

共創回收手推車報告

Report on
Co-Designing Iron Trolley for
Cardboards Recycling



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前言

Foreword

共創回收手推車的實驗，是理大賽馬會社創「騷·In·廬」計劃第二季「關懷長者就業」主題延伸出來的行動項目。和這一季的其他行動項目一樣，我們透過了解長者的就業情況，來深入探索一些既能令長者發揮所長，又能減低其工作勞損的方法。

我們搭建平台，讓公眾參加者連結社區組織和用家，在專業設計師的帶領下實驗創新點子。這個社會上有很多臥虎藏龍的有心人，他們跨領域的才能、對社區的熱誠及了解，能促使這些創新方案或產品「落地」實行。

在項目籌備時，我們接觸了一些關注拾荒長者的團體，發現這些團體熟悉拾荒長者的需要、工作環境和生活，對如何改善他們的工作條件有很好的想法，但礙於資源、人手和時間等各種因素而未有把想法實踐出來。其中一個意念，就是為回收紙皮的拾荒長者設計一部更安全、更附合人體工學的手推車。

我們召集的共創手推車設計團隊經過超過半年的研發，成功設計和製作了一部貼合拾荒長者工作需要和適合香港狹窄街道使用的回收工作手推車（簡稱：回收車）。回收車的設計最大特點是「貼地」，它雖非高科技的產品，但按照長者用家日常工作需要，用共同設計的方式，連結用家、社區組織和公眾參加者一起設計研發。結果回收車得到用家拾荒婆婆的欣賞。

The experiment of co-creating a recycling trolley is an action project extended from the theme of “Empathizing with Elderly in Workplace” in the second season of PolyU Jockey Club “Operation Solnno”. As with other action projects in this season, we investigate the working situations of the elders and explore different ways to enable them to make use of their strengths while reducing their work strain.

We set up a platform so that public participants can connect with community organizations and users, and experiment with innovative ideas under the leadership of professional designers. There are many hidden talents in this society who are enthusiastic and willing to apply their inter-disciplinary knowledges and care for community to facilitate the implementation of innovative solutions to tackle social issues.

During the project preparation, we contacted some community groups concerned about the needs, working environment and life of waste-picking elderlies. Even if they have a good idea on how to improve their working conditions, the community groups are restricted by resources, manpower or time to put ideas into practice. One of the common ideas is to design a safer and more ergonomic trolley for cardboard-recycling elders.

After more than half a year of research and development, the trolley co-design team we convened successfully designed and produced a recycling trolley that fits the needs of the elderly and is suitable for the narrow streets of Hong Kong. The biggest feature of the design is that it is “down-to-earthness”. Although it is not a high-tech product, it is designed to match the daily needs of elderly users. We encourage co-design approach connecting with users, community organizations and public participants to design and develop the recycling trolley, which is eventually appreciated by the waste-picking grannies.

在現今社會，基層長者工人受盡歧視，他們的勞工價值並未透過市場制度去彰顯出來，但藉著研討會及一系列工作坊，用設計思維方式，社區各持份者攜手以用家為本的角度去優化長者就業的處境，改善他們工作環境，對提升長者工作尊嚴有正面的作用。

香港理工大學

賽馬會社會創新設計院總監

實務教授（規劃）

凌嘉勤，銀紫荊勳賢

2020年1月

Nowadays, grassroots elder workers suffer from discrimination. Their labor value cannot be demonstrated through the market system. However, through seminars and a series of workshops where design thinking is deployed, all stakeholders in the community can join hands with users to tackle elderly employment issues. As such, we aim to optimize the employment situation of the elderly and improving their working environment, to have a positive effect on improving the work dignity of the elderly.

Ling Kar-Kan, SBS

Director, Jockey Club Design Institute for Social Innovation

Professor of Practice (Planning)

The Hong Kong Polytechnic University

January 2020



背景

Background

香港不少基層長者在社區從事拾荒工作，自食其力幫補生計之餘，亦為環保回收作出重大貢獻。然而，他們亦往往是被社會忽略的一群，沒有得到有效的協助。

與此同時，本地對基層拾荒者的研究很少。到目前為止，只有兩份較詳細和具有質性的拾荒長者研究，包括：2007年由樓瑋群教授為香港社會服務聯會所撰寫的《香港拾荒長者研究報告》和2018年拾平台發佈的《全港拾荒者調查研究報告》¹。前者發現拾荒長者在「老有所養」、「老有所屬」、和「老有所為」這三個方面都難以得到滿足；而後者則著重研究拾荒者從事拾荒工作的困難和他們對環保業的貢獻。

由於本港著重環保的風氣日強，市民對於回收行業從業員多了關注，也開始產生了一種認同感。拾荒者這個一直被忽視的群體亦開始受到注視，不少公眾都希望了解他們的處境，以及想辦法協助。

就此，香港理工大學（理大）賽馬會社會創新設計院（JCDISI）於2018年8月開展的理大賽馬會社創「騷·In·廬」計劃以「關懷長者就業」為第二季的主題。與在地團體拾平台合作，展開了一個關懷拾荒長者回收工作的「社創行動項目」，集合社會各方之力，按拾荒長者的實際需要，改良回收工作手推車設計，以協助拾荒長者減少工作勞損，提高工作時的安全，確保工作的尊嚴。

Many senior citizens from the grassroots in Hong Kong salvage recyclable waste as a way to make ends meet. Their work also contributes to the recycling industry. However, they are often neglected and receive little assistance.

Meanwhile, Hong Kong lacks research on waste pickers. There are only two relatively detailed and meaningful research projects on the topic up until now, including the **Hong Kong Waste Pickers Report** in 2007 conducted by Professor Vivian Lou of The Hong Kong Council for Social Service and the **Hong Kong Waste Picker Survey**¹ published by Waste Picker Platform in 2018. The former finds that older adults practicing cardboard recycling have a low satisfaction in 'livelihood', 'belonging' and 'active lifestyle'. The latter focuses on the challenges faced by waste pickers and their contributions to the local recycling industry.

As environmental awareness grows, there is a public interest towards the assistance given to stakeholders in the recycling industry and with it, a recognition of their work. The waste pickers community, who was previously overlooked, receives attention. The public is interested in understanding their working situations and is willing to offer help.

This echoes the theme of the second season of PolyU Jockey Club 'Operation Soinno'. The social design project initiated by PolyU's Jockey Club Design Institute for Social Innovation (JCDISI) at the end of 2018 is themed "Empathizing with Elderly in Workplace". Working with a local NGO Waste Picker Platform, the social innovation project focuses on helping waste pickers. Gathering talents from different sectors, the project is aimed to improve the design of trolleys to better suit the practical needs of waste pickers. The new design reduces the physical burden put on the workers, making work safer and dignified.

¹ Waste Picker Platform, 28th May 2018, The Hong Kong Waste Picker Survey (Chinese only: 全港拾荒者調查研究報告, [online access on:]http://newarrivals.org.hk/News/2783/New_Report_Ragpicker_Research_20180528.pdf)

共創設計的流程

The Process of Co-design

項目自 2018 年 11 月推行，舉辦拾荒長者友善設計工作坊，共吸引 25 名社區人士參加，他們透過三天的工作坊、落區觀察、與拾荒長者交流等等，一同構思出多個方案，包括改裝現時的回收工作手推車（簡稱「回收車」）、建立友善社區儲存空間等等。

工作坊後，在 JCDISI 的帶動下，四名參加者組成公眾設計團隊，與社區設計師、拾荒婆婆和拾平台的代表進一步落實構思，研究及設計不同可行的方案，經過多次測試，共花了約六個月完成製作全新設計的「回收車」原型：

階段一

2018 年 11 月為期三天的拾荒長者友善設計工作坊，啟發公眾討論，以同理同感態度，清晰界定拾荒長者所需要的「回收車」，參加者亦在社區組織拾平台協助下落區觀察和訪問，與拾荒長者交流，收集社區持份者的意見。透過工作坊內的創意思考工具，參加者共同構思意念、製作理想的「回收車」原型。

階段二

根據「階段一」產生的原型概念，由工作坊參加者組成公眾設計團隊，深入探討、研究不同設計意念的可行性，再落實產品原型製作，並進行用戶測試。

階段三

邀請兩位拾荒長者（黃姐、蘭姐）共試

The project began in November 2018. 25 participants from different sectors took part in the 'Social Innovation Design for Elderly Waste Pickers Workshop' in November. In the three-day workshop, the participants conceived numerous design proposals through field trips and face-to-face exchanges with waste pickers. These proposals include improving the current design of the trolleys used by the workers and organizing a waste-picker-friendly communal storage space.

After the workshop, four participants formed a trolley co-design team under the facilitation of JCDISI. The team continued to work with designers, waste pickers and Waste Picker Platform to further materialize their proposal through research and trials. The whole process spanned over six months and produced a prototype of a redesigned trolley:

First Stage

The three-day workshop held in November 2018 initiated an empathetic and sympathetic public discussion and established a clear vision of a 'recycling trolley' waste-picking elderly needs. Participants also paid visits and interviewed waste pickers with the help of Waste Picker Platform to collect the opinion of the stakeholders. Equipped with the creative thinking tools taught in the workshop, participated collectively brainstormed ideas and created a blueprint of an ideal 'recycling trolley'.

Second Stage

Based on the prototype created in the first stage, a trolley co-design team consists of workshop participants further investigated the feasibility of each design proposal, produced prototypes and conducted user testing.

Third Stage

The prototypes are tested by two waste-picking senior citizens (Ms.

用四星期，團隊收集她們的意見，再進行兩星期的觀察，以修訂設計。未來將再進行約十二個月的用家測試，確保產品安全及有效使用。

Wong and Ms. Chen) for four weeks. After collecting users' opinions and a two-week observation, the team revised their design. The prototype will undergo another 12-month user testing to ensure its safety and effectiveness.

設計過程全記錄

Complete Documentation of the Design Process

接著下來報告的內容主要是記錄「回收工作手推車」共創設計過程之中的設計原則、考慮和反覆測試的結果，以供讀者和未來的設計人員了解，以便加以利用和作生產的參考。

The following chapters document the co-design process, elaborating on the design principles, key design considerations and user testing results. The process is documented in detail in order to provide a useful reference for readers and designers to understand the methodology used and facilitate production and improvement of the design.



