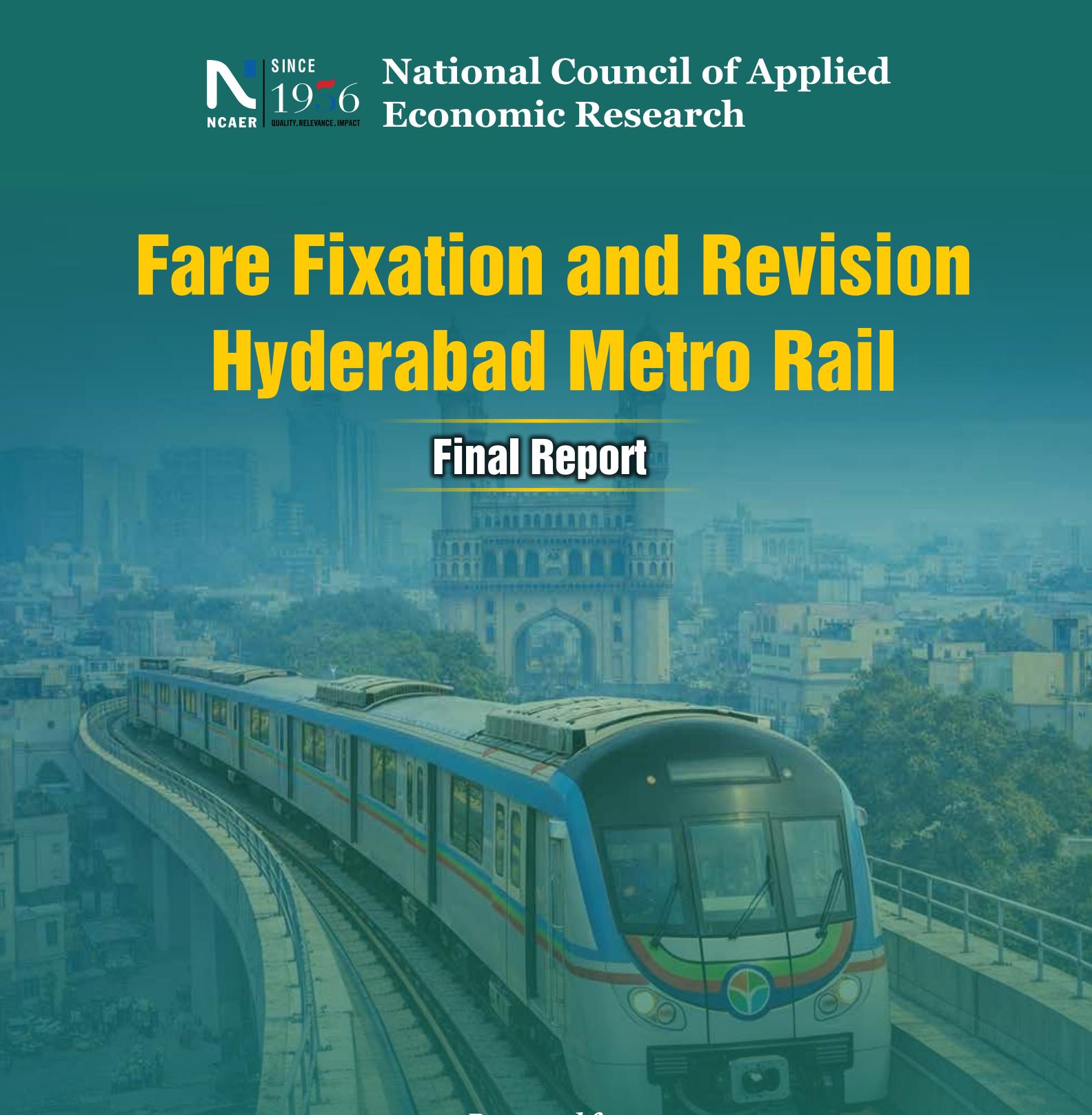
National Council of Applied Economic Research

