure 3.8 Histogram of compound scores for NGO posts related to active mobility (n = 121)

3.5.2 Emerging themes and topics of concern

The narrower sample allows for an in-depth read with content analysis approach. By this means, I examine each of these posts and classify them into the following topic groups: road safety, infrastructure, public health, consultation, recommendation, activity, and foreign best practice. Coupling the topics with sentiment scores, I find that most strongly negative posts concerned road safety, a primary theme by Street Reset content. A few other strongly negative posts sought public opinions towards infrastructure projects, introduced foreign best practice, provided recommendations to the government, or promoted the organization's activities. The strongly positive posts centered around a variety of content types including activity promotion, consultation, foreign best practice, and recommendation. I summarize each topic cluster by number of posts, average sentiment score, total number of likes, and provide representative examples (Table 3.2).

Table 3.2 Summary and example of each topic cluster for all active mobility related posts

Topic cluster	#	Average score	Total likes	Example (excerpt)	Organization & Date
road safety	17	-0.92	1,176	"Yesterday, a 76-year-old male cyclist user was hacked under the car by the driver of a field screw while turning left into Tangren Xin Village Road outside Pingshan Road. This is the first fatal traffic accident involving cyclists in 2021..." Pingshan South District Councilman Liang Deming wrote: https://bit.ly/3aeYcgH (Translation)	Street Reset 1/29/2021
infrastructure	4	0.47	78	"Pedestrian right of way is indeed a long battle. The railing is being removed instead of making people rethink the rights of the person. Pedestrian rights are a long battle. Let's take down the railings..." https://www.thestandnews.com/.../%E7%89%B9%E5%AF%AB-%E8.../ (Translation)	Designing Hong Kong 8/20/2020
public health	2	0.05	20	"Walk DVRC commissioned Social Policy Research (SPR) to undertake a survey to gauge perceptions of air pollution and its connection to health, especially respiratory related diseases, as well as to understand participants' experiences with traffic along DVRC. A total of 414 interviews were successfully conducted from 19 to 31 October 2019. Here are the Key Findings."	Walk DVRC 2/12/2020

Topic cluster	#	Average score	Total likes	Example (excerpt)	Organization & Date
consultation	11	0.28	171	"#BicycleTrack The bike track from Sheung Shui to Yuen Long is finally officially opened today, so you can pass through things in the New Territories. But there are also people who say that the bike route has to cross multiple roads and become broken worms. How can the design of the bike track be improved?" (Translation)	HKPSI 9/29/2020
recommendation	23	0.80	1,597	"Apart from Hong Kong Island, there are still other possibilities to set up coastal trails in our city. While travel overseas seems not to be possible in short term, why don't the government put more effort and resources in improving the existing pedestrian networks to allow people have a 'trailcation' in our home?"	Designing Hong Kong 1/3/2021
activity	49	0.81	1,326	"The 'Tsing Yi Travel' campaign is coming to an end. Thank you all for your participation and support over the past few months! ... we will make Tsing Yi a bike friendly community." (Translation)	Designing Hong Kong 2/28/2022
foreign best practice	15	0.35	1,126	"Cycle City #London, UK #Cycle Superhighway 2 CS2 launched in 2011 was initially marked by road marks, not physically separated by cars. Later, due to frequent accidents, #TransportLondon spent three years reviewing bike path designs and eventually building physical separation facilities on most of the road. "	HKPSI 2/13/2020

Based on this content analysis, several themes emerge from the topic clusters that highlight the most pressing active mobility concerns by Hong Kong's grassroots placemaking organizations, especially in the post-COVID period. I introduce each topic area, the roles of social media and stakeholders concerning active mobility planning in the following sections.

Planning issues: road safety, infrastructure, and health

Three topic clusters identify a group of posts concerning important active mobility related issues: road safety, infrastructure and health.

Road safety related posts contribute to almost all strongly negative posts, and most of them come from Street Reset since it has a more dedicated focus on street design: "We hope that Hong Kong's streets could be made to treat people walking and cycling more fairly. The use of road space should also be optimized, enabling a wider variety of convenient and reliable mode choices to the public, other than private vehicles and rail transport." The 17 posts yield an average sentiment score of -0.92 and 1,176 likes. In order to raise public awareness to the road safety issues, the posts often summarize some local traffic accident news followed by specific

street design recommendations or critiques to the government's current practice. For example, in Figure 3.9, the post quoted a news report about a fatal crash between a 76-year-old male cyclist and a concrete mixer on a rural highway. After setting the context, it advocated for a more cyclist friendly environment by urging the public to write to the Transport Department for a speedy review of the facilities and adding traffic signal controls.

Some posts advocate for other pedestrian and cycling friendly recommendations such as traffic speed reduction, adopting the Safety System Approach, allocating more space and priority to pedestrians, installing high-visibility crosswalks, reviewing pedestrian railings, imposing safety regulations to public service vehicles and vans, and making traffic accident data transparent. The Street Reset collected traffic collision data and published the “Hong Kong Traffic Injury Collision Database”² as a proactive effort to promote planning data transparency in Hong Kong.



Figure 3.9 Example post on road safety (Street Reset, 1/29/2021)

Four posts share general comments on walking or cycling infrastructure. For example, Figure 3.10 makes a slogan about pedestrian rights: “Pedestrian rights is a long battle. Let’s take down the railing”.

² <https://streetreset.shinyapps.io/hktrafficcollisions/>

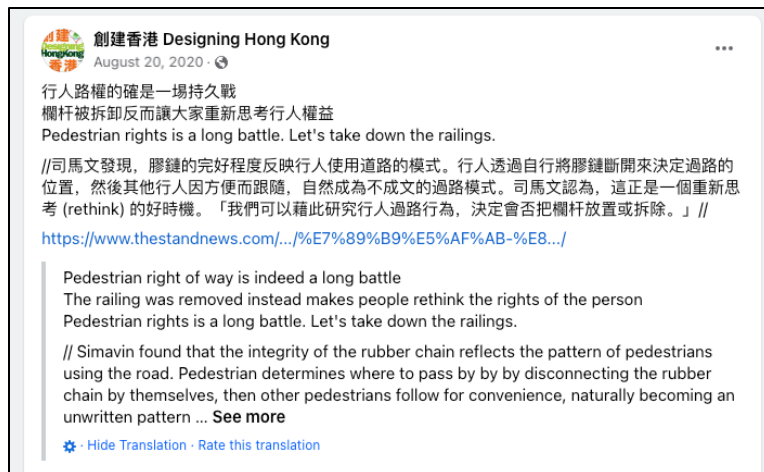


Figure 3.10 Example post on infrastructure (Designing Hong Kong, 8/20/2020)

Pedestrian railings have been a part of the political debate on pedestrian right of way in Hong Kong, as it manifested a confrontational frontier between the government and civil society in the public realm, especially since the protests (Figure 3.12). On the one hand, they have long been considered as a symbol for a car-dominant public realm where pedestrian activities are restricted to make room for traffic. In response to such criticism, the Transport Department piloted a decluttering of non-essential railings scheme as part of the “Walk in HK” initiative (Figure 3.13).



Figure 3.11 Media coverage on walkability issues in Hong Kong

Decluttering of non-essential railings in pilot areas

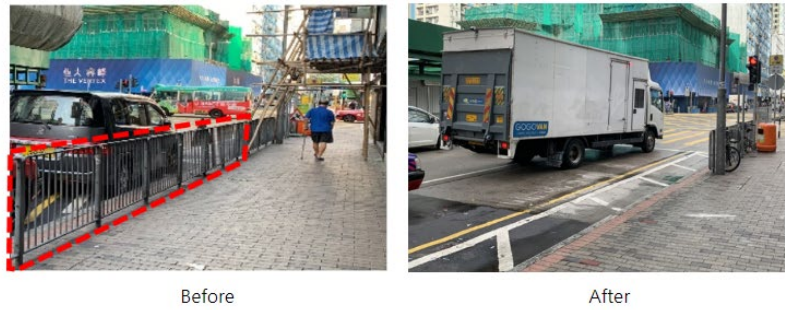


Figure 3.12 Government’s decluttering of non-essential railings in pilot areas (Transport Department)

On the other hand, since pedestrian railings were used as materials for barricades erected during the protests, they were found to be secured by the government despite several pilot schemes to remove them (Leigh & Lee, 2021) (Figure 3.13). The NGO voices on social media serve as a counterforce to the government’s ambiguous stand in pushing through walkability enhancement projects. They propose the human ecological approach to determine whether pedestrian railings should be installed or dismantled in certain locations.

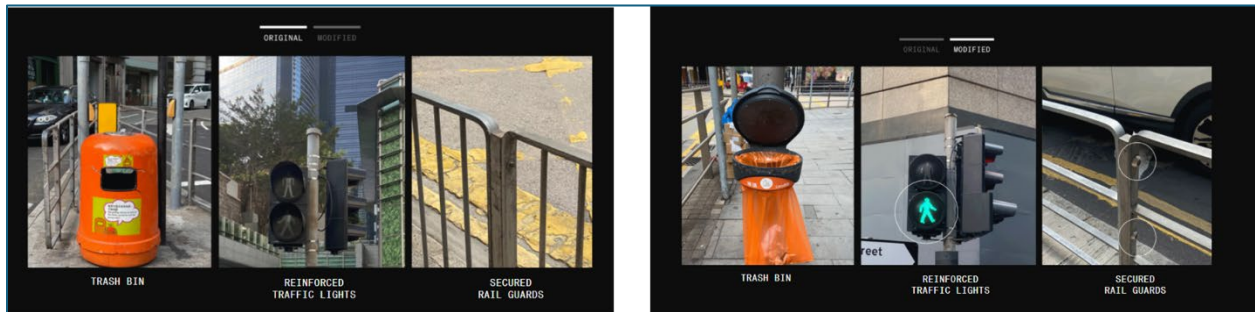


Figure 3.13 Left: original infrastructure before the protests; right: modified infrastructure after the protests. (Source: Bloomberg)

One post shares study results from a public health study. Walk DVRC commissioned a survey to understand opinions towards public health issues related to walking or cycling (Figure 3.14). Their findings reveal the need to educate the public about the concept of “walkability” as well as its connection to public health. This type of posts is mostly informational and provide basis of public consultation for the group’s advocacy activities, particularly the DVRC Initiative that submitted an application to the Town Planning Board to rezone DVRC to open space with environmentally friend public transit, which was supported by a number of NGOs public engagement feedback. Another public health related post advertises a slogan: “Walking is a healthy habit. Even a ten minutes’ walk could motivate your mood. Forward to your friends and family to walk everyday! #LetsWalk!”

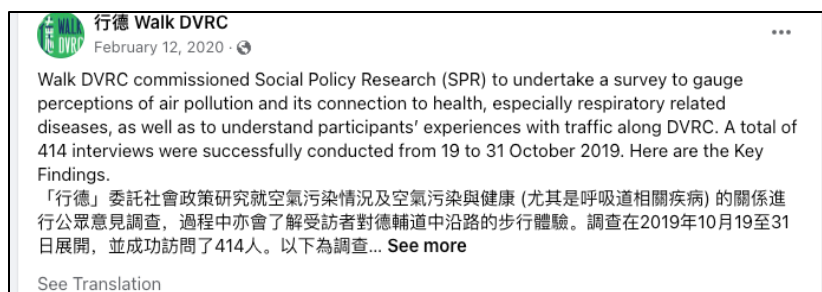


Figure 3.14 Example post on public health (Walk DVRC, 2/12/2020)

Planning process: consultation, recommendations, and invitation to activities

Posts on consultation, recommendations, and invitation to activities mobilize the public to participate in the planning process. These posts serve as the major targeted contents that advocate for the NGOs' missions. They are also the most popular content attracting most likes.

The consultation related posts serve a twofold role in facilitating the public consultation process. Some of them encourage the public to submit comments to the government's project consultations; others provoke public opinions on smaller projects. In the following example, HKPSI shares a prompt of problems with a new cycle track in the New Territories and asks for recommendations to improve the facilities (Figure 3.15). The recommendations do not necessarily turn into a rezoning application but support the public engagement effort by grassroots organizations. The 11 posts in this cluster generated 171 likes over the three years, and have yielded a neutral sentiment score of 0.28.



Figure 3.15 Example post on consultation (HKPSI, 9/29/2020)

Echoing the academic critics, NGO members express some sort of distrust to the government's policy and participation process. One NGO leader complained about the lack of substance in public consultation:

So, what happens usually is that when they go out to the community, they are already clear about what they want to do. When they go, they don't ask people for feedback. They can't do anything to change it, because they've already agreed on this issue with so many different departments that they're incredibly hazardous and to make changes. So, they

didn't essentially incorporate these comments. They don't get the public involved early enough at a conceptual stage.

He continued with the way how the local NGOs operate,

You can't do everything among organizations, but working together on topics with those who are interested, you can inform some movement behind each specific topic with only those people that have a relevance or an interest, and therefore you can be more effective and continue to be low cost. So that's how we work.

Another NGO member commented on his motivation of choosing to work for the NGO with a planning background: *"If the government is not doing things, we might as well build some prototypes of community engagement."*

There are 23 recommendations, mostly from Designing Hong Kong and Street Rest, attracted an overwhelmingly 1,597 likes. They make normative suggestions to the government on improving the walking and cycling environment, or advocate the public to make suggestions to the government (Figure 3.16). Organizations have different advocacy styles: the HKPSI more often provokes open-ended questions, Walk DVRC proposes what needs to be improved, Designing Hong Kong, while Designing Hong Kong and Street Reset appear more critical towards the government's car-centric street design. In general, this group of posts exhibit positivity with an average sentiment score of 0.8.

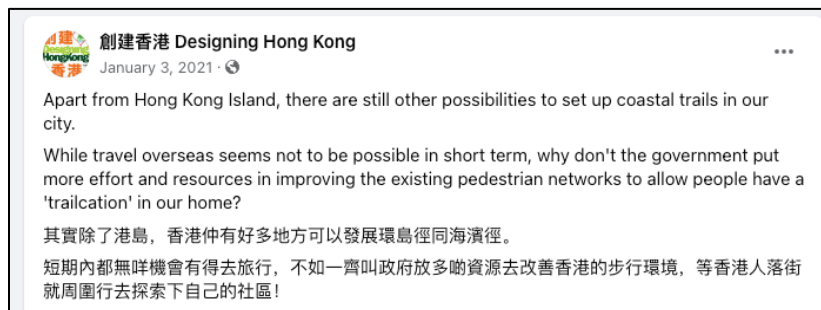


Figure 3.16 Example post on recommendation (Designing Hong Kong, 1/3/2021)

Much content references expert knowledge from planner scholars or state-of-the art practice in foreign cities, whose opinions echo several of my interviewees' remarks concerning a car-centric planning culture in Hong Kong. According to planning scholars and practitioners, the current transport planning practice lags behind by following an outdated, car-oriented design manual.

And the TPDM [Transport Planning and Design Manual] in Hong Kong is 50 years old, and the engineers as well. The ones that are still in place are still thinking in the mode where the car is kind of like a predominant mode. (Planning scholar)

Since social media serves as the main news outlet and communication channel with the public, the largest group of posts advertise the NGOs' public engagement activities. The 49 posts belong to this group, which received 1,326 likes over the three years. All four organizations post news

about past and future activities including human ecological street experiments, popup event, exhibitions, collaborative research projects, design competitions, public forums, community workshops, walking and cycling tours, etc. Some activities are jointly organized by several NGOs or supported by district councils. The following post by Designing Hong Kong (Figure 3.17) concludes the “Commute in Tsing Yi” campaign which aims to promote a cycling friendly environment and to cultivate cycling as a commute mode on the island of Tsing Yi.

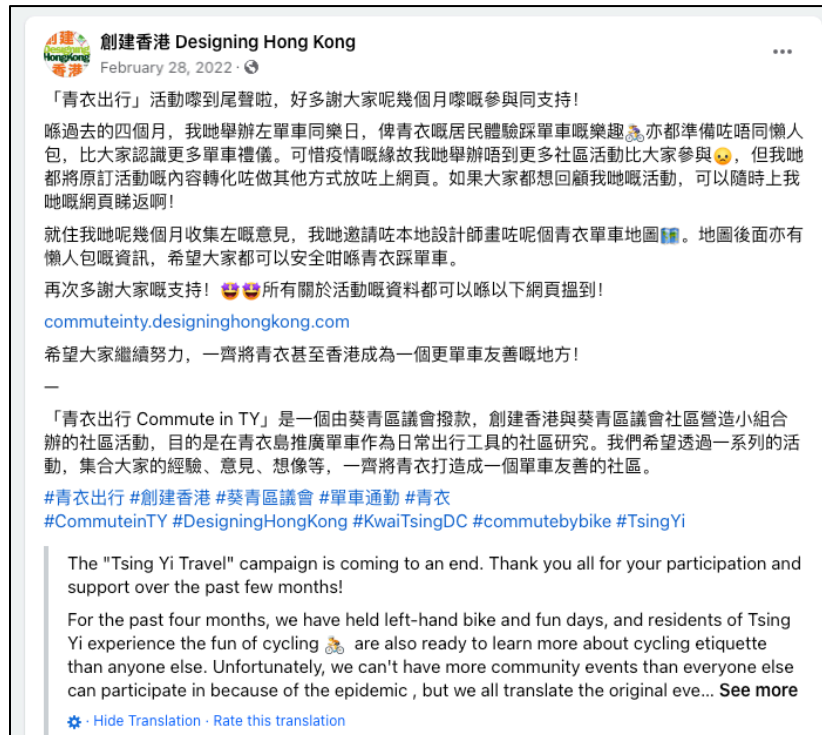


Figure 3.17 Example post on activity (Designing Hong Kong, 2/28/2022)

Exemplary cases: foreign best practice

Members of the local planning community show aspirations for a healthy and sustainable active mobility environment with reference to foreign practices, especially policies of Europe and the US. “*If they can do that, Hong Kong can do it,*” says one practitioner. A shared consensus between the government and grassroots community is that there are many things to learn from cities like London, New York, and some other European cities. Most interviewees mentioned foreign cases to compare with Hong Kong. One government engineer cited the public health benefit of active transport from a London report: “*I'm not sure whether you have read the cycle action plan of London. If people spend about 20 minutes on active transport every day and they'll bring more healthy hours to their lives. So that we're also looking on that KPI.*” The post by HKPSI introduces the Cycle Superhighway in London and the safety countermeasure by Transport for London (Figure 3.18). Other examples include traffic mirrors at intersections in London, the Netherlands’ pro-bicycle demonstrations in history, car-free Market Street in San Francisco, the Dutch-style roundabout, post-pandemic public space use in Australia, pedestrian

zone in Paris, 15-minute city, and Superkilen Park in Copenhagen. The 15 posts in this group turned out well received by the 1,126 likes.

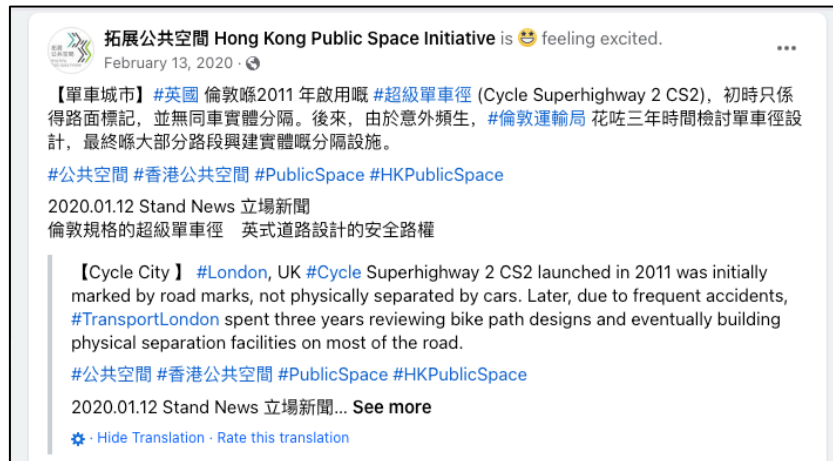


Figure 3.18 Example post on foreign best practice (2/13/2020)

3.5.3 The role of social media and planners in civil society

As illustrated by the abovementioned examples, social media platforms play two major roles in facilitating the civil society's public engagement efforts during the active transportation planning process in Hong Kong. First, they provide an outlet for NGOs to make their voices heard and to promote civic advocacy. Second, they serve as a communicative or intermediary channel between the public and government through project consultation led by NGOs. Compared with the ex-post consultations, social media forums moderated by NGOs receive immediate feedback from the public, which subsequently turns into collective advocacies for people-centric planning. Regardless of whether the organization retains a cooperative or independent relationship with the government, its social media platform acts as an engagement tool in lieu of the public consultation process. The first role supports the NGOs in leading empowered participation process (Cohen-Blankshtain et al., 2013). The second facilitate the NGOs' mediator role to balance public and private sector interests (Morshed & Asami, 2015).

