



Transit Payments in India

A Case for Choice
and
Interoperability

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Abbreviations

AFC terminal	Automated fare collection terminals, used to validate and deduct fares at transit entry/exit points
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
CPT networks	Core public transit networks, including bus and metro networks
IPT networks	Intermediate public transit networks, including various kinds of rickshaws and private shuttle services
NCM Standards	National Common Mobility Standards
PoS device	Point of sale devices, which interact with fare media to fulfil a payment transaction
PPI	Prepaid Payment Instrument
MTS	Mass Transit System
MoHUA	Ministry of Housing and Urban Affairs, Government of India
MORTH	Ministry of Road Transport and Highways, Government of India
NPCI	National Payments Corporation of India
ToD	Transit-oriented Development
QR Code	Quick Response code
RBI	Reserve Bank of India
UMTA	Unified Metropolitan Transport Authority
UPI	Unified Payments Interface

Summary

Transit-oriented development (ToD) epitomises a policy approach to public infrastructure that gives priority to ease of living. In a growing and urbanising India, public transit must be modernised to ensure ease of movement for everyone.

While India has rapidly adopted digital payments, with yearly transaction volumes rising from 127 crore to more than 12,700 crore in the last decade, mass transit systems continue to rely on cash or closed-loop transit cards with reloadable balances.

The Government's *One Nation, One Card* initiative is an important effort to amalgamate an otherwise fragmented transit payments environment, in which efficiencies in ticketing, payment processing and fare regulation remain to be unlocked.

Transit authorities must lay emphasis on account-based ticketing systems which support contactless cards and QR payments, over systems that can only interact with stored balances on a prepaid card.

Enabling account-based ticketing entails deploying up-linked systems at transit gates or turnstiles that support debit / credit cards as well as, UPI and virtual cards through dynamic QR codes and QR tickets.

The report begins by discussing the structure of India's public transit systems and their payment environments. It identifies gaps in transit payment systems by analysing commuter survey responses. It takes stock of developments in India and abroad to address concerns of commuter choice and interoperability in transit payments. Lastly, it discusses the value of online ticketing systems and integrated fare management solutions as a possible way towards choice and interoperability in transit payments.

Summary

Efforts to modernise public transit should take a people-centric approach and consider commuter preferences and the challenges they face. To inform such an approach, we conduct an on-ground survey in four metro cities to see how commuters perceive transit payments in India. We analyse commuter views of the cost, benefit, choice architecture of transit payments in these cities.

Earlier studies of public transit in India have focused on concerns of safety, insufficient infrastructure, and siloed information disseminating systems.¹ **Our research is unique for its focus on the problems commuters face while paying for public transit, and the factors that influence their perceptions of different payment modes.** The study examines existing payment modes such as cash and prepaid transit cards as well as upcoming modes such as debit/credit cards and smartphones.

Takeaways from our survey

- Over 90 percent of commuters use several modes of transit (such as autos and buses, along with metros) for their daily commute.

As commuters depend on more than one mode of transit, there is a need for end-to-end fare rationalisation and integrated ticketing across modes of transit.

- Three in four commuters prefer to have multiple payment options for transit fares. Commuters prefer interoperability in payment modes for the ability to choose the most convenient payment option for their needs.

A choice of payment options across bank cards, prepaid transit cards, and QR-based tickets would improve inclusivity and accessibility in public transit systems for tourists as well as locals.

- Two in three respondents (including 70 percent of millennials and GenZers and 87 percent of international and interstate travelers) want to be able to use their debit / credit cards as one of the payment options on public transit.

Transit payments in India need to be modernised beyond payment instruments having inbuilt prepaid balances.

- Two in three commuters say that incentives such as cashback offers, discounts and brand rewards would influence them towards a particular mode of payment.

Their preference reflects a larger shift toward cashless payments and indicates the potential value-addition from data-driven integrated fare management systems.

Our findings on commuter preferences, in particular the overwhelming demand for open-loop payments in transit, align with developments in mature transit systems in mega cities such as London, Hong Kong and Singapore.

Account-based ticketing systems break the silos of commuter fares and payment data created by prepaid transit cards, and enable the development of integrated ticketing and fare management systems. As a result, transit authorities can raise a single charge for multi-mode trips, and deliver tailored discounts or brand rewards to commuters. End-to-end fare management systems also enable local authorities to align supply with demand for first- and last-mile modes of transit such as private shuttles and rickshaws.

Considering the efficiency gains, policymakers in India should promote an integrated fare management system built over a range of interlinked open-loop payment options. Such solutions will need stakeholder coordination among the agencies governing transit systems, as well as engagement between the private and public sectors.



Delhi Metro during rush hour
Image credits: Pinterest @metrolifelineDelhi

Introduction

Moving about in India's growing cities

India is urbanising and digitising rapidly. Widely available low-cost internet, deep foundations in information technology, and rising incomes in a liberalised economy are fuelling the transformation.

Already, half of India's online shoppers live in tier Y or Z cities, which are also home to about half the documented startups in the country.² Smaller towns are beginning to reflect the urban characteristics of having a large, predominantly non-agrarian workforce³ and high internet adoption.⁴ People are increasingly moving to urban centres in search of better opportunities, and it is estimated that every other Indian will be living in a town or city by 2050.⁵

These trends warrant attention to public infrastructure. In particular, India must expedite the development of efficient public transit in urban centres to meet the mobility needs of an estimated 480 million daily commuters by 2031.⁶

The Government's policy response has rightly centered on transit-oriented development (ToD), which entails creating seamless, user friendly public transit solutions by coordinating amongst various public bodies and the private sector.⁷ Increased budget allocations for central schemes including the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and the Smart Cities Mission⁸ reflect the impetus behind infrastructure creation. Around 1.5 lakh kilometers of highway infrastructure have been built in the last decade,⁹ and in parallel the metro rail network was tripled in extent, from 248 kilometers in five cities in 2014, to over 775 kilometers in 20 cities in 2022.¹⁰

Yet gaps remain in achieving the ToD objectives of integrative transit solutions.¹¹ Public transit remains fragmented into core public transit (CPT) networks – including metros and buses – and unorganised intermediate public transit (IPT) networks – including various kinds of rickshaws and private shuttle services. Both are critical for commuters. While CPT networks are at the core of most journeys, IPT networks provide commuters with 'first mile' and 'last mile' connectivity.¹²

Meanwhile, public transit is governed by an amorphous accountability framework riddled with overlaps. A variety of public authorities at the municipal, state and central levels are involved in planning, authorising and operating transit systems. (*Annexure 2 details the institutional structure of public transit in India*)

A fragmentary public transit system is detrimental to people's ease of living. In the Ease of Living Index of the Ministry of Housing and Urban Affairs (MoHUA), an accessible and affordable public transit system is considered a vital determinant of the quality of life in urban India.¹³

Solutions aimed at achieving ToD objectives and improving ease of living must take a holistic view of public transit. This would mean exploring ways to make multi-mode transit easy for all residents, whether students, tourists, persons with disabilities, or the elderly.

Paying for public transit

While physical infrastructure such as highway networks and transit corridors are important steps towards ToD, interoperable payment solutions are an often overlooked means of creating seamless urban transit systems.

Transit payment systems in India are fragmented. By and large, CPT networks use prepaid transit cards (that are incompatible with each other) while IPT networks mostly rely on cash.

The resultant need to juggle many incompatible payment instruments leads to friction in urban commuters' daily lives. And the silos around fare and ticketing data preclude the possibility of unified fare management and ticketing solutions across modes of transit.

At present, mass transit system (MTS) operators issue prepaid transit cards and operate the payment terminals and backend fare management systems of their own networks. The prepaid cards issued by a particular MTS operator only work within its network, thereby creating a closed-loop payment environment. Intercity commuters and tourists are accordingly obliged to obtain a new prepaid card for every MTS network they access, and in any case, must pay cash to complete the first and last miles of their journey.

To be sure, some MTS operators are expanding their closed-loop networks to encompass more than one mode of transit – like the One card in Delhi, usable on the metro and public buses. A few CPT networks such as the Delhi Metro¹⁴ and Namma Metro in Bengaluru¹⁵ enable contactless payments for commuters via interoperable QR codes, such as Bharat QR and UPI QR (QR scan-and-pay), and paper or digital tickets that use QR codes (QR tickets). Upon the full rollout of the Government's National Common Mobility Card initiative, a common prepaid transit card will be usable across CPT networks in India. Even so, transit payments would be out of step with the changing way in which people are transacting in India.