Fare Fixation and Revision Hyderabad Metro Rail

Final Report



Prepared for

HYDERABAD METRO RAIL LIMITED

Prepared by

NATIONAL COUNCIL OF APPLIED ECONOMIC RESEARCH (NCAER)

December 2022

Hyderabad Metro Rail: Fare Fixation and Revision

Final Report

by

National Council of Applied Economic Research

For

Hyderabad Metro Rail Limited

Rasoolpura, Begumpet, Hyderabad – 500016. www.hmrl.co.in

December 2022

National Council of Applied Economic Research

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Foreword

In 2001, NCAER had conducted a study to recommend a Fare Structure for the Delhi Metro Rail System, which formed the basis for fixing primary fares for the Delhi Metro. The present study, "Hyderabad Metro Rail: Fare Fixation and Revision", is the second such study undertaken by NCAER.

The study approached the issue from two aspects – (i) the supply-side cost components involved in operating and maintaining the metro system in a model-based framework and (ii) demand side by looking at the affordability and willingness to pay by conducting a survey of metro and non-metro commuters in Hyderabad city. Being an important public policy matter, the study thus counterbalanced the imperative need for a cost-based 'durability aspect' of running an efficient and effective metro service from the supply side, with the affordability-based 'welfare aspect' for the commuters on the demand side. The team also examined the fare revision mechanisms followed by other major metro systems in the World such as Hong Kong and Singapore, and examples from within the country such as Delhi Metro, and Karnataka State Road Transport Corporation in the road transport sector.

A large number of commuters travel by the metro in Hyderabad with daily commuters exceeding 400 thousand during peak pre-pandemic periods. This is a testimony to the fact that the system has brought a radical shift in the transportation dynamics of the city. The city's population is growing with increase in commercial activities, and congestion on the roads is also increasing. Metro network expansion is an efficient option to cater to the growing demand for transportation in Hyderabad. The current NCAER study envisages to provide a deep analytical understanding for the Fare Fixation Committee (FFC), which has been formed by the Government of India to recommend fares for Hyderabad Metro Rail. The study uses ground level reflections through a survey of metro commuters to ascertain the degree of sensitivity to the proposed fare structure as well as a survey of non-commuters to assess the substitution in ridership of the metro system in Hyderabad.

I do hope this noteworthy and comprehensive report would encourage a thinking towards adoption of 'a balanced view' for fare fixation exercises in public transport systems, which have important public utility considerations. I would like to thank the NCAER team led by Dr Saurabh Bandyopadhyay with Dr Isha Dayal, Dr Palash Baruah, Dr Laxmi Joshi, Mr Ramakrishnan TS, and Dr Pradip Kumar Biswas as its core members, for carrying out this important study. My sincere thanks to Dr. Shashanka Bhide, Honorary Senior Adviser to NCAER and Member, Monetary Policy Committee, Reserve Bank of India; Dr. Sonalde Desai, Director of NCAER National Data Innovation Centre; and, Dr. Gurucharan Manna, Senior Advisor and former Director General of CSO and NSSO for their valuable guidance and insights for this study.

1st December 2022

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The NCAER team extends its sincere gratitude to the study's Internal Review Committee (IRC) members: Dr. Sonalde Desai, Professor and Centre Director, National Data Innovation Centre (NCAER NDIC), and Distinguished University Professor, University of Maryland College Park, USA; Dr. Gurucharan Manna, Senior Advisor, NCAER and former Director General of Central Statistical Organization (CSO) and National Sample Survey Organization (NSSO); and Dr. Shashanka Bhide, Honorary Senior Advisor, NCAER and a member of the Monetary Policy Committee (MPC), Reserve Bank of India; for their valuable suggestions and inputs on the report.

The NCAER team also thanks the Chairman and Members of the Hyderabad Metro Rail Fare Fixation Committee (FFC) for their questions and data requirements, which have helped enrich the report and its recommendations. Our gratitude to FFC Chairman: Justice Gudiseva Shyam Prasad (Retd.), High Court of Andhra Pradesh; FFC member: Dr. Surendrakumar Bagde, Additional Secretary (H&V), Ministry of Housing and Urban Affairs, Government of India; and FFC Member: Shri Arvind Kumar, Principal Secretary, Municipal Administration and Urban Development Department, Government of Telangana.