手推車共創工作坊參加者合照

Group photo of participants of "Social Innovation Design for Elderly Waste Pickers Workshop"



參加者在分享自己的創新想法

Participants shared their innovative ideas



參加者用木板製作一個新手推車的原型

Participants uses plywood board to create a trolley prototype

設計問題發現

Identifying Design Problems

香港的建築高密度又高聳林立，加上道路狹窄而擠迫。在如此獨特的城市環境中，手推車常常都被用作短途運輸的工具。

總結我們的觀察以及拾平台的調查報告所知，香港大部分拾荒者都年過60歲，有些更超過90歲。他們收集有價值的回收物（紙皮、鋁罐、金屬及膠樽等），再賣到回收店。手推車就是他們用作收集、儲存和運輸回收物的最主要工具。

拾荒者一直都受社會歧視，有人視之為「過街老鼠」，也經常被食環署驅趕。事實上，拾荒者對於社區的回收非常重要。2017年9月，內地整頓回收廢料入口，回收商會發起罷收廢紙，拾荒者停工，結果不到三日，就「廢紙圍城」。

正面肯定拾荒者的工作，能消除大眾對拾荒者的成見之餘，更名為這群長者建立工作的尊嚴。因此，設計小組向著這個方向而努力，由他們主要的工具入手，希望透過改善手推車的設計，使拾荒者能夠更有效更安全地完成工作，也讓社區明白他們的工作需要。

總結現時，拾荒長者使用的手推車時存在的難處有：

High building density and narrow roads in Hong Kong create a unique urban landscape in which trolleys are often the choice of transport for loading and unloading goods in short trips.

Summarizing our observation and the research results of Waste Picker Platform, many waste pickers are elderly over 60 years old; some are even well into their nineties. They collect recyclable materials (cardboard, aluminum cans, metals and plastic bottles, etc.) and sell them to recycling centers. They often use trolleys to transport their goods.

Waste pickers have been discriminated against and viewed as 'street rats'. They are often driven away by officers from the Food and Environmental Hygiene Department (FEHD). However, they have a crucial role in recycling in the community. In Sept 2017, as China limited the import of recycling waste, the Hong Kong General Association of Recycling Business stopped buying waste papers and cardboards. Waste pickers were forced out of work. In less than three days, waste papers accumulated all over the city.

Recognizing the value of their work can eradicate the deep-rooted prejudice towards waste pickers. Additionally, this can restore dignity to the group of elderly workers. It is with this aim that the co-design team works to improve the design of trolleys, an essential tool of the workers, and thus improving their productivity and educate the public about the nature of their work.

Elderly waste pickers had expressed difficulties using the existing trolleys. Their comments are summarized as follows:

- 經常被盜（或被執法人員沒收）
The trolleys are often stolen (or confiscated by officers)
- 長者推手推車時要彎身
They need to bend their backs when pushing
- 容量不足，以至經常出現超重載貨的問題
There is insufficient loading space, leading to overloading problems
- 沒有恰當及方便使用的捆綁裝置以固定回收物
No proper and easy-to-use strapping device to stabilize the recycling materials
- 沒有任何安全的設備，比如剎車，防撞，明顯辨悉的裝置等等
There are no security measures, for example, braking mechanism, anti-collision features or features for easy identification
- 沒有放置自用物品的地方
There is a lack of storage space

設計目的

Design Objectives

這次設計的目的是要把現時拾荒長者使用的角鐵手推車，改善得更安全，省力及配合本地環境和他們的使用習慣。

The design aims to improve the existing iron trolleys used by elderly waste-pickers, making it safer, easier to use and better adapt to the urban landscape and their using practices.

設計原則

Design Principles

- 盡量使用市場上可以買到的配件，以減輕成本及增加改裝的靈活性
- The components of the trolley should be readily available in the market in order to lower cost and enhance flexibility in changing parts
- 基於現有的設計來研發改善的方案
- The redesign should be based on the existing design and work towards improving its functionality

設計重點

Key Design Considerations

設計主要圍繞著手推車的人體工學、流暢度、儲物量以及保安問題上作出改善。以下總結設計小組討論過的建議（詳細請參考附件一設計指引）

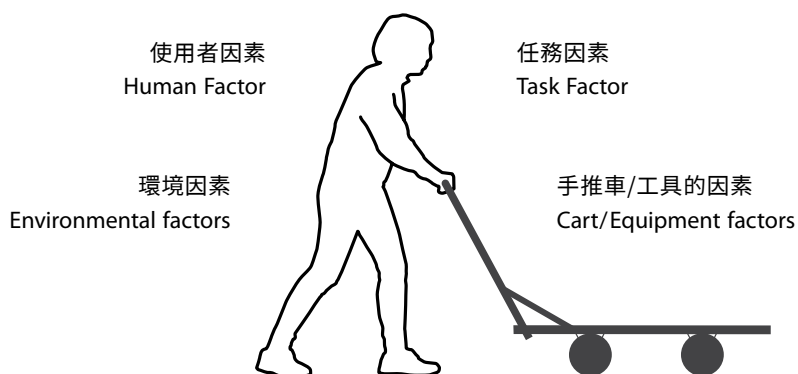
The redesign mainly takes into account considerations in ergonomics, driving performance, loading capacity and security. Below is a summary of recommendations discussed during the exchange among members in the design group. (Please refer to Appendix I: Design Brief for details)

要處理的項目 Considerations	具體原則 Principles	想法/建議 Ideas/ Recommendations
A 人體工學 Ergonomics	<ul style="list-style-type: none">• 不用經常彎腰 Do not need to bend their backs often• 移動時更省力 More power-efficient	<ul style="list-style-type: none">• 手推車把手的高度 Adjust the height of the trolleys' handle• 車輪的設計 Redesign the wheels
B 上學設計 Kerb-climbing	<ul style="list-style-type: none">• 省力 More power-efficient	<ul style="list-style-type: none">• 改變車輪的設計 Redesign the wheels
C 剎車方法 Braking Mechanism	<ul style="list-style-type: none">• 要容易操作 Easier controls	<ul style="list-style-type: none">• 添置單車剎車桿 Add bike brakes
D 儲物的空間 Storage Space	<ul style="list-style-type: none">• 要增加儲物空間 Increase storage space• 幫助收集其他回收物 Adaptable to other recycling materials	<ul style="list-style-type: none">• 擴充性 Add expandability• 加長車身 Lengthen the body• 使用方法的捆綁裝置 Add attachable components• 可以增加的配件 Add attachable components
E 保安方向 Security Consideration	<ul style="list-style-type: none">• 防盜竊 Anti-Theft Mechanism• 記錄位置 Record locations	<ul style="list-style-type: none">• 鎖 Install Lock• 可以回家收藏 Provide solution for home storage• 警告標示令人不敢偷走 Add warning sign to discourage theft• 加設 GPS 追蹤功能 Add GPS functionality
F 登記及聯絡 (加強手推車的辨識性 及拾荒者的組織性) Registration and Contact (improve the identification of trolley and the organization of waste pickers)	<ul style="list-style-type: none">• 足夠的資料，方便查閱 Sufficient information Easy to Check	<ul style="list-style-type: none">• QR 圖碼 Add QR code• 說明手推車擁有權 Indicate the ownership of the trolleys• 加強組織化 Enhance organizing

A. 在人體工學方面 Ergonomics

有四種因素會影響手推車的推動力度² 包括，使用者因素、任務因素、手推車設計因素、環境因素(如圖)。

Four factors affect the amount of hand force exerted when pushing a trolley². They are human factors, task factors, equipment factors and environmental factors (as indicated in the figure below)



使用者因素包括高度、年齡、性別、力量、姿勢等等；任務因素包括移動距離、推動力、持續的時間等等；手推車設計因素包括把手的高度、定位、車輪的性質等等；環境因素包括地面的性質、斜度和障礙物等等。

Human factors include height, age, sex, power and posture etc; Task factors are moving distance, pushing force and duration, etc; Equipment factors consists of handle heights, orientation and types of wheels; Environmental factors involve types of ground, inclination and obstacles, etc.

a. 使用者身高研究

Research of Users' Heights

拾荒者使用的手推車只有一種高度，未能配合長者的身高，有些日久使用而耗損，把手的位置被拉低，結果需要他們彎腰來推行，造成駝背 (rachio kyphosis) 和腰部勞損。

The existing iron trolleys popular among waste pickers have fixed handles. Their heights are not adjustable to the height of each elderly worker. Some wear off due to long-term use. As a result, their position is further lowered. The result is that waste pickers have to bend their back when pushing the trolleys, causing rachio kyphosis and lower back pain.

2 Darcor & Ergoweb, (2010). The Ergonomics of Manual Material Handling – Pushing and Pulling Tasks, [Online access, Access date: 23th April, 2019, <http://www.mhi.org/media/members/14023/130258038292642021.pdf>]



網絡圖片

Photo: internet photo



翻查了部分文獻資料，2004年北京65至80歲女性身高中位數是152.6厘米，男性的身高為165.5厘米³。1996年香港70-79歲的長者，女性身高中位數為148厘米，男性為162厘米⁴。以上的研究結果，與我們街上調查所得的結果接近。

我們的觀察之中，大部分拾荒長者為女性，她們的身高在124至157厘米之間，中位數為152厘米，而兩位男性的身高為157和160厘米，比一般女性為高（見附件二）。

According to literature, the median height of female aged 65-80 in Beijing in 2004 is 152.6cm and 165.5cm³ for their male counterparts. The median height of Hong Kong elderly aged 70-79 in 1996 is 148cm for female and 162 cm⁴ for male. The above data are similar to the survey we conducted on the streets.

