

Enhancing the Active Mobility Experience For Workers in the Changi Region

This Master Research Project about Changi Region was undertaken by Singapore University of Technology and Design (SUTD) postgraduate students with support from Urban Redevelopment Authority of Singapore (URA). The project ran between May 2024 and August 2024 and forms a core requirement of the MSc in Urban Science, Policy and Planning at SUTD.

Team	Yeo Han Liang Jeba Mi Zerah Julan Castro Sonia Kamarraj	Supervisors Dr Xin Yang Dr Felicity Chan	 SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

RESEARCH QUESTION

How can the Active Mobility experience be enhanced for workers, especially for last-mile journeys, for a more Connected Changi?



RESEARCH SUB-QUESTIONS

- 1 What are the active mobility barriers for Changi workers? What are the workers' perceptions of these barriers?
- 2 What interventions could be proposed to encourage active mobility in their journeys within Changi?

RESEARCH BACKGROUND & SIGNIFICANCE

 FUTURE DEVELOPMENTS Changi East Industrial Zone Changi East Urban District Airport Terminal 5	 FUTURE NORTHERN CORRIDOR Cross Island Line MRT 3km of new cycling paths 2.6km viaduct, road-widening	 LIFESTYLE DESTINATION Recreation & tourism Round island park connector Heritage trails
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ACTIVE MOBILITY BENEFITS



CHARACTERISTICS & ISSUES

 Increasing Business Activities	 Growing Worker Population	 Rising Vehicular Traffic	 Lack of Active Mobility Infrastructure	 Disconnected Physical Spaces	 Employment Dominated Hub
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ACTIVE MOBILITY

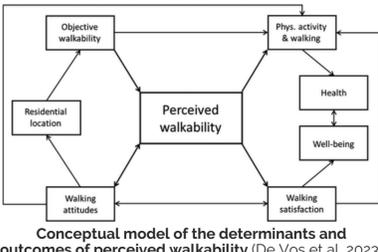
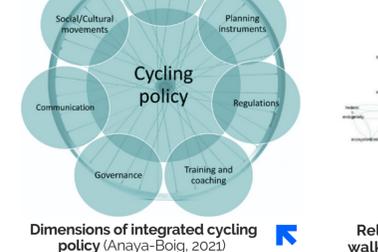
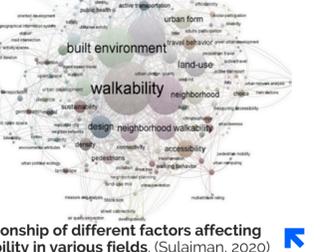
IN SINGAPORE 	IN CHANGI 										
<table border="1"> <tr> <td>Walk Ride Cycle SG / 2040 LTA Masterplan</td> <td>SG Walking and Cycling Design Guide / 2018, LTA + URA</td> <td>People Friendly Walking Cities Report / 2014, CLC + ULI</td> </tr> <tr> <td>Walk2Ride initiative</td> <td>Friendly Streets Pilot</td> <td>Walking and Cycling Towns</td> </tr> <tr> <td>Silver Zones</td> <td>Green Man+</td> <td>Enforcement Cameras</td> </tr> </table>	Walk Ride Cycle SG / 2040 LTA Masterplan	SG Walking and Cycling Design Guide / 2018, LTA + URA	People Friendly Walking Cities Report / 2014, CLC + ULI	Walk2Ride initiative	Friendly Streets Pilot	Walking and Cycling Towns	Silver Zones	Green Man+	Enforcement Cameras	Active Mobility infrastructure enhancement works in Changi (LTA, 2019)	Diversion of park connector network at Loyang Industrial Estate (NParks, 2024)
Walk Ride Cycle SG / 2040 LTA Masterplan	SG Walking and Cycling Design Guide / 2018, LTA + URA	People Friendly Walking Cities Report / 2014, CLC + ULI									
Walk2Ride initiative	Friendly Streets Pilot	Walking and Cycling Towns									
Silver Zones	Green Man+	Enforcement Cameras									