India already leads the world in the number of real-time digital payment transactions,¹⁶ and the lead is only expected to increase. Real-time digital payment volumes have grown by about 100 times since 2014¹⁷ on the back of a range of consumer-focused payment solutions and innovative payment acceptance technologies. Developments in digital payments have maintained interoperability as a core feature, and this has led to a far higher quantum of exchange over UPI, debit/credit cards, prepaid payment instruments (PPIs), among others. The value of interoperability is clear in the over 9,000 crore digital transactions worth INR 2,050 lakh crore conducted in India in just the first three quarters of FY23.¹⁸

However, UPI remains susceptible to instances of fraud and technical declines.¹⁹ While transaction volumes have risen exponentially in the last three years, the rate of transaction failures on UPI has kept pace with the growth. The likelihood of technical declines in UPI has increased in recent years, warranting concerted investments to improve the security and resilience of the UPI network. (Table 1)

Table 1: Monthly UPI statistics of the top 50 remitter banks²⁰ *

Year	April 2020	April 2021	April 2022	April 2023
Average UPI volume handled (crore)	3.42	9.07	11.93	18.66
Average transaction failure rate (% of total transactions)	10.8	8.4	11.0	10.4
Average technical decline rate (% of failed transactions caused by technical issues)	0.6	1.2	1.9	2.3

**Note: For 2022 and 2023, the averages were calculated for the top 50 remitter banks. For 2021 and 2020, the averages were calculated for the top 30 remitter banks. Average transaction failure rate is the sum of average transaction failures due to technical declines and the average transaction failures due to input errors, or breach of daily transaction limits etc.*

Interoperability however allows many payment instruments and infrastructures - each with its own advantages and limitations - to coexist, and this has boosted the growth of a competitive fintech sector that attracts consumers with offers of benefits such as discounts and tailored rewards.

In transit, interoperability enables commuters to pay at transit gates or turnstiles no matter the medium used: whether a physical card or a virtual card / ticket stored on a device.

As India expands its 5G network into more cities and regions,²¹ it is an opportune moment to build an interoperable payment environment which leverages open-loop payment instruments and mobility data to improve the commuter experience (Box 1). Payment interoperability would ensure secure, efficient and accessible digital payments that directly enhance ease of living in the long run.

Box 1. A primer on closed-loop and open-loop payment instruments

Payment instruments such as debit cards or prepaid transit cards use microprocessors to store data and to interact with nearby devices. Most such microprocessors or chips work on global security protocols known as Europay, Mastercard and Visa (EMV) standards.

Thus, debit cards can interact with automated teller machines (ATMs) or point of sale (PoS) devices. Similarly, transit cards can interact with gates at transit entry / exit points. Payment cards can broadly be divided into ‘account-based cards’ or ‘stored-value cards.’

<i>Feature</i>	<i>Account-based cards</i>	<i>Stored-value cards</i>
<i>Maintaining account balance</i>	Account-based cards are linked to the account balance maintained on bank servers	The balance is stored on the card itself, and needs to be topped up for transactions to be made
<i>Interactions with PoS devices</i>	PoS devices connect to bank servers to exchange data and complete a transaction	PoS devices read data stored on the card itself and do not interact with external servers

In transit systems, it is conventionally MTS operators who maintain control and visibility over the fare calculation and collection lifecycle through stored-value cards. This creates challenges in building interoperable fare management solutions. An increasing trend is towards account-based ticketing systems, where the possible uses and efficiency gains are manifold.

Closed-loop prepaid cards

Closed loop cards are stored-value cards that only work within a defined network. Prepaid transit cards issued by MTS operators are a popular example of closed-loop, stored-value cards.

These cards are configured on a particular MTS network of transit gates and cannot be used elsewhere. MTS operators such as DMRC, BMRCL and others incur high costs in operating a network of transit gates where the travel cards they issue can work.

Transit turnstiles at entry points verify minimum balances stored inside prepaid transit cards. When commuters tap their cards upon exit, transit turnstiles calculate and deduct commuter fares depending on the distance traveled or time taken.

As usability is limited to the network of compatible transit turnstiles and systems, closed-loop cards have a major drawback in terms of scalability.

Open-loop contactless smart cards

Open-loop contactless smart cards are account-based cards. They are 'open-loop' in the sense that their usability is not limited to compatible systems at the transit turnstiles of a particular MTS operator. Contactless 'tap-n-pay' cards issued by banks are a popular example of open-loop contactless smart cards.

Being account-based cards, they are linked with the commuter's bank account, wherefrom fares are deducted at transit entry / exit points. **Since account-based cards interact with the banking infrastructure when used, secure technology layers and fare-management solutions across modes of transit can be built and scaled.**

Mega cities around the world have unlocked efficiency gains in transit payments by using open-loop contactless smart cards in public transit systems.

Regulation of transit payment instruments in India

Payment instruments such as co-branded cards or PPIs are governed by RBI regulations. The RBI's master direction on PPIs (MD on PPIs) lays down a framework for MTS operators to issue closed-loop payment instruments called PPI-MTS (prepaid transit cards).²²

The master direction on the issuance and conduct of credit and debit cards (MD on Card Issuance) lets MTS operators enter into co-branding arrangements with banks to issue debit cards which are usable on their networks.²³

Prepaid transit cards

The RBI broadly classifies PPIs as either small or full KYC PPIs, depending on the extent of KYC conducted by PPI issuers. Unlike small PPIs, full KYC PPIs permit cash withdrawal up to specified limits, and have higher ceilings on loadable balances.

The MD on PPIs stipulates a separate category of PPIs which can be issued by MTS operators within their network of AFC terminals (PPI-MTS). These PPIs have reloadable balances up to a ceiling of INR 3,000, and do not allow cash-outs or refund of funds from stored balances.

Notably, while ordinary PPIs are required to achieve interoperability by design, prepaid transit cards need not be interoperable with each other.²⁴

MTS operators have discretion over the extent of KYC conducted for prepaid transit cards. Other requirements pertaining to escrow arrangements, customer grievance redressal, agent due diligence, etc. apply equally to all kinds of PPIs.

A prepaid transit card offers limited functionality outside the transit turnstiles of the issuing MTS operator's network. The MD on PPIs stipulates that a prepaid transit card can only be used at those merchant outlets whose activities are allied with, related to, or carried on within the premises of the MTS .

Co-branded cards

Co-branded cards, on the other hand, can be used across merchant outlets just as ordinary debit / credit cards. An MTS operator may partner with a bank to issue a co-branded card as per the MD on Card Issuance. In a co-branding arrangement, the bank is responsible for issuing the card and managing transactions, while the role of the MTS operator as co-branding partner is limited to marketing, distribution, and enabling access to cardholders. Notably, the MD on Card Issuance prohibits co-branding partners from accessing transaction data relating to the co-branded card.²⁵

A number of MTS operators have announced tie-ups with banks to issue co-branded cards, given the recent emphasis on interoperability by the NPCI and the Government. (*See Section IV, Domestic perspectives*)

The following sections discuss the contours of interoperable payment and fare management environments in public transit by analysing commuter preferences in India and best practices abroad.

3

How Commuters Travel



Inside an auto-rickshaw

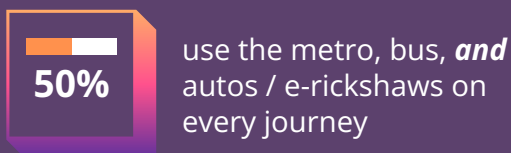
Image credits: Pinterest @uchaudhary1563

We surveyed 1,250 commuters²⁶ on the ground in four cities in January 2023 for a first hand account of urban Indian commuters' perceptions and preferences in transit payments.

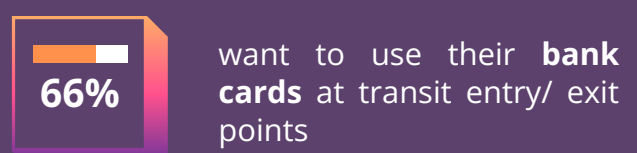
We engaged with a mixed group of commuters, including students, working professionals, immigrant workers, and tourists in about 60 different locations in Bengaluru, Hyderabad, Mumbai and Delhi. Most survey respondents were younger than 35 years of age, and some 40 percent were women. 30 of the 1,250 respondents were foreign nationals. (*Annexure 1, Parts B and C contain demographic and location details, respectively*)

Key Findings

How commuters travel



How commuters prefer to pay



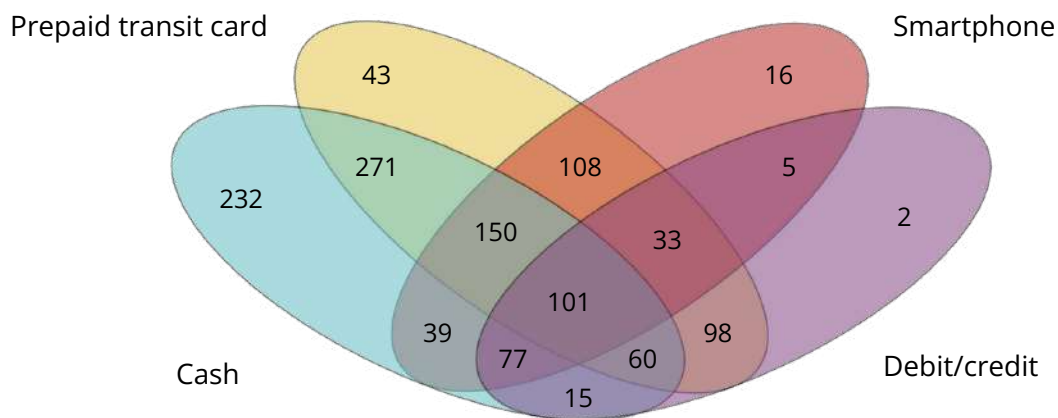
What the basket of payment options should look like

Asked to choose from a set of four payment methods for public transit, 43 percent of respondents chose a set of two payment options, 26 percent chose a set of three options, and 8 percent chose all four options. (*Figure 1*)

76 percent included cash in their preferred payment options. The next highest preference was for QR-based payments (69 percent). And a sizeable portion (31 percent) opted for debit/credit cards as a payment option together with other modes. (*Annexure 1, Part A contains a detailed breakdown of commuter preferences*)

Notably, younger cohorts exhibited greater preference for using their debit/credit card as a payment option on public transit. (Figure 8) This, in line with the evolving demography of India, implies that the preference debit/credit card as a payment option on public transit is likely to grow over time, while commuters' reliance on cash and prepaid transit cards is likely to fall. This inference correlates with the rising access to digital payment products and fintech solutions such as virtual cards in India.