Our street survey showed that most waste pickers are female, of height ranging from 124cm to 157cm. The median is 152cm. The two male workers in the group are 157cm and 160cm respectively, taller than the average female. (See Appendix II)

b. 把手高度在手肘與臀部之間

Setting Handle Heights between Elbows and Hips

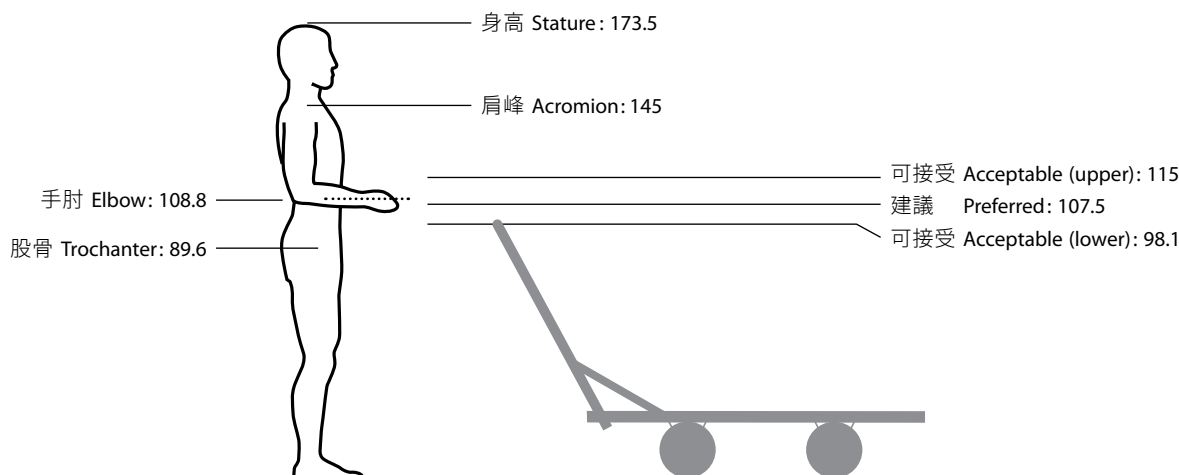
根據人體工學指引⁵，手推車的把手高度建議設於使用者的手肘和臀部之間。參照上一部份人體高度的平均資料，我們可以把手推車的把手高度定於介乎於73.6厘米至119.4厘米之間以適合香港的長者使用。為了能夠方便不同高度的手推車使用者，設計團隊計劃設計三種不同高度的把手高度。

The Ergonomics of Manual Material Handling⁵ suggested that trolley handles should be positioned between the users' elbows and hips. Referencing the data of average human heights aforementioned, the optimal handle height for Hong Kong elderly is between 73.6cm to 119.4cm above the ground. In order to accommodate users of different height, the team designed a handle with three adjustable positions.

3 T Hu, H & Li, Zhizhong & B Yan, J & F Wang, X & Xiao, Hui & Y Duan, J & Zheng, Lei. (2007). Anthropometric measurement of the Chinese elderly living in the Beijing area. *International Journal of Industrial Ergonomics*. 37. 303-311. 10.1016/j.ergon.2006.11.006.

4 LENORE J. LAUNER, TAMARA HARRIS, on behalf of the Ad Hoc Committee on the Statistics of Anthropometry and Aging, Weight, Height and Body Mass Index Distributions in Geographically and Ethnically Diverse Samples of Older Persons, Age and Ageing, Volume 25, Issue 4, July 1996, Pages 300-306, <https://doi.org/10.1093/ageing/25.4.300>

5 The Ergonomics of Manual Material Handling- Pushing and Pulling Tasks. [online available, access date:23th April, 2019, <http://www.mhi.org/media/members/14023/130258038292642021.pdf>]



大部份的文獻都建議把手的高度等於大約手肘高度⁶
 Most literature suggested that handle height should be around the height of elbows⁶

今次測試的用家黃姐，64歲，身高149厘米，手肘高度90厘米，臀部高65厘米。手推車的把手設計在於85厘米。這是符合人體工學的設計。

In this user testing, Wong, 64, is 149cm tall. Her elbows and hips are 90cm and 65cm above the ground respectively. The handlebar of the redesigned trolley is set at 85cm. The design meets the ergonomic principles.

c. 車輪的改裝 Modifying the Wheels



設計師把原本手推車的輪子拆去，前輪換上萬向輪，方便手推車轉彎。
 Designers removed the original wheels of the trolleys and replaced the front wheels with castor wheels. This makes turning easier.

⁶ Zhou, Jie & Wiggermann, Neal. (2017). Ergonomic evaluation of brake pedal and push handle locations on hospital beds. Applied Ergonomics. 60. 305-312. 10.1016/j.apergo.2016.12.012.

B. 上學設計

Kerb-climbing Ability

拾荒者每天平均工作 5.5 小時，大部分時間是推著手推車於街道上行走，於是一架省力、易於操作、「好推」的手推車對他們非常重要。市面買到的手推車，沒有轉向功能，而且用的車輪直徑較細短，所以較為費力。

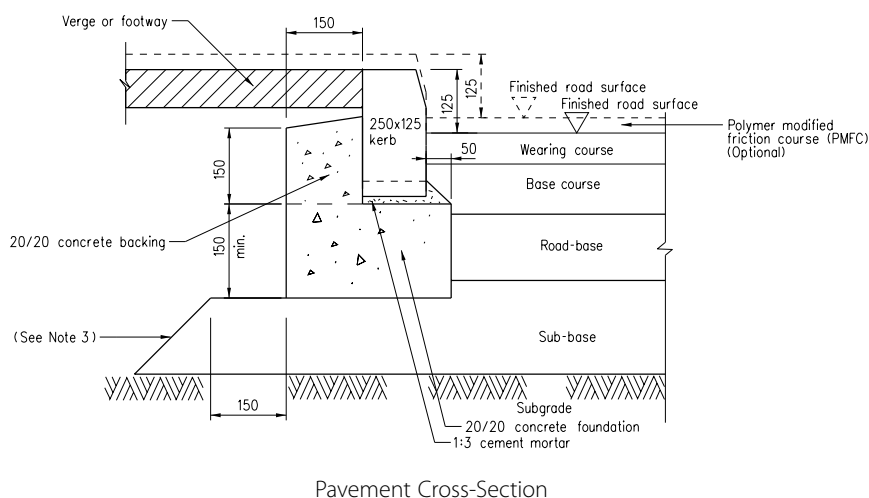
另外，設計團隊觀察到，由於香港的行人路較為擁擠和經常有障礙物，手推車的使用者很多時被迫在行車路和行人路上穿梭，路途中會遇到不同的壘位，因此，其中一個手推車的設計特點是研究如何令到手推車上壘能輕鬆。

壘位即是路緣 (Kerb)，是道路和其他構造物 (一般是行人道) 之間的分隔對界線。這個壘位的高度一般約是 12.5 厘米 (如下圖)，簡單來說，就是於行車路與行人道之間的障礙物，增加汽車的阻力，保障行人的安全。設計團隊觀察及量度了不同地方的壘位，發現壘位高度在 9.5 厘米至 14.2 厘米之間 (見附件三)。

Waste pickers work on average 5.5 hours daily, with most of their working time spent on pushing trolleys on the streets. Therefore, a power-efficient, easy-to-operate trolleys are of utmost importance to the workers. The trolleys in the market do not have turning capabilities. The diameter of the wheels is also smaller, making pushing harder.

On the other hand, the co-design team has observed that because of crowded sidewalks and often obstructions on the road, waste pickers need to push their trolleys up kerbs when travelling back and forth from streets to roads. Hence, one of the design considerations focuses on developing a kerb-climbing mechanism.

Kerbs (or Curb in American English) is a kind of partition separating roads and other structures (usually sidewalks). Kerbs are generally 12.5cm tall (as indicated in the figure below). Simple speaking, kerbs are protective obstacle installed between roads and sidewalks to act as a barrier between cars and pedestrians. The team observed and measured kerb in different locations and found out their heights range from 9.5cm and 14.2cm (See Appendix III).



行人路的橫切面圖 (來源：路政署)

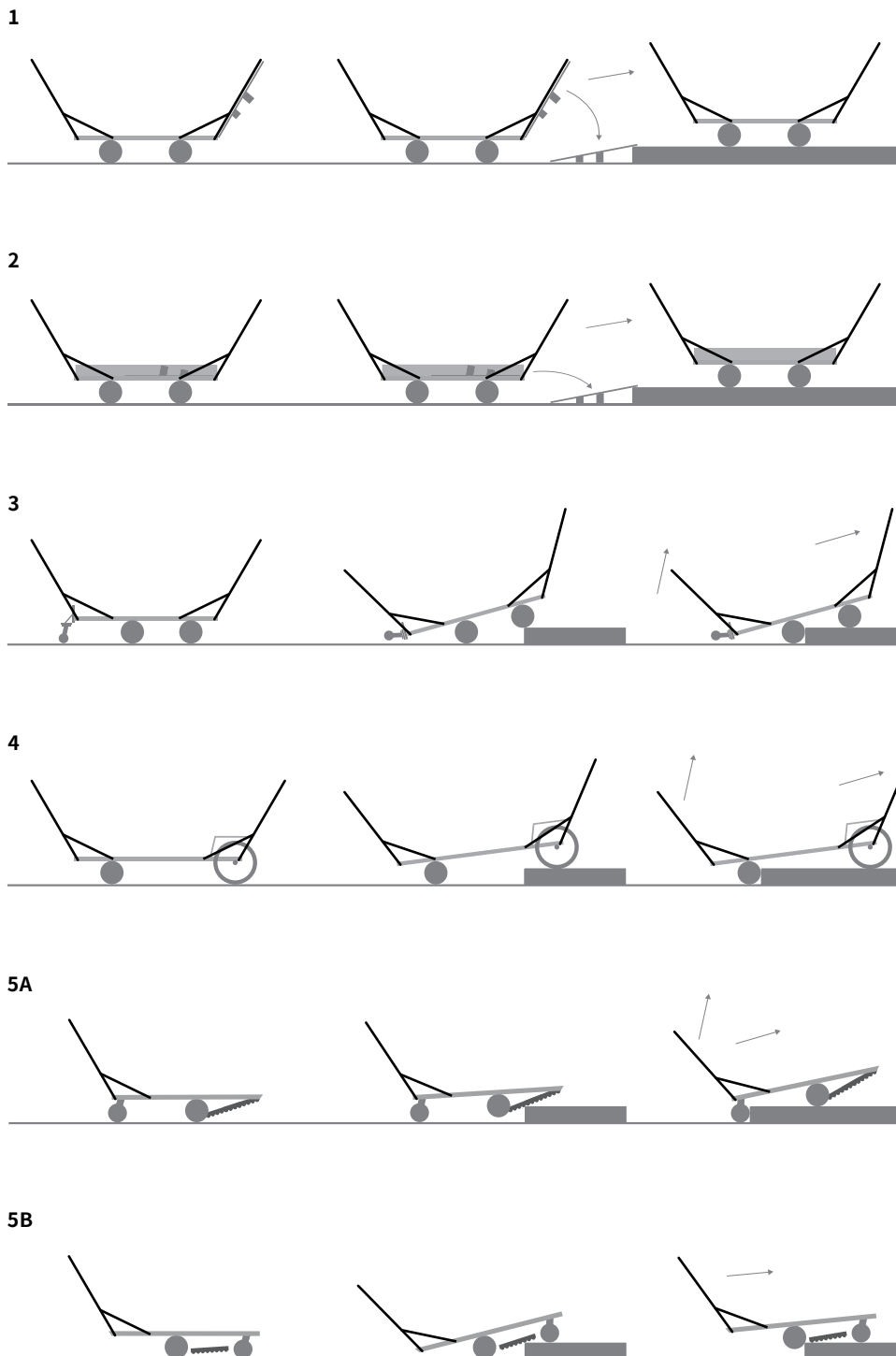
Cross-section of pavement (Source: Highways Department)

