



# Safe and Secure Public Transport in Delhi

**Framework to collect and analyse gender disaggregated travel data from public transport ticketing systems**

August 2024

HVT055 – LC023

### Suggested Citation

The Urban Catalysys. (2024). *Framework to collect and analyse gender disaggregated travel data from public transport ticketing systems*. The Urban Catalysys: Mumbai.

### Acknowledgements

We are very appreciative of the Delhi Transport Department and Delhi Transport Corporation for their support throughout the project. Specifically, we are grateful to:

- Shri Ashish Kundra (IAS), Principal Secretary to Lieutenant Governor, Government of the National Capital Territory of Delhi (GNCTD)
- Shri Prashant Goyal (IAS), Principal Secretary and Transport Commissioner, Government of the National Capital Territory of Delhi (GNCTD)
- Smt Shilpa Shinde (IAS), Managing Director, Delhi Transport Corporation.

The core team members of this project are: Sonal Shah (Team Leader), Manisha Sharma, Abhijit Sengupta, Sujata Savant and Shradha Gupta. We are grateful to the DT Global Team for project management support: Neil Ebenezer (Team Leader), Samuel Fookes and Jeff Turner for his technical reviews.

There are multiple stakeholders who collaborated with us in this project. We appreciate the support by Indraprastha Institute for Information Technology, Tummoc, Azad Foundation, Martha Farrell Foundation, Delhi Skills and Entrepreneurship University, Janki Devi Memorial College, TN College of Competition, and Kasturba Institute of Technology.

**Disclaimer:** This technical note is developed based on the learnings from the Safe and Secure Public Transport in Delhi project, funded by UKAID through the UK Foreign, Commonwealth & Development Office under the High-Volume Transport Applied Research Programme, managed by DT Global. The views expressed in this technical note does not necessarily reflect the UK government's official policies.



# Table of Contents

Abbreviations	4
List of Figures	4
List of Tables	4
<b>Executive Summary</b>	<b>5</b>
<b>1. Background</b>	<b>7</b>
1.1 Ticketing methods in Delhi’s bus-based transport	7
1.2 Commuter data collected by different ticketing methods	9
<b>2. Entry points for collecting disaggregate data by gender, age and disability through ticketing systems</b>	<b>11</b>
2.1 Tag tickets issued through ETMs	11
2.2 Include data on gender, age and disability during registration on mobile phone ticketing applications	13
2.3 Include data on gender, age and disability during the registration process for closed-loop smart cards	14
2.4 Enable data sharing by the issuing and acquiring banks for NCMC	15
2.5 Use disaggregated data for improving safety and security in bus transport operations	16
2.6 Create an easy-to-use dashboard and how to do it	18
<b>3. Conclusion</b>	<b>19</b>
<b>References</b>	<b>20</b>



## Abbreviations

AFC	Automatic Fare Collection
API	Application Programming Interface
CCTV	Closed-circuit television
CNG	Compressed Natural Gas
CSV	Comma Separated Value
DIMTS	Delhi Integrated Multimodal Transport System
DTC	Delhi Transport Corporation
DMRC	Delhi Metro Rail Corporation
ETM	Electronic Ticketing Machine
GPRS	General Packet Radio Service
JSON	JavaScript object notation
KYC	Know Your Customer
MoHUA	Ministry of Housing and Urban Affairs
MOU	Memorandum of Understanding
NCMC	National Common Mobility Card
ODA	One Delhi Application
NFC	Near Field Communication
PAN	Permanent Account Number
PIS	Public Information System
PTA	Public Transport Authority
PWD	Person with Disability
QR	Quick Response
SAM	Secure Access Module
UPI	Unified Payments Interface

## List of Figures

Figure 1: Timeline of different ticketing options In Delhi's buses.....	8
Figure 2 Existing ticket issuance process in DIMTS.....	8
Figure 3: Framework for integrating gender disaggregated data in public transport ticketing systems in Delhi.....	11
Figure 4: Data flow for NCMC ecosystem by the Ministry of Housing and Urban Affairs (MoHUA) .....	16
Figure 5: Illustration of a gender-responsive bus shelter.....	17
Figure 6: Dummy dashboard.....	18

## List of Tables

Table 1: Data collected by the existing ticketing methods in bus-based public transport in Delhi.....	9
Table 2: Tag tickets by electronic ticketing machines and issuing personalised electronic bus passes ....	12
Table 3: Mandate all users of mobile-based applications to provide data on gender, age and disability during registration.....	13
Table 4: Include data on age, gender and disability in the closed-loop smart card database .....	14
Table 5: Roles of different entities in data sharing for open-loop cards .....	15
Table 6: Avenues to utilise gender disaggregated ticketing data .....	16



# Executive Summary

There is a substantial gap in creating gender-responsive public transport systems, despite the growing recognition of gender mainstreaming in urban transport. This gap stems from gender-blind data used by public transport authorities resulting in the inadvertent exclusion of women and girls from public transport planning and service provision. Traditional data sources, such as household surveys and census, often fail to provide sufficient insights into the dynamic nature of public transport usage due to their limited scope.

The digitalisation of public transport offers an opportunity to collect disaggregated data, as big data is generated through digital ticketing, automatic vehicle location systems, passenger counting systems and more. However, the potential of big data can only be realised if insights derived from it are used for policy and operational improvements. A global literature review of public transport ticketing data usage reveals that gender disaggregated data is either not collected or, if collected, is not used to address service gaps through a gendered lens. This is often due to privacy regulations and the limited analytical capacities of public transport authorities. Collecting and analysing disaggregated data by gender, age and disability can help public transport services meet the diverse needs of users.

This note provides key entry points for collecting gender, age and disability disaggregated ticketing data, using a case study of a mega South Asian city—Delhi, India. The approach can be adapted for other cities based on their level of digitalisation of ticketing systems. In Delhi’s public transport system, tickets can be purchased through multiple channels—electronic ticketing machines (ETMs), mobile phone applications, closed-loop smart cards and the national common mobility card (NCMC). The table below outlines the types of data collected through the bus-based public transport ticketing system in Delhi.

Table: Data collected from different ticketing system in Delhi

	Data Collected	Ticketing System							
		Paper ticket		Electronically generated tickets					
		Pre-printed paper ticket	ETM generated ticket	Delhi Metro card	One Delhi application	Tummoc	Chartr	Physical bus pass	Electronic bus pass
Travel data	Boarding & alighting station		●	●	●	●	●		
	Boarding time*		●	●	●	●	●		
	Alighting time*			●					
	Date		●	●	●	●	●		
	Route number	●	●	●	●	●	●		
	Bus number		●	●	●	●	●		
	Fare amount**	●	●	●	●	●	●		
	Payment method			●	●	●	●		
Commuter data	Gender	●	●		●	●	●	●	●
	Age							●	●
	Disability							●	●

● This data is only collected for male commuters.