Given the professional background of most NGO members, planners in the civil society become an important force that complements the lack of governmental agency for active transportation planning in Hong Kong. It is the social media on virtual space that provides professional planners with an alternative hat to apply their professional knowledge as an additional actor. Most often these planners are involved in advocacies for pedestrian and cyclist rights in that they act for the missions of their NGOs in the civil society that represent certain interest groups. Sometimes they practice in the capacity of communicators to the extent that they moderate the discussions through social media as a new form of consensus building. The rapidly developing communication tools empower both planners and citizens in collaborative decision-making, reshaping the power dynamics in the planning process from the time when planning theory was developed.

3.6. Discussion and Conclusion

The active transportation planning process in Hong Kong manifests a complex interplay between the government and civil society, which exemplifies a multifaceted process across public participation, economic incentive, institutional organization, planning culture and politics. Over time, civic urbanism emerges in Hong Kong in the form of placemaking NGOs facilitated by social media, as an emerging instrument to public engagement of the formal planning process. Despite the gap between plans and advocacies, the civic engagement on social media platforms reveals opportunities for governmental agencies to collaborate with civil society organizations for more people-centric active transportation planning. The case also demonstrates two general pathways to active transportation project implementation in Hong Kong: by approval and by negotiation, in a centralized planning paradigm with limited formal participation.

Several themes emerge from interviews and content analysis, which highlight the pressing issues concerning the active mobility landscape in Hong Kong. First, the institutional organization for pedestrian and bicycle planning requires more inter-departmental coordination to ensure effective and consistent policy implementation. Second, the MTR's value-generation model determines a lack of pedestrian connectivity that goes beyond the station area. Third, the official public participation retains some degree of tokenism where the planning agencies release little detail or quantitative analysis to inform the public prior to project implementation. Fourth, the engineer-led Transport Department leaves the public an impression of relying on an outdated Transport Planning & Design Manual that reinforces a car-oriented culture for active transportation planning. A few specific built environment elements frequently mentioned in post content drop hints for the critical urban design interventions (e.g., crosswalk, traffic light, pedestrian railing) to be explored in the next chapters. Lastly, some activists attribute the disconnection between policy and advocacy and a lack of people-centric mindset for a fair share of street space to the "small" government that lacks political will to implement concrete changes.

The rich text from online posts also reveals the role of social media as an insurgent outlet for advocacy and a collaborative decision-making process. In this process, planners in the civil society see the gaps between policy strategies in high-level plans and grassroots advocacies, as well as the conflict between rational planning and democratic participation. One NGO leader commented on such gap,

I think it's the normal thing that people are concerned about the challenges that they have in their life...The accessibility of choices in Hong Kong has dramatically improved but I don't think necessarily people think of it in those terms so easily...If the government want people to be happier with the city, they should highlight all these benefits and remind people, so that they were complained less... On the big thing, maybe people are in public housing... There are these kinds of big issues in the city. But are people complaining about it initially? No, because they may not have framed it like that.

Another planner and NGO member remarked that the communities are more concerned about basic needs whereas urban planning and transportation planning are considered high-level stuff. His thought echoes the other interviewee that the public is more likely to be mobilized by immediate concerns, than higher-level goals like Climate Change. Housing may be seen as the most pressing issue in Hong Kong's planning, but opinions on the issues are so scattered and it would be hard to draw a conclusion.

3.6.1 Limitations and Future Studies

Due to restricted API access to Facebook, the number of posts analyzed in this study is limited. Although the 121 active mobility related posts capture rich textual data on NGO behaviors, it is still considered a limited sample to generate patterns from NLP. Since the data only covers the opinion from a narrow sample of NGO leaders who are likely to share a similar profile of young planning professionals, the public opinions gauged from this study do not necessarily reflect the those of an unbiased population. However, as pointed out by several interviewees, these are probably the group of people who have the strongest opinions towards public space and street design issues in Hong Kong. If the NGOs can successfully mobilize the remaining population, especially the average Facebook page followers, the posts should present more diverse opinions.

Future studies could adopt a similar approach by analyzing contents from other social media platforms such as X (previously known as Twitter), especially for areas where other platforms are more commonly used by NGOs. Moreover, even though I have compared the change in number of posts by each NGO over time, it is worth comparing the content from before and after COVID-19 and the social movement. By extending the study period, I can track the evolution of sentiments and issues of concern over time. Across geographies, the Hong Kong case can be studied in comparison with other cities or regions such as the Bay Area, to further investigate the roles of NGOs and advocacy groups in the planning paradigm. Finally, the integration with mainland China, as well as how it influences the role of social media in mediating advocacy-government relationship is a topic worthwhile for closer examination.

3.6.2 Conclusion

In this chapter, I conduct an exploratory study leveraging social media platforms to gauge public opinions in a top-down planning regime. Given the scarcity of data focusing on voices from the grassroots community, I utilize social media text and interviews to uncover the civil society's involvement in active transportation planning in an international context. Using a mixed method approach, I developed a preliminary screening to analyze focused topic areas and sample, that can lead to more systematic analysis for future studies. In Chapter 4, I investigate the implementation of one infrastructure (i.e. marked crosswalks) for active transportation. In Chapter 5, I take a human ecological approach to examine the pedestrian-infrastructure dynamics of several street level built environment interventions.

Despite Hong Kong's unique built environment and planning institution, lessons learned from the tension between pedestrians, cyclists and other road users, as well as the interaction between civil society and planning institutions may provide insights to many high-density cities around the world, especially with new challenges brought by the COVID-19 pandemic.

Chapter 4 Effects of Active Transportation Plans on the Built Environment in the San Francisco Bay Area

4.1. Introduction

Plans, as a primary outcome of planning, play a critical role in shaping the built environment and human behavior. Over the past few decades, active transportation plans, or pedestrian and bicycle plans have become a common type of plans by counties, cities, and other jurisdictions in the U.S., which aim to promote sustainable means of transportation. Previous studies have described spatial and temporal patterns of pedestrian and bicycle plans (Aytur et al., 2013; Evenson et al., 2023; Steinman et al., 2010), behavioral effects in terms of walking and cycling activities (Duncan, 2023), as well as their impact on traffic safety (Kerr et al., 2013). A wider range of literatures study the relationship between built environment, travel behavior and safety (Ewing & Cervero, 2010; Zegeer et al., 2001). Nevertheless, few studies have yet investigated the causal pathway of plan implementation (Burby, 2003; Lyles et al., 2016; Millard-Ball, 2013).

In this chapter, I study the association between plans and the built environment changes that occur, plausibly through plan implementation. I aim to answer one primary research question: *do active transportation plans affect the built environment over time?* By focusing on the various jurisdictions in the San Francisco Bay Area, I hope to understand the paradox of centralized planning in a decentralized institution, in the sense that each jurisdictions adopts different active transportation master plans. This is also a comparative study with the previous chapter that examines the nuances of civil society involvement and public participation as a decentralized paradigm under a centralized planning institution in Hong Kong.

The planning process for sustainable transportation under different political and institutional circumstances, in itself makes a case for comparison. Neither case in the comparison between Hong Kong and San Francisco stands only for its unique context, in that greater stakeholder involvement makes comprehensive plans stronger (Burby, 2003) whereas plans make stakeholders more involved during the process (Duncan, 2023).

To answer the primary research question, I use a combination of two novel datasets: 1) an AI-generated longitudinal crosswalk dataset; and 2) a manually coded inventory of active transportation plans in the San Francisco Bay Area, which represent the built environment and active transportation plans respectively. I introduce the background, literature, data and method, as well as findings of this study in the following sections.

4.2. Assessing the Influence of Transportation Plans

While planning requires significant forward thinking, not often does it look retrospectively to evaluate the effectiveness of plans. Scholarly work has assessed local plan implementation under

the conformance and performance framework (Figure 4.1). It defines the plan implementation process with three main phases: Plan Development and Adoption, Implementation, and Outcomes, where the ultimate impacts as a result of planning outcomes are used for evaluating the adoption and implementation of plans. A resurgence of planning literature reflects on the causal impacts of plans - do plans matter for the actual implementation of policy? For example, Millard-Ball (2013) systematically evaluates the outcome from 478 California municipal climate action plans, but only finds cities use climate plans to codify policies likely to happen anyway.

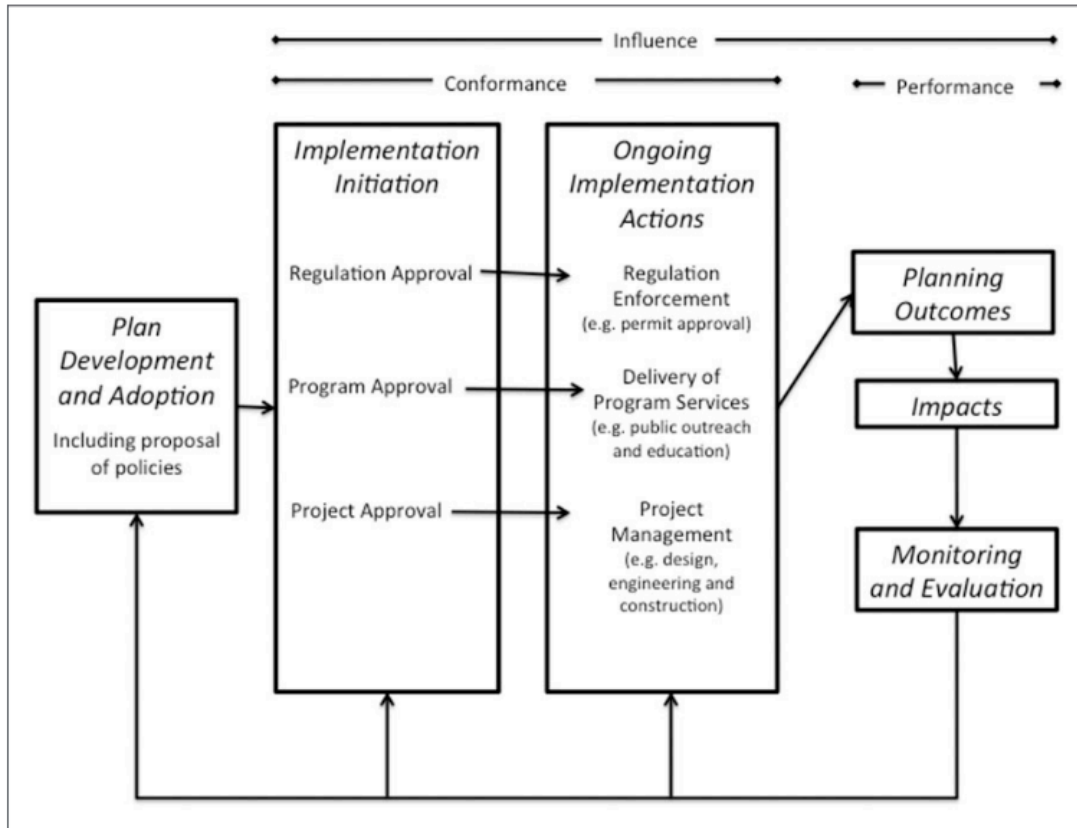


Figure 4.1 Conceptual framework for phases of plan implementation (Lyles et al., 2016)

Several mechanisms may support the positive impacts of local active transportation plans. First, the plan makes the adopting jurisdictions more likely to implement active transportation infrastructure enhancements. The adoption of a plan can generate institutional commitment that attracts more political and funding support to improve walking and cycling environments. Furthermore, the planning process itself and public outreach components of the plan can have spillover effects in addition to the planning outcomes, such as providing community education and increasing public awareness and acceptance.

So far, few transportation studies have delved into the pathways from plan implementation to outcomes. Many studies analyze the intermediary association between the built environment and travel behavior (Ewing & Cervero, 2010), which draws a link between planning outcomes and

the impacts concerning public health, social or environmental outcomes. A few others try to understand the overall safety or behavioral impacts of the presence of the plans. For example, Duncan (2023) uses a before and after research design with a 13-year panel data to empirically examine the influence of adopting a comprehensive pedestrian plan on percent of walk commute in large US municipalities. By a similar token, Kerr et al. (2013) analyze the causal path between the presence of pedestrian/bicycle plans and pedestrian/bicyclist nonfatal and fatal injury rates in municipalities of North Carolina. However, empirical studies have been so far limited by data resolution and scope. Although the literature demonstrated that the level of plan implementation varies by the type of policy and geography, few studies have empirically examined specific components of the plans as well as their implementation at a street scale. Given data availability, the level and quality of plan implementation could be inspected so that to evaluate the effectiveness of local active transportation programs.

4.3. Master Plans for Active Transportation in the San Francisco Bay Area

The plans that I examine constitute a variety of pedestrian and bicycle master plans adopted by individual counties and cities over the past two decades in the nine-county San Francisco Bay Area.

The California Active Transportation Safety Information Pages (CATSIP) curate an inventory of adopted master plans in California including transportation safety plans, stand-alone pedestrian plans, combined pedestrian-bicycle plans, and active transportation plans. In addition to the master plans, local or regional transportation agencies develop other active transportation related policy documents like Complete Streets policies, Vision Zero action plans, and Safe Route to School programs, which target specific policy goals but have less comprehensive place-based treatment proposals than the master plans.

Many plans take a Safe System Approach and highlight pedestrian or bicyclist high injury networks or priority areas for targeted enhancements. They also introduce some specific safety countermeasures such as traffic signals, speed controls, sidewalks, crosswalks, pedestrian walkways, and bike lanes. These enhancement projects often present around transit station areas, especially those that exhibit certain characteristics. For example, as Li et al. (2022) demonstrate with data from San Francisco, transit stations with higher ridership and those in areas with denser population, jobs and road network tend to exhibit better walkability with higher coverage of pedestrian infrastructure, also reflecting more public investment to the crosswalk visibility enhancements. Furthermore, Li & Rodriguez (2024) find that rail transit ridership increase across the U.S. was associated with higher rail station area high-visibility crosswalk, moderated by auto-ownership and land use. Given such associations, I choose to focus on the level of crosswalk visibility enhancements, as an indicator for the level of overall pedestrian safety enhancements. I aim to further investigate the role of plan implementation to the enhancements. The following sections outline research design and findings that center around a narrow set of research questions concerning plans and built environment outcomes.

4.4. Research Design

4.4.1 Research question

Under the general research question *do active transportation plans affect the built environment over time?* I aim to answer the following questions: 1) Is the presence of active transportation plans (i.e., pedestrian master plans, bicycle master plans, or combined active transportation plans) associated with lead to an increase in safety countermeasures (marked crosswalks) in priority areas (rail stations)? Does the mention of specific treatment (e.g., marked crosswalk) in the plan make a difference in the outcome of plan implementation? I hypothesize that the pedestrian environment enhancements are likely to happen with concrete and specific recommendations in the plans. 2) How is time since adoption of the initial plan associated with changes in implementation? I hypothesize that the longer since the initial plan, the more likely pedestrian environment improves.

Because the process can involve multiple factors when plans get implemented and lead to built environment changes, I narrow down the scope to focus only on a sample geography and infrastructure type most relevant to this study.

4.4.2 Study area

Since transit station areas are often considered as priority areas in safety enhancement programs, and given the relevance of pedestrian access for the success of rail station. I focus on all street intersections within the 250-meter buffer area at stations of two major rail transit operators in the Bay Area, BART and Caltrain with a total of 72 stations (43 BART and 29 Caltrain stations; Artherton, Broadway Caltrain, and West Dublin/Pleasanton BART stations are not included) (Figure 4.2). The study area covers five of the nine-county Bay Area without the four north Bay counties (Marin, Napa, Solano, and Sonoma), as well as 36 different municipalities (Appendix D). The study period spans 11 years, between 2010 and 2019.

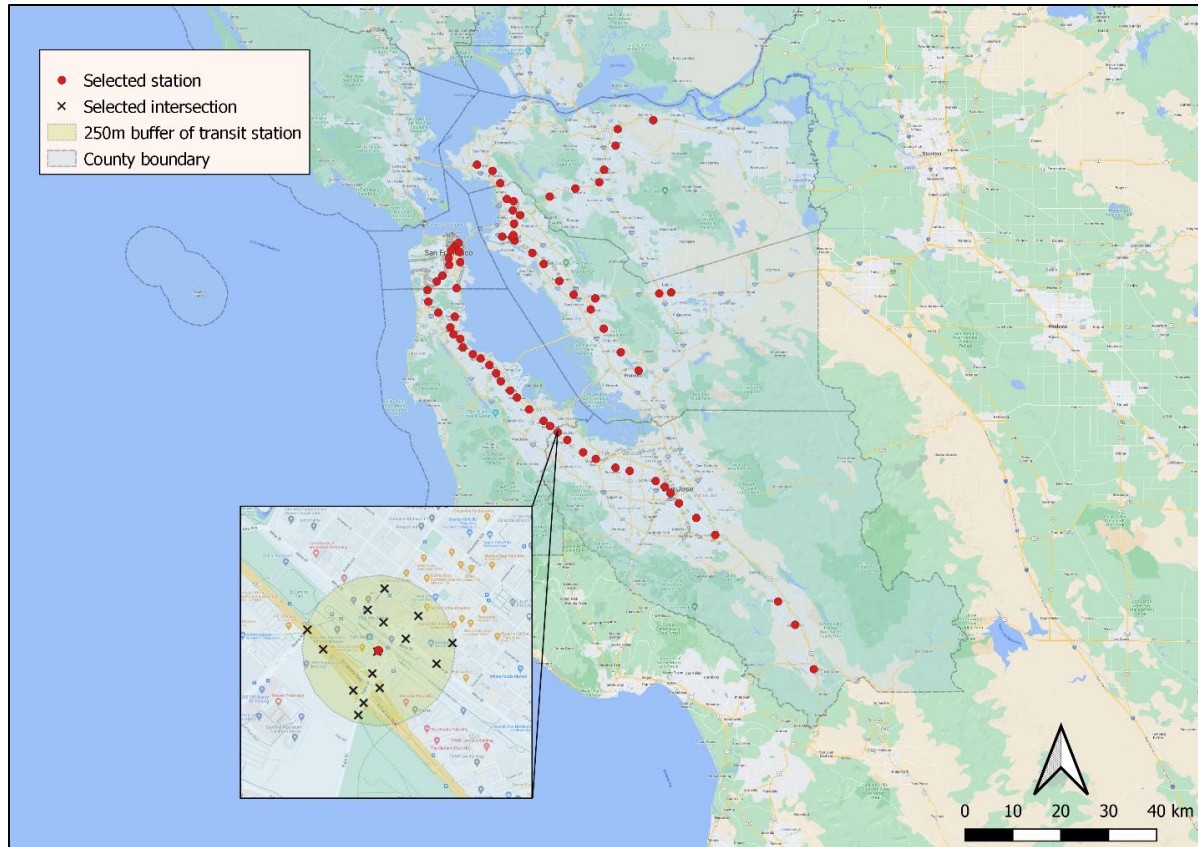


Figure 4.2 Map of the Bay Area rail station locations (n=72)

4.4.3 Model specifications

I estimate the treatment effect of plans on crosswalk visibility enhancements using a structural equation model (SEM) facilitated by a directed acyclic graph (DAG) to parse out possible causal effects, moderators, and confounders in the model (Figure 4.3). I use the DAG to help identify key variables to include in a parsimonious model.