Figure 1: Detailed choice matrix of 1,250 survey respondents



Utility of bank cards

63%

believe debit/credit cards would improve convenience and save time

Binding considerations in preference-making

63%

would pick a digital payment mode based on the incentives/ rewards offered

Perspectives of international and interstate travellers

Our survey included people from popular junction points in all four cities, such as railway and bus stations, to understand the perspectives of international and interstate travelers.²⁷

While international tourist arrivals are expected to increase slowly after the pandemic-led disruptions, several significant issues remain unaddressed. Notably, all the tourists we surveyed had used the metro to travel across the city, in combination with a bus or auto/e-rickshaw. This could be due to the high level of cleanliness maintained in the metro, along with the easy process for buying tickets.

Interestingly, not a single respondent opted for just one payment mode. 60 percent opted for triple payment options, while 40 percent opted for dual combinations. This is because many tourists to India come from developed economies such as the United States, United Kingdom and Canada, where credit cards are frequently used to pay transit fares. It is not so in India, however, where only 3 percent of people use credit cards,²⁸ which cannot yet be used for ground transit. The inability to use a familiar payment mode can be a pain point for foreigners as they must familiarise themselves with the various other payment options, such as cards, tickets/smart cards and debit/credit cards where applicable.

Tourists' preference for using debit/credit cards on Indian public transit is apparent from the survey results, where 50 percent of respondents cited the lack of interoperability across different modes of transit (and the inability to use debit/credit cards at multiple locations) as an important consideration.

Almost all respondents (87 percent) indicated that using a debit/credit card would be convenient for them, and 77 percent agreed it would save them time as they wouldn't have to purchase and recharge a prepaid transit card. For interstate commuters, buses/shuttles were the most used mode of transit, such that 84 percent traveled by them in combination with the metro and/or autos or e-rickshaws.

Just over half of interstate commuters (51 percent) said they use QR scan-and-pay options for daily transactions, followed by cash (21 percent) and debit cards (19 percent). And most respondents (73 percent) preferred to multiple payment options on public transit.

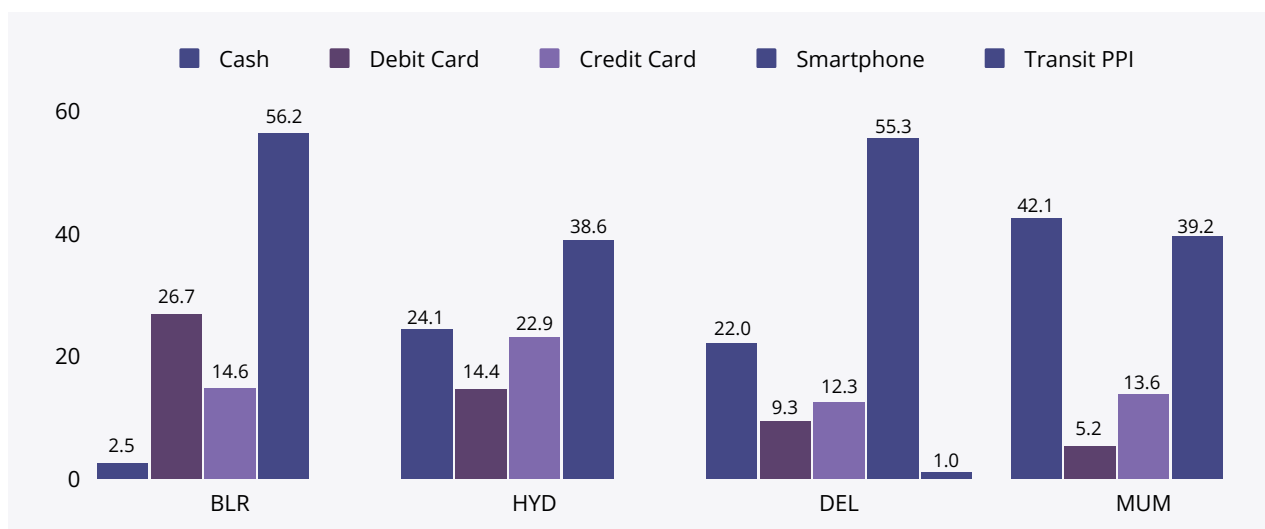
The benefits of using a debit/credit card were also widely recognised: 68 percent of respondents agreed that it's convenient to use a debit/credit card. As with international travelers, the fear of losing their debit/credit card was not a concern for most interstate travelers. However 77 percent of international travelers cited lack of interoperability as being a potential obstacle.

In the next section we analyse survey responses about the preferred modes of transport and payment options used by a diverse set of respondents, and conclude with a summary of key takeaways highlighting the gaps found by the survey.

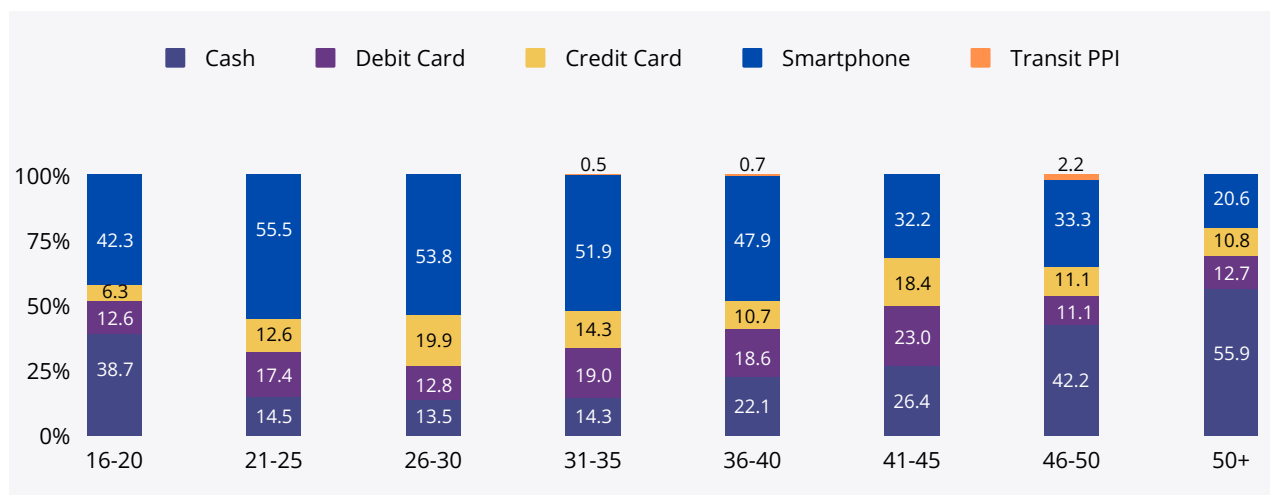
Analysis of survey responses

A. How commuters make retail payments in general

There is considerable heterogeneity in the payment modes used in different cities. Figure 2 shows the payment modes used by commuters for daily transactions. QR scan-and-pay is the most used payment mode in all four cities, followed by cash.

Figure 2: Payment modes used for daily transactions

The share of respondents using cash is considerably lower in Bengaluru, at only 2.5 percent, while in Mumbai, nearly half the respondents use cash. Similarly, debit/credit cards are more popular in Bengaluru (41 percent) and Hyderabad (37 percent) than in Delhi (22 percent) or Mumbai (19 percent).

Figure 3: Preferred mode of payment by age group

The payment modes used by different age groups are also heterogeneous (*Figure 3*). Cash use is highest amongst young adults (aged 16 to 20) and people older than 46 years.