\* This is inferred from the mode of transport.

● For mobile phone applications, this data can be inferred from the time of validation.

\*\* A flat fare of Rs 10 per ticket is considered for female tickets in buses. Women do not pay for tickets in buses.

■ Mobile phone-based applications.

Source: *The Urban Catalysts*

ETMs could issue electronically generated paper tickets with a gender tag of commuter during the issuance process. It is recommended that zero-value tickets be generated for electronic bus pass users, to capture travel data. Mobile phone applications can mandate users to provide data on gender, age and disability during registration. Although gender data is currently collected by mobile phone applications in Delhi due to the fare-free travel scheme; travel data such as boarding and alighting stations is not collected. Public transport authorities must ensure that gender disaggregated data is captured along with boarding and alighting data through these applications and shared with them.



**Indian cities are in the process of implementing the NCMC, which is an open-loop<sup>1</sup> system. In London, a 70% adoption rate of contactless card payment was achieved after a decade.** This provides a reference timeline for NCMC adoption in India. Therefore, the existing closed-loop<sup>2</sup> smart card of the Delhi Metro should be updated to include data on gender, age and disability during the registration or top-up process. During NCMC adoption, it is crucial to mandate issuing banks to share anonymised user data with acquiring banks and ensure this data is shared with public transport authorities. This data can then be correlated with travel data collected through automatic fare collection (AFC) system to understand commuter's travel behaviour.

**Some potential applications of this data could be developing gender-responsive first and last mile connectivity, prioritising safety improvements at bus stops with high female commuter's footfall and improvements in operations of bus services.** This includes prioritising deployment of female-operated first and last mile services at transit stops with higher share of female passengers; and prioritising safe, accessible walking infrastructure within walking distance of transit stops with higher share of overall and female passengers. Transit stops can be prioritised for safety improvements based on boarding and alighting data and cover the whole city in a phased manner. Bus services can be augmented with regular, midi or mini buses in the peak hours to prevent overcrowding. Female conductors and drivers can be prioritised on routes with more female passengers.

**The role of the Delhi Transport Department is critical due to the presence of multiple public transport authorities.** These are Delhi Transport Corporation (DTC), Delhi Integrated Multimodal Transport System (DIMTS) and Delhi Metro Rail Corporation (DMRC). The transport department has to consolidate all the data from different ticketing systems onto one platform, to analyse public transport usage by mode and overall travel behaviour in the city.

---

<sup>1</sup> An open-loop system allows passengers to use their existing bank-issued contactless cards to pay for public transport journeys. These open-loop payment cards are interoperable across different public transport systems, provided the fare collection system is configured to accept them.

<sup>2</sup> In a closed-loop system, the public transport authority issues a transit card that is valid for fare payment exclusively within the respective public transport network.



# 1. Background

**Big data is an emerging paradigm that has garnered significant global attention, particularly within the transportation industry.** It is defined by the three Vs—volume (the amount of data), variety (the diversity of data types), and velocity (the speed at which data is generated and transmitted) (Torre-Bastida, et al., 2018). Big data holds the potential for not only improving the efficiency of public transport but also enhancing the commuters' travel experience.

**Digitalisation in public transport has generated vast amounts of data** through digital ticketing, automatic vehicle location systems, passenger counting systems and more. However, the potential of big data can be realised if insights derived from it are used for policy and operational improvements. Digital public transport ticketing systems are a significant source of data, providing detailed information on public transport operations and the travel patterns of commuters.

**A literature review of the use of ticketing data globally indicates that gender disaggregated data is either not collected or if collected, is not being utilised to address service gaps through a gendered lens.** This could be due to privacy laws and the limited analytical capability or server capacity with public transport authorities. Existing research on the use of public transport ticketing data is focused on understanding passenger travel patterns and behaviour, operational analysis, service improvement in terms of route rationalisation, or increase in frequency (Cevallos, Turino, & Jin, 2021). Public transport services can meet the diverse needs of users by collecting and analysing gender and disaggregated data. This will improve operational efficiency of the system, while ensuring a more inclusive and equitable transportation system.

This note presents key entry points for collecting gender, age and disability disaggregated ticketing data, using a case study of a mega South Asian city—Delhi, India. It draws on the research and learnings from the project **Safe and Secure Public Transport in Delhi**—supported by UK Aid through the High-Volume Transport Applied Research programme. The project aimed to leverage the digitalisation of public transport systems, including ticketing, to address service gaps and enable a safer travel experience for women and girls.

## 1.1 Ticketing methods in Delhi's bus-based transport

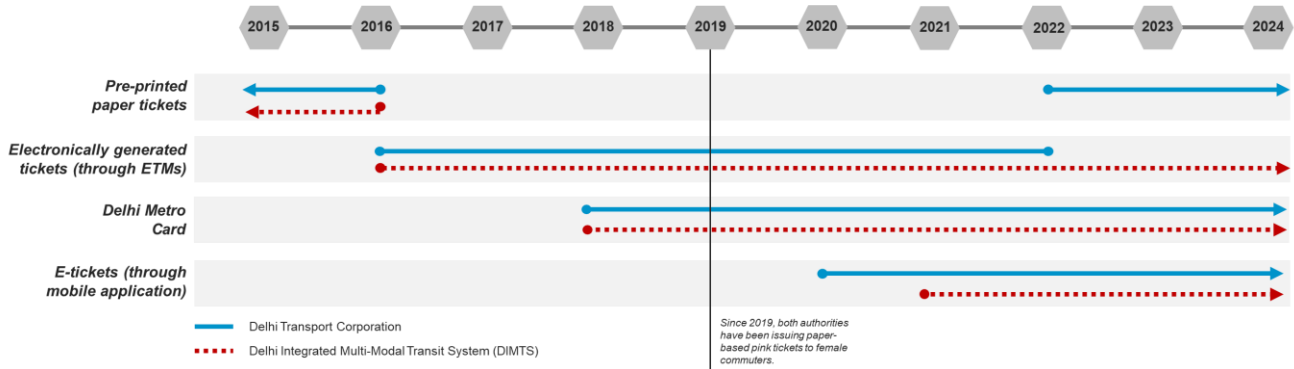
**Bus services in Delhi are managed by the Delhi Transport Corporation (DTC) and Delhi Integrated Multi-Modal Transit System Limited (DIMTS).** DIMTS is a private agency that operates buses for the Delhi government under the cluster bus scheme through a gross-cost model introduced in 2011. Both the entities have their individual ticketing system and are overseen by the Transport Department of Delhi. Currently, DTC operates a fleet of 4,346 buses, of which 3,191 are low-floor compressed natural gas (CNG) buses and 1,155 are low-floor electric or e-buses. DIMTS has a fleet of 2,841 buses, including 94 e-buses. In total, Delhi has a fleet of 1,249 e-buses on the road (Planning Department, Government of NCT of Delhi, 2024).