Saurabh Bandyopadhyay
Senior Fellow, NCAER

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List of Abbreviations

AC	Air-conditioned
AFC	Automatic Fare Collection
AR	Acceptance rate
BMTC	Bangalore Metropolitan Transport Corporation CA Concession Agreement
CAGR	Compounded Annual Growth Rate
CBTC	Communication Based Train Control
COVID-19	Coronavirus Disease 2019
CPI	Consumer Price Index
CSE	Centre for Science and Environment
CTS	Comprehensive Transport Study
DA	Dearness allowance
DBFOT	Design-Build-Finance-Operate-Transfer
DMRC	Delhi Metro Rail Corporation
DPR	Detailed Project Report
DTC	Delhi Transport Corporation
E	Estimated figures
FAM	Fare Adjustment Mechanism
FFC	Fare Fixation Committee
FY	Financial Year
GHMC	Greater Hyderabad Municipal Corporation
GNCTD	Government of National Capital Territory of Delhi
H1	First half (of a Financial Year)
HH	Household
HK$	Hong Kong dollar
HMA	Hyderabad Metropolitan Area
HMDA	Hyderabad Metropolitan Development Authority
HMR	Hyderabad Metro Rail
IIM	Indian Institute of Management
IT	Information Technology
KCR	Kowloon-Canton Railway
KCRC	Kowloon-Canton Railway Corporation

KSRTC	Karnataka State Road Transport Corporation
kVA	Kilo-Volt-Ampere
L&T	Larsen & Toubro
LTMRHL	L&T Metro Rail (Hyderabad) Limited
MEP	Mechanical, Electrical and Plumbing
MGBS	Mahatma Gandhi Bus Station
MMHI	Median Monthly Household Income
MMTS	Multi-modal Transport System
MRTS	Mass Rapid Transit System
MTR	Mass Transit Railway
MTRCL	Mass Transit Railway Corporation Limited
NCAER	National Council of Applied Economic Research
NCR	National Capital Region
O&M	Operation and maintenance
O-D	Origin-Destination
PAT	Profit after Tax
PBIT	Profit before Interest and Taxes
PCI	Per Capita Income
PPP	Public Private Partnership
PTC	Public Transport Council
Q1	First quarter (of a Financial Year)
Q3	Third quarter (of a Financial Year)
QR code	Quick Response code
RBI	Reserve Bank of India
RBT	Regenerative Braking Technology
RoI	Return on Investment
S$	Singapore dollar
SCADA	Supervisory Control and Data Acquisition
TC	Transportation and Communication
TOD	Transit Oriented Development
TSERC	Telangana State Electricity Regulatory Commission
TSRTC	Telangana State Road Transport Corporation
WPI	Wholesale Price Index
y-o-y	Year-on-year

Executive Summary

Hyderabad Metro Rail (HMR) is an initiative to fulfill the growing need for transportation in the city of Hyderabad. Based on the Mass Rapid Transit System (MRTS), HMR intends to reduce traffic congestion across Hyderabad, lower pollution level, and improve the 'livability index' of the city.

The ambitious HMR project was awarded to Larsen & Toubro (L&T), which incorporated a special purpose vehicle, L&T Metro Rail (Hyderabad) Limited (LTMRHL) as "the Concessionaire" to enter into an agreement with the then Government of Andhra Pradesh in September 2010, for the implementation of the Project on Design-Build-Finance-Operate-Transfer (DBFOT) basis.

HMR began operations in November 2017. Consultancy studies had estimated the ridership and revenue of HMR prior to beginning of operations, on the basis of which the initial fares of HMR were fixed over the existing distance-wise fare slabs.

However, various factors have impacted the ability of HMR to generate revenue. Cost pressures have simultaneously increased. In turn, the optimality of initial fares, over the existing distance-wise slabs, may too be questioned.