a. 容易上學的設計方案

Enhancing the Kerb-climbing Ability of Trolleys

由於不同地區的學位的高度不同，而且有些地方高度差大，因此為了使手推車容易上學，設計團隊思考了以下五個方案的優劣處：

As the heights of kerbs are different in different locations, and some have a huge height difference, the team devised five proposals of kerb-climbing mechanisms and discussed the strengths and weaknesses of each design:



設計方案 Design Proposals	優點 Strengths	缺點 Weaknesses
<p>1 於手推車把手添置可拆下的斜板，上學前將斜板卸下 Installing a detachable ramp, the ramp can be employed whenever the trolleys need to move up a kerb</p>	<ul style="list-style-type: none"> • 操作容易 Easy operability • 容易維護 Easy maintenance • 可達到目的 Achieve objective • 容易安裝 Easy installation 	<ul style="list-style-type: none"> • 步驟多，行動慢 Slow and involves many steps • 不方便急於推上學 Inconvenient when in a hurry • 增加手推車的重量 Increase the weight of the trolley
<p>2 於手推車上設有收斜板的空間及間格 Adding storage space for the detachable ramp</p>	<ul style="list-style-type: none"> • 增加收納空間 Increase storage space • 操作容易 Easy operability • 要彎身拿斜板 Need to bend to reach the ramp 	<ul style="list-style-type: none"> • 車身重量增加 Increase the weight of the trolley • 減少收納紙板的空間 Reduce loading capacity
<p>3 將尾輪移前，令車的重心產生繞繞板的作用，使車身容易傾斜，並於車尾加上一個附助輪，令車頭容易上升 Moving the back wheels towards the front to create a see-saw effect. The shifted centre of weight makes the body leans backwards. By adding an auxiliary wheel at the back, it is easier to tile the trolley up the kerb</p>	<ul style="list-style-type: none"> • 結構簡單 Simple structure • 成本低 Low cost • 容易操作 Easy operability 	<ul style="list-style-type: none"> • 小車輪的損耗可能很大 Small wheels are more easily worn out • 尾輪上學仍需要很大的力氣 Back wheels still require a lot of strength to climb kerbs • 推車時可能不安全 Relatively unsafe when pushing • 輔助輪子易失支持 Auxiliary wheel can easily lose support
<p>4 加大前面的車輪 Enlarging the front wheels</p>	<ul style="list-style-type: none"> • 容易操作 Easy operability • 磨擦力低 Low friction • 操作簡單，但要於車頭拉上學 Easy to operate when climbing kerbs from the front 	<ul style="list-style-type: none"> • 重量增加 Increase the weight of the trolley • 大車輪容易碰花汽車 Big wheels may scratch cars • 尾輪上學仍需要很大的力氣 Back wheels still require a lot of strength to climb kerbs
<p>5A 在車底增加一排流利條滑軌 Adding a small roller track under the trolley in the market</p>	<ul style="list-style-type: none"> • 容易操作 Easy operability • 市面上沒有這種設計 No design of the same type • 未知成效 Efficiency still unknown 	<ul style="list-style-type: none"> • 成本高 High cost • 結構略為複雜 Complicated structure
<p>5B 在車底前方增加一排流利條滑軌 Adding a small roller track under the front side of the trolley</p>	<ul style="list-style-type: none"> • 容易操作 Easy operability • 市面上沒有這種設計 No design of the same type in the market 	<ul style="list-style-type: none"> • 尾輪上學仍需要很大的力氣 Back wheels still require a lot of strength to climb kerbs • 結構略為複雜 Complicated structure

b. 設計方案 5B

Design Proposal 5B

在考慮了上述多種方案之後，由於設計方案 5B 是一個較為罕見創新，因此設計團隊決定實踐並予以測試。測試涉及兩大問題，第一，測試不同的流利條；第二，流利條距離地面的高度。

After considering the proposals above, the team decided to work on materializing the proposal 5B, which is the most innovative approach to the problem. Testings concerns two main aspects of the design: First, different types of roller tracks; Second, the height of the roller tracks from ground.

效果

Results

測試一

- 上學時，流條利內小輪子之間的空隙，會卡在路沿上
- 對上學有幫助，但仍要很大力才可推動

Test 1

- When climbing kerbs, the kerbs got stuck between the gaps between the wheels
 - It helps kerb-climbing but still requires a lot of force
-

測試二

- 選用輪子直徑較細的流利條，輪與輪之間的空隙縮短，不會卡在路沿上
- 比測試一更省力

Test 2

- Using two roller tracks with wheels of smaller diameter. As the gap between wheels are smaller, it does not get stuck
 - It requires less force when climbing compared with test 1
-

測試三

- 用一條直的鐵代替流利條
- 不會卡住路沿
- 推上學的力度比測試二大些

Test 3

- Replacing the rollers with a straight iron bar
 - It does not get stuck
 - It requires more force than test 2
-

測試四

- 雙流利條可以解決了流利條輪與輪之間卡住的情況
- 這型號流利條的小輪子包著矽膠，顯得更耐用
- 小輪子可以獨立更換
- 制作過程稍複雜
- 成本稍偏高

Test 4

- Double rollers reduce the possibility of getting stuck
- The wheels of this type of rollers is wrapped in silicon and seemingly more durable
- The wheels are replaceable
- The production process is more complicated
- Cost is slightly higher

測試一
Test 1



測試二
Test 2



測試三
Test 3



測試四
Test 4



c. 上壘測試

Kerb-climbing Tests

測試團隊於4月進行了多次的上壘測試，最後發現流利條對於上壘有幫助，而且越貼近地面，那作用更大。不過由於使用流利條上壘時用力方向是跟普通手推車不同，所以就算增加了流利條，也不是太容易使用。女性用家成功推上壘的機率較低。

The team conducted multiple kerb-climbing tests in April. The test concluded that roller tracks make kerb-climbing easier. Moreover, the closer they are to the ground, the more effective they are. However, the new design requires a different way of manipulating. Even with the added rollers, it still needs a certain amount of force to climb up the kerbs. It is more difficult for female waste pickers to push the trolleys up a kerb.



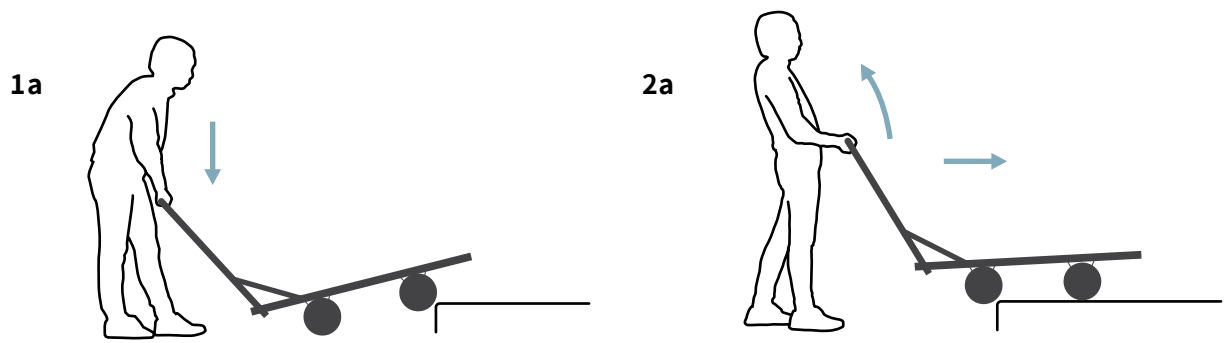
第一次測試上壘的裝置
First time testing the kerb-climbing mechanism



測試上壘的相片記錄
Documentation of kerb-climbing testing

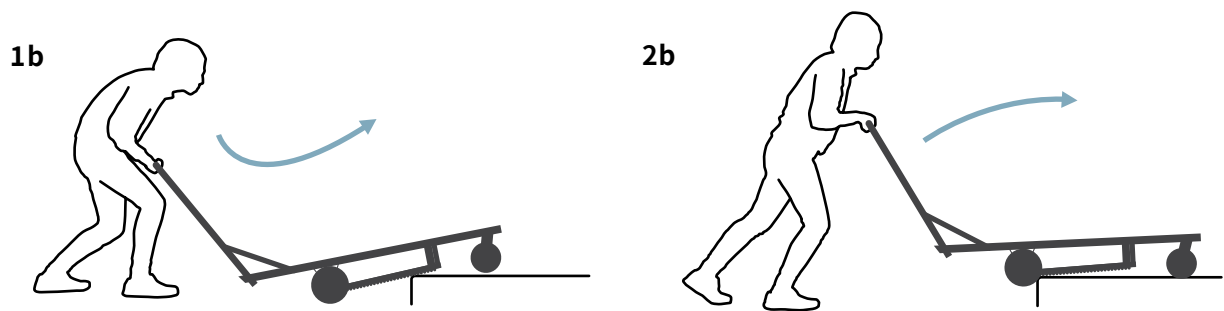
傳統方式

Traditional kerb climbing mechanism



新設計

New design



由於新的設計是需要運用推力(標示 2b)，使手推車推上壘，和原本的設計於步驟 (2a) 要拉起整架手推車不同。新的方法需要屈曲前膝，傾斜但拉直身體，運用腳部跟地面產生的磨擦力，把手推車推上壘。雖然可以更省力，而且減少腰部受傷的機會，但長者用家很多不能屈膝，他們習慣了用力的方法也不容易改變，這成為設計團隊的另一難題。

Since the new design requires pushing rather than lifting to climb the kerbs (indicated in figure 2b). The way of manipulating is different from the existing model (2a). The users need to bend their knees, lean in, straighten their backs to push the trolley up the kerb using the friction between the ground and the feet. Although the new design is more power-efficient and reduces the possibility of lower-back injury, many elderly workers cannot bend their knees. It also takes time for them to get used to the new way of manipulating the trolley. This poses a new challenge for the co-design team.

d. 完善方案

Perfecting the Prototype

方法一

在原有的把手上增加延長的部分，令到用家可以在推上壘時，推動的支點提高，於是用家就不用屈膝用力了。

Method 1

By extending the original handle bar, designers raise the pivot point, thus the users do not need to bend their knees when pushing the trolleys up the kerbs.