In 2019, Delhi implemented a fare-free public bus travel scheme for women. Pink tickets are issued to female commuters irrespective of fare stage. This has initiated a process of collecting gender disaggregated ridership data. However, there are concerns regarding the veracity and reliability of this data as the tickets are not validated.

**There are multiple channels to buy tickets in Delhi's public transport system—through electronic ticketing machines (ETMs), mobile phone applications, closed-loop smart cards and the proposed national common mobility card (NCMC).**



Figure 1: Timeline of different ticketing options In Delhi's buses



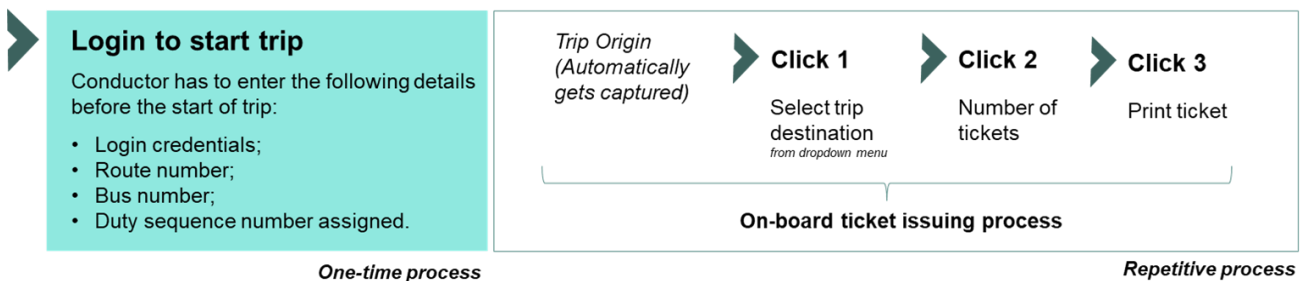
Source: The Urban Catalysts

DTC predominantly utilises pre-printed tickets for fare collection<sup>3</sup>. These pre-printed tickets are based on fare stages, requiring conductors to carry around eight different blocks of tickets—as reported by conductors during focus group discussions in August 2023. These blocks are categorised by fare stage and user type, such as children or adults. This system only captures the total number of tickets issued on any given route in a day.

DIMTS has been using handheld ETMs in the cluster buses since 2017 (DIMTS, 2017). The earlier ETMs were upgraded to Android-based machines with a touch screen and an integrated General Packet Radio Service (GPRS)<sup>4</sup> functionality in January 2021. Conductors issue electronic tickets using these handheld devices. A record of the generated tickets and relevant data such as origin, destination, fare stage, time of issuance and the number of tickets sold is maintained at the back end<sup>5</sup>.

In 2018, it was announced that the Delhi metro card<sup>6</sup> could be used in buses as well, provided ETM machines were available in buses (Taneja, 2018). During this period, the ETMs in both DTC and cluster buses underwent upgrades with the addition of a secure access module (SAM) chip, enabling the use of the metro card as a payment method in buses. However, the current lack of ETM machines in DTC buses poses a challenge in implementing this system.

Figure 2 Existing ticket issuance process in DIMTS



Source: The Urban Catalysts

<sup>3</sup> This approach has been in place since the phase-out of handheld ETMs in September 2022. Previously employed on DTC buses since 2016 (Banerjee, 2016), these ETMs had become either non-functional or in need of upgrades (Mint, 2023). As a result, conductors now issue pre-printed paper-based tickets on board.

<sup>4</sup> GPRS is a mobile data service used primarily for sending and receiving data over a cellular network.

<sup>5</sup> Informal conversation with ETM vendor of DIMTS.

<sup>6</sup> Closed loop card.





Several mobile phone applications, including One Delhi, Chartr and Tummoc, offer commuters the options to purchase tickets online. The One Delhi application (ODA) supports on-board ticketing by either utilising bus numbers or quick response (QR) codes available on e-buses. In addition to the QR code-based ticket, Tummoc enables users to pre-book tickets based on origin and destination. In March 2024, around 28% of total tickets were purchased using mobile phone applications, while 72% were purchased through the conductor for all routes in Mayapuri Depot.

In April 2024, WhatsApp ticketing also become available on buses (The Indian Express, 2024) through a number provided by DTC (+91-8744073223). A chatbot facilitates purchases, enabling users to specify their origin and destination and buy tickets using the unified payments interface (UPI) option. These digital ticketing methods are operational in DTC and DIMTS buses.

The Delhi Transport Department is in the process of introducing the NCMC in buses, which is a unified payment system designed for use across all modes of public transport in the country. It was launched in 2019 in India and has a dedicated stored value component (to avoid financial security risk) with a balance that can be used for transit and low-value retail transactions. NCMC is an open-loop card and could be a debit/ credit/ prepaid card. It requires public transport authorities to upgrade their AFC system including back end and terminals/ validators/ ETM devices as per NCMC specifications. It can only be issued to users upon completion of know your customer (KYC) details which involves providing proof of identity – commonly utilising documents, such as the Aadhaar card or Permanent Account Number (PAN) card.

## 1.2 Commuter data collected by different ticketing methods

In Delhi, the collection of gender data in buses is driven by the fare-free travel scheme (Table 1). In cities without similar initiatives for fare-free travel for women and with comparable ticketing infrastructure, gender disaggregated ridership data is largely unavailable<sup>7</sup>. There is a significant advantage in data collection efficiency and accuracy when utilising electronic ticketing systems compared to traditional pre-printed paper tickets. However, these need to be integrated to ensure that key travel parameters of bus transport users are captured. The demographic parameters include gender, age and disability. The travel data includes trip origin, destination, time of travel, route and the fare.