IDENTIFIED RESEARCH GAPS

Limited Research on Active Mobility in Industrial & Airport Regions
Existing studies primarily focus on residential & city centres, neglecting the specific challenges & opportunities for active mobility in industrial parks & airport hubs

Absence of Customised Environmental Audit Tools
While various environmental audit tools exist, there is a lack of tools specifically designed to assess active mobility conditions in industrial & airport settings

LITERATURE REVIEW

 Conceptual model of the determinants and outcomes of perceived walkability (De Vos et al., 2023)	 Dimensions of integrated cycling policy (Anaya-Boig, 2021)	 Relationship of different factors affecting walkability in various fields. (Sulaiman, 2020)
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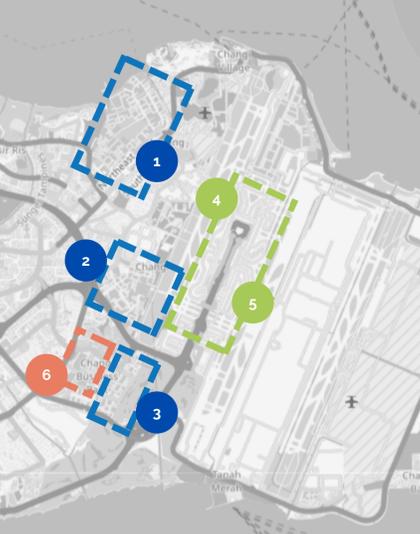
ACADEMIC & POLICY CONTRIBUTIONS

 Local Level Infrastructure interventions for Changi Region; Policy suggestions for active mobility	 National Level Guide for industrial estate redevelopment	 Academic Contribution Development of assessment methodology
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RESEARCH METHODOLOGY

FUNDAMENTALS OF ACTIVE MOBILITY DESIGN (LTA & URA, 2018)	 DIRECT	1 Assess Perception of Workers through Online Surveys • Assess critical barriers to active mobility • Identify areas to enhance active mobility • Identify hotspots for further analysis	 Survey Methodology Online questionnaire 15-minute duration
	 COMFORT	 YOUR JOURNEY MATTERS.	 Participants Profile 45 valid responses from workers aged 21+ & at least 1 month of work experience in Changi in the past 6 months
	 SAFE		 Survey Focus Evaluate active mobility infrastructure based on direct, comfort & safety
	3 Phase Audit	2 Conduct Environmental Audit of Changi • Evaluate presence & quality of built environment elements • How well they support workers to walk & cycle	61 questions across 7 categories to assess Accessibility, Comfort & Safety
			Develop draft audit tool based on literature Conduct researcher audit through site visits Refine questions & test with workers via walkalong interview

SPECIFIC SITES IDENTIFIED FOR STUDY

	INDUSTRIAL CLUSTERS 1. Loyang Industrial Park 2. Changi North Industrial Estate 3. Changi South Industrial Estate
	AIRPORT CLUSTERS 4. Changi Airport Terminals 1 to 3 5. Terminal 2 to 4 Park Connector
	BUSINESS CLUSTER 6. Changi Business Park
	• Audited sites through non-participatory observation • At least 2 researchers at a time during weekday morning & evening peak hours

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SITE INTERVENTIONS: INDUSTRIAL & BUSINESS CLUSTERS

Industrial Cluster Intervention #1: Facilitate & Encourage Last Mile Cycling



Extend cycling paths and reclaim road lanes in inner areas
Provide seamless connections from public transport nodes



Enhance cycling services
Bike rental & parking, shower facilities near public transport nodes



Actively promote cycling as an attractive option
Active lifestyle that is beneficial to workers and society; shift culture through community events

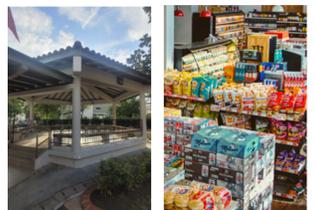
Industrial Cluster Intervention #2: Redesign Transport & Active Mobility Infrastructure



Redesign road + cycling & walking network
Expand paths to reduce conflict between pedestrians and cyclists, with additional safety measures



Improvement of walking & cycling paths
Well-defined paths; regular maintenance & upkeep; clear signages for wayfinding