The key reasons, which provide insights into the imbalance between the costs and revenue of HMR are:

i) Delays in generating revenue due to delays in project completion
ii) Over the last five years of metro operations, actual ridership has been far below projected ridership
iii) Cash inflow as a percentage of cash outflow is only 19% in 2021-22
iv) Total revenue up to 2021-22 constituted only 40.23% of debt servicing (interest and capital repayment) of HMR
v) Metro fares have remained unchanged since 2017, while in the last five years the Consumer Price Index of Telangana (Urban) has increased by 24.50%

At the time of financial closure for HMR project construction, it was expected that the entire network will be operationalized by July 2017. Even as the first 30 km segment of the Project was put into operation in November 2017, the balance was expected to be completed by November 2018. However, the same was delayed further mainly due to delays in receiving right-of-way, resulting in the entire network becoming operational only by February 2020. The cumulative delay of 33 months led to an increase in the cost of the project, while at the same time affecting ridership growth. The advent of COVID-19 pandemic in March 2020 further affected the passenger traffic levels in HMR, thereby bringing in challenges to the overall financial viability of the Hyderabad metro system because of under-recoveries of the cost of the Project.

Prior to the onset of the Covid-19 pandemic, majority of the metro commuters were employees working in IT and other corporates. However, the work-from-home trend popularized during the pandemic has disturbed the ridership and revenue projections of the previous studies, thereby directly impacting the revenue generation of HMR and the ability of the Concessionaire to meet its cost liabilities.

The operational difficulties being faced by HMR is therefore a matter of concern. A suitable fare revision and rationalization, which can help recover the actual operating expenses of HMR at the least, can help the metro services achieve durability success.

In light of the above, HMR is seeking a fare revision for Hyderabad metro.

National Council of Applied Economic Research (NCAER), New Delhi has been appointed with an objective to assist the Fare Fixation Committee in the fare revision exercise, through:

1. Conducting an on-ground passenger survey of metro and non-metro commuters.
2. Ascertaining the degree of sensitivity to the proposed higher fare.
3. Assessing substitution in the ridership of the metro system in Hyderabad.
4. Arriving at a 'Hyderabad Factor' that would balance between maximizing revenue and affordability.

5. Recommending a "balanced" formula-based fare structure that could be implemented. To this aim, an informed and balanced fare revision framework has been formulated.

After studying fare revision frameworks of other public transport systems in India and abroad, primarily the fare revision mechanisms followed for Hong Kong metro, Singapore metro, Delhi metro, and Karnataka State Road Transport Corporation (KSRTC), NCAER has proposed a fare revision mechanism for HMR, which incorporates:

1. Operation and maintenance (O&M) costs using the actual cost incurred by the Concessionaire, the actual electricity tariff rate, and the overall retail inflation by factoring in Consumer Price Index (CPI) of Telangana (Urban)
2. Public affordability and willingness to pay by conducting a survey of metro and non- metro commuters in Hyderabad city
3. A safeguard, i.e. an upper bound to fare revisions, such that future fare revisions are reasonable and continue to factor in public affordability

A formula based approach has been suggested to take a considerate view of the costs borne by the operator, and this has been combined with a survey-based approach to gauge the public affordability and their willingness to pay.

By utilizing only the cost-based components in the supply-side fare revision formula, fare per slab can be increased by 41.25%, implying a 7.15% compounded annual increase (y-o-y) for the intervening period from the last fare fixation in FY 2017-18 till FY 2021-22.

To factor in public affordability and willingness to pay, NCAER conducted a survey of metro commuters to ascertain the degree of sensitivity to the proposed higher fare, and a simultaneous survey of non-commuters to assess the substitution in ridership of the metro system in Hyderabad.

Of the 1383 metro commuters surveyed, 81% reported their willingness to continue travelling by the metro even if their fares increased. The sample was representative, and the responses have been profiled over the commuters' household income, household transport expenditure, affordability, distance travelled, years since commuting by metro, profession, age, and gender. The acceptance to a higher fare is high and comparable across all profiles.