The varied preference between digital and physical modes of payment likely is due to the different functionalities they offer. The familiarity of cash, anonymity, and protection from

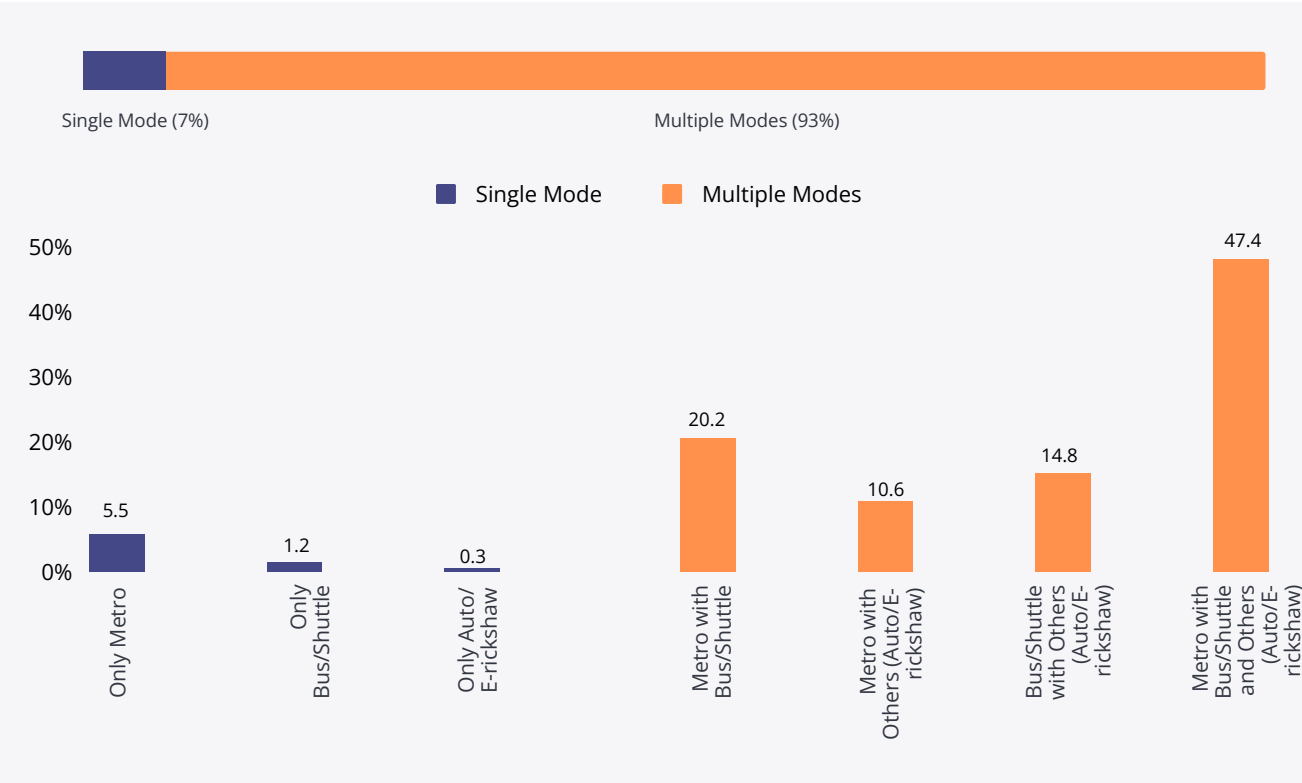
online fraud may be some of the reasons behind the preference for cash amongst older people. And as QR-based modes and debit/credit cards offer benefits including cashback incentives and reward points, permit exact payments to be made, and are convenient to use, most of the younger and tech-savvy cohort of commuters prefer these payment modes to cash.

B. How commuters travel

Commuters use many modes of public transport. 83 percent use the metro in combination with another mode. (Figure 4)

Nearly half of all commuters use all three modes of transit on each journey – the metro, shuttles/buses, and autos/e-rickshaws – while the other half use two of the three modes in combination.

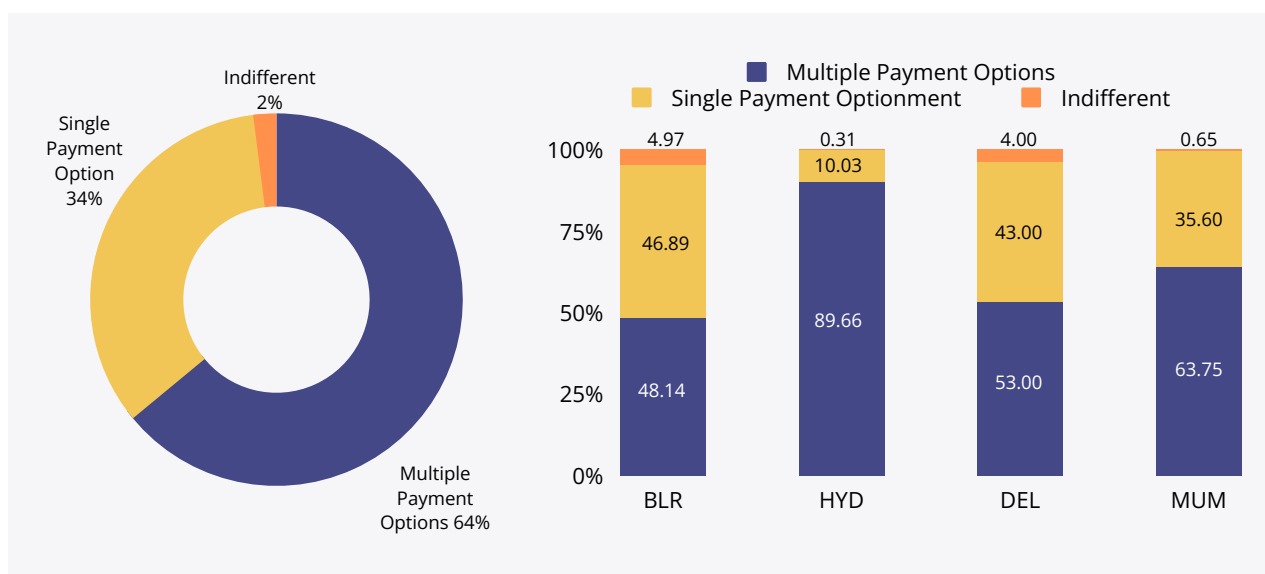
Figure 4: Preferred mode of transit



C. How commuters prefer to pay on public transit

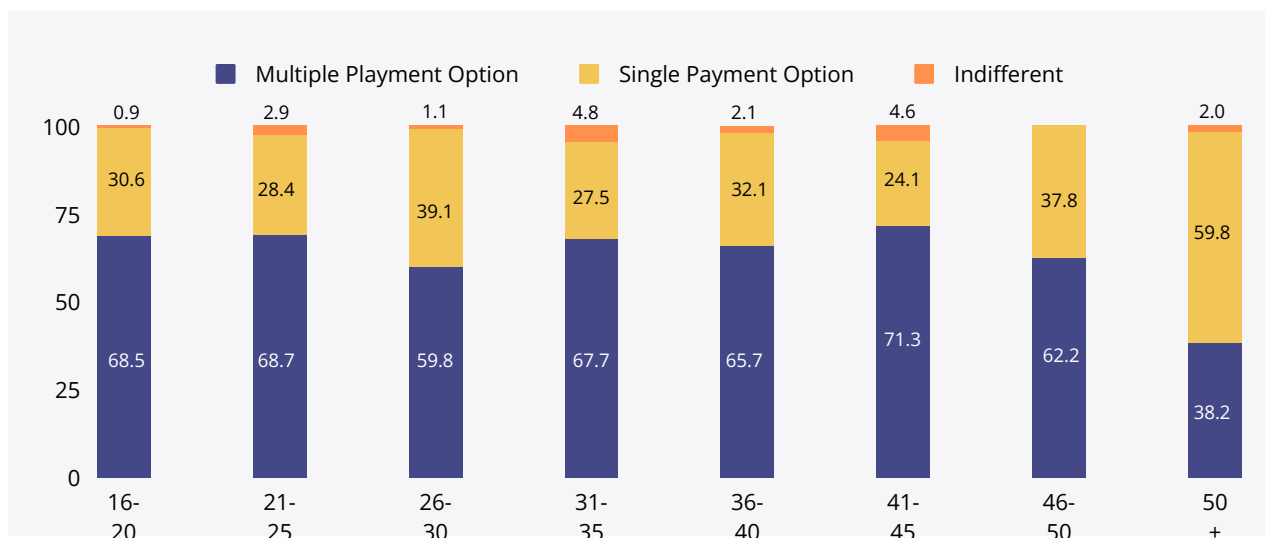
For reasons of convenience, most commuters would like several payment options to be available for public transit fares. (Figure 5)

Figure 5: Preference for single or multiple payment options (by city)



64 percent of commuters wanted multiple payment options to be available in public transit. Notably, close to 90 percent of respondents from Hyderabad preferred multiple payment options, followed by Mumbai (64 percent), Delhi (53 percent) and Bengaluru (48 percent).²⁹

Figure 6: Preference for single or multiple payment options (by age)



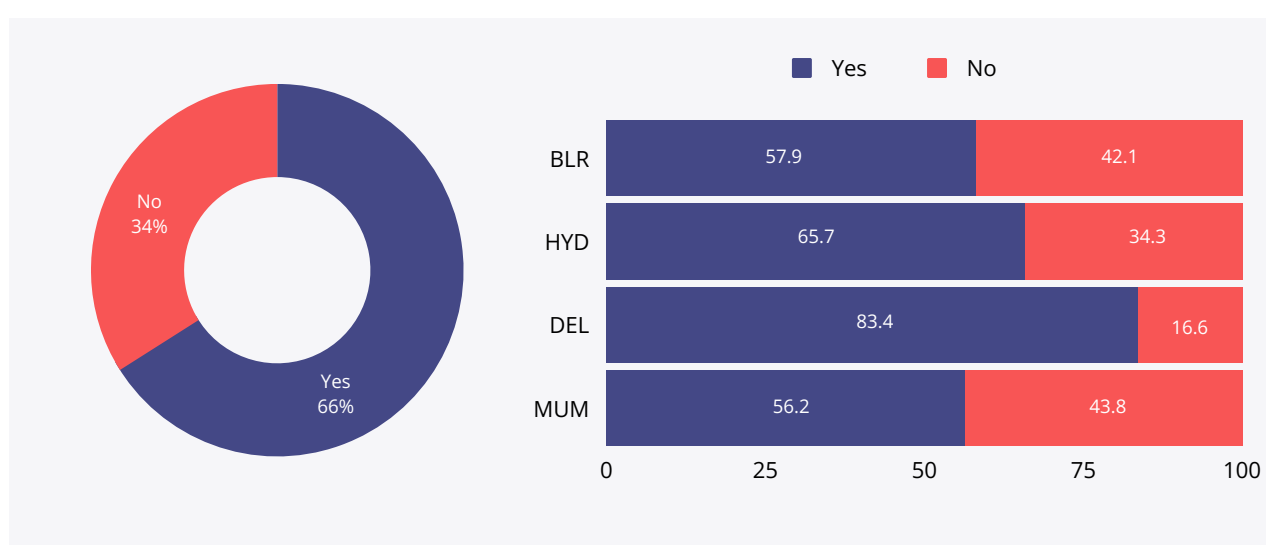
When presented with a set of specified payment options 76 percent of respondents chose a basket of more than one payment option. The change in preference by roughly 12 percent of respondents, from multiple to a single payment option, can be explained by a change in the question frame.³⁰ When survey respondents are presented with detailed options, they tend to favour used cases, or experienced utility, while with broad options they tend to favour expected utility. Being presented with detailed options can also cause negative mental accounting, leading to myopia and higher aversion to loss, or a higher opportunity cost of the endowment.