The unit of analysis for model estimation is the station area. Because it takes time for plans to take effect, as well as for the planning priority to reflect changes in road safety risk and pedestrian exposure conditions, I use treatment and confounding variables one year before the observation of crosswalk presence. I estimate three sets of panel (station-year) regression models, one for marked crosswalks in general (including both conventional parallel lines and high-visibility ones), the other two specifically for parallel-line crosswalks and high-visibility crosswalks. To adjust for the correlation among stations within the same municipality, I estimate the models using clustered standard errors.

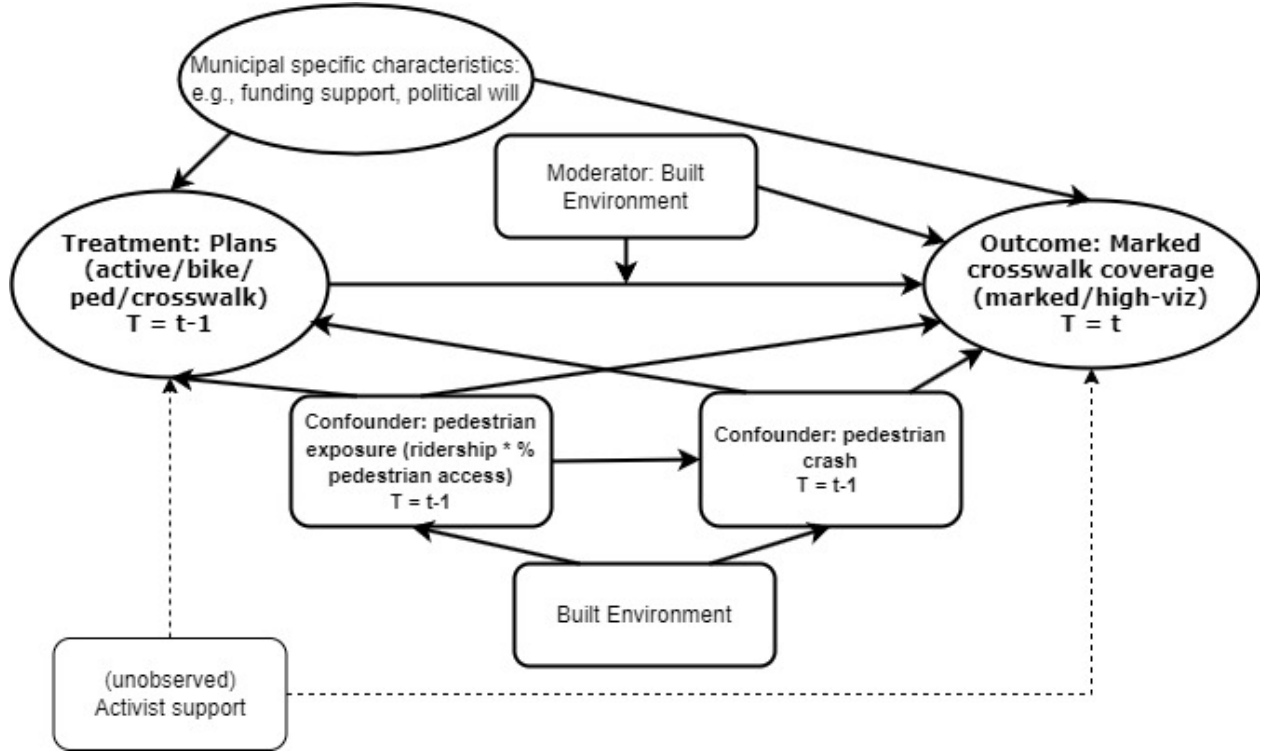


Figure 4.3 DAG for SEM

The model specification is as follows:

$$C_{it} = P0_{it-1} + P1_{it-1} + P2_{it-1} + P3_{it-1} + BE_i * P0_{it-1} + BE_i * P1_{it-1} + BE_i * P2_{it-1} + BE_i * P3_{it-1} + S_{it-1} + R_{it-1} + T + c_i + \varepsilon_{it}$$

where,

C_{it} is the share of intersections with marked or high-visibility crosswalks within rail station buffer area i in year t ;

P_{it-1} indicates whether there is a presence of plans (pedestrian, or combined) in the previous year $t-1$ ($P0$), whether the plans specifically mention crosswalk visibility enhancement ($P1$), the number of years since initial adoption of the plans ($P2$), and whether the current plan is an updated version of the initial plan ($P3$);

BE_i are the station specific built environment characteristics;

S_{it-1} is a dummy variable indicating whether there was a fatal or severe injury pedestrian related crash within the station area in the previous year;

R_{it-1} is a proxy of pedestrian exposure in the previous year measured by the product of station level ridership and pedestrian access mode share to that station;

T is the year fixed effect to control for the general trend of marked crosswalk increase over time;

c_i is the municipal fixed effect dummy;

ε_{it} is the error term;

Coefficient estimates β s for each variable are omitted in the notation.

Dependent variable (outcome)

I estimate two sets of models with three different outcome variables (C_{it}). First is the percent coverage of both types of marked crosswalks in station areas which indicates the percent of intersections with marked crosswalks. Second is the percent coverage of parallel-line crosswalks in each station area. The other is the percent coverage of high-visibility crosswalks in station areas measuring the crosswalk visibility enhancements. All range from 0 to 100.

Independent variables

I manually examine and code the four plan status variables ($P0_{it} - P3_{it}$) for each jurisdiction where the stations are located. I identify these treatment variables based on the hypotheses that the presence of active transportation plans makes more effective implementation of crosswalk visibility enhancements, plans that explicit recommend crosswalk treatments are more likely to implement crosswalk visibility enhancement, the longer time since the initial plan adoption and updates make the improvements less significant.

The station area built environment and socioeconomic characteristics serve as moderators to the effect of plans on crosswalk outcomes. In fact in a San Francisco study, Li et al. (2022) find that several station area variables including *percent of zero-vehicle households*, *percent of low-income workers*, *population density*, *job density*, *job-household ratio*, *road network density*, and *auto network density* all have significant associations with changes in percent coverage of marked crosswalks or high-visibility crosswalks over the years. Since these variables are likely correlated, I select two variables that have significant associations with both outcomes, *percent of zero-vehicle household* and *population density*, and use them as moderators using interactive terms. For built environment moderators, I use 2018 data across the board without considering the time-variant factors.

Additionally, I include two confounding variables: 1) presence of fatal or severe injury pedestrian crash in the previous year, and 2) the product of station level share of pedestrian access and station time-variant average weekday ridership. The rationale for considering pedestrian crashes and station level ridership lies in that counties or municipalities will likely prioritize pedestrian safety enhancements in areas that exhibit high fatal and severe injury patterns based on crash data, and stations with higher pedestrian volumes. Planners decide where to prioritize in order of the magnitude of potential benefit within certain time and funding constraints.

The time fixed effects assume a constant trend in station area marked crosswalk coverage during the period where T denotes the year of observation. The municipality fixed effects capture the time-invariant characteristics of a jurisdiction that can determine the level of completeness of pedestrian infrastructure such as funding support, political will, which are not separately estimated by the model.

4.4.4 Data

I collect first-hand data on both the plans and built environment changes throughout a period between 2010 and 2020. Particularly, I leverage a self-generated high-resolution crosswalk dataset and a manually coded local active transportation master plan inventory for statistical analysis.

Crosswalk data

I choose to focus on a prevalent pedestrian safety countermeasure, the crosswalk visibility enhancements as a result of implementing pedestrian and active transportation plans, which are considered effective measures to improve road safety at pedestrian crossing locations (Figure 4.4). According to the Federal Highway Administration (FHWA), crosswalk visibility enhancements can reduce crashes by 23-48% (Federal Highway Administration, 2018). Improved road safety can also encourage more walking, and provide better pedestrian access to transit stations (Aston et al., 2020), which in turn promotes sustainable means of transportation. Particularly, high visibility crosswalk markings often serve as a safety countermeasure to enhance the visibility of crosswalks compared with the standard parallel lines (Figure 4.5).

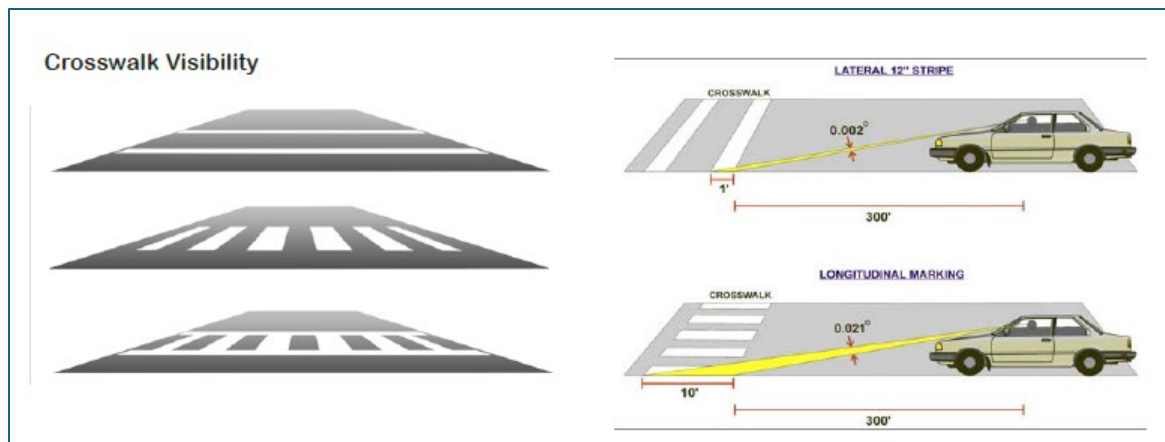


Figure 4.4 Standard parallel and variations of perpendicular or longitudinal striping patterns. Longitudinal bars are more visible to approaching motorists. Source: City of Richmond Pedestrian Plan, 2011.

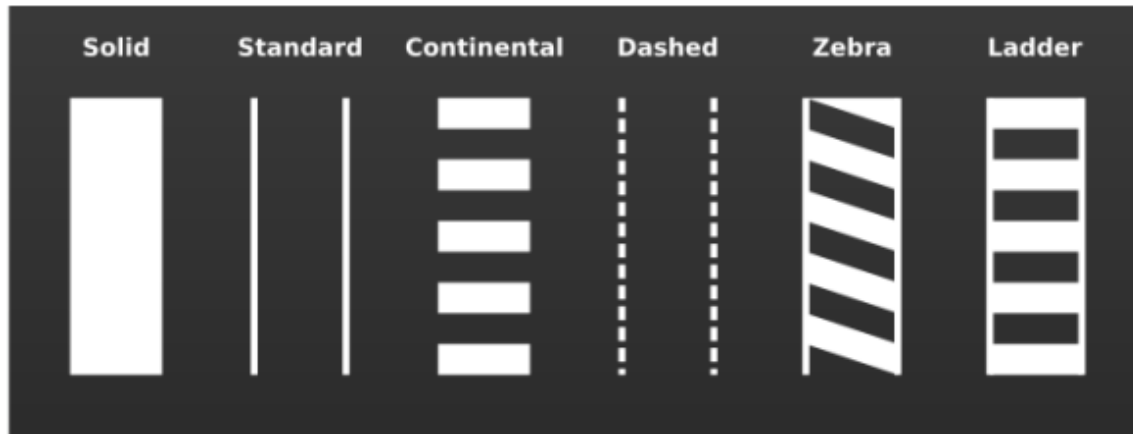


Figure 4.5 Crosswalk styles. Source: SF Better Streets

The recent increase in resolution and coverage of satellite and Street View imagery, combined with advanced computing technologies including machine learning and artificial intelligence, offers an unprecedented opportunity to produce this data at scale. The application of computer vision on Google Street View (GSV) has demonstrated emerging interests at the intersection of computer science and planning literature in the past decade. Particularly, the application of image classification, image segmentation, object detection, and representation learning on street view imagery has the potential to identify the presence or obtain fine-grained built environment measures (Li & Sheng, 2022). Using this computer vision approach, I first generate a national longitudinal crosswalk dataset from GSV imagery, then take a subset of the data for the Bay Area analysis in this study.

The original national dataset documents the historical presence of crosswalks at 38,350 unique intersections within a 250-m buffer of 4,417 transit-oriented development (TOD) stations in the United States from each year between 2007 and 2020. The project obtained GSV imagery capturing all historical panoramas (360-degree views) within 15 meters of each intersection. For each year from 2007 to 2020, we selected the panorama closest to each intersection when more than one panorama was available. We removed all panoramas captured indoors. To minimize optical distortion, we used a flat horizontal pitch and split each 360-degree panorama into four 90-degree images of size 640 pixels by 640 pixels with North, East, South, and West headings respectively. This gave us a total of 230,536 unique panoramas and 922,144 images. On average, each intersection has 6 years of Street View images available out of the 14 consecutive years (2007-2020) investigated. Most of the years have more than 20% of the intersections covered by Google Street View. Technical details of the data generation process are documented in a related paper derived from this project (Li et al., 2022). Figure 4.6 illustrates the model deployment pipeline to generate inference results of the presence of marked crosswalks and high-visibility crosswalks at intersection locations. We made imputations to fill the gaps where Street View images were not available for certain location-year.

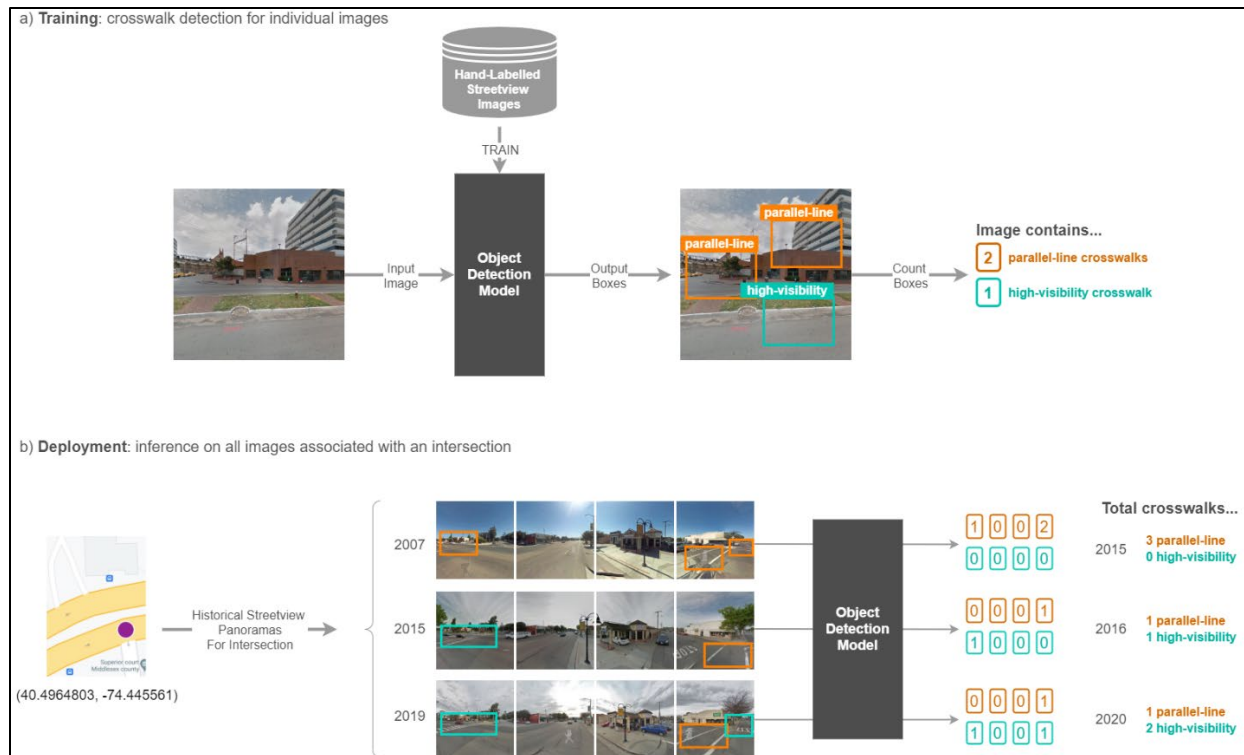


Figure 4.6 Schematic diagram of model deployment (Li, et al., 2022)

I use a subset of this data by looking at the intersections at the direct proximity of 72 BART and Caltrain stations in the study area. The longitudinal dataset makes it possible to systematically measure changes across years.

Plan data

With assistance from the California Active Transportation Safety Information Pages (CATSIP) and web search tools, I collected all active transportation master plans (including bicycle and pedestrian plans) published by each county and municipality since 2007. I document the type of plans, initial publishing year, versions of plan updates by year for each jurisdiction which has at least one BART or Caltrain station. I approximate the year indicated in the plan's title as the initial year of plan implementation. A majority of the counties or municipalities have at least one type of plan implemented over the years. I determine whether a plan has explicitly mentioned the crosswalk treatment by searching for the word "crosswalk" in the document and examine the content. I match each station with a municipality, or county unincorporated area. As Figure 4.7 Number of proposed plans by year at sample station shows, a majority of planned treatments were proposed in the BART and Caltrain by respect jurisdictions during the study period between 2011 and 2020.

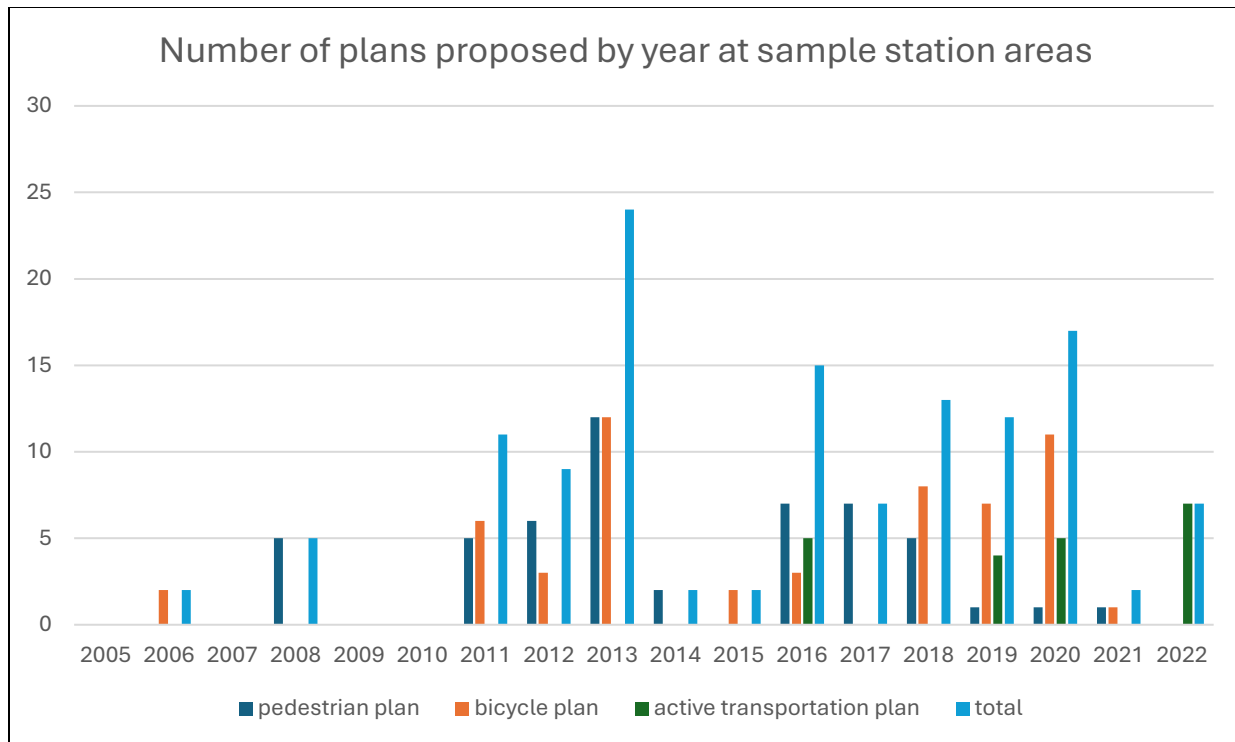


Figure 4.7 Number of proposed plans by year at sample station areas

Other data

I utilize several other data sources including Environmental Protection Agency (EPA)’s Smart Location Database (SLD) (EPA, 2021), the Transportation Injury Mapping System (TIMS), as well as BART and Caltrain ridership reports to account for station specific characteristics. The 2020 version of SLD combines several aspects of the built environment measures such as density and centrality at block group level derived from 2018 American Community Survey (ACS) 5-year estimate and 2018 HERE Maps NAVSTREETS. I aggregate the SLD measures to an average of all census block groups that intersect with the half-mile buffer of each station, a larger buffer than the crosswalk measure considering the neighborhood scale influence of these measures. The TIMS data developed by Berkeley’s SafeTREC has geocoded crash records for the state of California over time. I summarize the number of pedestrian-related crashes as well as the severity of these crashes within each station area per year. I derive pedestrian exposure measure by combining the February BART and Caltrain average weekday ridership along with estimated share of pedestrian access to each station from an MTC regional transit onboard survey conducted in 2012.