方法二

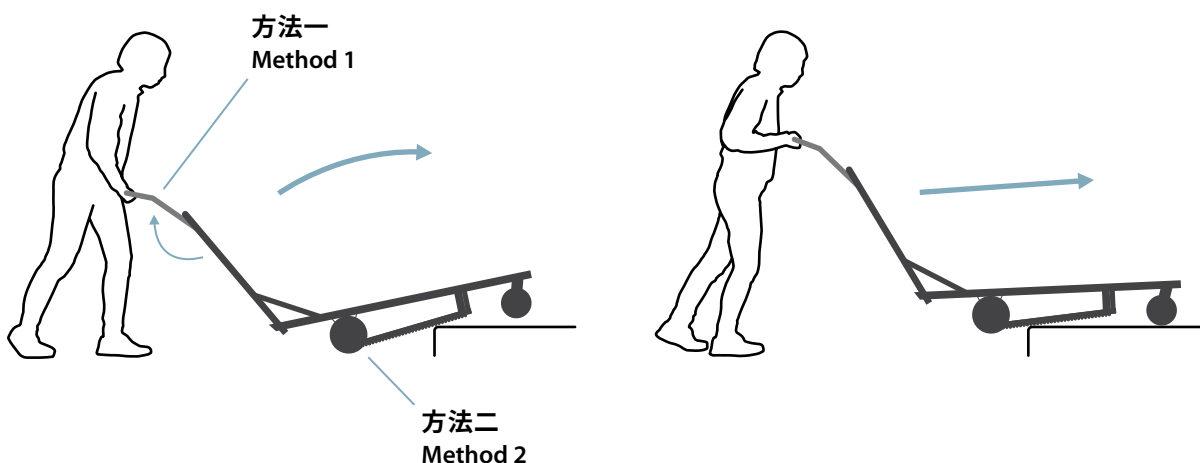
調整車輪的距離。由於第一次測試的上壘時發現，後輪放得太前的話，當流利條撞到壘時，手推車需要維持很大的斜度才可以緊貼地面借力，所以阻力很大，而且操作人員需要蹲下身軀。因此，設計團隊建議改善的方案是把後輪調後，而把流利條拉低貼近地面，增加前後輪的距離，就可以減低手推車上壘的斜度。

Method 2

Adjusting the distance between wheels. In the first test, it was discovered that if the back wheels are positioned too much towards the front, the trolleys will need a large-angle tilt for the rollers to make contact to the ground, significantly increasing resistance. This also means that the operators need to partially squat to push it up. In light of this, the team revised their design by moving back wheels further towards the back while lowering the rollers closer to the ground. By increasing the distance between the front and back rows of the wheels, it reduces the trolley's tilting when climbing kerbs.

改善方案後的示意圖如下，使用者推動時就不用蹲低身體了：

The figure below shows the revised design. In this version, operators do not need to bend their knees when pushing up:



改善方案後的示意圖，使用者推動時就不用蹲低身體了。

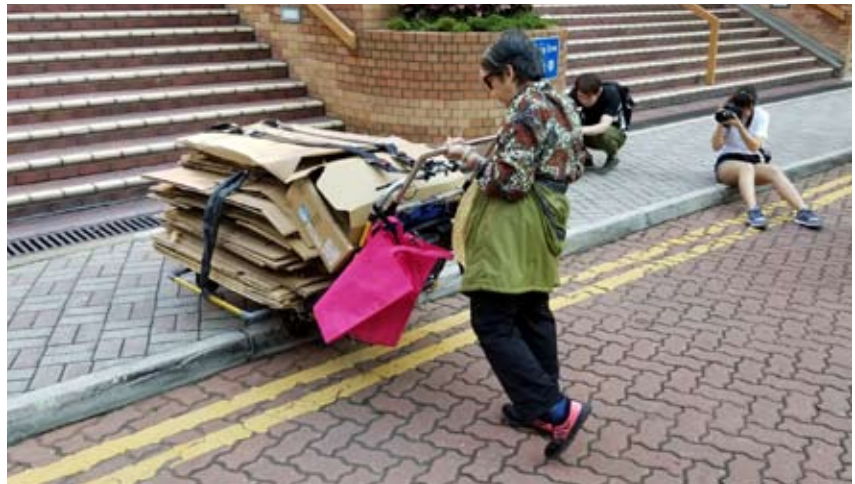
In the revised design, the operator does not need to bend their knees when pushing up.

紅圈位置就是增加的
測試用的把手
The red circle indicates
the additional handle
installed for the test



採用了改良方法之後，測試對象都可以很輕鬆推手推車上學。
Adopting the revised design, the operators can push the trolley up the kerb
using much less effort.

4月15日測試，增加了測試
把手和量度把手的高度。
On 15 April, users tested the
trolley with additional handle
and measured its height.



4月26日測試，附加把手
定案，所以上學更輕鬆。
On 26 April, the trolleys
equipped with the
additional handle is much
easier to push up a kerb.



C. 剎車方法 Braking Mechanism

現時市面上售賣的手推車都沒有剎車的功能，可是，在收集回收物時，能夠令手推車停定，或者能在上落斜坡時減低速度對手推車使用者有很大的幫助。

有見及此，設計團隊參考了一些剎車方案，最後決定用單車剎車裝置改裝。

The iron trolleys available in the market does not have a braking mechanism installed. However, such a braking mechanism that allows user to control the speed when ascending or descending a slope would be very useful.

In view of this, the co-design team studied several different braking mechanisms and decided to use modified bike brakes for the trolleys.



攝於大館展覽
photographed in a Tai Kwun's exhibition

手推車的剎車杆設置於把手旁邊，是「超記」車的設計。這款剎車杆的機制複雜，只可以用單手控制，年長的使用者或可能沒有足夠力量控制。

The braking lever is installed at the side of the handle bar. This design is signature of Chiu Kee.

This braking mechanism is relatively complicated. Only can be operated using one hand, older workers might not have enough strength to control the mechanism.



網絡圖片
image from the Internet

右邊這手推車的剎車杆設置於把手之下，要用單腳踩下來控制。考慮到年長的使用者手腳或可能不太靈活，用單腳控制會出現困難。

The braking mechanism of this trolley is installed under the handle bar and is controlled by stepping on the brake.

Considering older adults are less agile, this mechanism might be difficult to use.

採用的設計方案

Adopted design proposals



剎車控制杆設置於手推車的把手上，使用非常方便。如想停定之後靜止手推車，可以把控制杆扣於旁邊設置的鋼索上，手推車即可停定不動，方便上落貨物。

The braking lever is conveniently installed on the handle bar. To park the trolley, the operator can tie the brake to the handle. This allows the trolley to remain stationary when loading and unloading.



用家可以輕易在落斜時控制車速

Users are able to control the speed of the trolley when going down the slope

D. 儲物的空間 Storage Space

a. 增加載貨空間和平衡 Improved Loading Capacity and Trolley Balance

由於拾荒長者經常會推著大堆的紙皮和回收物，手推車載貨空間增加，可以使他們收集更多貨物，掙取更多生活費。

其中一個設計意念是用塑膠水管搭建一個可折疊的擴充平台，增加手推車的載貨量。同時，前面和左右兩邊的擴充平台可以幫助貨物平衡。

Elderly waste pickers usually collect a massive pile of cardboard and recyclable materials. Increasing the trolley's loading capacity can allow users to pile up more materials, thus earning more income from one trip.

One design idea is to install an additional foldable platform that can expand when needed. The expandable platform increases loading capacity. Furthermore, the expandable platform at the front, left and right side of the trolley can help improve balance.



b. 增加儲物空間

Increased Storage Space



車後的儲物箱，內存手套、安全反光衣、雨衣、急求包、鏢刀，鎖等等。而使用者可以放入銀包及電話等財物，再用鎖鎖上。

The storage box at the back of the trolley stores gloves, reflective vests, raincoats, first aid kit, cutter and lock. Users can put their wallets, mobile phones and other belongings in the lockable box.



車前的不織布袋，內藏有一大片防水帆布，以備下雨時防止弄濕車上的貨物。

The non-woven bag in the front stores a large piece of waterproof fabric, which can be used to cover the recyclables under rain.

c. 扣緊貨物的裝置

A Mechanism to Secure Goods



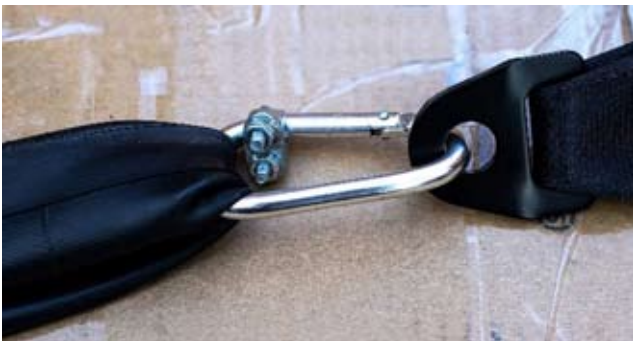
利用安全扣連接有彈性的廢車胎，拾荒長者就可以利用兩隻手的拉緊貨物。

The safety belt connecting the reused elastic tires allow waste pickers to secure goods easily using two hands



廢車胎綁於擴充車架之中，可以增加載貨量和穩定性，不用彎腰去操作。

The reused tires are tied to the expandable platform to increase loading capacity and stability. The operators can easily deploy the mechanism without bending their backs.