Utilizing information on the willingness to pay of such metro commuters has helped NCAER arrive at a demand side fare revision per slab, which is reflective of public acceptability and affordability.

Of the 1,134 non-metro commuters surveyed, 52% are willing to shift to the metro at the existing fares, of which 45% are willing to shift even if the metro fares increase. The substitution effect from other modes of travel (eg. auto, cab, premium/ordinary bus, or private vehicles) to the metro is indicated, considering that time and cost of travel across all road- based modes in Hyderabad city has increased.

With due consideration to the aforementioned discussion, it is also noted that the acceptance of metro among metro and non-metro commuters will increase with better last mile connectivity, less crowd through more coaches or higher frequency, and parking availability at metro stations, albeit perhaps at additional costs to HMR.

The fare increase per slab derived through the survey results is balanced with the cost-based fare increase per slab, to arrive at a revised fare structure for HMR.

The average fare of the existing HMR fare structure is Rs.36.6. The average fare of the revised fare structure for HMR is Rs.50. This indicates an increase of 37% over 2017-18 and 2021-22.

A fare increase of 37% over five years (2017-2022) translates into a Compounded Annual Growth Rate (CAGR) of 6.5% (rounded off to 7%). During the same comparable period, per capita income of Telangana increased by 11.8%, indicating increasing affordability of its residents. Considering that 7% CAGR represents an annual rate of fare increase, which subsumes both the supply and demand side aspects, future fare revisions may be undertaken as follows:

1) Calculate fare increase per slab using the cost-based supply-side formula. Say this value is SS%.
2) Compare SS% with CAGR of 7%
3) Fare revision rate = Minimum of (SS%, CAGR of 7%)

The above implies that HMR fares may be revised using the percentage increase derived from the supply side formula, or by a maximum CAGR of 7%, whichever is lower. This safeguard, which incorporates willingness to pay of metro commuters according to a survey conducted in 2022, may be considered valid for the next five years (i.e. until FY 2027-28).

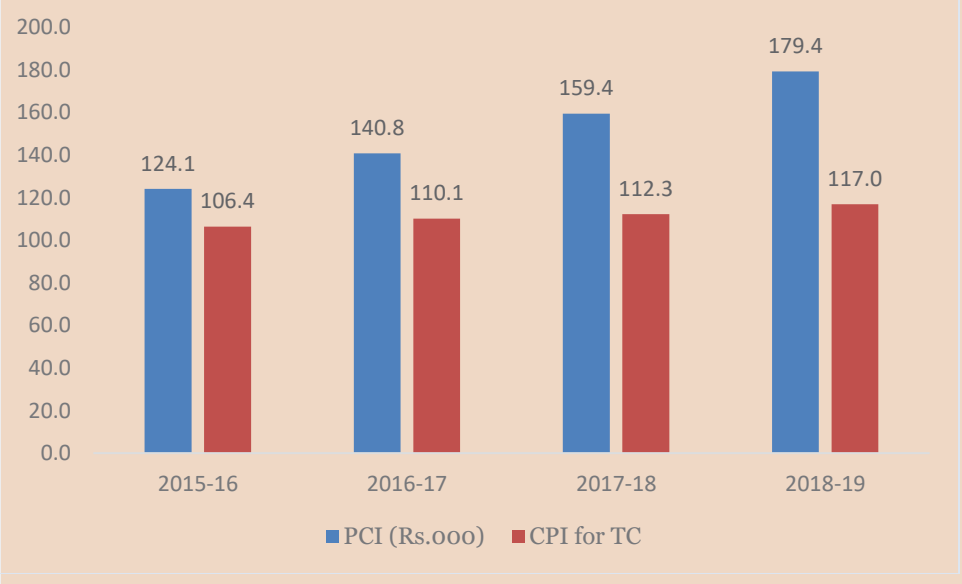
SECTION I
Introduction

The city of Hyderabad is the fourth most populous in India with a population of over 10 million people. To increase mobility and help Hyderabad become a greener city, the metro rail project integrates multi-modal public transport with ample urban spaces and infrastructure development. The Hyderabad Metro Rail project was awarded to Larsen & Toubro (L&T), as a special purpose vehicle, as "the Concessionaire" to enter into an agreement with the then Government of Andhra Pradesh in September 2010, for the implementation of the Project on Design-Build-Finance-Operate-Transfer (DBFOT) basis and has added a new dimension to the city of Hyderabad and runs through 69.2 KM in Phase-I.