Respondents across age groups want multiple payment options for public transit. (Figure 6) The exception was respondents older than 50, who indicated higher preference for simplified single payment modes over the convenience of multiple modes.

D. Commuters' preference for debit / credit cards on public transit

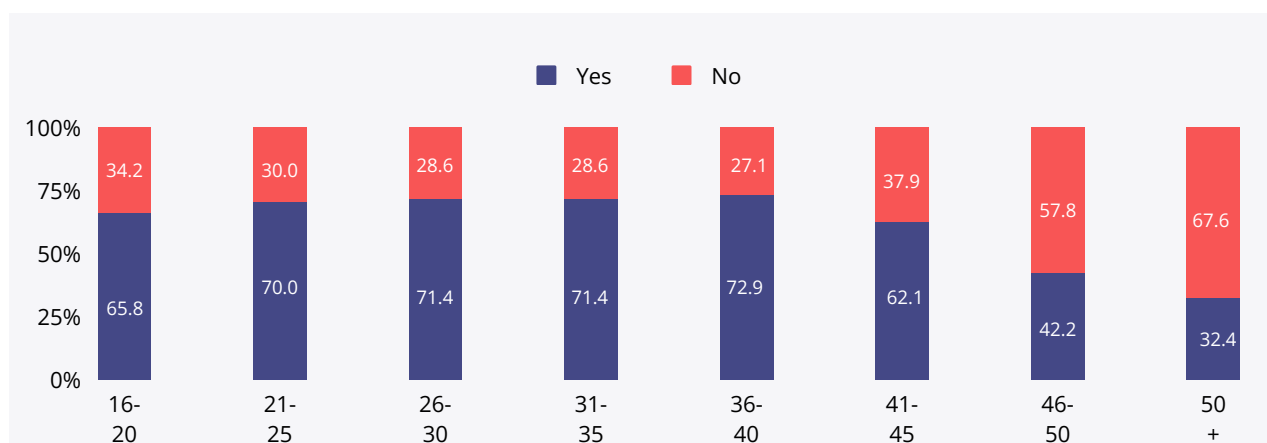
The preference for using bank cards for transit was highest in Hyderabad (83 percent) followed by Delhi (66 percent), Mumbai (58 percent) and Bengaluru (56 percent). (Figure 7)

Figure 7: Preference for debit/credit cards (by city)



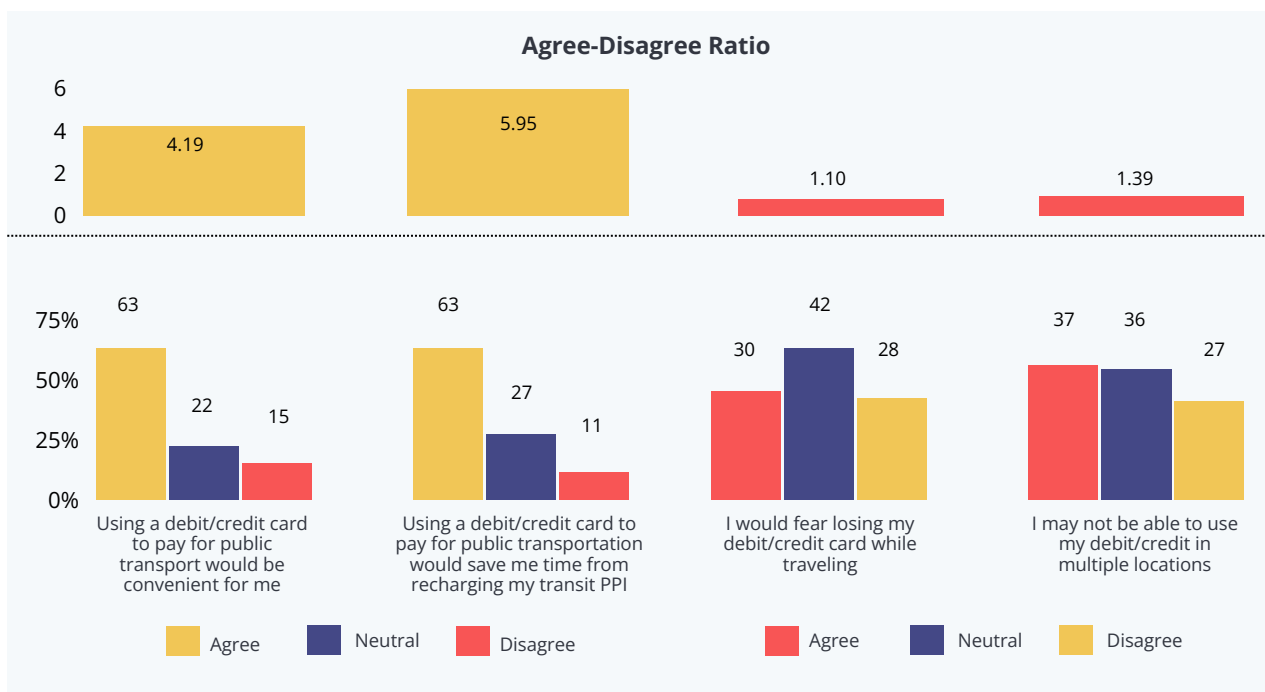
By age, the preference for debit/credit cards was highest among commuters of age 16–45 years, and drops to less than 50 percent for respondents older than 46. This is another instance of preferring existing or familiar modes of payment to the unfamiliar.

Figure 8: Preference for debit/credit cards (by age)



63 percent agreed that using a debit/credit card would be convenient and would save time over having to recharge a prepaid transit card. (Figure 9) There was a high ratio of agreement to disagreement as regards the convenience and time-saving aspects of using debit/credit cards on public transit. Specifically, for every person who disagreed, there were approximately five people who agreed that bank cards would save time. The advantages of using a debit/credit card outweighed the perceived potential drawbacks, such as fear of losing the card or concerns about interoperability. Here the agreement to disagreement ratios were evenly split.

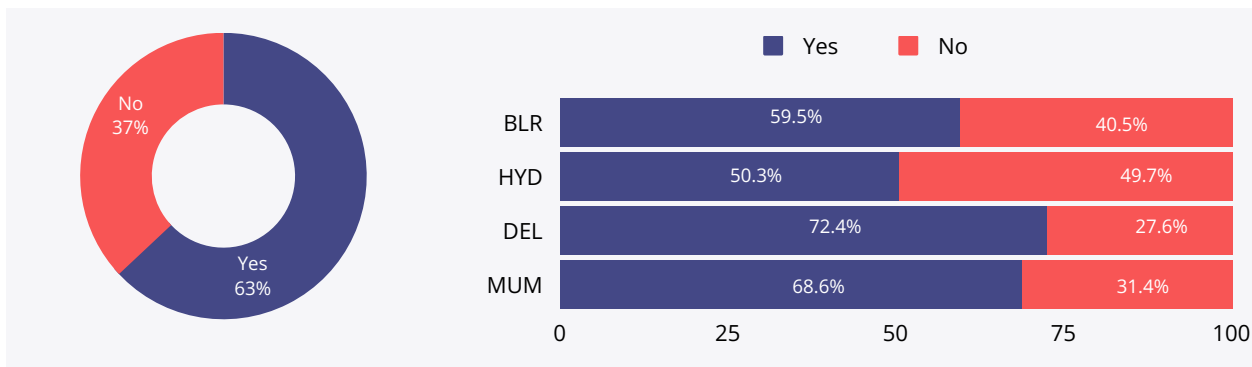
Figure 9: Commuter perceptions of using debit/credit cards on public transit



E. Factors affecting commuters' choice for a particular mode of payment

Reward incentives such as discounts, cash back, loyalty points, mileage and vouchers are important considerations for commuters in choosing a digital payment instrument over another. (Figure 10)