Table 1: Data collected by the existing ticketing methods in bus-based public transport in Delhi

	Data Collected	Paper ticket	Electronically generated tickets						
		Pre-printed paper ticket	ETM generated ticket	Delhi Metro card	One Delhi application	Tummoc	Chartr	Physical bus pass	Electronic bus pass
<b>Travel data</b>	Boarding & alighting station		●	●	●	●	●		
	Boarding time*		●	●	●	●	●		
	Alighting time*			●					
	Date		●	●	●	●	●		
	Route number	●	●	●	●	●	●		
	Bus number		●	●	●	●	●		
	Fare amount**	●	●	●	●	●	●		
	Payment method			●	●	●	●		
<b>Commuter data</b>	Gender	●	●		●	●	●	●	●
	Age							●	●
	Disability							●	●

● This data is only collected for male commuters.

■ Mobile phone-based applications.

\* This is inferred from the mode of transport.

● For mobile phone applications, this data can be inferred from the time of validation.

\*\* A flat fare of Rs 10 per ticket is considered for female tickets in buses. Women do not pay for tickets in buses.

<sup>7</sup> Some exceptions include the Capital Region for Urban Transport (CRUT) and Kerala State Road Transport Corporation (KSRTC).



Source: *The Urban Catalysts*

In the current scenario, there are some challenges in realising the benefits of digital ticketing systems in Delhi's public buses<sup>8</sup>.

- The travel behaviour of bus pass users is not captured; and the transition to personalised electronic bus passes can create these opportunities with ETM validators.
- The ETMs currently used by DIMTS are equipped with a QR code scanner and card reader, capable of validating online-generated tickets and payments through metro cards or debit/ bank cards. However, these are not functional<sup>9</sup>.
- One Delhi application and Tummoc capture gender of the users. However, there is no verification of the identity of the person. ODA does not record origin and destination for female commuters. DTC receives the total number of tickets sold via mobile phone applications, without passenger identification and travel behaviour data.
- Age and disability data are not captured, which could help understand the profile of users, especially young people, students, senior citizens and persons with disabilities.

---

<sup>8</sup> DTC is in the process of appointing a vendor for ETMs and NCMC.

<sup>9</sup> Informal discussion with the Project Manager of ETMs at DIMTS.

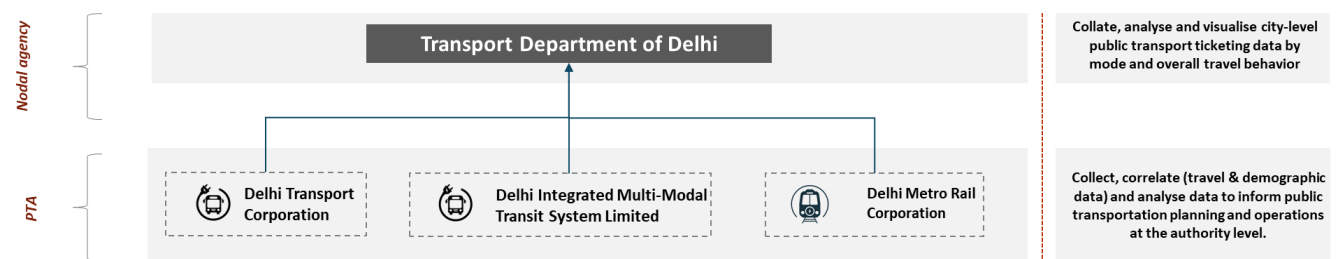


## 2. Entry points for collecting data on gender, age and disability through ticketing systems

The digitalisation of public transport ticketing systems is in its early stages, and cities are currently in a phase of exploration and learning. This presents an opportunity to integrate gender, age and disability disaggregated data collection into these evolving systems.

A data analytical framework is proposed using Delhi’s public transport system as a case example (Figure 3). This data will need to be collated and analysed by each public transport authority (PTA) and the Transport Department for mode-wise and overall travel behaviour. An operational dashboard with adequate server capacity will be required to analyse the substantial volume of travel data collected through different ticketing systems. The following section builds on this framework, based on consultations with key stakeholders such as DTC, DIMTS and mobile application vendors.

Figure 3: Framework for integrating gender disaggregated data in public transport ticketing systems in Delhi



Source: The Urban Catalysts

### 2.1 Tag tickets issued through ETMs

Pre-printed paper-based tickets for women in Delhi are color-coded (pink tickets). This allows for capturing the total female ridership on a route (system-wide figures could be calculated by summation of route-wise ridership).

ETMs could issue electronically generated paper tickets with the gender tag of the commuter during the issuance process. Age and disability tags could be considered subsequently or commuters can be nudged towards mobile phone application-based or card-based tickets.

Bus passes are estimated to be used by a majority of passengers. Concessional bus passes provide information on the subsidies availed by different groups of commuters. It is recommended that zero-value tickets be generated for electronic bus pass users to capture travel data (trip origin, destination, travel time). It will also provide insights about the number of students, senior citizens, persons with disabilities and others<sup>10</sup>. It is critical to ensure that the scanners in ETMs are operational to validate the tickets and passes.

<sup>10</sup> Printed bus passes need to be phased out to electronic passes.



Table 2: Tag tickets by electronic ticketing machines and issuing personalised electronic bus passes

<p><b>Recommendation:</b></p> <ul style="list-style-type: none"> <li>• Include gender tag in tickets generated by ETMs as a first step;</li> <li>• Issuing personalised electronic bus passes which includes data on gender, age and disability</li> </ul> <p><b>Recommended tags:</b></p> <p>1 <b>Gender:</b> Male, Female, Other</p>		
Efforts required		
Role of public transport authority	Role of service provider	Implementation time
<ul style="list-style-type: none"> <li>• Public Transport Authority should include a clause in the contract with the ETM provider to add an option for collecting the gender of the commuter; and to issue zero-value tickets to bus pass users.</li> <li>• Provide training to conductors on how to use the ETM and the importance of entering the right information.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>For DTC/DIMTS or cities where fare-free travel scheme is implemented for women:</b> ETMs should be used to issue or validate electronic tickets. Zero-value tickets can be issued to female commuters, instead of pre-printed pink tickets.                         <ul style="list-style-type: none"> <li>- <b>Update existing ETMs:</b> This requires updating the software configuration in the back end.                                 <p>To implement this update, the development of a code and logic is required to integrate into the back-end system. Generally, adjustments to parameters do not incur additional monetary costs. However, the ETM provider may need to account for associated expenses, which could involve nominal fees for their personnel's involvement in the process.</p> <p>Additionally, the PTA will need to ask the ETM provider to enable functionality for QR code validators in ETMs. ETM providers will need to update the software for all devices and to update the back-end system accordingly.</p> </li> <li>- <b>New ETMs:</b> When considering the purchase of a new ETM, the recommendation leans towards an Android-based touchscreen model with validators and near field communication (NFC) card reader. A new Android-based ETM with validators costs INR 20,000–25,000. An additional cost for NFC card reader should be considered.</li> </ul> </li> </ul>	<p><b>For the existing ETMs:</b> 3–15 days to develop the code, pilot test and scale up.</p>

Source: The Urban Catalysts



## 2.2 Include data on gender, age and disability during registration on mobile phone ticketing applications

Multiple mobile-based applications such as One Delhi, Tummoc and Chartr facilitate online ticket purchases in Delhi. These applications capture gender of the user during registration, to ensure that women using the application are not charged.