4.5. Findings

I discuss findings from content analysis of plans in terms of recommendations for crosswalk enhancements, as well as the model results assessments of recommendations in this section.

4.5.1 Recommendations for Crosswalk Enhancements in the Plans

According to data from the California Active Transportation Safety Information Pages (CATSIP), 65 out of the 110 Bay Area jurisdictions have so far proposed at least one type of active transportation plan, including 53 pedestrian plans, 60 bicycle plans, and 18 combined active transportation plans. Most jurisdictions have started adopting active transportation plans since 2006, with more cities and counties contributing to the trend throughout the past decade. Twenty-six out of the 41 Bay Area jurisdictions municipalities with BART or Caltrain stations (Figure of Appendix D), including three counties and 23 municipalities (63% of all jurisdictions) that have adopted some form of pedestrian master plans between the 2010 and 2020. Most citywide pedestrian plans came much later than bicycle plans in the same jurisdiction. Some of them were derived from a component of city general plans. Some cities adopt a combined bicycle and pedestrian plan succeeding a bicycle plan by adding a pedestrian component to the previous plan.

All except for one plans have included crosswalk visibility enhancements in various forms (See Table D in Appendix D). Most plans first evaluate the existing conditions of crosswalks, then identify the gaps and priority areas for safety improvements, and recommend crosswalk enhancements. Recommendations for crosswalk enhancement present in the form of capital projects, Safe Routes to School/Transit programs, crosswalk improvement guidelines, recommended crosswalk improvements, and site-specific recommendations. For example, City of San Mateo's Citywide Pedestrian Master Plan outlines citywide safety laws and crosswalk conditions in the Existing Conditions chapter (Figure 4.8); City of Burlingame provides a general toolkit for crosswalk safety and accessibility solutions in the Recommendation chapter (Figure 4.9); City of South San Francisco has site-specific recommendations for cost estimation purpose in its Pedestrian Master Plan (Figure 4.10).

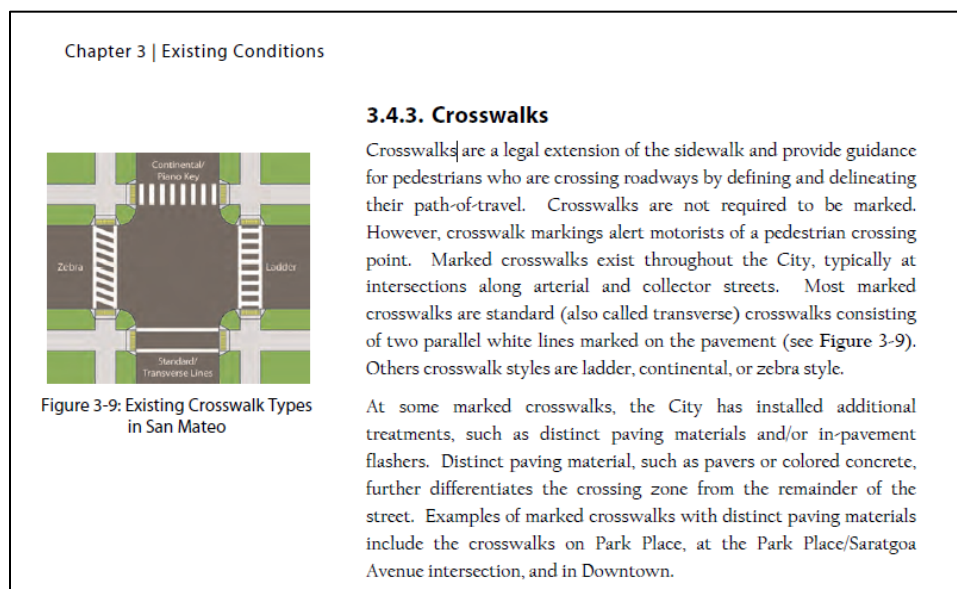


Figure 4.8 Existing conditions of crosswalks in Citywide Pedestrian Master Plan (City of San Mateo, 2012)

04. RECOMMENDATIONS

The toolkit below is not an exhaustive list of potential solutions. Exact solutions for each location should be selected based on engineering and planning judgment and best practices to maximize safety and pedestrian accessibility.

Pavement Markings & Crosswalks

Advance Stop & Advance Yield Markings

Advance yield pavement markings, also referred to as “Shark’s teeth,” are markings placed on the roadway 20’-50’ before a mid-block crosswalk or crosswalk at an intersection approach without a signal or stop sign.

Stop lines are solid white lines that extend across approach lanes. They may be used to indicate the point behind which vehicles are required to stop in compliance with a STOP sign, or some other traffic control device that requires vehicles to stop.



Crosswalks

All crosswalk recommendations are subject to a pedestrian needs analysis to determine the safest, most efficient location to install the crosswalk.

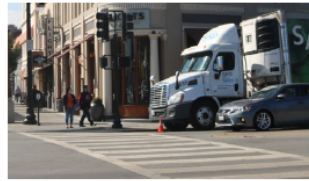
Crosswalks

Transverse crosswalks consist of two thick lines that demarcate pedestrian right-of-way at intersections. High-visibility crosswalks are crosswalks that are marked with thick bars, drawing additional attention and awareness to the crossing. There are multiple high-visibility crosswalk designs (continental ladder, etc.).

In school zones, these crossings are yellow, as opposed to the standard white color.

Decorative Crosswalks

Decorative crosswalks can add a placemaking element to the street, while still serving the primary visibility and awareness objectives of a marked crosswalk. Decorative crosswalks can be themed to reflect the surrounding neighborhood or nearby destinations. Decorative crosswalks meet certain design parameters to remain compliant with state and federal standards; most importantly that they include the transverse markings around any decorative pavement treatment.



Raised Crosswalks and Raised Intersections

A raised crosswalk is a modification of a speed table. Speed tables reduce vehicle speeds by elevating the entire wheelbase of a vehicle (unlike a speed bump that raises each axle individually). Speed tables can be designed to include a mid-block raised crosswalk; in these cases, the height of speed table matches the sidewalk. This treatment makes pedestrians more visible to approaching motorists and also slows vehicles.

Figure 4.9 Crosswalk recommendations in Bicycle and Pedestrian Master Plan (City of Burlingame, 2020)

ID #	Location	Recommendations	Detailed Recs
1-1	McLellan Drive and Mission Road	Extend median and add a median tip on the east leg of the crossing	Vertical Median
1-1			Concrete Surface
1-1			Remove Thermoplastic Lane Striping
1-1		Add school zone features at all four legs of the intersection; include high visibility yellow crosswalks, advance pedestrian crossing signs, and advance stop bars at all legs (El Camino HS is located at the southeast corner)	High Visibility Crosswalk Restriping
1-1			New Signage
1-1			Advance Stop Bars
1-2	McLellan Drive from Mission Road to El Camino Real	Install sidewalk on north side of McLellan Drive between Mission Road and BART station entrance	Sidewalk
1-2			Curb and Gutter
1-2		Install bulb out on northeast corner of El Camino or provide medians and pedestrian refuge to shorten crossing distance	Neckdowns/ Bulb-Out
1-2			Advance Stop Bars
1-2		Improve existing median island between BART/Trader Joe driveways and El Camino Real	Vertical Median
1-2			Concrete Surface

Figure 4.10 Site-specific recommendations in Pedestrian Master Plan (City of South San Francisco, 2011)

4.5.2 Station Area Crosswalk Visibility Enhancement Over Time

Given the different levels of details specified in each plan, the implementation pathways of crosswalk enhancements vary across each station area's jurisdiction. Comparing the first and last year of the study period, many station areas follow the pathway of upgrading from parallel-line crosswalks to high-visibility ones, especially where the jurisdictions have adopted pedestrian master plans (Figure 4.11). This is evident by the dropping of average percent of parallel-line crosswalks (from above to below 80%) and the increase of percent of high-visibility crosswalks (from around 50% to above 60%) around BART and Caltrain station areas during the period (Figure 4.12). Notably, Caltrain station areas had more significant changes than BART, but with overall similar levels of high-visibility crosswalk coverage in both the beginning and end of the period.

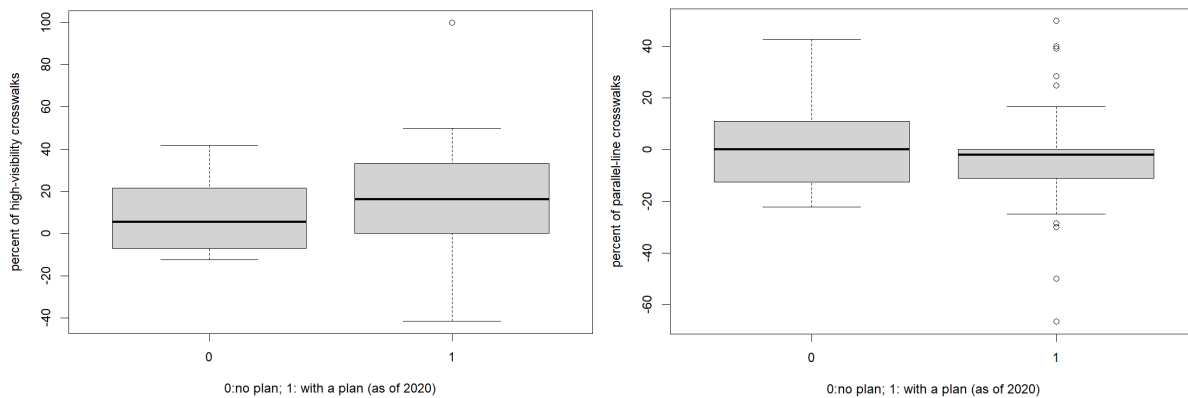


Figure 4.11 Distribution of the percent coverage of high-visibility crosswalks around stations with and without a plan



Figure 4.12 Average percent of marked crosswalk coverage around station areas (2011-2020); left: parallel-line crosswalks, right: high-visibility crosswalk, note y-axes are of difference scales.

Station areas saw various pathways to change during the study period. Figure 4.13 shows the changes in parallel-line and high-visibility crosswalk coverages in each BART and Caltrain station area across the ten-year period between 2011 and 2020. Most station areas followed the general trend with upgraded parallel-line to high-visibility crosswalks (i.e., towards the first or second quadrant), especially those that had lower coverages of marked crosswalks in the first year, for example, 22nd Street Caltrain, Glen Park, and South Hayward. Among these three stations, 22nd Street Caltrain and Glen Park stations fall into the jurisdiction of the City and County of San Francisco which has adopted a citywide pedestrian strategy in 2013 built on the Better Streets Plan (2010), while South Hayward sits in the City of Hayward whose first bicycle and pedestrian master plan did not come out until the end of study period in 2020.

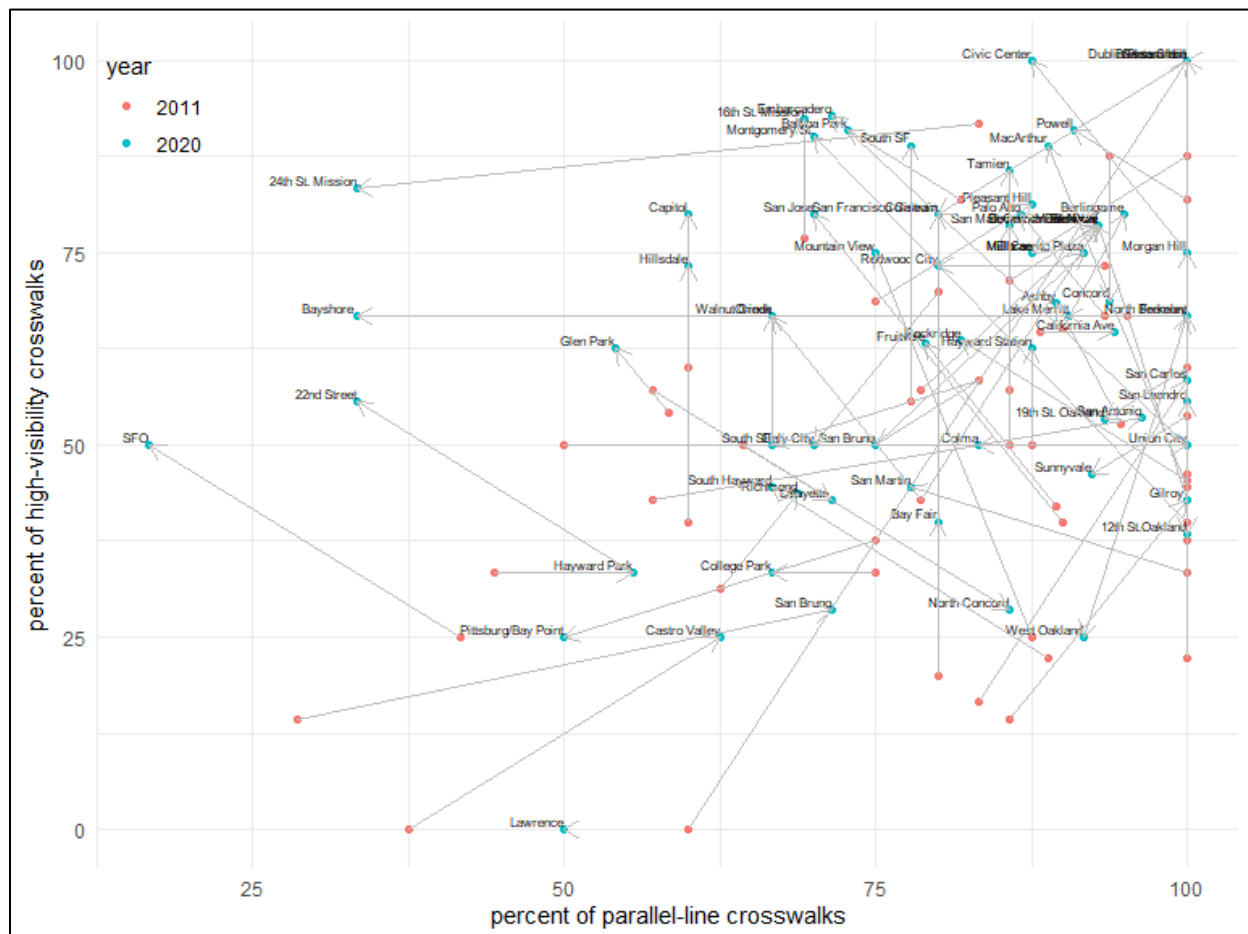


Figure 4.13 Pathways to change for crosswalk visibility enhancement in each BART and Caltrain station area between 2011 and 2020

The San Francisco Pedestrian Strategy (2013) identifies one adjacent street surrounding Glen Park BART station as one of the high-priority streets “repaving projects do not yet include pedestrian improvements” (Figure 4.14). It is unclear when exactly the improvements were implemented, but it turns out that there has been a steady increase (from 54% - 63%) in the percent of high-visibility crosswalks over the years.

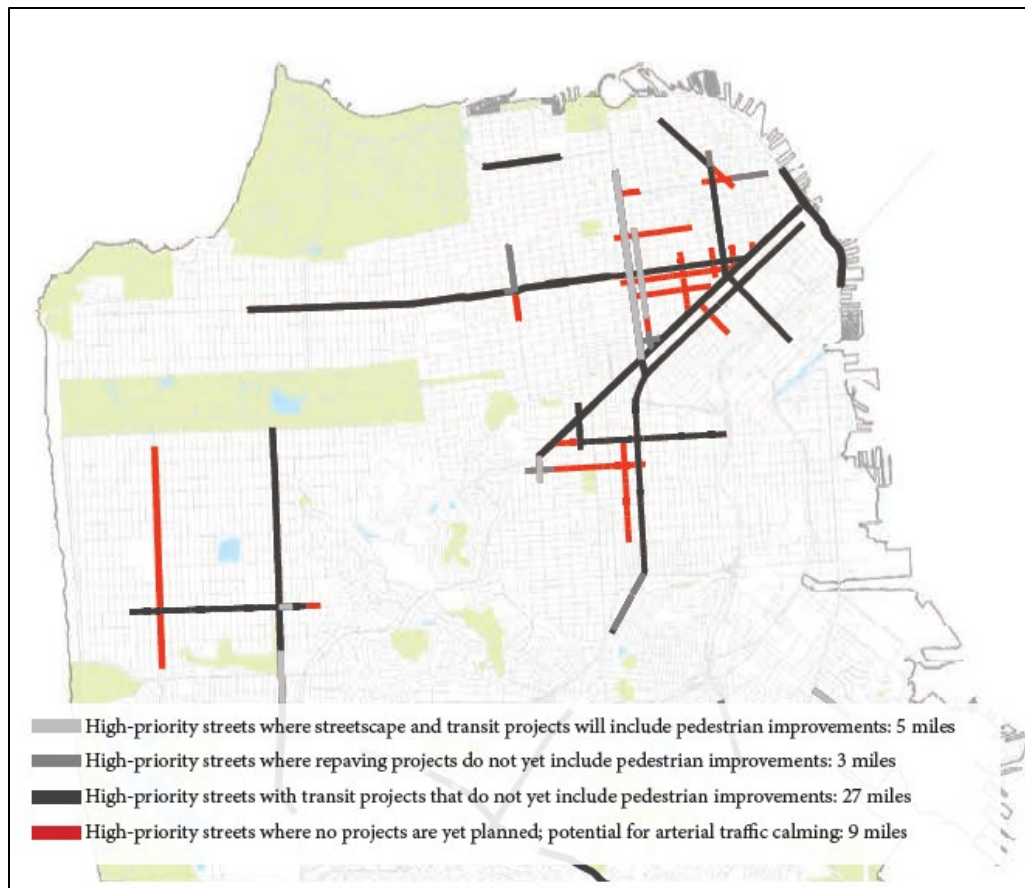


Figure 4.14 Complete Street integration and pedestrian safety and walkability improvements in San Francisco Pedestrian Strategy (April 2013)

There was no mention of any site-specific recommendation for the 22nd Street Caltrain station or the South Hayward station. Nevertheless, both station areas caught up in high-visibility crosswalk coverage over the years. The greatest improvements happened in station areas with the lowest level of high-visibility crosswalk coverage to start with. Most station areas' trajectories stay in the first quadrant where the more urban station areas tend to have higher levels of crosswalk enhancements with smaller changes over time, regardless of plans.