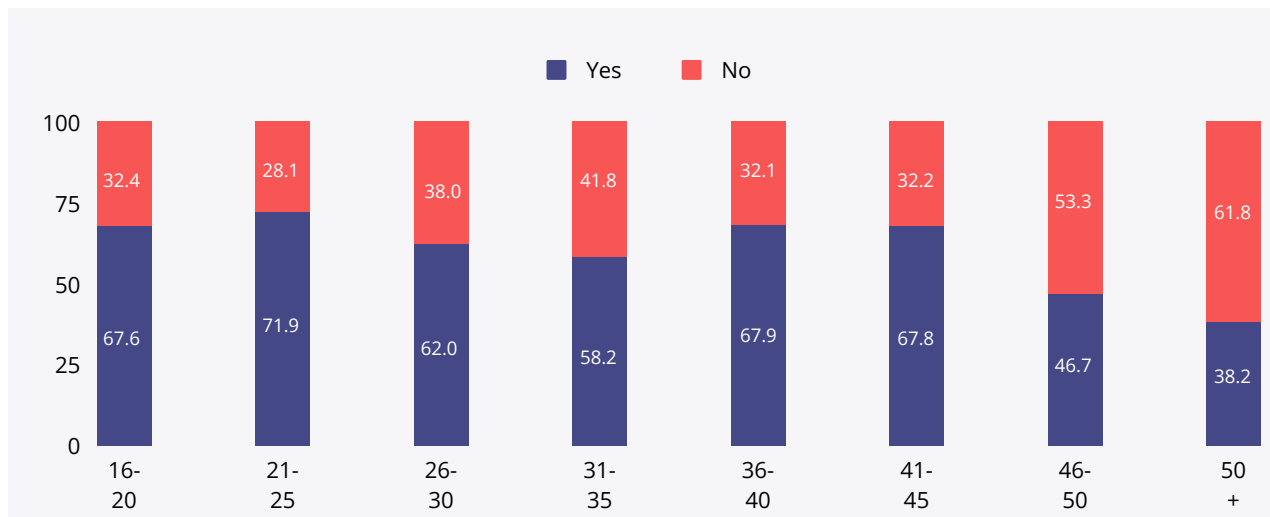
Figure 10: Role of incentives / rewards in choosing a payment mode



The majority of commuters (63 percent) said that incentives such as cashback offers, discounts, brand rewards and loyalty points were important when picking a particular digital payment option to pay for transit. The portion was 72 percent in Hyderabad, 69 percent in Bengaluru, 60 percent in Mumbai, and 50 percent in Delhi.

A similar trend is observed across age groups, as seen in Figure 11.

Figure 11: Role of incentives / rewards in choosing a payment mode, by age



Convenience and saving time were the major reasons commuters gave in favour of using debit/credit cards on public transit.

Takeaways

Responses to the survey highlight the following characteristics of urban commuters in India.

- **Allow choice in fare media.** Over 90 percent of commuters use multiple public transit modes for their daily commute, and over 60 percent want multiple payment options to be available in public transit. Thus, payment infrastructure on public transit systems should be agnostic of the payment option used.
- **Millennials and GenZers prefer bank cards on public transit.** 66 percent of commuters prefer using bank-issued debit or credit cards for transit fares, along with other payment options. Over 70 percent of millennials and GenZers want to use their bank cards for public transit for reasons such as increased convenience with not having to recharge prepaid transit cards, and the likelihood of earning rewards and incentives.
- **Leverage the smartphone.** Commuters in India have a high preference for QR scan-and-pay and QR tickets in public transit. Payment infrastructure on public transit should support real-time payments using UPI, virtual cards and PPIs.

4

Building Interoperability

एवं टिकट
जांच लें।



A passenger loads funds onto her prepaid transit card

Image credits: Arvind Yadav / Hindustan Times / Getty Images

Domestic perspectives

Efforts to build interoperability in transit payments date back over a decade, to the launch of the 'More' card in Delhi. Albeit limited to the Delhi metro and a few bus routes, it was the first electronic fare medium that could be used across modes of transit.³¹ Later, in 2014, the National Urban Transportation Policy (NUTP) highlighted the need for a common mobility card for payments across transit modes, towards greater multi-modal integration of Mass Rapid Transit (MRT) systems.³²

Standards and specifications for a common mobility card (the NCM Standards) were released the next year by an expert committee constituted by the Union Government.³³

The committee emphasised the need for a system-level shift in transit payments, including locally developed Automated Fare Collection (AFC) terminals, cards, readers, and security standards. Subsequently, card networks such as the NPCI, Visa and Mastercard launched debit cards compatible with the NCM Standards.

Box 2. Deep dive into the NCM Standards

The NCM Standards entail service-based reloadable wallets residing on EMV-based open loop smart cards linked to the user's bank account. Users add a service to the card when they enter a new CPT network, and make fare payments at transit gates or turnstiles using the balance stored in the reloadable wallet. Cards issued on the NCM Standards are thus a combination of account-based and stored-value cards.

Importantly, the NCM Standards enable offline transit payments, where only the stored value component of the card interacts with the transit gate.³⁴

So, while cards on the NCM Standards can be used for retail transactions at any uplinked PoS device, they interact with transit gates like prepaid stored-value cards. Cards on NCM Standards support offline transit payments by design. Although MTS Operators need to upgrade transit turnstiles to be compliant with NCM Standards, these upgrades would not enable open-loop payments where transit turnstiles interact with bank servers to process payments.

Cards on the NCM Standards have seen limited uptake so far. The cards are issued by MTS operators in a time-consuming process,³⁵ and commuters bear the processing charges for a top-up or recharge.³⁶

A 2022 report by a Parliamentary Standing Committee on Housing and Urban Affairs took note of the slow pace of deployment of systems compliant with the NCM Standards.³⁷ It observed particularly that compliant systems had not been installed in major cities such as Kolkata, Jaipur, Lucknow, Kanpur, Chennai or in Gujarat.

A key advantage of the NCM Standards is that MTS operators, who earlier issued incompatible prepaid transit cards, can now enter co-branding arrangements with banks to issue cards that can be used across CPT networks in India. For instance, Kochi Metro Rail Ltd. tied up with Axis Bank to issue the Kochi One card, Mumbai Metro One Pvt. Ltd. tied up with Paytm Payments Bank, and the Chennai Metro Rail Corporation joined hands with the State Bank of India to issue cards on the NCM Standards.

Similarly, the Ahmedabad Municipal Corporation has tied up with ICICI Bank to issue *Janmitra* smart cards as part of the Ahmedabad Smart City Mission. These cards serve as a single payment instrument in retail, transit and allied services such as parking, road tolls, entry fees for public spaces and more.

Co-branded cards on the NCM Standards have clear advantages over the closed loop PPI-MTS products in terms of convenience and usability, and so contribute to raising the ease of living.

However, since cards on the NCM Standards enable offline interactions at AFC terminals,³⁸ the shift from closed loop PPI-MTS to the NCM Standards only extends the size of the ‘closed loop’, from individual CPT networks to multiple CPT networks across cities.

This in turn means that the legacy problems with prepaid transit cards (such as data silos and limitations in developing integrated fare management systems) would persist even if all transit systems were to adopt cards on the NCM Standards.

Thus, the NCM Standards are not a silver bullet. Transit payment solutions should consider the varied preferences and constraints of the public. As an instance, a MoHUA survey showed that most IPT drivers (particularly those older than 30) prefer to be paid in cash.³⁹ The survey also indicates commuters’ preference for cash payments, and suggests that the lack of fare integration across modes of transit is a key hurdle to greater acceptance of cashless payments. **Transit authorities in India should therefore look beyond systems that only interact with in-built balances of stored-value cards, and explore solutions that allow all forms of payments to interoperate.**

Along with the idiosyncrasies of Indian public transit systems, it is equally important to keep in mind the global trends and best practices in transit payments. Global mega cities serve the daily transit needs of populations comparable to Indian cities and may offer useful insights into diverse aspects.⁴⁰ These include policies aimed at empowering consumer choice in transit payments, streamlining coordination between multiple authorities for payments interoperability, and enhancing the role of the private sector in enabling seamless transit payments.

With this in mind, we discuss the transit payment systems in London, Hong Kong and Singapore below. Each of these mega cities has a highly developed public transit infrastructure. We also look at Japan as a whole, given that governance and oversight of transit systems is divided across different administrative regions in the country.

Global perspectives

Transit systems in mega cities such as London, Singapore and Hong Kong support payments using prepaid transit cards, open-loop contactless smart cards as well as smartphones.⁴¹

These cities took a step-by-step approach in upgrading their transit payment infrastructures. Initially, only closed-loop prepaid transit cards were usable across different modes of public transit. Transit authorities in London, Hong Kong and Singapore enabled account-based ticketing systems to reduce issuance costs associated with prepaid cards, decrease the multi-modal commute time, and make transit payments seamless for tourists.

Account-based ticketing through open loop contactless smart cards and smartphones made transit payments seamless with ordinary retail payments. Singapore's SimplyGo EZLink⁴² recorded over a million transactions inside the first 10 days of the first pilot with Mastercard.⁴³ Similarly, contactless smart cards are widely used by commuters in London⁴⁴ and Hong Kong.⁴⁵

The experience of these mega cities illustrates the benefits of enabling both open loop and closed loop payment systems together. **Interoperable payment options across multiple transport modes, simplify commuters' experience with public transit and make densely populated cities more liveable. In particular, account-based ticketing systems help make transit systems more accessible for international travelers.**

Japan offers a distinct perspective which bears relevance from an Indian context.⁴⁶ As of 2013, there were 10 different closed-loop transit cards in operation,⁴⁷ each issued by a different transport operator.⁴⁸

Each transit card could only be used in a specific region, and differed in terms of initial costs and renewal/maintenance fees. This created a complex system and one that was particularly hard for tourists to navigate.