Mobile phone applications like Tummoc enable users to purchase a single ticket for multimodal trips or multiple trips within the same mode, facilitating the capture of interchange stations. This feature helps capture interchanges or trip chaining, which is predominantly undertaken by women for household and caregiving responsibilities. A limitation of these applications is that they do not capture detailed travel information for female commuters. Consequently, when a woman purchases a ticket, only the bus number, route, booking time and ticket quantity are recorded; other data, such as boarding and alighting stations, are not captured. This oversight diminishes the effectiveness of online ticketing systems as travel pattern of female commuters doesn't get captured. Therefore, it is important for public transport agencies to ensure that gender disaggregated data is captured, along with the boarding and alighting data.

Additionally, a system should be established to ensure data sharing with the public transport agency. This could be incorporated into the contract or memorandum of understanding (MOU) for granting permission to issue tickets. The shared data should include boarding and alighting patterns, travel times and fare details.

Table 3: Mandate all users of mobile-based applications to provide data on gender, age and disability during registration

<p><b>Recommendation:</b> Mandate all users of mobile-based applications to provide anonymized data on gender, age and disability during registration. This is a one-time requirement.</p> <p><b>Recommended tags:</b></p> <p>2 <b>Gender:</b> Male, Female and Other</p> <p>3 <b>Age:</b> age of the commuter</p> <p>4 <b>Disability:</b> locomotive, vision, hearing, speaking, cognitive, none</p>		
Efforts required		
Role of public transport authority	Role of service provider	Implementation time
<ul style="list-style-type: none"> <li>The PTA should require all mobile application developers to include data on gender, age and disability of the user during registration, with protocols to protect their privacy. Only upon compliance with this requirement will PTA consider granting licenses or permissions for access to official transit data, including the number of buses in operation and application programming interfaces (APIs) facilitating real-time tracking of bus locations.</li> <li>PTA is required to include a provision in the contract with the ETM provider, stipulating</li> </ul>	<ul style="list-style-type: none"> <li><b>In the existing application,</b> the back-end code needs to be updated to store the newly collected data on age and disability. The user interface design will also have to be updated to incorporate these fields into the registration process. This will have nominal cost implications.</li> <li>Existing users should receive a prompt to input their data on age and disability, after the application is updated.</li> <li><b>For new users,</b> the registration process should include provisions for collecting data on age, gender and disability.</li> </ul>	<p>Three to 15 days to develop the code and pilot test on the existing application.</p>



<p>that QR code validators must be functional within the ETMs.</p> <ul style="list-style-type: none"> <li>PTA should mandate mobile phone application developers to provide the following data for each ticket:             <ul style="list-style-type: none"> <li>Origin and destination;</li> <li>Ticket booking time and date;</li> <li>Gender of the user;</li> <li>Age of the user;</li> <li>Bus number;</li> <li>Route number;</li> <li>Route direction;</li> <li>Fare.</li> </ul> </li> </ul>	<p><b>Data privacy</b></p> <p>As per The Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021<sup>1</sup>, the mobile phone application provider should update their privacy policy and user agreement in English and other relevant languages to update users on the access and usage of the data collected (Ministry of Electronics and Information Technology, 2023). They should provide users with regular updates regarding any changes to the privacy policy or other relevant aspects.</p> <p>There is minimal need to implement access control mechanisms for children on public transport applications due to the nature of the content; however, regulating the advertisements displayed on these platforms remains essential.</p>	
--	---	--

Source: *The Urban Catalysts*

### 2.3 Include data on gender, age and disability during the registration process for closed-loop smart cards

Closed-loop smart card technology, primarily employed within metro rail systems, is now expanding its utility to include buses. In Delhi, commuters can use their Delhi Metro smart cards to purchase bus tickets if ETMs on buses are equipped with swipe functionality (Taneja, 2018).

Learnings from London reveal that contactless payments achieved a 70% adoption rate after a decade of the implementation of the system (Mastercard, 2022). This may serve as a useful reminder regarding the time frame for wide scale adoption of the national common mobility card (NCCMC) in India. It underscores the importance of continuing efforts towards collecting gender, age and disability data in other ticketing modes including smart cards.

Table 4: Include data on age, gender and disability in the closed-loop smart card database

<p><b>Recommendation:</b> Include data on age, gender and disability in the closed loop smart card database.</p>		
<p><b>Recommended tags:</b></p>		
<p>1 <b>Gender:</b> Male, Female, Other</p>		
<p>2 <b>Age:</b> age of the commuter</p>		
<p>3 <b>Disability:</b> locomotive, vision, hearing, speaking, cognitive, none</p>		
<p>Efforts required</p>		
<p>Role of public transport authority</p>	<p>Role of service provider</p>	<p>Implementation time</p>
<p>DTC will need to ensure that fare collection equipment is enabled to accept a smart card (with NFC technology).</p>	<p>The service provider is the DMRC. It will need to require commuters to provide this data upon registration of new cards or during a top-up.</p>	<p>The tagging of all the metro rail cards in Delhi should be undertaken on priority. There are 25 million metro cards in</p>



		circulation today in Delhi (Gandhiok, 2022).
--	--	--

Source: The Urban Catalysts

## 2.4 Enable data sharing by the issuing and acquiring banks for NCMC

The introduction of the NCMC, an open-loop payment system, has brought two new entities into the picture – the issuing and acquiring financial institutions or banks (Soehnchen, 2022). The issuer refers to the bank or financial institution responsible for issuing payment cards (debit/ credit cards) to users and holds the authority to approve or decline transaction requests. On the other hand, the acquirer bank is the financial institution that receives, processes and settles transactions on behalf of the public transport authority. Currently, 48 banks issue NCMCs (Bhakta & Mishra, 2024).