4.5.3 Effects of Active Transportation Plans on Crosswalk Visibility Enhancements

Table 4.1 summarizes the dependent and independent variables included in the models. On average, over 90% of station area intersections had marked crosswalks installed but only 55% had high-visibility crosswalks. About two third of the jurisdictions among the study sample had at least one type of active transportation plan implemented over the years, and average length of plan implementation is 5 years. About 26% of the station area had plans with an update during the study period, and around 59% of the station areas were associated with a city and county level plan that specify the crosswalk enhancement recommendations.

Table 4.1 Summary statistics of variables (N= 720)

Variable	Mean	St. Dev.	Min	Max
percent coverage of parallel-line crosswalks	80.85	18.96	0.00	100.00
percent coverage of high-visibility crosswalks	54.68	22.41	0.00	100.00
percent coverage of marked crosswalks	90.23	14.83	0.00	100.00
average weekday ridership at station	6,168	7,602	19	46,076
percent of pedestrian access to station	40.89	23.61	0.00	93.88
presence of fatal or severe injury pedestrian crash	0.17	0.37	0.00	1.00
percent of zero vehicle household (2008)	13.79	13.53	1.79	62.00
population density (2008)	14.03	12.61	0.41	60.64
presence of plan	0.67	0.47	0.00	1.00
age of initial plan by years	4.90	5.07	0.00	18.00
number of updates	0.26	0.47	0.00	2.00
presence of crosswalk enhancement	0.59	0.49	0.00	1.00
observation year	2016	3	2011	2020

Table 4.2 shows the model estimates for each of the three crosswalk visibility enhancements: parallel-line, high-visibility, and marked crosswalks in station areas. I use separate models to compare the effects of plans to different types of treatments. The model results suggest several trends in crosswalk enhancements as a result of pedestrian master plan adoption between 2010 and 2020 (

Table 4.2). First, there has not been a significant change in the percent coverage of marked crosswalks in selected station areas, as indicated by the year coefficient for the marked crosswalk model. However, as the plan got older, the coverage of high-visibility crosswalks improved. Assuming the initial year of the plan indicates the year of adoption, the longer an active transportation plan remains adopted, the percent coverage of high-visibility crosswalk increases. Specifically, one more year of pedestrian plan adoption is associated with 1.6% more coverage of high-visibility crosswalks around the station area. Conversely, the presence of a plan alone was not significantly associated with the share of intersections with crosswalk visibility enhancements. Second, there was a constant trend of decrease in parallel-line crosswalks over the period (negative time fixed effect in the second model), which implies the upgrading or replacement from traditional parallel-line crosswalks to high-visibility ones. In fact, the first model shows a significant decrease over the years in parallel-line crosswalks, by an average of 0.66% per year. Third, station area household vehicle ownership, and population density both had moderating effects on the changes in parallel-line crosswalks by plan adoption. Station areas with a higher percent of zero vehicle households tend to receive more parallel-line crosswalks with the presence of plans, whereas the age of plan added more negative effects with more zero vehicle households. Higher density areas had more elimination of parallel-line crosswalks with crosswalk enhancement recommendations in the plan. Finally, severe or fatal-injury pedestrian

crashes and station area pedestrian exposure (*average weekday ridership * percent of pedestrian access*) both had positive associations with high-visibility crosswalk coverage. Overall marked crosswalk coverage was primarily associated with pedestrian exposure to station access.

Table 4.2 Panel regression results (clustered standard errors in parentheses)

	<i>Dependent variable:</i>		
	% parallel	% high-viz	% marked
<i>presence of plan</i>	1.078 (5.151)	-16.829 (10.679)	1.342 (2.600)
<i>age of initial plan</i>	0.439 (0.456)	1.600 * (0.825)	0.009 (0.376)
<i>number of plan updates</i>	-6.390 (4.881)	-6.015 (4.470)	-3.220 (3.376)
<i>presence of crosswalk enhancement</i>	4.556 (4.913)	13.278 (10.925)	2.584 (3.020)
<i>presence of plan * percent of zero vehicle household (2018)</i>	0.605 *** (0.220)	-0.079 (0.589)	0.086 (0.177)
<i>age of initial plan * percent of zero vehicle household (2018)</i>	-0.035 * (0.018)	-0.004 (0.062)	0.002 (0.010)
<i>number of plan updates * percent of zero vehicle household (2018)</i>	0.082 (0.151)	0.064 (0.250)	0.031 (0.070)
<i>presence of crosswalk enhancement * percent of zero vehicle household (2018)</i>	0.176 (0.203)	-0.323 (0.375)	0.017 (0.141)
<i>presence of plan * population density (2018)</i>	0.123 (0.170)	0.940 (0.872)	0.124 (0.227)
<i>age of initial plan * population density (2018)</i>	0.016 (0.014)	-0.025 (0.031)	0.006 (0.013)
<i>number of plan updates * population density (2018)</i>	-0.058 (0.140)	0.053 (0.160)	-0.030 (0.115)
<i>presence of crosswalk enhancement * population density (2018)</i>	-0.449 ** (0.189)	-0.223 (0.775)	-0.068 (0.236)
<i>average weekday ridership * percent of pedestrian mode of access to station</i>	0.0001 (0.000)	0.001 *** (0.000)	0.0002 * (0.000)
<i>presence of fatal or severe injury pedestrian crash</i>	0.306 (1.272)	3.964 ** (1.955)	0.254 (0.942)
<i>year</i>	-0.662 * (0.377)	0.770 (0.515)	-0.030 (0.290)

	<i>Dependent variable:</i>		
	% parallel	% high-viz	% marked
Observations	720	720	720
R ²	0.126	0.166	0.047
Adjusted R ²	0.059	0.102	-0.026
F Statistic (df = 15; 668)	6.401 ***	8.844 ***	2.191 ***
<i>Note:</i>		* <i>p</i> <0.1; ** <i>p</i> <0.05; *** <i>p</i> <0.01	

While results from statistical analysis provides insight into the association between plans and crosswalk visibility change, qualitative assessment of the plans helps to identify the variations in crosswalk enhancement pathways across station areas and jurisdictions.

4.6. Discussion and Conclusion

This chapter uses a mixed method approach to investigate the trends and implementation pathways of pedestrian infrastructure enhancements around BART and Caltrain stations in the San Francisco Bay Area. It utilizes several novel datasets generated from unstructured data with statistical modeling, to systematically examine the built environment changes and their association with plans at a high spatial-temporal resolution. While our previous study found a general trend of marked crosswalk replacement over time (Li et al., 2022), findings from this chapter suggest the potential role of plans in making effective changes in marked crosswalks at station area intersections, as well as the interactive effects contributed by a variety of station area characteristics. The upgrading and addition of high-visibility crosswalks exhibit an overall improvement of pedestrian environment. While previous studies shows no significant relationship between plan implementation and the increase of walking (Duncan, 2023), this study does show that the presence of plan can have some intermediary effect on the positive change to the built environment in terms of pedestrian safety enhancement that can lead to more pleasant pedestrian experience.

However, the statistical models present weak or no statistically significant associations between most indicators of plan implementation (i.e., presence of the plan, updates, and age of initial plan) and pedestrian infrastructure improvements. The results imply little relevance of the question whether a local jurisdiction should put down specific recommendations to pedestrian or active transportation master plans. Indeed, pedestrian environment enhancements could take place through other street enhancement programs such as Safe Route to Schools, Vision Zero, and Complete Streets. Many other unobserved factors could also influence the effectiveness of plan implementation, for example, targeted funding support for active transportation infrastructure, advocacies and community support. This finding, to some extent, corroborates with those studies on other types of plans suggesting little causal impacts of plans the codify policies that are likely to happen regardless of the plans (Millard-Ball, 2013).

4.6.1 Limitations and Future Studies

A few limitations remain in the models that require further development to improve the model validity. In this study, I only examine the crosswalks at intersection locations, which do not include the midblock crosswalks. Moreover, by visually observing the stripping changes, I ignore the signaling improvement, which serves as an important safety countermeasure. Since crosswalk visibility enhancements are primarily prioritized at uncontrolled crosswalk locations, the observed changes do not reflect the crosswalk overall safety improvement at signalized intersections. Furthermore, attributing station area road improvements to city or countywide pedestrian master plans simplifies issues such as road ownership and funding allocation. A few other factors such as external funding support for active transportation projects and advocacies also add to both the adoption of plans and crosswalk visibility enhancements. Therefore, the goal of this study is not to claim the causal relationship between plans and crosswalk visibility outcomes, but to show the associations that could elucidate the direction for more in-depth assessment, both quantitatively and qualitatively.

Future studies could benefit from exploring other crosswalk safety countermeasures than visibility enhancement, as well as funding mechanisms. The model could also investigate different units of analysis, for example, instead of an aggregate measure for each station area, the comprehensive crosswalk dataset enables intersection level analysis. To improve the model validity, a change-on-change model would be helpful to identify the causal relationship between specific treatments recommended in the plan and the changes in pedestrian infrastructure. Moreover, instead of one year of time lag, the model should also consider a longer period for plan adoption to come into effect. Finally, some unobserved confounders such as activists' influence on plans and implementation need further investigation.

Chapter 5 Two Cultures of Walking: Observing Station Area Pedestrian Behaviors in Hong Kong and San Francisco

5.1. Introduction

Hong Kong and the San Francisco share many common strategies to design street space for pedestrians, though they seem to possess two distinct cultures of walking on the backdrop of their own street dynamics. From a U.S. perspective, density and accessibility naturally make it easier to walk (including walking to transit) than to drive in the current streetscape, although it turns out historically as a result of power shift between pedestrians, cars and other road users on street space (Norton, 2008). In Hong Kong the public discontent about poor pedestrian environment provokes questions concerning the relationship between a *walking city* and a *walkable city*. The former makes people walk while the latter makes people enjoy walking. Since urban form and land use pattern predetermine the travel options (Zhang, 2006), walking in Hong Kong is not about a choice but a necessity. One local news article alleged, “Hong Kong should be the best place for foot traffic, except for the fact that it’s not...”

Design choices do not necessarily support the best user experience. While in the Bay Area, some transportation planners find physical separations between pedestrians and automobiles such as the use of metal fences desirable for enhancing safety, the fences are considered by Hong Kong public space activists as a symbol of car superiority that exploits pedestrian right of way. Whereas in the Bay Area, marked crosswalks, especially high-visibility ones are getting increasingly popular (see Chapter 4), in Hong Kong, traffic engineers remove marked crosswalks because they find them ineffective in directing high-volume pedestrian flows – *people are going to jaywalk anyway*. The list of contrasting examples can go on and on. Do pedestrian behaviors vary across cultures? Are they affected by the built environment, or culture, or both? How can street design accommodate for different pedestrian experience? Although there is no simple answer to these questions, the answers depart from built environment and travel behavior literature, but rather on human-environment interactions, the experience of walking aside from levels of walking.

Earlier chapters of this dissertation describe important differences in the actors, institutions, and motivations around active transportation planning in Hong Kong and the Bay Area. They identify the stakeholders who lead the street reform or are involved in active transportation planning in both contexts. They also spot the gaps that remain in the implementation of pedestrian infrastructure improvements. Much tension in Hong Kong emerges from the relationship between road users, especially pedestrians and cars, whereas in the Bay Area implementation of

pedestrian safety enhancements vary across jurisdictions. What remains to be explored is relationship between street design and pedestrian behaviors.

Although seemingly a provocative comparison, only a handful of empirical studies have drawn comparisons between Asian and American cities. The global metropolitan scale study by Newman & Kenworthy (1989) made the case of comparing Hong Kong and San Francisco in that they represent two contrasting urban forms at the density-energy consumption spectrum. Some other regional scale studies compare urban spatial structure and travel behaviors between Hong Kong and U.S. cities. For example, Zhang (2004) compares the spatial structure and travel mode choice in Hong Kong and Boston, which confirms the independent role of land use on travel choice from travel and time costs. Monkkonen & Zhang (2014) compare and contrast the spatial segregation patterns of Hong Kong and San Francisco. Nevertheless, no study has explored the similarities and differences of pedestrian behaviors across different urban form contexts.

This chapter delves into the user perspective to examine the interactions between pedestrians and the built environment, specifically the behavioral responses to pedestrian infrastructure improvements in the contexts of Hong Kong and the San Francisco Bay Area. By comparing pedestrian behaviors across cultures, the nuances can inform context-sensitive street design and traffic management in a global sustainable transportation policy transfer (Klotz et al., 2019).

5.2. Literature

5.2.1 Human Scale Design and People-Centered Approach to Pedestrian Planning

Planners and urban designers have since the last century explored various approaches to study human activities in public space so as to inform design interventions. These approaches support the prevalent urban design principle by Danish architect and urban designer Jan Gehl that urban environments should be designed at a human scale, where streets and public spaces should meet the needs and experience of pedestrians, which can in turn create walkable neighborhoods with accessible amenities (Gehl & Rogers, 2010). This principle has also largely influenced the urban design practice worldwide through popular design manuals such as the National Association of City Transportation Officials (NACTO) Urban Street Design Guide (National Association of City Transportation Officials, 2013), which outlines guidelines and best practices for people-centered street design that prioritizes public life and safety of all road users.

Jan Gehl's approach emphasizes the use of established tools developed in environmental research. These tools rely on direct observation and systematic analysis of how people use and move through public spaces to gain insights into how to utilize public spaces (Gehl & Svarre, 2013). Through the basic tools of observation and interviews, Whyte (1980) studied social interactions accommodated by many small public spaces in the 1980s. A similar approach was applied and documented in an early systematic study of the pedestrian activities by the Regional Plan Association (Pushkarev, 1975).

In recent years, urban researchers broadened the toolkit to provide an even more comprehensive representation of pedestrian behaviors and their interactions with the built environment. For example, Kim (2012) uses an integration of surveying and ethnography to understand the spatial dynamics of mixed-use sidewalk space in Ho Chi Minh City, Vietnam. With the rise of AI and machine learning technologies, some scholars apply computer vision to systematically detect pedestrian environment and walking behaviors (Basu & Sevtsuk, 2022; Hosseini et al., 2023, 2024; Li et al., 2022; Yilmaz & Kurkcuglu, 2024). These technological advances open the door for examining the various aspects of pedestrian interaction with the human scale environment.

5.2.2 Built Environment and Pedestrian Safety

The primary goal of the pedestrian environment enhancements as promoted in different levels of pedestrian plans including active transportation plans, Complete Street, Vision Zero initiatives, Safe Routes to Schools programs all over the world, is to improve road safety while to promote walking by enhancing pedestrian experience.

Many studies have associated built environment features with pedestrian crash risk. For example, Merlin et al. (2020) review literature on relationship between the built environment and road safety, and identify built environment measures as being related to higher exposure or higher rates of crash risk per unit of exposure. Cho et al. (2009) demonstrate a simultaneous but opposite relationship between perceived safety of the built environment and actual crash risks of pedestrian and bicyclist. On road infrastructure, the Federal Highway Administration (FHA) has suggested 28 safety countermeasures and strategies in reducing roadway fatalities and serious injuries (Federal Highway Administration, n.d.), which include eight pedestrian-related safety countermeasures: crosswalk visibility enhancements, leading pedestrian interval, medians and pedestrian refuge islands in urban and suburban areas, pedestrian hybrid beacons, rectangular rapid flashing beacons (RRFB), road diets, and walkways.

5.2.3 Cultures and Human Behavior

Previous studies have made the case for comparing individual behaviors across cultures. For example, Awad et al. (2018)'s *Moral Machine Experiment* reveals cross-cultural ethical variations from a 2.3 million-people decision sample in 233 countries around the world, which identifies substantial difference in key moral preferences in autonomous driving scenarios. A follow-up study shows that people from Western countries are more likely to endorse sacrifice than people in Eastern countries, reflecting an individualist-collectivist division and an obstacle for implementing universal machine ethics across cultures (Awad et al., 2020). A few other psychological studies conduct cognitive experiments verifying the different capability of incorporating contextual information between individuals from Asian and North American countries, and that individuals tend to show the cognitive characteristics common in the host culture (Kitayama et al., 2003).

Culture, custom, and habit as well as policy context all tend to play a role in determining the effectiveness of sustainable transportation policy interventions (Pucher et al., 2010). Some

studies attempt to capture the impact of social and cultural heterogeneity through cross-country comparison. They compare the relationship between the built environment and travel behavior characteristics in different countries. For example, Giuliano & Narayan (2003) show that the density impact on travel in the U.S. is not as significant in Great Britain. Similarly, Guerra et al. (2020) reveal opposite directions of density impact on cycling between Mexican and U.S. cities, possibly due to the fundamental difference in land use patterns. Likewise, Guerra & Li (2021) find substantial differences in the strength and statistical significance of urban form variables on individual commute mode choice in the U.S. and Mexico, whereas policies to increase land use mix probably would not promote much walking in place where land use is already highly mixed. Among European countries, cyclists' travel behaviors exhibit differences across geographical, economics, climatic and socio-cultural contexts, though not as compelling as those across continents (Raser et al., 2018).

Few studies have yet drawn links specifically between pedestrian activity and the built environment, especially from a cross-culture comparative perspective. Just like travel behavior studies in general, most previous studies focus on aggregate behaviors and regional land use patterns rather than human-scale design. Furthermore, these studies seldom take into account other sensory aspects that people perceive within the environment, beyond visual or physical form. However, there has been an increasing interest in incorporating multimodal environmental sensors into the measurement of pedestrian comfort or experience (Dang et al., 2013). For example, Uttley & Fotios (2017) find the association between ambient light condition and pedestrian safety at crossings. Harvey (2024) evaluates the use of wearable biosensors to measure pedestrians' electrodermal activity (EDA) for understanding emotional responses to environmental design.

Using a human ecological approach, this study makes a comparison of human-scale pedestrian activities and interactions in not only different urban contexts, but also variations of the ambient environment. I aim to answer the research question: how do pedestrian behaviors differ across cultures? Specifically, I examine the behaviors at transit station area intersections.

5.3. Research Design

Given the policy relevance for implementing pedestrian-oriented street design, I compare the pedestrian environment, use of infrastructure, and walking behaviors at transit station area intersections in Hong Kong and San Francisco, in order to investigate the question of how street design can meet the needs for different pedestrian experience across two cultures. First, I inspect the pedestrian right of way in terms of time and space in both locations. Then I examine how pedestrians use space dedicated for them (i.e., sidewalks, crosswalks) the use of dedicated space (i.e., sidewalk, crosswalk) as well as their behavioral characteristics (e.g., walking speed, yielding, and traffic rule violation) in both places. My hypothesis is that pedestrian behaviors vary across cultures despite similar street design and traffic rules.

I first conduct a broad assessment of pedestrian environment at 270 intersections in 94 MTR station areas in Hong Kong, and 13 intersections in 11 station areas in the Bay Area. Then, I chose three case study station areas in each of the cities to compare pedestrian behaviors and interactions with the environment in both contexts by stratifying high, medium, and low pedestrian areas.

5.3.1 Identifying Locations for Measurement

In order to have a rich and diverse set of pedestrian infrastructure and behavior data, I focus on the intersections in proximity to Hong Kong MTR, BART and Caltrain stations, which are expected to have more dedicated pedestrian infrastructure and higher pedestrian volumes. As of the time of my fieldwork (2022), MTR operated 97 stations whereas BART and Caltrain operated 78 stations across both territories (Figure 5.1).