Japan's transport operators have since taken steps towards interoperability.⁴⁹ This has meant linking the acceptance infrastructure of the various transit cards in circulation, such that the transit cards issued by one operator can be used in other regions as well. Other forms of transit payments such as virtual cards leveraging QR codes were also developed in parallel.

However, paying fares using open-loop bank cards is still not an option in Japan, although a few transport operators are conducting pilots to test these alternatives.⁴⁹ Enabling open-loop payments might not only reduce the issuing and management costs associated with multiple cards, but help deliver greater functionality to commuters in Japan.

The case of Japan highlights the importance of an integrated transit payment system. A key challenge here is in aligning the incentives of multiple private and public transport operators towards an open-loop payment environment for commuters.

Table 2: Summary of key characteristics of public transit systems in London, Japan, Hong Kong and Singapore

	London	Japan	Hong Kong	Singapore
Interoperable payment and fare collection systems	✓	✓*	✓	✓
Presence of both open-loop and closed-loop payment environments	✓	X	✓	✓
QR tickets and QR scan-and-pay	✓	✓	✓	✓

Source: Author's own

**Note: Transit payments in Japan are interoperable across modes of transit within specific regions. Cross-country interoperability is absent.*

5

Leapfrogging Transit Payments in India



An account-based payment terminal in New York
Image credits: Wikimedia Commons User: Tdorante10

The jurisdictions we study all operate transit payment systems that are interoperable and consistent across all modes of transit. This resonates with the learnings from our survey. Indians are increasingly adopting digital payments and commuters want to choose from a variety of payment options in CPT and IPT networks.

Recent developments in transit payment interoperability have centered on phasing out closed-loop prepaid cards in favour of cards issued on the NCM Standards. Thus, instead of creating multiple closed-loop payment environments, MTS operators authorise the issuance of co-branded cards with service-based reloadable wallets. While this is a significant improvement from siloed closed-loop payment environments, account-based ticketing systems would further improve the ease of living and yield greater efficiency gains for transit authorities.

Account-based ticketing leverages the growing behavioural shift towards digital payments in India by enabling mobile ticketing and open-loop payments on public transit. Looking ahead, it may pave the way for integrated ticketing solutions and end-to-end fare management systems that would in turn improve ease of living standards and further the Government's ToD objectives.

Interoperability via account-based ticketing systems

Account-based ticketing systems allow transit turnstiles to interact with bank servers through interoperable QR codes and uplinked PoS devices.

Mobile ticketing solutions.

Mobile ticketing makes use of cost-effective QR technologies at acceptance points by turning the smartphone into a payment instrument. QR scan-and-pay uses dynamic QR codes to let commuters pay fares using UPI, virtual debit/credit cards or PPIs. Similarly, QR tickets enable the smartphone to serve as a ticket at transit entry gates. In this way, mobile ticketing unlocks the gains from India's recent strides in digital payments and fintech, be it in interoperable PPI wallets, UPI, or reward-bearing virtual cards.

Mobile ticketing can play a critical role in IPT networks. At present, ~45 percent of IPT drivers accept or are willing to accept cashless payments.⁵⁰ As smartphones progressively become better and more affordable, adoption and acceptance levels are likely to increase.⁵¹ Although challenges remain with limited connectivity in underground stations and poor network zones, the rapid rollout of 5G and optical fibre networks across India underlines the significant opportunity for mobile ticketing, particularly for IPT networks.⁵²

Open-loop contactless smart cards.

Open-loop contactless smart cards use established global standards to securely interact with bank servers. They lend higher convenience benefits as commuters can travel and pay just as they do in other retail use cases.

Transit authorities can levy flat-distance-based fares when the commuter taps her card at a transit gate upon exit, or at the time of entry.

Open-loop payment technologies may be configured such that card taps are logged at entry gates and forwarded to bank servers for verification. If the verification process flags an issue with the customer's account, such as an existing unpaid charge, the card gets blacklisted by the transit network until settlement. Upon successful verification, commuter fares are charged based on the fare model adopted by transit authorities.

For instance, under the 'accumulated fare' model, dynamic fares are aggregated across multiple transit modes to raise an accumulated charge. Similarly, Commuters may obtain rolling subscriptions or decide to authorise payments under a pay-as-you-go model.

Table 3: Characteristics of transit payment instruments

Card / Characteristics	Payments using prepaid transit cards	Transit payments using cards on NCM Standards	Transit payments using account-based ticketing systems
User experience	Need to purchase different transit cards for different CPT networks	Prepaid balance on the same card can be used across multiple CPT networks	Can be used in CPT networks across cities without any need for loading prepaid balances
Issuance	MTS operators issue cards themselves	MTS operators issue cards under co-branding arrangements with banks	MTS operators don't incur issuance or card management costs
Potential for fintech innovations	Limited owing to offline payments and siloed fare data	Limited owing to offline payments and siloed fare data	Open-loop technologies allow for integrated fare management solutions

Acceptance of account-based ticketing systems directly at transit entry points can provide additional fare management and orchestration functionalities for transit authorities.

Since open-loop technologies break the hitherto siloed fare and payment data, they are crucial building blocks for integrated fare management solutions run by transit authorities.

Technology service providers play a key role in building the necessary technology solutions at the back end for transit authorities. Fintech businesses can develop easy-to-use apps that serve as front-ends for these fare management solutions. As a result, commuters access real-time updates on fares across CPT and IPT networks, make bookings for end-to-end journeys and access tailored discounts and brand rewards.

Enabling integrated fare management

Integrated fare management entails using back-end technology solutions that analyse card taps and QR scans at transit entry / exit points to offer commuters incentives for using public transit systems.⁵³

Integrated fare management solutions deploy fare rationalisation logic that factors in the number of transport modes used, the commuter profile (i.e. whether they are a student, tourist etc.), travel duration, etc.⁵⁴ These solutions leverage data from card taps and QR scans to form aggregated mobility data lakes, offering authorities a holistic understanding of regional passenger movement and payment patterns.

By making transit payments seamless and more convenient, these solutions can substantially aid in ease of living for commuters in India. CPT networks can be made more commuter friendly, particularly with add-on services, like fare capping, concessions, delay refunds, real-time notifications of disruptions, journey etc. Aside from improved planning and project implementation, these insights can enhance the delivery of social security initiatives, such as bus fare waivers for female passengers in Delhi.⁵⁵ Exchange of fare and mobility data with businesses and advertisers can help consumers avail targeted brand rewards and loyalty discounts for public transit in a city.

The Kochi One platform illustrates how integrated ticketing can improve the consumer transit experience in India. (Box 3)

Box 3. Kochi One: Building integrated fare management in India

Kochi One is a digital public transport platform under Kerala state's multimodal integration project. The platform offers integrated ticketing and fare management across multiple MTS operators and IPT networks, including bus, metro, auto/e-rickshaw and water taxi services.

The front-end mobile application allows users to plan their journeys and receive personalised incentives and discounts based on their travel history and expressed preference. Payments on the platform are enabled via account-based ticketing systems such as open-loop cards, mobile ticketing and PPIs.

Notably, the integration of IPT networks within Kochi One was enabled by formalising private bus operators into Limited Liability Partnerships or as private societies. Similarly, the role of auto/e-rickshaws was given due recognition. Transport authorities in Kochi established a cooperative society after a consultation process with auto/e-rickshaw drivers. They also implemented a tiered coordination framework with the state transport authorities, which improved fleet management and route rationalisation in IPT networks.

In addition, account-based ticketing and integrated fare management systems can help in route rationalisation to align demand and supply for first and last mile transit. IPT networks tend to be concentrated in the city centers, and drivers are often compelled to make dead runs (i.e. where an auto/e-rickshaw travels on hire to a destination but returns to its stand without a passenger). Data lakes on passenger movements in IPT networks may help authorities dynamically rationalise routes across state bus networks, private shuttle services and auto/e-rickshaws.

While route rationalisation to align demand and supply for first and last mile transit is important, any integrated technology infrastructure should ensure that IPT drivers / operators retain autonomy, and receive payments directly from their passengers. Accordingly, digital payments via virtual cards and UPI through QR scan-and-pay options should be scaled across IPT networks. Fintech products may help in gamifying the commuter experience, for instance by allowing users to share information relating to their IPT trips and payments to accumulate points and avail discounts on the CPT legs of their journey.

Besides passenger comfort and ease of living, such integrated fare management systems reinforce confidence and trust in public transit. Such an approach would ensure that all types of Indian commuters and foreign tourists are accounted for in the transit payment architecture, particularly given the income disparity and variable levels of digital literacy.⁵⁶

Annexure 1

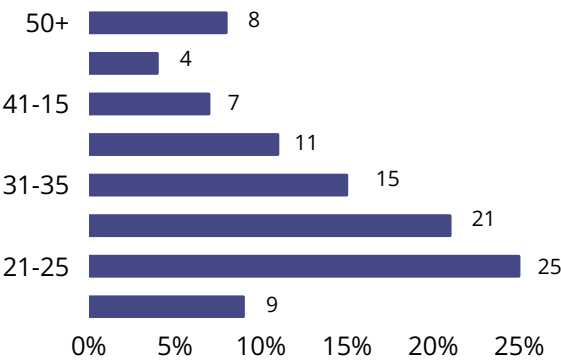
Part A.