這個金屬扣用來接駁安全帶與廢車胎

This metal buckle connects the safety belt and the reused tire



手推車總共有三條索帶

The trolley has three cargo securing belts in total

d. 反光安全裝置

Safety Reflective Features

車身配備警示燈和反光貼，增加路面行駛時的辨識度。

The trolley is equipped with warning lights and reflective sticker to increase its visibility when driving on the road.



E. 保安方向

Security Consideration

a. 防盜鎖

Anti-theft Lock

在防盜方面，令到盜賊難以推走手推車是其中一個方法，於是設計團隊搜集了不同的鎖鏈，考慮因素包括價錢和方便性。以下是一些例子：



Regarding security, one good way to counter theft is to make it harder for thieves to push the trolleys away. Following this train of thought, the team collected a number of different locks and chains. After considering the price and the ease of use, below are some examples:

防盜竊的另一個可行的方法是讓盜竊者不能輕易賣賊贓，增加阻嚇性。設計團隊建議於手推車上加上不可以拆除警示語句：「此手推車是屬 XXX 所有之非賣品，如有變賣，實屬偷竊」

Another approach to prevent theft is by making it difficult to resell stolen trolleys and enhance deterrent effect. The team recommended adding warning signs on the trolley with phrases such as “This trolley is XXX’s property. Reselling stolen property constitutes theft.”



設計團隊觀察到，拾荒長者於夜晚停泊手推車時會留下大半車的紙皮，建議用左圖這種鐵製鎖鏈來鎖住手推車。

The team observed that elderly waste pickers usually left a cartful of cardboard as they park their trolleys at night. They suggested using the chain shown at the left to lock the trolley in place.

回收手推車設計成果效能介紹

Features of the Redesigned 'Recycling Trolley'



新設計的「回收車」規格

The specifications of New "Recycling Trolley"

摺合尺寸 Size folded : 1200mm (L) x 560mm (W) x 300mm (H)

打開尺寸 Size opened : 1300mm (L) x 850mm (W) x 860mm (H)

淨重 Net Weight : 36kg

最大承載量 Maximum carrying capacity: 100kg

手推車的新設計最大特色是「貼地」，切合拾荒者實際工作需要。手推車以市面上最普及的鐵車仔做藍本加以改良，使之變得更安全、省力及配合本地環境之使用。

The signature feature of the new trolley is its "down-to-earthness". Based on the most popular iron-trolley on the market, it is made to be safer, more labor-saving and adaptable to the local environment.

特點

Features

- 易於上學
Easy kerb-climbing mechanism
- 轉向省力
Easy navigation
- 具備剎車功能
With the function of brakes on the rear wheels
- 鎖車裝置
Locking device
- 與現時常用手推車比較，載相同重量的貨物會更加平穩
Goods of same weight is more stable on the new recycling trolley when compared with the traditional trolley
- 切合拾荒者實際的工作需要，並能配備他們日常需要的配件
Meet the actual work needs of waste pickers and equip them with the accessories they need every day
- 利用現有最常見的鐵車仔改裝，使之變得更安全、省力、配合本地環境使用
Based on the design of common iron-trolley selling on the market, made to be safer, more effort-saving and adaptable to the local environment



社區簡介活動

Showcase in the Community

為了向社區內的長者簡介新設計的回收手推車的特點，賽馬會社會創新設計院聯同設計團隊於2019年9月，土瓜灣的空地上首次展出改良後的「回收車」。

In order to introduce the newly designed recycling trolley to the elders in the community, JCDSI and the trolley co-design team organized a case exhibition of them improved "Recycling Trolley" in September 2019 on the open space in To Kwa Wan.

為了令設計更加完善，我們找來了拾荒長者（黃姐、蘭姐）為「回收車」作了前期的道路測試。他們共試用四星期，時間包括：

For perfecting the design, two elder waste pickers Ms. Wong and Ms. Chen were invited to try the new recycling trolley for four weeks.

- 黃姐於2019年7月2至14日期間，在上水試用新設計「回收車」
Ms. Wong, conducted during 2nd July 2019 to 14th July 2019 in Sheung Shui
- 蘭姐於2019年7月30日至8月13日期間，在北角試用新設計「回收車」
Ms. Chen, conducted during 30th July 2019 to 13th August 2019 in North Point

黃姐和蘭姐試用期間的意見包括：

Ms. Wong and Ms. Chen shared their user experience and made the following design suggestions:

- 摺疊支架左右打開的闊度需要調整
The width of both sides of the expandable platform need readjustment
- 回收車的三條索帶可以減少至兩條，視乎用家的需要
Depending on the user's need, the cargo securing belts can be reduced from three in the current design to two straps per trolley.
- 車架需要添置膠片，可以防止小型物件掉下
The trolley frames need additional plastic toe boards to prevent small objects from falling off.
- 車身有點重，但現階段未有解決方案
The trolley body is still a little bit heavy. However, there is no solution currently.

在回收工作手推車的社區簡介會進行期間，街坊的反應很踴躍，對於新設計的回收車都感到十分好奇，踴躍查詢回收車的設計和功能，數小時的簡介活動吸引了約100名街坊以及多名媒體[見附件四]的代表到場了解。

The presentation was well-received by the community where the event was held. The audience is curious about the redesigned trolley and enthusiastically inquire about the trolley's design and functions. The presentation, which spanned over a few hours, attracted around 100 audience members and reporters from several media outlets (see Appendix IV).



設計手推車的「車仔實驗組」成員合照

A group photo of the members from the trolley redesign team



義工向婆婆簡介回收車的功能，街坊亦覺得很有趣。

A volunteer explained the different functions of the trolley to a senior. She found it interesting.



JCDISI 的總監凌嘉勤發言，期望手推車可以減輕拾荒者的工作勞損。

The director of JCDISI, Mr. K.K. Ling spoke at the event. He hoped the redesigned trolley could alleviate the physical strain waste-picking work out on the elderly workers.



街坊都在討論回收車的特點，
評價正面。

The audience discussed the features of the new design.

The comments were generally positive.



附件一：設計指引

Appendix I: Design Brief

目的：改善現有拾荒者所使用的手推車，使之更安全，省力及配合本地環境之使用。

手推車所需改善的範疇

保安： 停泊鎖車，防盜，加標記聯絡及有用資料工具收藏

人體工學： 免勞損（工作高度及舒適度）

操作： 有煞車功能，轉向及推動省力，車身總重量要輕，視線不受阻，有省力上街壘的設計

容量： 考慮合適的載貨量，紙皮的大細，有擴展運載量的功能

貨件分類： 主要是紙皮，次要是鋁罐

所配備的工具： 剗刀兩至三把、手套、雨衣、鎖、繩索之類、太陽帽、藥品急救包

- 安全：
1. 免工傷（刀傷、扭傷、碰撞）
 2. 在行人路及馬路（防止與道路使用者有衝突）
 3. 使用者的安全，免碰撞，手推車免碰撞其它東西
 4. 上落斜可煞停，防反車／跌紙皮
 5. 防火

- 配合環境使用：
1. 天氣（雨天及暴曬時使用）
 2. 拆箱地點（免被檢控及驅趕）
 3. 推車路線（道路的闊度、出入口情況）
 4. 儲存地方（紙皮暫存時的情況）
 5. 擺放手推車地方

其它考慮：

情感需要：壓力（被檢控）、形象（被誤解）、職業操守及社會身分

法例：執法範圍、阻街定義（法例—非人性化，定義模糊？）

設計考慮：成本、製作技術及難度、時間、維修成本

用家期望：增加儲物空間，容易推動及操作

Objective: Improve the design of the existing trolleys used by waste pickers to make it safer, more power-efficient and more suitable for the specific urban environment in which it is being used.

Areas to be improved for the trolley

Security:	Parking lock, anti-theft, additional signs with contact information and storage for tools
Ergonomics:	Anti-injuries (height of the handle and comfort)
Operation:	Braking mechanism, more power-efficient turning and pushing, lightweight, do not block the user's field of vision, require less force to climb kerbs
Storage Space:	Consider the optimal loading capacity, the size of cardboard, expandable platform to increase loading capacity
Types of cargo:	predominantly cardboard and sometimes aluminium cans Set of equipment: Cutter 2-3, gloves, raincoat, lock, ropes, cap, first aid kit
Safety:	<ol style="list-style-type: none">1. Anti-injuries (minimize injury caused by slicing, spraining, twisting and collision)2. Sidewalk and road safety (prevent conflict with other road users)3. Users' safety, anti-bumping and prevent the trolley from bumping into other objects in the streets4. Braking when climbing up and down slopes. Anti-rollover/prevent cargo from falling5. Fire-resistant
Adaptable to different environments:	<ol style="list-style-type: none">1. Weather (heavy rain or under scolding heat)2. Loading location (prevent prosecution and dispersal)3. Route (widths of pavements, entrances and exits)4. Storage location (temporary storage of cardboard)5. Parking location
Other considerations:	Emotional needs: pressure (fear of prosecution), image (misunderstood), professionalism and social status Legal considerations: the scope of enforcement, the legal definition of street obstruction (is the law too rigid, is the legal definition too vague?) Design considerations: cost, production techniques and difficulties, time and repairing cost User expectations: additional storage space, easy to push

附件二：拾荒者身高調查

Appendix II : Heights of Waste Pickers

調查於 2019 年 2 月進行，結果如下：

Data as follows (survey conducted in February 2019) :