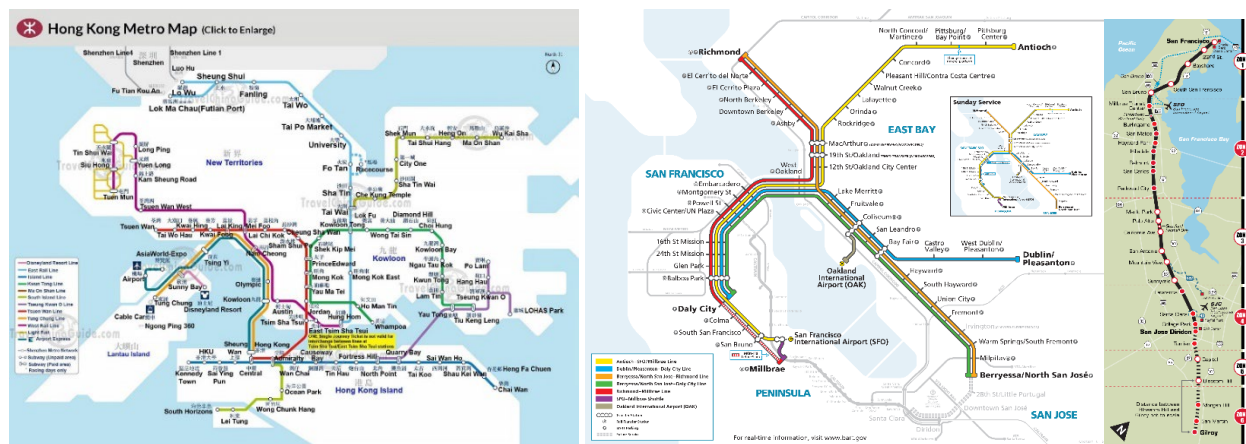


Figure 5.1 Systems maps of Hong Kong MTR, BART and Caltrain (2021)

I conducted fieldwork in Hong Kong over a three-month period between April and June 2022. I observed 94 out of the 97 MTR stations in Hong Kong, except for two terminal stations at the Hong Kong-Mainland China borders (Lo Wu and Lok Ma Chau), and the Racecourse Station that only opens on race days.

In the Bay Area, I observed 11 stations among the 78 BART and Caltrain stations in May, June 2023 and May 2024. The sample selection considers station typologies based on pedestrian volume and share of pedestrian access to each station from an MTC regional transit onboard survey conducted around 2012. Two of the three case study stations I chose for behavioral comparison (Powell Street and Montgomery Street) had the largest share of pedestrian access (89.17%, 93.88%) among all Bay Area stations, which is comparable to that of most MTR stations. The other station (Pittsburg/Bay Point) had the lowest pedestrian access rate at 12.27%.

I intersect a 250-m buffer around each rail station with street networks extracted from OpenStreetMap (OSM), and identify all intersections in each station buffer area. I label them on maps prior to the fieldwork to help navigate the locations (Figure 5.2). This list of intersections serves as the candidate locations for validation during the fieldwork. I further select a sample of

major intersections from the primary list after validation, which consists of 270 intersections in Hong Kong and 13 intersections in the San Francisco Bay Area.

5.3.2 Data Collection

Through a combination of tools and techniques including observation, videography, and environmental sensing. I gathered data on pedestrian activity and the environment. In person observation was documented manually using an observation sheet per station area. The observation sheets include the date, weather, station name, as well as the intersection ID, time, pedestrian infrastructure (i.e., marked or unmarked crosswalks), traffic control (i.e., signalized or unsignalized), light, noise level, air quality, and pedestrian flows (heavy, medium, or light). At each intersection, I set up a tripod attached to a GoPro device that recorded videos of pedestrian crossing for at least two signal phases or five minutes at unsignalized locations (Appendix E). While recording, I used an outdoor air quality monitor (Temtop M2000C) to measure levels of PM2.5, PM10, particles, CO₂, temperature, and humidity. I relied on two iOS Apps (i.e., Light Meter, Decibel X) to monitor the light and sound. I put down the environmental conditions measured by the monitors. At the same time, I took notes on other information such as weather and traffic conditions. The field data collection took a total of 30 days during the period between 2022 and 2024, which contributed to a dataset with 283 intersection locations (270 in Hong Kong, 13 in the Bay Area) around 105 rail stations (94 in Hong Kong, 11 in the Bay Area). I collected data only during the day, between the hours of 8am and 5pm, and when it was not rainy.

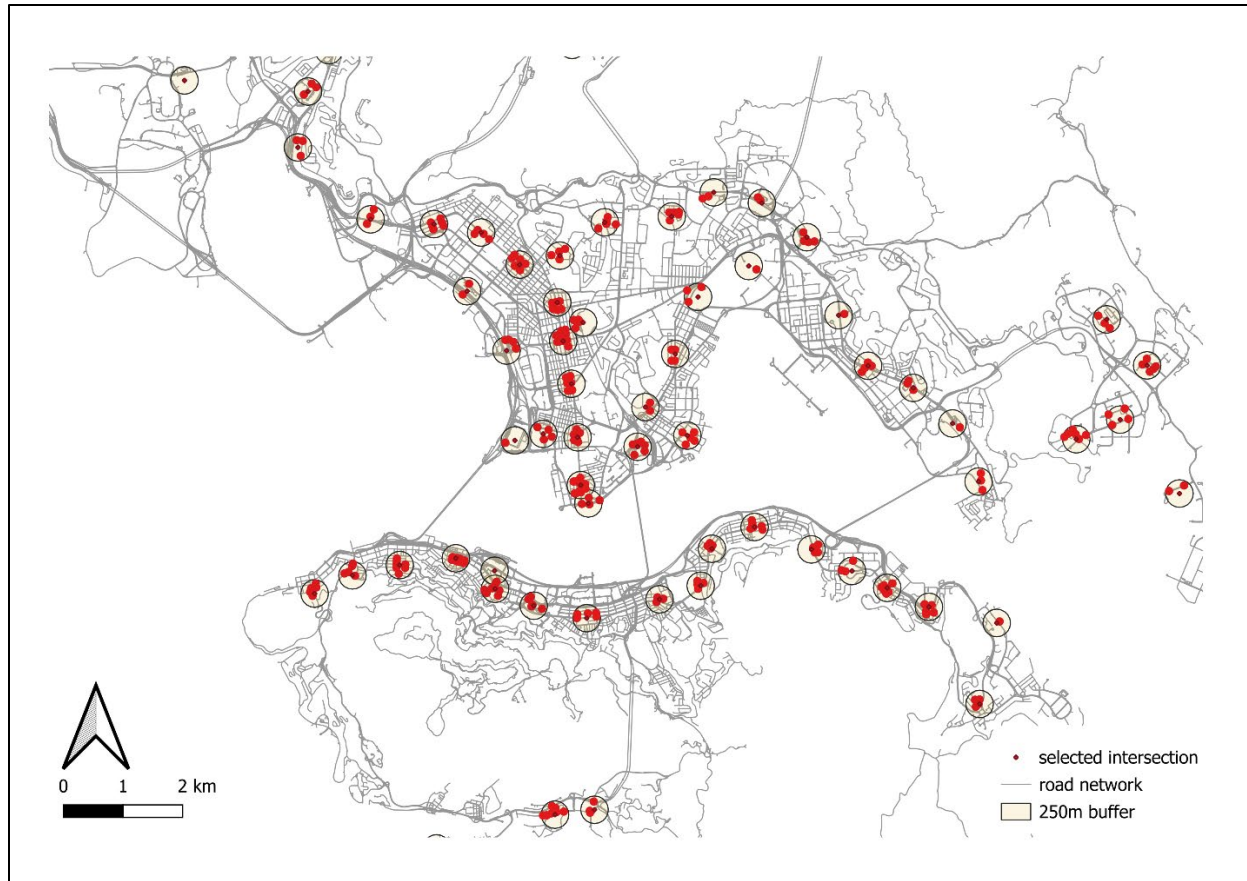


Figure 5.2 Sampling for MTR station area intersections

5.3.3 Data Analysis

I first summarize by system the data including street design (space configuration, right of way, infrastructure) and traffic rules (signal control, speed). Second, I compare the measures of the ambient environment (e.g., light, noise level, air quality, temperature, humidity), which helps to get an overall picture of the station area pedestrian environment in both places. Finally, I analyze a selected sample from both places with three types of station area intersections in terms of pedestrian flow density (heavy, medium, and light), in order to compare pedestrian behaviors and interactions with the environment. I determine the pedestrian density groups by relative pedestrian volume per minute compared with other stations in the system. For this smaller sample, I explore several measures of pedestrian activity with the assistance from Google Earth images and video footage. Specifically, I estimate the distribution of space dedicated to pedestrians, signal timing for pedestrians (if applicable), walking speeds, use of space, traffic rule violations by pedestrians and yielding behaviors. I develop and estimate for individual and aggregate pedestrian crossing behavior measures using the following methods.

Dedicated pedestrian area ratio

To calculate the ratio of dedicated pedestrian area ratio, I first identify the intersection area by connecting the stop lines at each approach and measuring the area within the polygon. Then, I estimate the total area of all dedicated marked crosswalks within this intersection. Finally, the ratio is calculated by dividing the area of marked crosswalks by total area of the intersection. For example, in Figure 5.3, the ratio can be estimated by the sum of green polygons divided by red polygon. This measure serves as an indicator for pedestrian right of way at that location.

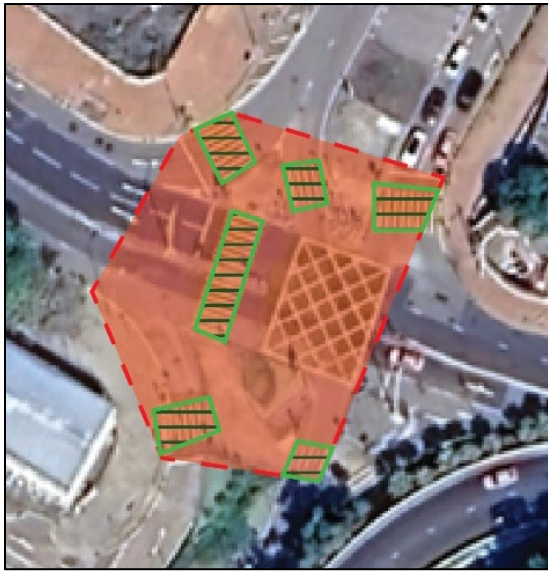


Figure 5.3 Diagram of dedicated pedestrian area ratio estimation (red: intersection area; green hatch: marked crosswalks)

Dedicated signal timing ratio

Dedicated signal timing ratio serves as a temporal indicator for the time allocation for pedestrian right of way during each signal phase. I record the length of a full traffic signal cycle length and dedicated pedestrian phase at each intersection. This measure takes the ratio of pedestrian phase divided by the full traffic signal cycle length. To ensure a stable measurement, I take the average duration of several full cycles throughout the time lapse of the videos.

Pedestrian use of space

Given the allocated pedestrian right of way in terms of space and time, I observe the use of dedicated right of way by pedestrians. Specifically, I estimate the average walking speed from crosswalk length and crossing time of all pedestrians observed in the video. At high pedestrian density locations, I select a sample of 10 pedestrians within one pedestrian phase. Moreover, I identify the hotspots of pedestrian paths on marked crosswalks in terms of the utilization of space and gap distances between pedestrians. These measures help to identify design gaps from pedestrian needs.

Traffic rule violation and yielding behavior

For pedestrians, traffic rule violations mostly refer to the mismatch between their walking behavior and the dedicated right of way by space and time, also known colloquially as *jaywalking*. Here I adopt the broad definition of *jaywalking* including crossing against a red light. Yielding behavior refers to whether vehicles yield to pedestrians at an uncontrolled intersection. I estimate the rates of both pedestrian jaywalking and vehicle yielding, and compare across Hong Kong and Bay Area locations.

Once I calculate all above measures, I compare each set of measures by intersection locations with similar pedestrian density from both places.

5.3.4 Selected Sample for Case Studies

Among the 105 observed station areas, I select six that represent high, medium, and low pedestrian flow from both Hong Kong and San Francisco Bay Area, which cover a wide variety of pedestrian environment and traffic conditions. Table 5.1 summarizes the ridership and pedestrian access data based on multiple sources.

By direct comparison, the MTR system carries more than dozens of times the passengers than the BART system, with a much denser station area pedestrian environment. I categorize stations based on relative pedestrian volumes observed at intersections within the station buffer areas compared with other stations within the same system (i.e., MRT or BART). Causeway Bay and Wan Chai stations (#5 and #90 in Figure 5.2) are situated at central locations of the Hong Kong Island. The areas around both stations are among one of the busiest districts, a major cultural and commercial center of Hong Kong. The Island Line which both stations belong to, has the third highest daily average patronage after the East Rail Line and Tuen Wan Line. Likewise, BART Powell and Montgomery Street stations are among the ones with the highest ridership and share of pedestrian access to station. Contrary to safety in numbers, the high-density pedestrian presence at these locations makes them hotspots for pedestrian-related crashes, according to the Hong Kong Traffic Injury Collision Database and the Transportation Injury Mapping System (TIMS). The two light-volume stations, South Horizon and Pittsburg/Bay Point are both terminus stations at the end of new transit lines in the residential areas.

Table 5.1 Selected case study stations

	Station	Ridership ¹	Pedestrian volume ²	Mode of access ³
Hong Kong	Causeway Bay	797,000	Heavy	Mostly pedestrian
	Wan Chai	797,000 ⁴	Medium	Mostly pedestrian
	South Horizon		Light	Mostly pedestrian
SF Bay Area	Powell St	29,363	Heavy	89.17%
	Montgomery St	43,823	Medium	93.88%
	Pittsburg/Bay Point	6,645	Light	12.27%

1. Hong Kong MTR station ridership based on daily average patronage of Island Line in 2010, and an estimate of that for South Island Line by MTR; (<https://www.tlb.gov.hk/eng/legislative/transport/replies/land/2011/201106083a.pdf>); SF BART ridership based on average weekday ridership in 2019 (the most recent pre-COVID year).
2. The pedestrian volume is relative to other station areas within the same system.
3. BART mode of access data from MTC regional transit onboard survey (2012).
4. The ridership level for Hong Kong stations are only available by line. Causeway Bay and Wan Chai MTR stations are both located on Island Line. The Causeway Bay station area has exceptionally high pedestrian density because of the commercial area and pedestrian zone.

5.4. Findings

5.4.1 Pedestrian Crosswalks in Hong Kong and the San Francisco Bay Area

At the intersection level, the pedestrian environment mainly consists of crossing facilities (i.e., at-grade or grade-separated walkways) and traffic signals. While a majority of station area crossings in the Bay Area are at-grade crossings, quite a number of MTR stations are accessed by grade-separated crossings such as a pedestrian footbridge or underground walkway (Figure 5.4). The use of grade-separated crossings according to the Transport Department, ensures safety for pedestrians and minimizes disruption to vehicular traffic. However, to some public space activists, overly relying on grade-separation design prioritizes cars by sacrificing pedestrian right of way, which makes it inconvenient to cross, and pedestrians disconnected to place. The Bay Area, on the other hand, does not have as many dedicated pedestrian facilities as Hong Kong. According to the findings in the previous chapter, the average coverage of high-visibility crosswalks among Bay Area stations is around 55%. Whilst 63% of pedestrian crossings in the 270 observed locations in Hong Kong, have painted markings, many of the remaining ones have grade-separated crossings or dedicated walking paths.

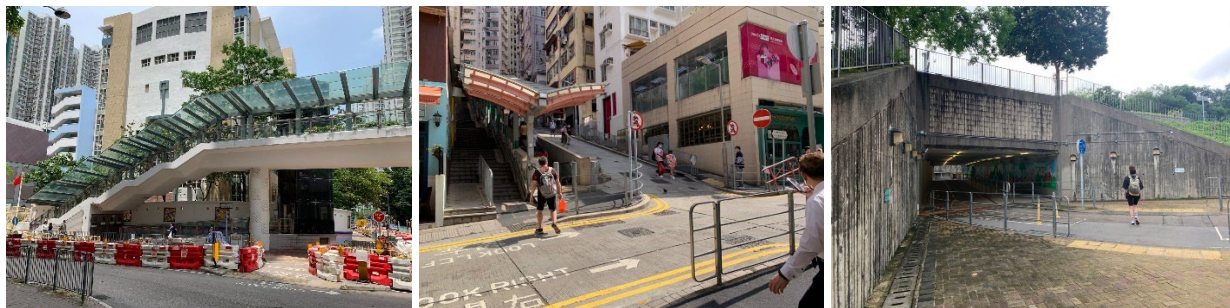


Figure 5.4 Pedestrian crossings in Hong Kong

Figure 5.5 shows two typical signal-controlled intersections with marked crosswalks in Hong Kong and San Francisco. All signal-controlled crosswalks in Hong Kong are delineated by yellow striped markings while white stripes mark uncontrolled intersection with flashing beacon. Some uncontrolled crossings not marked by stripes are indicated by an arrow and cautionary words “Look Right” in both English and Chinese. Most Bay Area marked crosswalks have white stripping, with parallel-line crosswalks and continental crosswalks being the most prevalent types. They are also generally less flexible in terms of width and configuration than those of Hong Kong at a typical intersection.



Figure 5.5 Typical signal-controlled intersections in Hong Kong and San Francisco (top: Hong Kong; bottom: San Francisco). Source: Google Earth.

U.S. cities implement a more diverse toolkit of pedestrian safety countermeasures such as adaptive traffic signal, leading pedestrian interval, and traffic calming. In the Bay Area, the active transportation plans by local jurisdictions often include recommendations for implementing these treatments, especially in transit adjacent areas. However, in Hong Kong, these treatments are limited to pilot project locations. For example, the Transport Department commenced a pilot real-time adaptive traffic signal project at five intersections and trail auxiliary devices for pedestrians at 4 intersections across the whole territory (Figure 5.6).

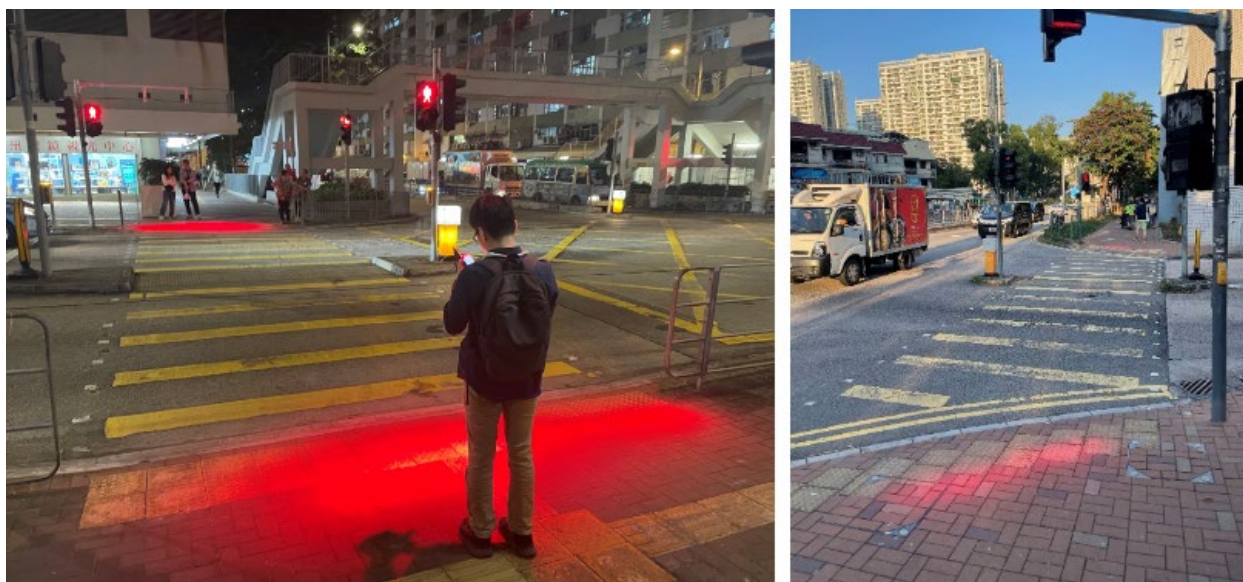


Figure 5.6 Auxiliary devices to enhance pedestrian safety at road crossings. Source: Hong Kong Transport Department.