Table 4: Preferred payment basket composition

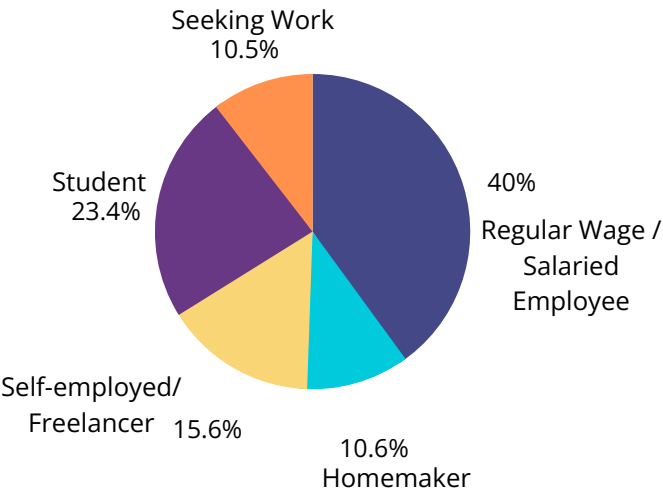
Single payment options	293 (23.4%)
Cash	232
Prepaid transit card	43
Smartphone	16
Debit/credit card	2
Dual payment options	536 (42.9%)
Cash & Prepaid transit card	271
Cash & Debit/credit card	15
Cash & Smartphone	39
Prepaid transit card & Debit/credit card	98
Prepaid transit card & Smartphone	108
Smartphone & Debit/credit card	5
Triple payment options	320 (25.6%)
Cash, Prepaid transit card & Smartphone	150
Cash, Prepaid transit card & Debit/credit card	60
Cash, Smartphone & Debit/credit card	77
Prepaid transit card, Smartphone & Debit/credit card	33
Quad payment option	101 (8.1%)
Cash, Prepaid transit card, Smartphone & Debit/credit card	101
Total	1,250 (100%)

Part B. Demographics

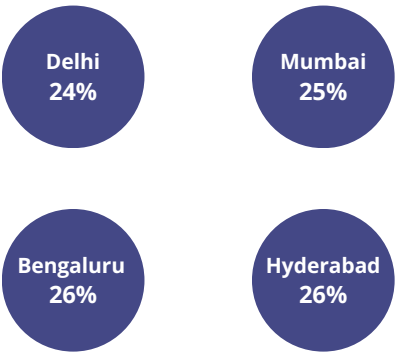
Respondents by Age, Percent



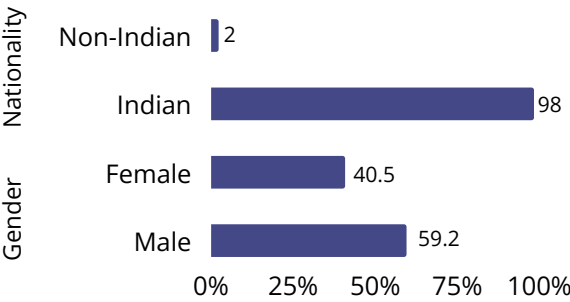
Respondents by Occupation, Percent



Locations



Respondents by Gender and Nationality, Percent



Part C. Survey Locations

The survey was conducted in 12–15 locations in each of the four cities (Delhi, Bengaluru, Mumbai and Hyderabad).

The locations were picked to ensure representative and heterogeneous responses. For instance, locations such as Anand Vihar in Delhi and Kengeri in Bengaluru were chosen so as to engage with commuters travelling from different states. Similarly, critical transit hubs such as Rajiv Chowk in Delhi, the Chhatrapati Shivaji Terminus in Mumbai and Ameerpet in Hyderabad were also selected for the survey. Table 2 provides a city-wise breakdown of all survey locations.

Bengaluru

Nadaprabhu Kempegowda
Sir M. Visveswaraya Station
Dr B.R Ambedkar Vidhana Soudha
M.G Road
Rajaji Nagar
Yeshwanthpur

Peenya
Hebbal
Vijayanagara, Jnanabharathi
Kengeri Bus Terminal, Jayanagar
Banashankari,
K.R Market

Hyderabad

RTC Crossroads
Kacheguda
Secunderabad East
L.B Nagar
Hitech City
Ameerpet

Parade Ground
JNTU College
Lingampally
M.G Bus Station
Assembly
Falaknuma

Delhi

Rajiv Chowk
Central Secretariat
Azadpur
Delhi University North Campus
Kashmere Gate
New Delhi Station

Anand Vihar
Mayur Vihar
Dwarka Sector 21
Huda City Centre
AIIMS Delhi
Lajpat Nagar

Mumbai

Andheri
Bandra
Ghatkopar
Kurla
Wadala
Goregaon

Borivali
Chembur
CST (VT)
Dadar
Churchgate
Mumbai Central

Annexure 2

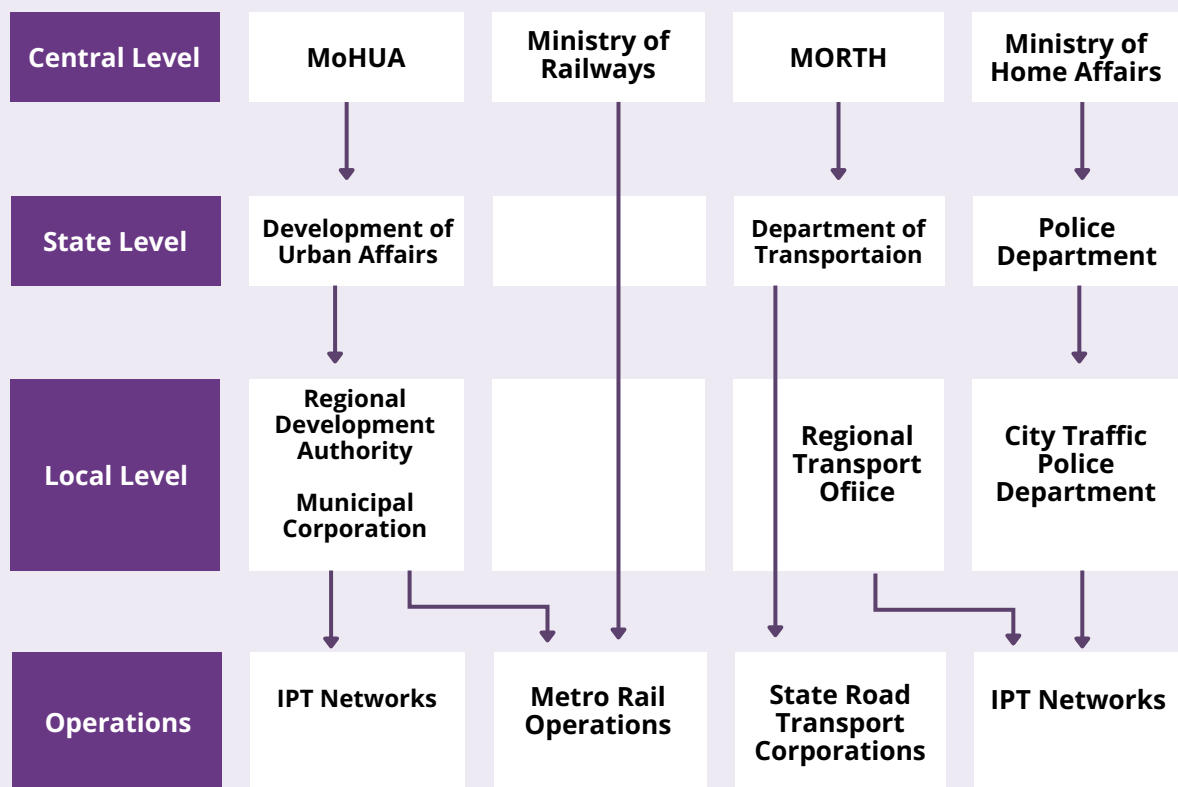
Fragmentary legal and institutional frameworks

The power and responsibility structures for public transit systems are diffused be it in planning, project implementation, or operations. For instance, apart from the urban affairs departments of the central and state governments, statutory bodies known as development authorities are responsible for planning and sanctioning infrastructure projects.

Their responsibilities overlap with constitutional bodies known as municipal corporations in the urban centers. Operations of CPT systems are carried out by public corporations with varying degrees of involvement from central and state ministries.⁵⁷

Lastly, IPT systems lack consistency and transparency in oversight.⁵⁸ The road transport offices of various state governments, traffic police authorities and municipal corporations share responsibility in authorising IPT drivers and sanctioning routes.

Box 4: Fragmentation in Indian public transit



Annexure 2

For these reasons, the NUTP 2014 emphasised setting up Unified Metropolitan Transport Authorities (UMTAs) to allow for integrated planning and delivery of services such as common ticketing and fare management across modes of transit.

Subsequently, under the 2017 Metro Rail Policy, the Government mandated the establishing of UMTA as a statutory body in all states where metro rail projects had been set up with central assistance.⁵⁹

As things stand, however, only a few cities, including Bengaluru, Kochi, Mumbai and Hyderabad, have a duly established and functional UMTA.⁶⁰



Autos line up outside a metro station in Gurugram
Image credits: YouTube @AnujN

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- 25 Supra note 23, Paragraph 21(b).
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