More pleasant and enjoyable experience
Weather-proof infrastructure; wider range of amenities & recreation options

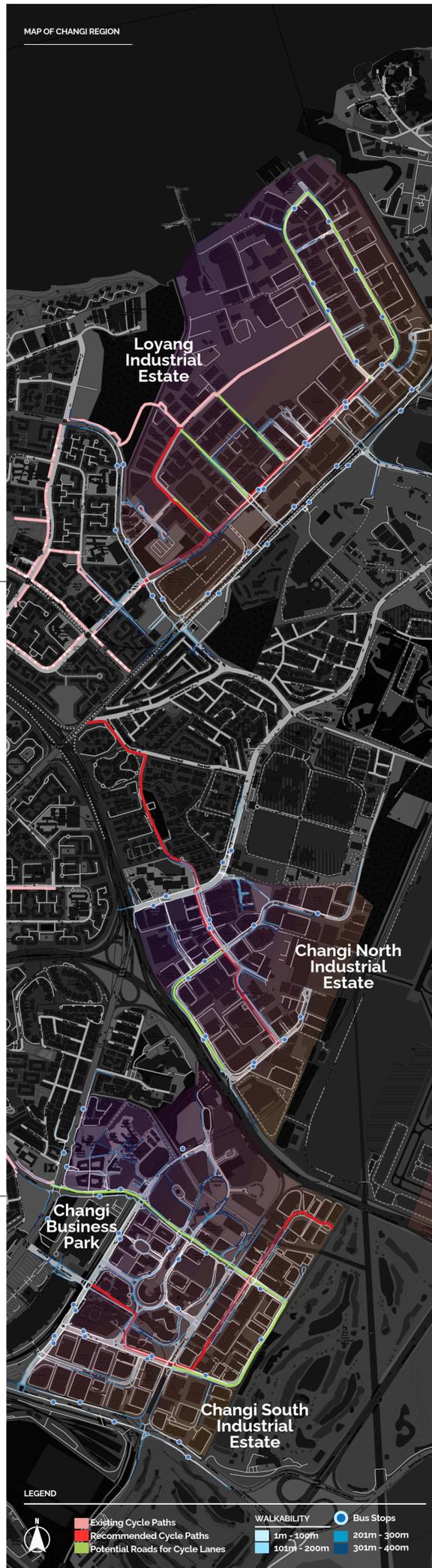
Business Cluster: Enhance Workers' Last Mile Experience



More bicycle rental services & parking spots
Encourage greater use of existing infrastructure and well-designed paths



Clearer, more intuitive walking paths
Re-design based on pedestrian behaviour (more direct routes) and with more distinct markers



ENVIRONMENTAL AUDIT RESULTS

Key Observations

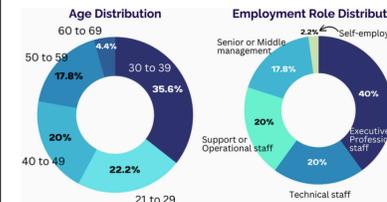


Loyang & Changi North Industrial Estates - ranked lowest for all 7 categories. Interventions should be prioritised.

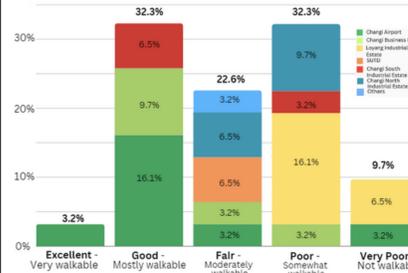
Changi South Industrial Estate - significantly low scores for 4 out of 7 categories - maintenance, legibility, aesthetics/ imageability & universal design. Pilot projects can be tested here.