5.4.2 Ambient Environment

The ambient environment, though not directly linked to traffic control or the pedestrian right of way, might as well have subtle influence on pedestrian behavior and experience of walking. The sensory data collected from 279 stations encompasses a wide range of ambient environmental measures including air quality, temperature, humidity, light, and sound. Table 5.2 summarizes the ambient environmental factors measured at station area intersections in Hong Kong and San Francisco Bay Area.

Table 5.2 Summary of ambient environmental factors measured at station area intersections

Measures	Mean	Hong Kong (N = 270)				SF Bay Area (N = 9)				
		Std. Dev.	Max.	Min.	Median	Mean	Std. Dev.	Max.	Min.	Median
Light (lux)	11,070	10,563	84,246	751	7,808	19,129	13,707	39,607	2,184	17,568
Sound (dB)	69	5	86	55	69	65	15	84	38	68
PM 2.5 (ug/m3)	26	9	70	12	24	15	3	19	13	15
PM 10 (ug/m3)	33	13	97	14	30	18	4	24	14	17
Particles (counts/L)	11,905	2,374	22,597	6,675	11,395	8,275	772	9,554	7,299	8,415
CO ² (ppm)	441	38	675	261	435	475	72	628	418	442
Temperature (Celsius)	32	4	52	24	32	27	4	31	22	28
Humidity (%)	58	12	89	29	57	39	7	48	31	39

Overall, the two regions share similar ranges of ambient environmental factors, though the Bay Area has better air quality as indicated by lower levels of pollutants (i.e., PM 2.5, PM 10, and

particles) than the more urban, denser environment in Hong Kong. The Bay Area also has a higher level of average light, likely due to more sunny days.

5.4.3 Pedestrian Behaviors at Crossings

Given the similar at-grade pedestrian infrastructure and ambient environment, and since the type of crosswalk and signal control are associated with a signal warrant based on pedestrian volumes, I stratify by pedestrian density at intersections when comparing pedestrian behaviors. This is important because the volume-based approach from various traffic design manuals in both places makes pedestrian infrastructure and signal controls comparable by volume groups.

In the following section, I present findings from each observation group within six station areas, three in Hong Kong and the other three in the Bay Area. All except for the Pittsburg/Bay Point Station have more than one intersection-level observations, so I aggregate the intersection data into a single observation and report the averages. Table 5.3 summarizes each specific characteristic by comparison.

High pedestrian density intersections

The high pedestrian density locations have the most comprehensive intersection configuration and pedestrian-oriented infrastructure (Figure 5.7). The four selected intersections in MTR Causeway Bay and BART Powell Street station areas all have highly visible marked crosswalks at all approaches and dedicated pedestrian signal phases. By restricting vehicle access, Hong Kong pedestrians enjoy a higher average share of dedicated pedestrian area at the crossings (80%) than those of the Bay Area (53%). At the Jardine's Crescent/Hennessy Rd/Yee Wo St intersection, the whole intersection is painted with yellow stripes with two remaining vehicle approaches, allowing for a pedestrian scramble during the pedestrian signal phase. At the Great George St/Paterson St intersection, the three crosswalks are extended to over 40 feet to direct a heavy pedestrian flow exiting the MTR station. The Bay Area intersections, on the other hand, employ more standard crosswalk striping, less than 20 feet wide.



Figure 5.7 High pedestrian density intersections

1. Top from left to right: Causeway Bay: Jardine's Crescent/Hennessy Rd/Yee Wo St intersection, Great George St/Paterson St intersection, street view at MTR F1 exit; bottom from left to right: Powell: Powell/O'Farrell St intersection, Mission/4th St intersection, street view at Powell/O'Farrell St intersection.

Both places allocated the greatest share of pedestrian signal phase time to high pedestrian density intersections compared with the medium and low-density intersections, an average of 58% and 40% for Hong Kong and the San Francisco Bay Area respectively. The longer dedicated pedestrian signal phases not only accommodate for more pedestrians, but also reduce pedestrians' exposure to traffic, thus reducing the risk of "jaywalking". This is evident by my observation in both Hong Kong and the Bay Area stations where pedestrians are less likely to "jaywalk" in more pedestrian-friendly environment where they are allocated with more time and space to cross the street. They are also prone to walk in a slower and more steady speed ranging from 2.5 to 4.2 feet per second (Table 5.3). As illustrated by Figure 5.8, both places have a few pedestrians stepping outside the dedicated zone. The green lines mark pedestrian paths with the marked crosswalks, whereas red dashed lines show the "jaywalking" paths. Given the more than four times wider crosswalk of the Causeway Bay intersection than the Powell Street intersection (55.3 feet vs. 13.3 feet), the reason for "jaywalking" at the former is mostly to take shortcuts to destinations, while the latter sees a clear pedestrian overflow where some of them are forced to walk out in order to bypass the crowds.

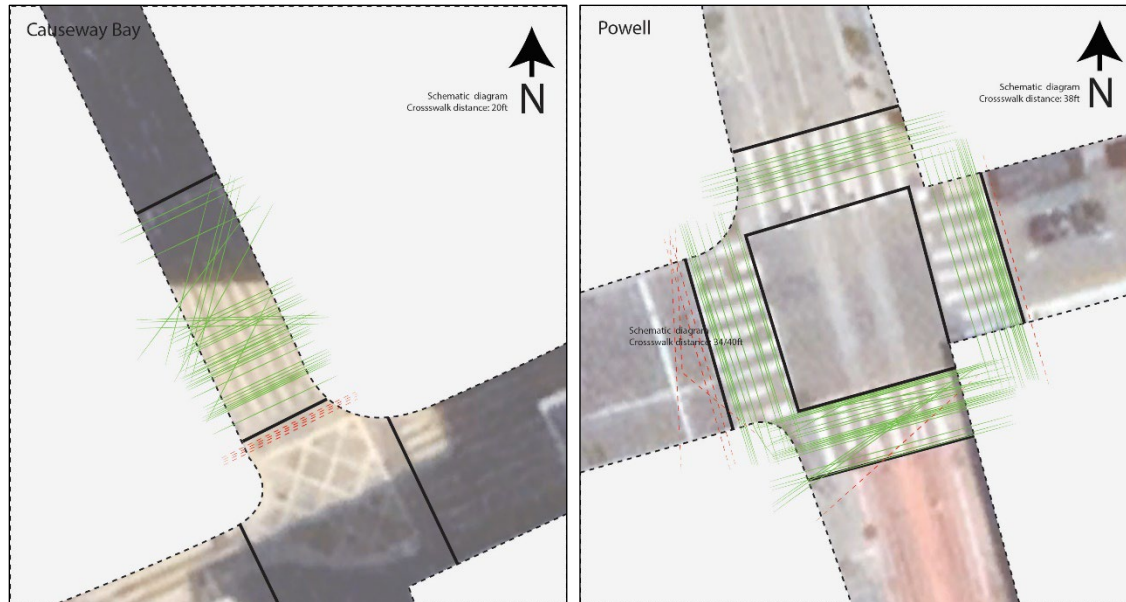


Figure 5.8 Schematic diagrams of pedestrian paths at high pedestrian density intersections (left: a crossing at Causeway Bay station area; right: crosswalks at Powell station area)

Medium pedestrian density intersections

For a typical pedestrian crosswalk at medium pedestrian density locations, however, Hong Kong and the Bay Area intersections use the same type of continental crosswalks, and apply other similar pedestrian infrastructure design treatments such as curb extension, though in Hong Kong pedestrian refuge islands are widely seen (Figure 5.9). Because of the less compact intersection configuration and offset of crosswalks, these medium pedestrian intersections in Hong Kong have a lower average dedicated area ratio around 30%, whereas the Bay Area intersections allocate about 75% of space to pedestrians thanks to the curb extensions. The former share a 24% dedicated pedestrian phase time compared with a 40% share of the latter.

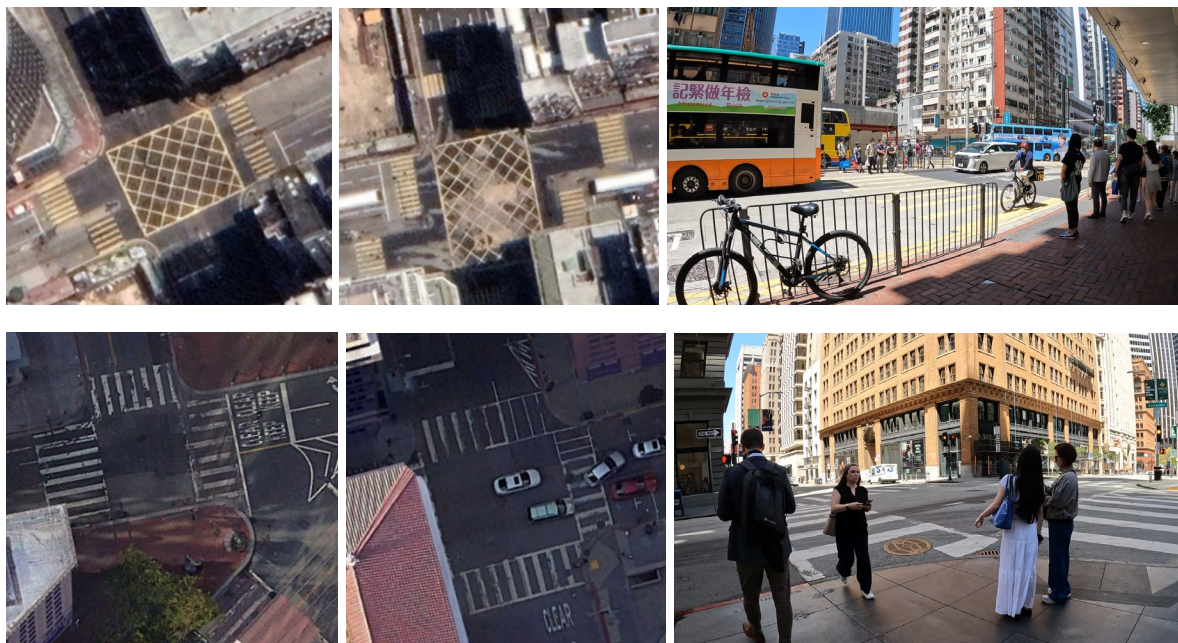


Figure 5.9 Medium pedestrian density intersections

1. Top from left to right: Wan Chai: Hennessy Rd/Fleming Rd intersection, Lockhart Rd/Fleming Rd intersection, street view at Hennessy Rd/Fleming Rd intersection; bottom from left to right: Montgomery: Market/Sutter/Sansome St intersection, Sansome/Bush St intersection, street view at Sansome/Bush St intersection.

The Hong Kong pedestrians walk at speeds ranging from 1.0 to 5.7 feet per second; those from the Bay Area walk at 4.8 to 5.0 feet per second (Table 5.3). While the upper bounds of the speed range are similarly higher than more pedestrian-friendly intersections, the lower bounds present some stark difference. From my observation, pedestrians often see the urge to finish crossing in a more car-centric location, especially when they are not protected by the dedicated right of way (i.e., in the case of “jaywalking”), which leads to a faster crossing speed. The reason for much slower lower bound for Hong Kong pedestrians who move only one foot per second attributes to pedestrian refuge islands. This is a prevalent design feature incorporated into many intersections design. In the two Hong Kong examples (top left and top middle of Figure 5.9), the intersection design introduces pedestrian refuge islands half-way in the crosswalks which are also about double the width of the crosswalk stripping. On a busy-traffic street, this space holds a significant number of pedestrians in the middle of a crosswalk and shortens the length of each crossing. This design potentially encourages “jaywalking” behaviors as pedestrians perceive crossing on red lights as less risky, while at the same time it slows down the average crossing speed due to the long waits on refuge island yielding to traffic. The “jaywalkers” in the Bay Area intersections generally do not yield to traffic within a crossing.

As for the use of dedicated space, pedestrians tend to utilize the whole span of a strip width by predominantly taking over the two sides and middle of the crosswalk zone (Figure 5.10). Two reasons contribute to the violation of pedestrian right of way at medium-density intersections in both places: taking a shortcut, or a pedestrian overflow at a narrow crossing. Notably, the Hong

Kong pedestrians sometimes do not voluntarily choose to violate the right of way by taking a shortcut. Rather, sidewalks are fenced by guard rails. Once a pedestrian exits their right of way through an opening, they have no way back until another intersection. As a result, some “jaywalkers” reach the crosswalks from outside the dedicated paths.



Figure 5.10 Schematic diagrams of pedestrian paths at medium pedestrian density intersections (left: crossings at Wan Chai station area; right: crosswalks at Montgomery station area)

Low pedestrian density intersections

The low pedestrian density locations in the Bay Area feature less comprehensive infrastructure. For example, the Pittsburg/Bay Point BART station adopts simple parallel-line uncontrolled crosswalks. However, the South Horizons MTR station area intersections retain a combination of three types of crossing: signal controlled, uncontrolled cautionary, and footbridge (Figure 5.11). Given this difference in crosswalk types, Hong Kong pedestrians are allotted with a higher share of dedicated walking space and time in relative lower density crossing locations than their Bay Area counterparts (Table 5.3).

Although the signal-controlled crossings in Hong Kong’s low-density areas are meant to protect pedestrians, they seem no more effective than uncontrolled crossings. It is unclear whether these pedestrian signals are actuated since they do not adjust to pedestrian volumes. In fact, the dedicated pedestrian signal ratio is only 6% at the signal-controlled intersection. During a five-minute observation at the Lee Nam Rd/Yi Nam Rd intersection, all 11 pedestrians crossed on red lights, and some of them had to yield to traffic on the refuge island for a long time. It seems peculiar that all pedestrians crossing at a protected intersection need to yield to free flow cars since the dedicated pedestrian phase is extremely short.

In comparison, the low-density Bay Area locations provide more flexibility for pedestrians to take caution, and for cars to yield at uncontrolled crossings. In low-density driveways, many pedestrians do not stay within the parallel lines but choose to take a shortcut (Figure 5.12). As a result, the range of walking speed at low-pedestrian density locations follows the pattern of medium pedestrian density locations in Hong Kong, reflecting the relatively high-stress pedestrian environment. In the Bay Area location however, it resembles the pattern of a high pedestrian density intersection, with less obstruction from car traffic.



Figure 5.11 Low pedestrian density intersections

1. Top from left to right: South Horizons: South Horizon Drive/Yi Nam Rd intersection, Ap Lei Chau Bridge Rd/Yi Nam Rd intersection, street view at Lee Nam Rd/Yi Nam Rd intersection; bottom from left to right: Pittsburg/Bay Point Station intersection, street view at Pittsburg/Bay Point Station intersection.

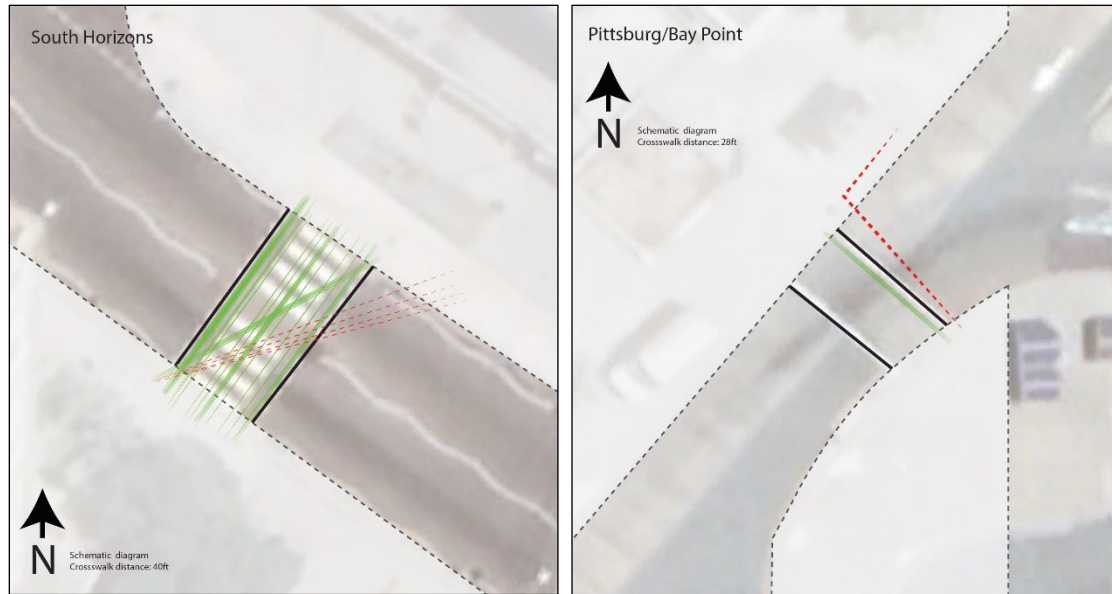


Figure 5.12 Schematic diagrams of pedestrian paths at low pedestrian density intersections (left: a crossing at South Horizons station area; right: crosswalks at Pittsburg/Bay Point station area)

Table 5.3 Comparison of pedestrian behaviors at high, medium, and low-density intersections

Pedestrian density	Hong Kong			SF Bay Area		
	<i>High</i>	<i>Medium</i>	<i>Low</i>	<i>High</i>	<i>Medium</i>	<i>Low</i>
Volume per crossing (per minute)	20-50	5-20	<5	10-30	5-10	<5
Infrastructure	signal-controlled crosswalks, wide strips or dedicated intersection	signal-controlled crosswalks, refuge island, curb extension	unsignalized/signalized crosswalks, refuge island, footbridge, walkway	signal-controlled crosswalks	signal-controlled crosswalks	uncontrolled crosswalks
Dedicated pedestrian area ratio	0.80	0.31	0.30	0.53	0.75	0
Dedicated pedestrian signal ratio	0.58	0.24	0.06	0.40	0.33	0
Walking speed (ft/sec)	2.5-4.0	1.0-5.7	1.6-6.7	2.5-4.2	4.8-5.0	2.2-4.8
Use of space	most pedestrians stay in crosswalks, some take shortcuts	most pedestrians stay in crosswalks, a few take shortcuts, wait on refuge islands	most pedestrians stay in crosswalks, some take shortcuts	most pedestrians stay in crosswalks, pedestrian overflow	most pedestrians stay in crosswalks, a few take shortcuts	not so effective simple crosswalks, take shortest paths
Crossing on red	a few crossing on red	very few	most do not follow signal lights	a few crossing on red	a few crossing on red	-
Traffic rule violation and yielding behavior	a few "jaywalkers"	a few "jaywalkers", need to yield to traffic	need to yield to traffic	a few "jaywalkers"	a few "jaywalkers"	uncontrolled crosswalks

5.5. Discussion and Conclusion

This chapter utilizes a comprehensive dataset on behavior, infrastructure, and environment for the pedestrians collected at 283 heavy rail station areas in Hong Kong and the San Francisco Bay Area, to understand the nuances of pedestrian interaction with human scale environment across two seemingly different cultures for walking in the context of contrasting urban form, car-dependency, as well as the perception of walking. I ask the question of whether there are similarities or differences in pedestrian environment, use of infrastructure, and walking behaviors across cultures, in order to form the basis for context-specific urban design and policy recommendations.

Several findings emerge from the analytical results which highlight the importance of observing context-specific nuances in human-centric urban design. First, although there are some differences, the general types of pedestrian infrastructure and ambient environment surrounding transit-access pedestrians present more similarities than differences across cultures. Second, a typical pedestrian in Hong Kong and San Francisco appear to behave in a similar manner given a comparable level of perceived stress and risk from cars. For example, I find that in places with car-oriented traffic and limited dedicated pedestrian right of way in terms of space and time, both Hong Kong and Bay Area pedestrians tend to walk faster than in places with more pedestrian-oriented infrastructure. “Jaywalking” or violation of traffic rules more prevalently happen in locations that dedicate less space or time for pedestrians. Third, as expected, regions differ in their choices of a selective set of design treatments to a specific road or traffic flow condition. However, this sometimes may lead to counter effective or unintended results. The pedestrian space design in Hong Kong reflects a design preference for the separate between pedestrians and cars by using grade-separation crossings and sidewalk fences, which adds benefits to a smooth traffic at the expense of the burden to pedestrians when they have to take extra efforts to cross a street or risk safety to take a more direct path. Moreover, a signal-controlled crossing does not necessarily protect pedestrian right of way, unless it allocates enough time to the pedestrian phase. Likewise, a crosswalk does not ensure the exclusive use of dedicated space, unless it adjusts to behavioral characteristics such as desired crossing directions, pedestrian density, walking speed, as well as individual idiosyncrasy that can only be captured at human scale.