As per the Interface Specification of NCMC Ecosystem – Version 1.2, the current recommended communication architecture includes the flow of transit and financial data between issuing bank, AFC system and acquiring bank (Centre for Development of Advanced Computing, 2020). Transit data is captured by the AFC system during the reading of fare media. Meanwhile, financial data<sup>11</sup>, transmitted either through the AFC system or from the acquirer bank to the issuing bank, facilitates the clearing of financial transactions. Additionally, user information is maintained with the issuer bank in the case of a bank card.

Public transport authorities will need to include conditions to obtain gender, age and disability data by the acquiring bank in their contracts. Simultaneously, the issuing bank will need to be mandated by relevant authorities to share this information with the acquiring bank. This demographic data can then be correlated with the travel data in the AFC system to understand commuter behaviour.

Table 5: Roles of different entities in data sharing for open-loop cards

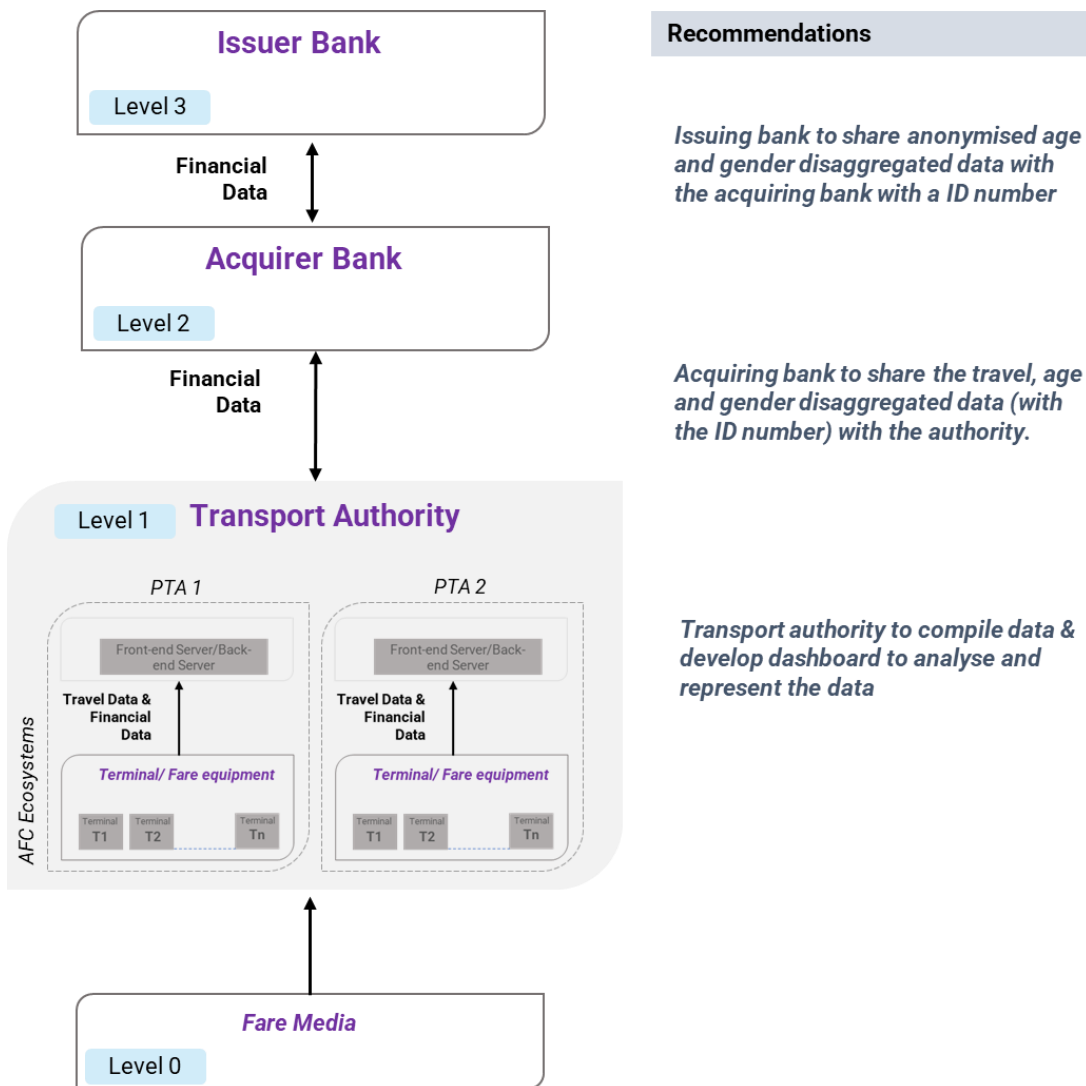
<b>Recommendation:</b> Enable data sharing by different service providers.		
<b>Efforts required</b>		
Role of public transport authority	Role of service provider	Implementation time
Public transport authorities will need to include conditions to obtain only anonymised data on gender, age and disability by the acquiring bank. The acquiring bank will have a contract with the public transport authority to process payments.	<p><b>Multiple service providers are involved:</b></p> <ol style="list-style-type: none"> <li><b>Acquiring bank:</b> Their responsibility is to collect only age, gender and disability data from the issuing bank and link it with the card number.</li> <li><b>Automatic fare collection system provider:</b> AFC system provider will have to link the travel data of a card to the user information received from the acquiring bank. This linkage is established via a shared identifier, which is the card number.</li> </ol> <p><b>Other prerequisites upon which the entire process relies:</b> The issuing bank will need to be mandated by relevant authorities to share this information with the acquiring bank.</p>	Given that the NCMC implementation is underway, these components can be integrated into the systems, including contracts, from the inception of the process.