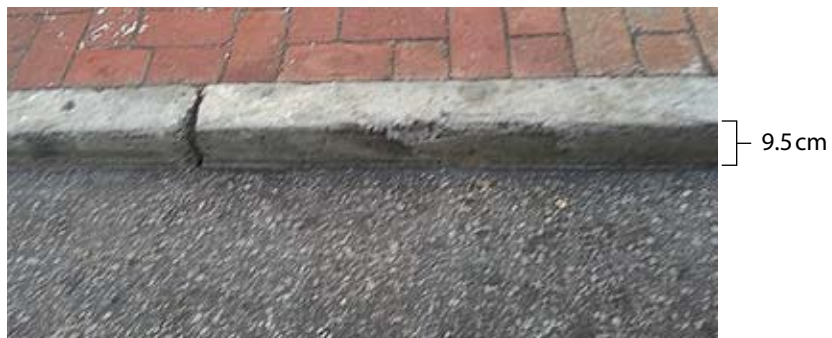
年齡 Age	性別 Gender	身高 Height (cm)
45	F	157
61	F	147
62	F	152
65	F	155
66	F	149
67	F	155
67	M	157
68	F	124
75	F	157
78	F	145
82	M	160

附件三：壘位高度

Appendix III: Kerb Heights

設計團隊觀察到的壘位高度（攝於2019年2月，元朗）

Kerb Heights as observed by the design team (photographed in Feb 2019, Yuen Long)



附件四：媒體報導

Appendix IV: Media Coverage

標題 Title	媒體名稱 Media	出版日期 Publishing Date
1. Cardboard nannies'are given an upgrade	South China Morning Post	16/9/2019
2. "Hong Kong's 'cardboard grannies' get trolley upgrade after team from redesign Polytechnic University does – and new ones come with a burglar alarm"	South China Morning Post	16/9/2019
3. 理大助拾荒長者 改裝安全回收車 成本約三千 省力易用	星島日報	16/9/2019
4. 理大研手推車 紓拾荒者勞損	香港經濟日報	16/9/2019
5. 理大：增萬向輪煞車功能 省力 手推車助拾荒長者	am730	16/9/2019
6. 理大社創改裝手推車 長者讚好用 增煞車防盜功能 上斜轉彎更佳	晴報	16/9/2019
7. 長者拾荒勞損多 理大設計手推車助減負擔	Topick	16/9/2019
8. 拾荒者新車上路 成本 3000 元可鎖車上學 紙皮婆婆：省力免失車	01新聞	16/9/2019
9. 實試 理大全新手推車實試 減執紙皮長者之苦	Unwire.hk	6/11/2019
10. 專訪 理大拾荒手推車 真用家·紙皮婆婆專訪	Unwire.hk	13/11/2019
11. Meet Hong Kong's grannies forced to collect cardboard	BBC	17/12/2019
12. 老齡化香港的縮影：拾荒者蘭姐的故事	BBC	24/12/2019
13. 【#香港地】改良手推車 幫拾荒者減勞損	U Magazine	11/2/2020

附件五：GPS 和登記制度的研究

Appendix V: Research on GPS and Registration System

拾荒者的工作有如自僱人士，收入低之餘又沒有工作保障，經常需要面對各種不利的處境，包括：與同業爭紙皮發生爭執，被驅趕，被偷去回收物或個人財物，被回收店不禮貌對待和「呢秤」。

關注拾荒者權益的組織拾平台於 2018 年底開始試驗拾荒者登記制度，記錄拾荒者的聯絡資料。食物環境衛生署的職員曾在街上檢控一位高齡的拾荒者而引起社會的反響，拾平台成功遊說部份地區的執法人員，當見到已登記的手推車阻礙通道時，可以聯絡拾荒者限時之內移去阻礙物，減少與市民的磨擦。

現時拾平台的登記制度主要會記錄拾荒者的電話、姓名、工作地區及位置等等。而登記的資料會透過 QR 圖碼於手推車上顯示。

設計團隊曾經構想，在手推車上設置 GPS 全球定位系統，來監察位置，以及防止手推車被盜；與此同時，可以建立系統，增強市民與拾荒長者的互動。

Most waste pickers in Hong Kong are self-employed. Low income and lack of work benefits often put them in unfavourable situations, such as: fighting with other workers over cardboard, being dispersed by officers, having their cargo and personal belongings stolen, mistreated by recycling business owners and cheating with weights.

Waste Picker Platform, an NGO focused on the rights of waste pickers, began a registration system at the end of 2018 to catalogue contact information of the worker. The prosecution of an elderly waste picker by an FEHD officer has garnered much attention lately. With the new system in place, the Platform successfully convinced law enforcement in some districts to be more flexible since they can notify waste pickers in time when their trolleys cause any obstruction, thus defusing conflicts between citizens and waste pickers.

Currently, the Waste Picker Platform registration system keeps a record of the telephone number, name, working district and location of waste pickers. The information is accessible through scanning the QR code on the redesigned trolley.

The design team had considered installing GPS to the trolley to monitor the location of each worker and to prevent theft. At the same time, this system can foster trust and interaction between citizens and the elderly waste pickers.

GPS 的安裝考慮

GPS 系統的要求擁有的基本功能：

- 可以查找及定位手推車的位置
- 定位系統可以控制多部手推車
- 警報提醒鎖定狀態下的手推車被突然推動
- 可以儲存手推車每天經過的路線
- 容許多方平台使用

Considerations for the installation of GPS

The GPS should equip these basic functions:

- to orient and search for the location of the trolleys
- to control multiple trolleys through GPS
- to prevent theft by installing a security alarm that will be triggered when a locker trolley is moved
- to catalogue the daily route taken by the trolleys
- to allow information to be accessible to other platforms



參考共享單車以 GPS 定位車輛位置

Reference to Bicycle-Sharing System, GPS is used to locate bicycles.

測試 GPS 產品和系統

Testing GPS products and systems

設計團隊測試了現時在市面上發售的
兩款 GPS 產品和系統。

The design team has tested 2 GPS products and
systems on the market.

A 款：迷你 GPS 定位追蹤器 超細小 精準定位

Type A: these mini GPS tracking devices are portable and accurate

價錢 price : \$1,199 – \$1,799



優 Strengths

- 電池持久性強，可以待機 30 天
the battery can last for 30 days in sleeping mode
- 控制界面可以同時控制多部 GPS 追蹤器
the user interface can control multiple devices
- 定位差距 100 米左右
accuracy up to around 100m

劣 Weaknesses

- 控制界面複雜，難以使用
the user interface is complicated and hard to use
- 震動提醒功能不敏感
the vibration alarm is not sensitive

B 款：徽章 GPS 定位器兒童智能個人跟踪器防走失防丟手環老人追蹤器

Type B: GPS badge tracker specifically designed for children and
older adults to prevent the danger of wandering

價錢 price : \$1,299 – \$869



優 Strengths

- 控制界面方便易用
the user interface is easy to use
- 可用到震動提示，音效高，但不敏感
the vibration alarm is loud but not sensitive

劣 Weaknesses

- 不能控制多部追蹤器
cannot control multiple devices
- 定位差距大，相差超過 500 米
fairly inaccurate, the error can be over 500 meter

最後，由於考慮完各項因素之後，設計團隊決定放棄這個想法，原因如下：

After considering numerous factors, the design team decided to give up on this idea because of the following reasons:

- 市面上銷售的GPS性能差別大
 - 可靠度不高，在測試時，多種詳列功能都不能使用
 - 定位的差距大，如果考慮要追尋失車的話，應該十分困難
 - 價格貴，而且用戶需要付上網費，拾荒者或支援團體拾平台未必可以承擔這個價錢
 - 需要智能電話才可以使用，拾荒者未必懂得使用
- The functionality of GPS available on the market varies drastically
 - These systems are not reliable. During the test, many listed functions are not available
 - These GPS devices are inaccurate. It is difficult to use them to locate lost trolleys
 - They are expensive and require the user to pay a network fee every time it is being used. It might not be affordable for waste pickers and the Waste Picker Platform
 - They require smartphones, which not every waste picker knows how to use

附件六：友善拾荒社區的想像

Appendix VI: Imagining on a Waste-Picker-Friendly Community

在設計手推車的時候，設計團隊亦發現回收物的儲存空間和容納手推車擺放的空間是一個大問題。除了要求政策上的改善之外，或者亦能夠在建立一個對拾荒者友善的社區，從而令泊車和儲存不再是問題。

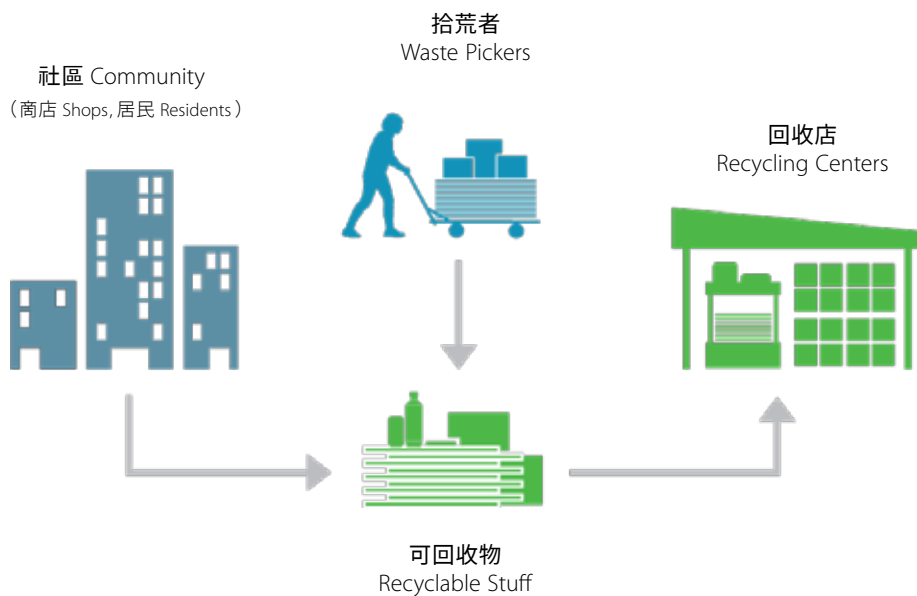
While designing the trolleys, the team realized the storage of recycling materials and trolleys pose a huge challenge to the project. In addition to policy changes, the team speculated that a waste-picker-friendly community could be a solution to the problem. When the community is more accepting of their work, parking trolleys will cease to be a problem.

傳統的拾荒者生態

A Conventional Working Environment of a Waste Picker

商店和居民把自己產生的紙皮及可回收的物品丟棄於街道或者社區某處，拾荒者每天會在社區不同地方尋找有價值的回收物，包括紙皮、鋁罐和其他有價值的回收物，收集後送到回收店去售賣。

Shops and residents dispose of cardboard and recycling materials on the streets or in some locations in the neighborhood, where waste pickers go to search for valuable materials such as cardboard, aluminum cans and other recycling materials. They sell the collected material to recycling centers.