Some of the findings support case-based policy review and anecdotes in terms of local issues regarding pedestrian environment in Hong Kong (Ng, 2012). They, from a human scale user perspective, supplement some of the existing transportation-system based studies on pedestrian behaviors in Hong Kong (Hei, 2020). Moreover, it makes a case for cross-cultural comparison in the context of global policy transfer, which enables a reflective thinking of local practices for example to validate when and where universal design standards apply. Although previous studies have attempted cross-cultural comparisons on sustainable transportation policies (Kwan et al., 2014; Wang, 2010), none of them has delved into human scale street design interventions or their dynamic interactions with individual behaviors.

This study underscores the importance of dynamic human scale observation for human ecology, urban design, and human behavior studies, especially given the emergence of AI technology that can potentially facilitate data collection and processing at a finer level and for a larger scale. On street design, Hong Kong and San Francisco can reference each other for what is doing well and not so well in their daily practices, from an unconventional perspective.

5.5.1 Limitations and Future Studies

Despite the novelty of the data and research approach, there remain a few areas that need further investigation in the future. First of all, given the limited resources and short time frame, I only analyze a subsample of the collected data for case studies, which should be extended to a more comprehensive systematic analysis across both regions. Should more data become available, the comparison could incorporate more cities and regions. Future data collection effort could also resolve the issue of imbalanced sample sizes across the regions for comparison. Second, not all measures were taken at a perfectly comparable setting that controls for time-of-day, day-of-week variations. Third, the next step of this study needs to test the significance of the associations between design treatments and individual behaviors using statistical methods. In this way, the various environmental measures collected by multiple sensors could all contribute as control factors. Finally, this line of research needs to consider applying AI to data collection and preprocessing as the first step (Basu & Sevtsuk, 2022; Hosseini et al., 2024), before proceeding with the empirical study. Researchers should collaborate on combining these two lines of research that are currently separated in most cases.

Chapter 6 Conclusions

This dissertation investigates active transportation planning, the built environment and pedestrian behaviors in three interconnected empirical studies in Hong Kong and the San Francisco Bay Area. It employs a wide variety of data and analytical methods to explore the relationship between stakeholders, plans, active transportation infrastructure and pedestrian behaviors across different cultural contexts.

6.1. Key Takeaways

The first study examines the use of social media by local placemaking NGOs in Hong Kong, and its role in facilitating public participation process in active transportation planning. It utilizes social media texts and in-depth interviews with stakeholders to gauge opinions towards active transportation issues in Hong Kong, as well as how the NGOs employ social media tool to engage the public for active transportation agendas where formal participation channel exhibits limited capacity. The findings reveal the role of social media as an insurgent outlet for advocacy and collaborative decision-making. The case also demonstrates the opportunities for governmental agencies to collaborate with civil society organizations for more people-centric active transportation planning.

The second study uses a mixed method approach to investigate the trends and implementation pathways of pedestrian infrastructure enhancements around BART and Caltrain stations in the San Francisco Bay Area. It utilizes several novel datasets generated from unstructured data with statistical modeling, to systematically examine the built environment changes and their association with plans at a high spatial-temporal resolution. It alludes the role of plans in making effective changes in marked crosswalks at station area intersections, as well as the interactive effects contributed by a variety of station area characteristics. The upgrading and addition of high-visibility crosswalks show an overall improvement of pedestrian environment, reflecting the overall effectiveness of the presence of master plans.

The third empirical chapter presents a comparative study of pedestrian behaviors across Hong Kong and the San Francisco Bay Area. It utilizes a comprehensive dataset on behavior, infrastructure, and environment for the pedestrians collected at 283 heavy rail station areas, to understand the nuances of pedestrian interaction with human scale environment across two seemingly different cultures for walking in the context of contrasting urban form, car-dependency, as well as the perception of walking. The findings highlight the importance of observing the context-specific nuances in human-centric urban design. First, the general types of pedestrian infrastructure and ambient environment surrounding transit-access pedestrians present more similarities than differences across cultures. Second, a typical pedestrian in Hong Kong and San Francisco appear to behave in a similar manner given a comparable level of perceived stress

and risk from cars. Third, regions differ in their choices of a selective set of design treatments to a specific road or traffic flow condition. However, this sometimes may lead to counter effective or unintended results.

6.2. Contributions

This dissertation makes four main contributions to the academic literature on sustainable transportation policy, planning and urban design.

First, it adds to the theory *for* transportation planning that focuses on the planning process. Despite being a major theme of the general planning literature, most transportation studies take a quantitative approach that fails to capture the complex interplay between institutions and stakeholders. The case study on Hong Kong reveals the nuances of how public participation takes place in a seemingly less democratic and strong planning institution. Regarding Brooks (2002)'s definition of four alternative paradigms for planning, planners in practice moderate the existing paradigm by traversing between the role of activists and communicators in a less democratic process, and being rationalists and incrementalists in a more democratic process.

Second, it draws a direct link between active transportation plans and built environment change using longitudinal data that support improved casual evaluation. The case study on San Francisco highlights how plans get implemented differently across geographies, which has implications for the effectiveness in terms of safety and accessibility improvement. Moreover, the contrast of the institutional setting with the Hong Kong case manifests the role of plans as a strong instrument under a weak planning institution.

Third, there have not been many microlevel comparative studies for active transportation. The direct comparison of individual behaviors in a diverse set of built environments and cultural contexts supports the hypothesis that people are accustomed to behaviors of different walking culture pertaining to each pedestrian environment. The findings imply that specific urban design tactics should be tailored for each walking culture.

Fourth, this study utilizes data from multiple sources including text data from social media, interviews, street view imagery, and field observation. It applies a variety of state-of-the-art methods including machine learning and artificial intelligence to synthesize information from qualitative and quantitative sources. It introduces a mixed method research framework combining empirical statistics and qualitative case studies that can be generalized to other research projects to capture both the patterns and nuances of the planning mechanism. Given the scarcity of structured data in certain cases, these methods help to extract key information from massive unstructured data for systematic analysis.

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Appendices

Appendix A: Institutional Review Boards (IRB) Approval



Committee for Protection of Human Subjects (CPHS)
Office for Protection of Human Subjects (OPHS)

1608 Fourth Street, Suite 220
Berkeley, CA 94710-5940
510 642-7461
ophs@berkeley.edu
cphs.berkeley.edu
FWA# 00006252



NOTICE OF APPROVAL FOR HUMAN RESEARCH

DATE: *June 04, 2021*
TO: *Daniel Rodriguez, City & Regional Planning*
Meiqing Li, City & Regional Planning
CPHS PROTOCOL NUMBER: *2021-05-14334*
CPHS PROTOCOL TITLE: *Integrated Active Transportation Planning: Cultures, Trends, and Behaviors in Hong Kong and San Francisco - Part 1*
FUNDING SOURCE(S): *NONE*

A(n) *new* application was submitted for the above-referenced protocol. Your submission has been reviewed by the Office for Protection of Human Subjects (OPHS) and granted exemption, as it satisfies the Federal and/or UC Berkeley requirements under category(ies) 2 .

Effective Date: *June 04, 2021*

Expiration Date: *June 03, 2031*

Amendments/Modifications: Any change in the design, conduct, or key personnel of this research must be approved by the OPHS *prior* to implementation. For more information, see [Amend/Modify an Approved Protocol](#).

Please note that although your research has been deemed exempt from full committee and subcommittee review, you still have a responsibility to protect your subjects, and the research should be conducted in accordance with the principles of the Belmont Report. Download the Belmont Report at this link: www.hhs.gov/ohrp/humansubjects/guidance/belmont.html.

This approval is issued under University of California, Berkeley Federalwide Assurance #00006252.

Note: Exempt determinations are good for ten years. If the study continues beyond the ten-year period, the protocol must be cloned and re-submitted for an updated exempt determination.

If you have any questions about this matter, please contact the OPHS staff at 642-7461 or email ophs@berkeley.edu .

Sincerely,

Office for Protection of Human Subjects (OPHS)
UC Berkeley

Appendix B: Invitation Email Template

Subject: Invitation to Interview for Doctoral Research³

Dear Mr. X,

My name is Meiqing Li, a PhD Candidate in City and Regional Planning at UC Berkeley. I got your contact from one of your colleagues at the Transport Department. I am currently in Hong Kong conducting fieldwork for my doctoral dissertation research titled “*Integrated Active Transportation Planning: Cultures, Trends, and Behaviors in Hong Kong and San Francisco*”. As part of my research project, I hope to understand the active transportation planning process, and the associated evolution of built environment and active transportation infrastructure in Hong Kong. I was wondering if either you or any of your colleagues would be available for an interview sometime in the following weeks before the end of June. The interview will be about an hour, and I am flexible for either in-person or Zoom meeting depending on your availability.

This research is approved by the Office for Protection of Human Subjects (OPHS) at University of California Berkeley under Committee for Protection of Human Subjects (CPHS) Protocol number 2021-05-14334. Please let me know if you have any questions or need more information. Also, feel free to contact my dissertation chair Professor Daniel Rodriguez at danrod@berkeley.edu, if you require further information or verification. Looking forward to hearing from you. Thank you!

Sincerely,
Meiqing Li
PhD Candidate | Department of City and Regional Planning
University of California, Berkeley

Table B. List of interviewees

#	Stakeholder	Date	Mode
1	Civic activist, community leader	5/26/2022	In-person
2	Independent consultant/Practitioner	6/1/2022	Zoom
3	Planning professional	4/25/2022	In-person
4	Planning professional	3/27/2023	Zoom
5	Government engineer	6/9/2022	Zoom
6	Scholar	6/6/2022	In-person
7	Scholar	6/21/2022	In-person
8	Scholar	6/29/2022	Zoom

³ Actual wordings tailored to individual interviewees.

Appendix C: Semi-structured Interview Guide

Government Officials and Planners

- What has been your involvement with the city's active transportation planning? When did you begin working on these plans? Has your role evolved? What are your primary areas of responsibility?
- Which department was overseeing these plans? What were the government's objectives undertaking active transportation plans? What are the primary benefits? What are the costs?
- Do you see the city's active transportation plan as an integral part of the climate action plan?
- What were the challenges of implementation of pedestrian-oriented transportation policy and design? Do you see the culture evolve? In what direction?
- Is there a procedure in place for the public to participate in the decision-making process? If so, what is the procedure? To what extent? What are the most pressing concerns about the pedestrian walking environment to your knowledge?

Researchers and Scholars

- What has been your involvement with the city's active transportation planning? What are your primary areas of research? When did you begin working on this research topic?
- What is your general perspective on the city's active transportation plans? Do you think it helps to address the quality of walking environment and climate change mitigation?
- What is your perspective on the most pressing concerns about the pedestrian walking/cycling environment? What are the opportunities and challenges implementing active transportation strategies?
- How well do you see the policies adjust to local context?
- Do you believe there is a culture of walking/cycling that differs across contexts (e.g., European, US, Asian cities)? Any specific examples that you find compelling?

Civic and Grassroots Advocates

- What has been your involvement with active transportation planning? When did you begin engaging with the street reform movement? Has your role evolved? How and why?
- What is your perspective on the government's plans to promote active transportation as a means for climate mitigation?

- What is your perspective on the most pressing concerns about the pedestrian walking/cycling environment? What are the opportunities and challenges implementing active transportation strategies?
- How well do you see the policies adjust to local context?
- Do you believe there is a culture of walking/cycling that differs across contexts (e.g., European, US, Asian cities)? Any specific examples that you find compelling?
- What are your advocacy/organizing objectives with regards to active transportation, street reform, and placemaking? What strategies have you employed?
- How does this work further your organization's mission?

Appendix D: List of Jurisdictions Studied in the San Francisco Bay Area

Alameda			
Berkeley	Castro Valley CDP	Fremont	Hayward
Oakland	Pleasanton	San Leandro	Union City
Contra Costa			
Bay Point CDP	Concord	Contra Costa Centre CDP	El Cerrito
Lafayette	Orinda	Richmond	Walnut Creek
San Francisco			
San Francisco			
San Mateo			
Belmont	Burlingame	Colma Town	Daly City
Menlo Park	Millbrae	Redwood City	San Bruno
San Mateo	South San Francisco		
Santa Clara			
Gilroy	Morgan Hill	Mountain View	Palo Alto
San Jose	San Martin CDP	Santa Clara	Sunnyvale

Figure D. Five counties and 36 municipalities in the study sample

Table D: Crosswalk enhancements in active transportation master plans by Bay Area jurisdictions

	Jurisdiction	Plan name	Year	Crosswalk enhancement in the plan
1	Alameda County	Alameda Countywide Pedestrian Plan	2012	Capital projects; countywide priorities: crosswalk and sidewalk improvements that create safe the continuous access to transit stations and stops
2	City of Belmont	Comprehensive Pedestrian and Bicycle Plan	2016	Safe routes to school: enhanced crosswalk striping; Intersection accommodations for pedestrians, ADA inventory; marked crosswalk improvements (high-visibility crosswalks); pedestrian improvements in capital improvement program
3	City of Berkeley	Pedestrian Plan	2020	Improve human-scale lighting; recommended upgrading and adding enhanced crosswalks; marked crosswalk gap; proposed stripe high-visibility crosswalks; faded crosswalks
4	City of Burlingame	Bicycle and Pedestrian Master Plan	2020	Design policies: routinely evaluate locations for enhancing crosswalks; enhanced crosswalks on some higher-volume streets and standard crosswalks on lower-volume streets; unmarked crosswalks; pedestrian improvement recommendations: high-visibility markings

	Jurisdiction	Plan name	Year	Crosswalk enhancement in the plan
5	Town of Colma	Colma Bicycle and Pedestrian Master Plan	2023	Lack of crosswalks at intersections; restriping, improve the visibility of crosswalks; improvement projects, add high-visibility, marked crosswalks
6	City of Concord	Bicycle, Pedestrian & Safe Routes to Transit Plan	2016	No mention
7	Contra Costa County	Countywide Bicycle and Pedestrian Plan	2018	Making crosswalks and bikeways safer; improved crosswalks that will encourage people to walk or bicycle to the new Pittsburg City Center BART station; pedestrian needs assessment; safer crossing, high-visibility crosswalks
8	City of Daly City	Walk Bike Daly City - Pedestrian and Bicycle Master Plan	2020	Caltrans pedestrian improvements projects, high-visibility crosswalks; priority pedestrian projects
9	City of El Cerrito	Circulation Plan for Bicyclists and Pedestrians	2007, 2016	Access improvement opportunity, crosswalk repainting, high-visibility crosswalks; uncontrolled crosswalk enhancement toolbox; pedestrian improvement projects
10	City of Fremont	Fremont Pedestrian Master Plan;	2007, 2016	Uncontrolled crosswalk improvements; high-visibility crosswalk markings; high-visibility crosswalk markings; recommend ladder crosswalk markings at all uncontrolled crosswalk locations; high-visibility crosswalk ladder markings at uncontrolled crosswalks on local streets adjacent to schools, on a case-by-case basis.
11	City of Hayward	Bicycle and Pedestrian Master Plan	2020	Performance measures: number of new or enhanced crosswalks (complete street); make all new or restriped crosswalks high visibility markings; program and policy recommendations: crosswalks and traffic control devices; recommended improvements, high-visibility crosswalks; transit supportive infrastructure; program and policy recommendations; crosswalk installation, removal, and enhancement policies
12	City of Mountain View	Pedestrian Master Plan	2014	Capital project implementation at intersections, high-visibility crosswalks
13	City of Oakland	Pedestrian Master Plan	2002, 2017	Crosswalk treatments; dangerous by design: having at least one intersection approach without a marked crosswalk; safety strategy: improvements and countermeasures
14	City of Orinda	Bicycle, Trail and Walkways Master Plan	2011	Recommendations: high-visibility markings, a quarter of a mile of all schools; intersection safety enhancements
15	City Palo Alto	Bicycle + Pedestrian Transportation Plan	2003, 2012	marked crossings (crosswalks); treatment priorities and locations; pedestrian improvements
16	City of Pleasanton	Bicycle and Pedestrian Master Plan	2018	Crosswalk policy, enhanced crosswalk; crosswalk safety research, design guidelines; treatment selection;
17	City of Richmond	Pedestrian Plan	2011	Crosswalk treatments; marked crosswalks in combination with other treatments (e.g., lighting, signals)

	Jurisdiction	Plan name	Year	Crosswalk enhancement in the plan
18	City of San Francisco	Better Streets Plan, Pedestrian Strategy	2010, 2013	Marked crosswalks, high-visibility crosswalks; colored and textured paving treatments to highlight pedestrian crosswalks; adding continental or 'ladder' crosswalks
19	City of San Jose	Pedestrian Master Plan	2008	Crossing treatments (striping, paving), marked crosswalks, upgraded high visibility crosswalks; striping improvements at controlled intersections; pavement markings at uncontrolled crosswalks; recommendation: high-visibility crosswalk striping; revising the City's marked crosswalk;
20	City of San Leandro	Bicycle and Pedestrian Master Plan	2018	Utilizing the new Crosswalk Improvement and Scoring Policy; enhance crosswalks access to transit; install enhanced pedestrian crossing facilities (such as high visibility crosswalks) at high volume traffic locations; recommended pedestrian projects
21	City of San Mateo	Citywide Pedestrian Master Plan	2012	Complete streets, crosswalks; pedestrian facilities within Caltrain stations; pedestrian network improvements; recommend a single high visibility crosswalk design
22	San Mateo County	San Mateo County Comprehensive Bicycle and Pedestrian Plan	2011	Downtown area improvements, high-visibility crosswalks; design guidelines for pedestrian focus areas
23	City of Santa Clara	Pedestrian Master Plan	2019	Crossing improvement: high-visibility crosswalk marking;
24	City of South San Francisco	Pedestrian Master Plan	2011	Recommended improvements: intersection crossing treatments; high visibility crosswalks
25	Union City	Bicycle and Pedestrian Master Plan	2021	Community input: enhanced crosswalks would be welcome; pedestrian project recommendations: high-visibility crosswalks
26	City of Walnut Creek	Pedestrian Master Plan	2016	Crosswalk Improvement Guidelines; the installation, removal and enhancement of crosswalks

Appendix E-1: Pedestrian Observation Sheet

Date: _____ Weather: _____
 No.: _____ Picture: _____

Station Name: _____

#1 Picture: Time: Infrastructure: Signal: Light: Sound: Air quality: Pedestrian flow:	#2 Picture: Time: Infrastructure: Signal: Light: Sound: Air quality: Pedestrian flow:
#3 Picture: Time: Infrastructure: Signal: Light: Sound: Air quality: Pedestrian flow:	#4 Picture: Time: Infrastructure: Signal: Light: Sound: Air quality: Pedestrian flow:
#5 Picture: Time: Infrastructure: Signal: Light: Sound: Air quality: Pedestrian flow:	#6 Picture: Time: Infrastructure: Signal: Light: Sound: Air quality: Pedestrian flow:
#7 Picture: Time: Infrastructure: Signal: Light: Sound: Air quality: Pedestrian flow:	#8 Picture: Time: Infrastructure: Signal: Light: Sound: Air quality: Pedestrian flow:

Appendix E-2: Field Observation Tools

A: GoPro equipment for video taking



B: Outdoor air quality monitor C: Field observation notes