SURVEY RESULTS

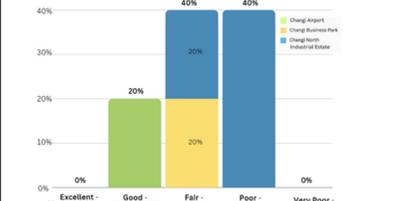
Workers' **demographic profile**: young workforce; across diverse roles (N=45)



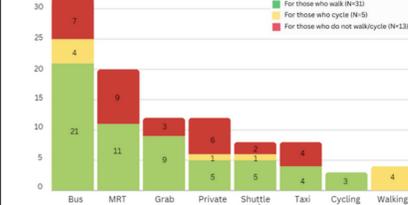
Workers' assessment of overall **walkability** in Changi Region (N=31)



Workers' assessment of overall **cyclability** in Changi Region (N=5)



Workers' other **common modes of transportation**



Workers' mean rating for **Direct, Comfort, & Safety** in Walking (N=31)

Category	Mean Rating
Directness in Walking	
Connectivity of walking paths	GOOD
Ease of access of the walking paths	GOOD
Walking accessibility for food and beverage services	FAIR
Walking accessibility for retail and shopping services	POOR
Seamless connections to MRT station	POOR
Seamless connections to bus stops	GOOD
Seamless connections to car parking	GOOD
Seamless connections to cycling paths/bike parking	FAIR
Comfort in Walking	
Sidewalk width	FAIR
Surface condition of sidewalks	GOOD
Cleanliness of sidewalks	GOOD
Presence of shelters and shades	POOR
Availability of benches and other resting facilities	POOR
Availability of toilets	POOR
Availability of drinking facility	POOR
Aesthetic appeal of the sidewalks	POOR
Presence of greenery and trees	GOOD
Noise level (i.e. peaceful)	FAIR
Safety in Walking	
Availability of traffic signs and information	GOOD
Quality of lighting along walking paths	FAIR
Harmonious use of sidewalks with cyclists	FAIR
Harmonious use of road crossings with motorists	FAIR

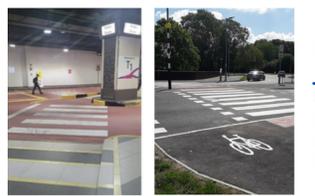
- Peak periods** of active mobility: 7:01 to 9:00 AM & 5:01 to 7:00 PM. Majority (69%) walk as part of their travel; 11% cycle
- Main reason** for walking is lack of alternative options. For cyclists, it is to maintain a healthy lifestyle.
- Main barriers for walking & cycling**: poor condition of pathways, poor weather conditions, safety concerns, lack of facilities and amenities.
- Top suggestions** to encourage walking: add more shelters and improve walking paths. For cycling: add more dedicated paths, improve biking-related facilities

SITE INTERVENTIONS: AIRPORT CLUSTER

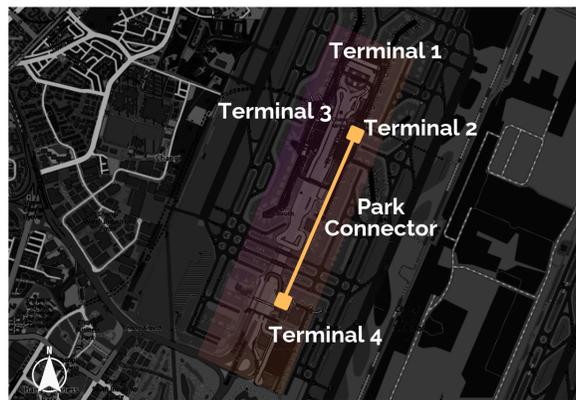
Enhance Workers' Last Mile Experience



Encourage morning peak cycling
Extend rental service hours to include morning peak to cater to workers



Enhance comfort of journeys
Formal traffic crossings & better lighting, ventilation in closed corridors and basement stops



IMPLICATION FOR FUTURE URBAN POLICIES & PLANNING

- Case study for other future Changi developments**
E.g. Changi East Industrial Zone, Airport Logistics Park, Terminal 5
- Mixed-methods approach** can be adapted & applied to assess other industrial estates
- Future researchers & planners** can use & build upon the survey & audit frameworks

LIMITATIONS & FUTURE RESEARCH AREAS

- Higher sample size would have been ideal.** Our findings nevertheless provide an indication of the workers' lived experiences
- Future researchers could pilot interventions at localised sites** to determine effectiveness & efficiency, before scaling up
- Further studies needed on changing behaviour,** beyond infrastructural improvements