在這種社區活動中，有時商店的職員會把回收物留起給某位拾荒者，這樣對於拾荒者來說是有用的幫助，可以令他們有穩定的回收量，也感到社區人士對他們的尊重。

更進一步來說，拾荒者及早把商店的回收物拿走，其實是讓回收物不再佔用商店內或商店外行人路的空間，因而使商店的操作更有效率。從這個角度來看，商店也許應該付給拾荒者合理的服務酬金，而不單是把回收物作為是對拾荒者的恩賜。

要建立拾荒者友善的社區，使他們的工作得更有尊嚴，需要社區的居民參與。透過重新設計手推車，設計團隊希望藉此推動更多居民認識拾荒者對於社區的貢獻。

In this environment, shop clerks sometimes save up recyclable materials to certain waste pickers, this is very helpful to them as it provides a stable amount of recyclable materials and makes them feel respected in the community.

Furthermore, waste pickers help early removal of the store's recyclables is actually to reclaim the storage space inside or outside the store, thus making the operation of the store more efficient. From this perspective, the store should probably pay the waste pickers a reasonable remuneration for their services, not just seem recyclables as a gift to them.

The participation of the residents in the community is needed to build a waste-picker-friendly community and restore the dignity of their work. Through redesigning the trolleys, the team hopes to make the community better understand the contribution of waste pickers.



設計團隊建議

Designers' Recommendation

把現時登記拾荒者的聯絡資料、活動範圍、工作時間、社區回收店資訊等公開於網上平台供社區人士查閱。當居民搬屋或添置新傢具時，可能要棄置大量紙皮，他們可於網上平台查找附近拾荒者的資訊，聯絡並把紙皮交到他們收集工作的附近。

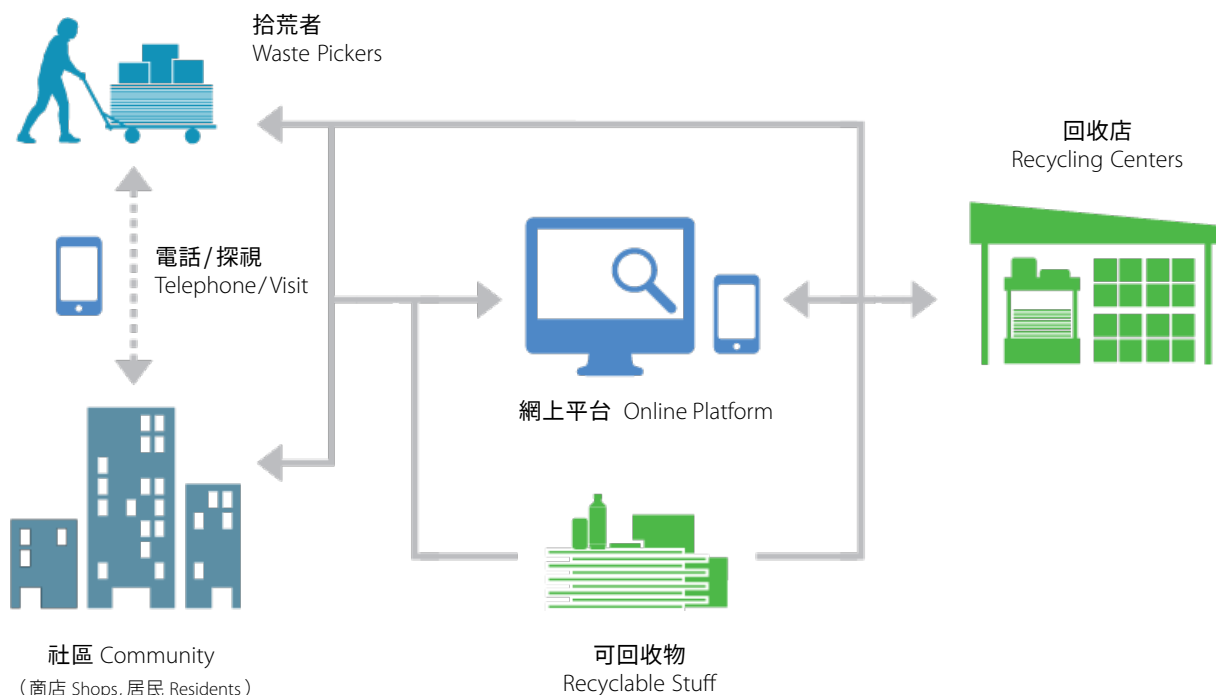
網上平台既可以幫助拾荒者找到更多的回收物，也可以便利社區的居民。居民亦可以透過平台上的資料，找到社區拾荒者的位置，主動去探望和關心他們的工作情況。

Making information such as the contact information, working district and working time of waste pickers as well as information of recycling centers accessible to the community through the Internet. During moving and buying new furniture, the residents may need to dispose of huge amounts of cardboard. They can search online for the information of the waste pickers working in their district, contact them and leave the cardboard to a place near to their working districts.

An online platform can not only help waste pickers to collect more recyclable materials but make lives easier for the residents. Through accessing information online, residents can locate waste pickers, pay a visit to them and better understand their working situation.

友善拾荒者社區的想像

Imagining a Waste-Picker-Friendly Community



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曹思穎女士	車仔實驗組成員
劉成強先生	車仔實驗組成員
劉泘中博士	理大工程學院生物醫學 工程系副課程主任
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Terry Siu	車仔實驗組成員
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設計意見提供

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一眾設計拾荒長者友善的
社區工作坊參加者

展覽場地/地區協助

拾平台

土家故事館

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The Trolley Co-design Team

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Ms Terry Siu, Member of the Trolley Co-design Team
Ms Gong-Lan Chen, Waste Picker working in North Point
Ms Yuet-Han Wong, Waste Picker working in Sheung Shui

Providing Design Ideas

Ms Mei-Siu Li, Hong Kong Food and Environmental Hygiene
Department Staff Rights Union

PolyU Industrial Center

Participants from Social Innovation Design for Elderly Waste
Pickers' workshop

Supporting the Community activities

Waste Picker Platform

House of To Kwa Wan Stories

Student helpers and volunteers

Miss Ka-Ying Chan, Student from School of Design, HKPolyU
Miss Suet-Yi Lee, Student from School of Design, HKPolyU
Miss Lau Yuen Ying, Ada, Student from Department of Applied Social Sciences, HKPolyU

關於理大賽馬會社創「騷·In·廬」

由香港理工大學(理大)賽馬會社會創新設計院主辦及香港賽馬會慈善信託基金捐助，於2018年開展，計劃為期三年，以期匯集社會各方，以創新理念和務實可行的社會創新方案，應對多項社會挑戰，共同改善香港的生活。以應對香港「雙老化」(即人口老化及住屋老化)的複合效應為工作的策略焦點，聯合學術界、非政府組織、專業團體、熱心的社會人士、企業和政府，攜手構建創新方案，並按此制訂建議的實際行動。

項目四大範疇

「十萬分之一」社創研討會—— JCDISI相信，假若每十萬人之中有一人，即香港七百多萬人口當中的七十多名市民，能貢獻時間、熱誠、知識與創意，攜手合作，定能為特定的社會議題帶來創新的解決方案。透過一系列的參與式研討會及工作坊，收集市民對社會議題的意見、促進討論，並共同設計務實和創新的方案。

社創行動項目—— 聯合非政府組織、專業團體和學術界，把「十萬分之一」社創研討會上衍生出來的創新理念，轉化成可以執行的設計及專案原型。

啟迪創新習作—— 將社會創新和設計思維引入中學課程，培育青年成為社會創新推動者，內容包括為中學師生開設社會創新工作坊、製作多媒體互動教材等等。

社創知識平台—— 以不同形式(如學術論文、短片、設計與指引、個案報告、工作坊、地區及國際會議、展覽等)，記錄是項計畫的各環節，包括社會創新過程、創造的方案與知識等等，並公開予公眾參考應用。

About POLYU JOCKEY CLUB “OPERATION SOINNO”

Organised by the Jockey Club Design Institute for Social Innovation (JCDISI) at The Hong Kong Polytechnic University (PolyU) and funded by The Hong Kong Jockey Club Charities Trust, the 3-year social innovation project commenced in 2018 aims to innovate solutions, in collaboration with a wide spectrum of stakeholders, to respond to social challenges with a view to improving life in Hong Kong. JCDISI puts its strategic focus on tackling the combined impact of “Double Ageing” (ageing of people and building) in Hong Kong, the programme would engage the trans-disciplinary forces of academia, non-governmental organisations, professional bodies, members of the public, corporations and the Government to generate innovative ideas and practical actions.

The Four Pillars of the project

“One from Hundred Thousand” — to organise a series of participatory symposia and workshops open to the public to collect views on social issues, facilitate discussion and co-create solutions. JCDISI names the platform based on the belief that if one person from every 100,000 people (i.e. 70+ persons from the 7 million+ population of Hong Kong) can sit together and contribute their time, passion, knowledge and creativity, they can innovate solutions for a specific problem.

“Solnno Action Projects” — to collaborate with non-government organisations, professional bodies and academia for developing innovative ideas generated at “One from Hundred Thousand” into designs or prototypes.

“Solnno Design Education” — to introduce social innovation and design thinking into the curriculum of secondary school education to nurture students as social innovators. Social innovation workshops will be organised for students and teachers and multi-media interactive teaching kits will be developed in this regard.

“Solnno Knowledge Platform” — to document and disseminate for public use the social innovation experience and knowledge generated from the programme through various formats, including academic papers, videos, design and practice guidelines, case study reports, workshops, regional and international conferences and exhibitions.

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查詢 Enquiry

賽馬會社會創新設計院

Jockey Club Design Institute for Social Innovation

香港九龍紅磡香港理工大學

賽馬會創新樓 V1218

V1218, Jockey Club Innovation Tower
The Hong Kong Polytechnic University
Hung Hom, Kowloon, Hong Kong

T: (852) 3400 3433

E: disi.enquiry@polyu.edu.hk

<https://www.polyujcsinno.hk>