Source: The Urban Catalysts

<sup>11</sup> Including time and amount of transaction, operator's reference Id, cardholder's details (masked)



Figure 4: Data flow for NCMC ecosystem by the Ministry of Housing and Urban Affairs (MoHUA)



Source: The Urban Catalysts, Data flow adapted from Centre for Development of Advanced Computing

## 2.5 Use disaggregated data for improving safety and security in bus transport operations

The collected travel data can be used to address service gaps in public transport and address issues from the whole of journey approach, including first and last mile connectivity. The following table outlines some ways in which the data can be utilised to make travel safer for women and girls:

Table 6: Avenues to utilise gender disaggregated ticketing data

Public transport journey	Insights extracted from ticketing data	Strategies to improve safety of women	Responsible authority
First and last mile connectivity	Identify bus stops with higher share of female commuters	Prioritise deployment of female operated first and last mile services at transit stops with higher share of female passengers	Transport Department of Delhi

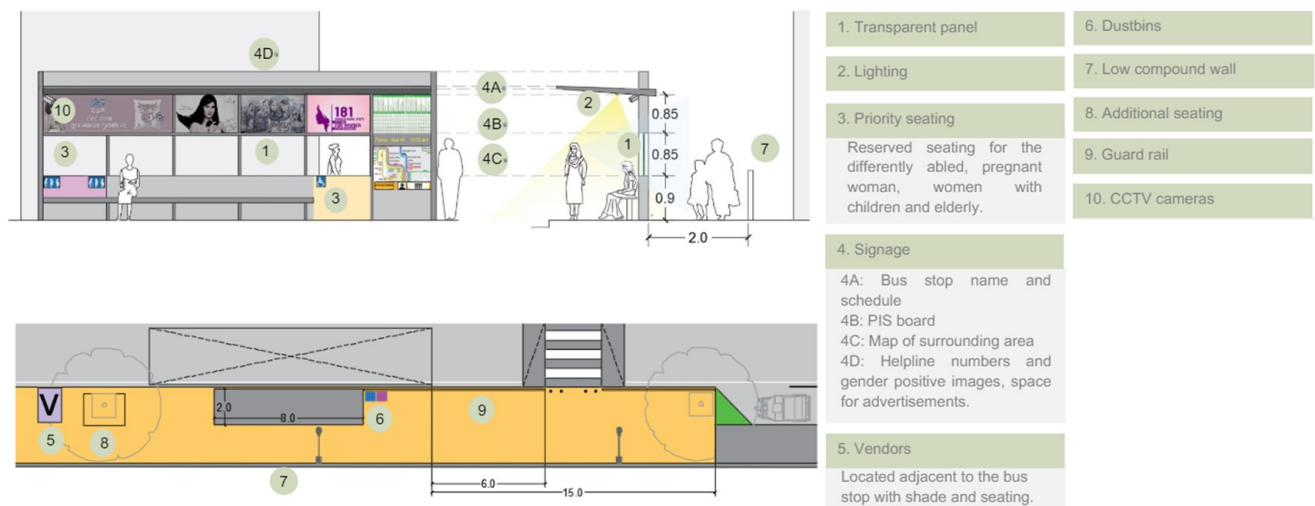




		Prioritise safe, accessible pedestrian infrastructure within walking distance of transit stops with higher share of overall and female passengers	Road owning agencies – Public Works Department, New Delhi Municipal Council, Municipal Corporation of Delhi
Transit stops	Boarding and alighting data	Select bus stops to prioritise safety improvements, such as adequate lighting, availability of information on the helpline number, SOS/panic button and closed-circuit television (CCTV) cameras. Additional facilities like reserved seats for women or care giver could also be provided (Figure 5).	Delhi Transport Infrastructure Development Corporation Limited
Bus operations	Route-wise travel details	Additional services by regular, midi or mini buses in the peak hour to prevent overcrowding	DTC
		Frequent point-to-point and/ or women-priority or women-only services in the peak hours, depending on travel behaviour or destinations (such as women-only colleges)	DTC
		Prioritise deployment of female conductors and drivers on routes with more female passengers	DTC
		Longer dwell times at stops with higher share of senior citizens and female passengers	DTC

Source: The Urban Catalysts

Figure 5: Illustration of a gender-responsive bus shelter



Source: (The Urban Catalysts & C3, 2020)

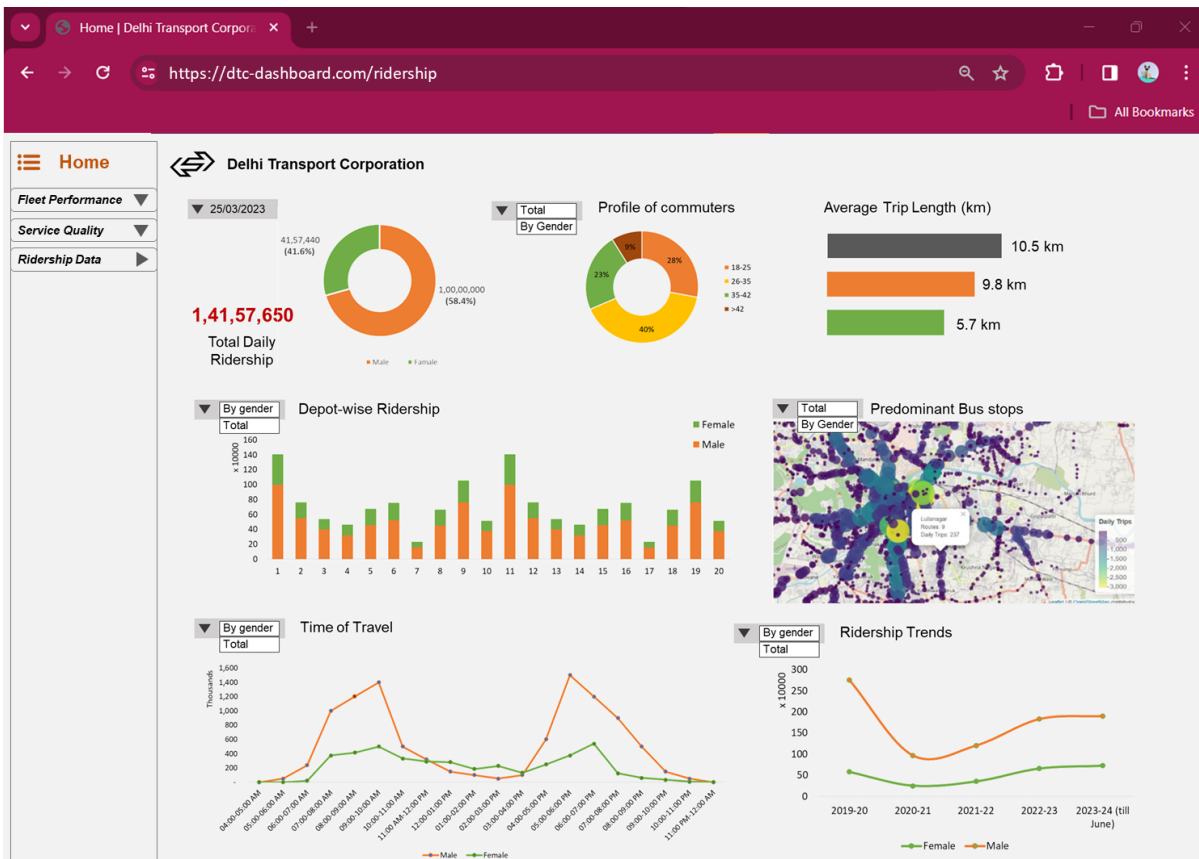


## 2.6 Create an easy-to-use dashboard and how to do it

As previously emphasised, technological advancements have enabled users to access multiple avenues for ticket purchases. In light of this, public transport authorities must consider the following key points:

1. **Data storage and integration:** Different ticketing methods may use varied data formats and standards. Therefore, the PTA should develop and implement measures to ensure compatibility by establishing protocols for data exchange. These could be APIs or standardised file formats, such as comma separated value (CSV) and JavaScript object notation (JSON). A mechanism should also be developed to synchronise data across different ticketing systems in real-time or at regular intervals to keep information up to date on the central server.
2. **Dashboard:** PTA should establish an operational dashboard with adequate server capacity to utilise the substantial volume of gender, age and user type disaggregated travel data. Gender-responsive service parameters need to be identified to monitor progress towards safe and secure bus transport operations. Some of the parameters include:
  - Daily ridership of the system by gender;
  - Tickets bought by different avenues by gender;
  - Daily route and depot-wise ridership;
  - Transit occupancy at different times of the day and night;
  - Peak and off-peak hours by gender;
  - Boarding and alighting patterns by gender;
  - Trip lengths by gender.

Figure 6: Dummy dashboard



Source: The Urban Catalysts



### 3. Conclusion

The road to a gender-responsive public transport system starts with the availability of reliable commuter data, which can be supplemented with perception surveys and infrastructure assessments to prioritise scarce resources for maximum impact. Obtaining big data through digital ticketing systems can go a long way in ensuring that the public transport services reflect the needs of all users, especially women and girls.



## References

- Bhakta, P., & Mishra, T. (2024, March 18). *RBI eases rules for centre's mobility card after limited success*. Retrieved from The Economic Times: <https://economictimes.indiatimes.com/tech/technology/centres-mobility-card-to-go-places-as-rbi-eases-rules/articleshow/108568824.cms?from=mdr>
- Centre for Development of Advanced Computing. (2020). *Interface Specification of NCMC Ecosystem Version 1.2 (Part IV to Part VII)*. Ministry of Housing and Urban Affairs. Retrieved from [https://stqc.gov.in/sites/default/files/NCMCInterfaceSpecifications\(PartIV-VII\).pdf](https://stqc.gov.in/sites/default/files/NCMCInterfaceSpecifications(PartIV-VII).pdf)
- Cevallos, F., Turino, L., & Jin, X. (2021). *A Synthesis on Data Mining Methods and Applications for Automated Fare Collection (AFC) Data*. Planning and Environmental Management Office. Retrieved from [https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/research/reports/fdot-bdv29-977-55-rpt.pdf?sfvrsn=13f9bb60\\_2](https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/research/reports/fdot-bdv29-977-55-rpt.pdf?sfvrsn=13f9bb60_2)
- DIMTS. (2017). Making way for smart mobility and transportation. Retrieved from <https://x.com/DimtsLtd/status/837276088032178177>
- Gandhiok, J. (2022). Retrieved from Hindustan Times: <https://www.hindustantimes.com/cities/delhi-news/78-commuters-use-smart-card-says-delhi-metro-101652639619606.html>
- High Court of Delhi. (2022). *Anti-Corruption Council of India v. State & Ors. W.P.(CRL) 2559/2019*. Retrieved from [https://www.livelaw.in/pdf\\_upload/1670322297994922332022-448330.pdf](https://www.livelaw.in/pdf_upload/1670322297994922332022-448330.pdf)
- Mastercard. (2022, December 13). *TfL celebrates a decade of contactless payment on London's buses*. Retrieved from Mastercard: <https://www.mastercard.com/news/europe/en/newsroom/press-releases/en/2022/december-2022/tfl-celebrates-a-decade-of-contactless-payment-on-london-s-buses/>
- Ministry of Electronics and Information Technology. (2023). *The Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021*. Retrieved from <https://www.meity.gov.in/writereaddata/files/Information%20Technology%20%28Intermediary%20Guidelines%20and%20Digital%20Media%20Ethics%20Code%29%20Rules%2C%202021%20%28updated%2006.04.2023%29-.pdf>
- Mint. (2023, January 09). *Delhi commuters to pay fares electronically on buses, metro soon*. Retrieved from <https://www.livemint.com/news/india/delhi-commuters-to-pay-fares-electronically-on-buses-metro-soon-deets-inside-1167322270976.html>
- Planning Department, Government of NCT of Delhi. (2024). *Economic Survey of Delhi 2023-24*. Retrieved from [https://delhiplanning.delhi.gov.in/sites/default/files/Planning/chapter\\_12.pdf](https://delhiplanning.delhi.gov.in/sites/default/files/Planning/chapter_12.pdf)
- Soehnchen, A. (2022). *Open Loop Payment in Public Transport*. UITP. Retrieved from <https://cms.uitp.org/wp/wp-content/uploads/2022/06/WhitePaper-OpenLoop-10June-online.pdf>
- Taneja, R. (2018, August 24). *Now, Swipe Your Metro Card To Pay For All DTC, Cluster Bus Rides In Delhi*. Retrieved from NDTV: <https://www.ndtv.com/delhi-news/now-swipe-your-metro-card-to-pay-for-all-dtc-cluster-bus-rides-in-delhi-1905404>
- The Indian Express. (2024, April 11). *WhatsApp now lets you get DTC bus tickets: Here's how*. Retrieved from The Indian Express: <https://indianexpress.com/article/technology/tech-news-technology/dtc-bus-tickets-whatsapp-9262038/>
- The Urban Catalysts & C3. (2020). *Safer Streets, Safer Cities in Bihar*. Retrieved from [https://www.theurbancatalysts.org/\\_files/ugd/90538e\\_085639f53ca9427e9a2e86744f9da96d.pdf](https://www.theurbancatalysts.org/_files/ugd/90538e_085639f53ca9427e9a2e86744f9da96d.pdf)
- Torre-Bastida, A. I., Ser, J. D., Laña, I., Ilardia, M., Bilbao, M. N., & Campos-Cordobés, S. (2018). *Big Data for transportation and mobility: recent advances, trends and challenges*. *IET Intelligent Transport Systems*. doi:10.1049/iet-its.2018.5188

The Urban Catalysts  
Delhi, India

Email: [sonal.shah@theurbancatalysts.org](mailto:sonal.shah@theurbancatalysts.org)  
Web: <https://www.theurbancatalysts.org/>