A large number of passengers travel by metro in Hyderabad with daily commuters exceeding 400 thousand in the recent past is a testimony of the fact that the system has brought in a radical shift in the transportation dynamics of the city. The city population is growing with increased commercial activities and metro expansion is an efficient option to cater to the demand for transport. Hyderabad Metro Rail (HMR) is an initiative to fulfill the growing need for transportation in the city of Hyderabad. Based on the Mass Rapid Transit System (MRTS), HMR intends to reduce traffic congestion across Hyderabad, lower pollution level, and improve the 'livability index' of the city.

Figure 1.1 below shows the Per Capita Income of Telangana and the Consumer Price Index for Transportation and Communication in the state. As per the availability of official data, per capita income has exhibited a double-digit growth during 2015-16 to 2018-19. On the other hand, cost of transportation and communication remained stable during the same period, reflecting better livability in the true sense of the term.

Figure 1.1: Per Capita Income (in thousand Rs.) and Consumer Price Index (CPI) of Transportation and Communication (TC) of Telangana



Source: Per capita income from Statista; CPI data from Ministry of Statistics and Programme Implementation

Salient Features of the Project:

- It is the largest Public Private Partnership (PPP) in the world with a total network of around seventy kilometers spread across Hyderabad city.
- Hyderabad Metro Rail operates on three distinct lines – Blue, Green, and Red, comfortably connected with existing Indian Railway terminals, Multi-modal Transport System (MMTS), and bus stations along the corridors.
- Eco-friendly, fully automated, and best-in-class transportation framework that would contribute to a reduction in carbon footprint, fuel consumption, and overall pollution using Regenerative Braking Technology (RBT) and running on Communication Based Train Control (CBTC) technology.
- Ultra-modern comfortable air-conditioned coaches helped reduce commuting time across the city.
- The Hyderabad Metro project brings in the 'best-in-class' resources and technology in every aspect of the project - stations, station planning, rolling stock, track work, depots, automatic fare collection (AFC), power supply, traction, and supervisory control and data acquisition (SCADA), signaling, train control, telecom, and MEP (mechanical, electrical and plumbing) systems.

Elevated station buildings at approximately every kilometre.

- Connects major offices, retail and residential areas - The two tracks (up and down lines) pass through the arterial roads of the city.
- Connects major bus stations at Miyapur, Mahatma Gandhi Bus Station (MGBS), Koti, Dilsukhnagar, and Jubilee Bus Station.
- Integration with existing rail terminals at Secunderabad, Begumpet, and Nampally.
- Link to MMTS services at Bharat Nagar, Begumpet, Khairatabad, and Malakpet.
- Faster, safer, and more comfortable air-conditioned travel with reduced travel time.
- High frequency of trains reduces waiting time.
- User-friendly stations with lifts, staircases, and facilities for the disabled.
- Parking facility at strategic locations along the route at the designated areas provided by the Government of Telangana.
- Automatic ticket vending machines - reduce waiting time in queues and counters.
- Automatic fare collection system – hassle-free entry and exit from the stations.
- Essential facilities at stations - toilets, public address, information system, telephones.

The map of Hyderabad Metro Rail (HMR) network is provided in **Annexure 1**.

I) BACKGROUND

HMR commenced metro services in Hyderabad on 28 November 2017. The initial fare fixation was based on the following principles:

1. To provide fast, clean, punctual, and affordable service to the city of Hyderabad
2. To keep the fares competitive with those charged in other modes of transport by also factoring the quality of service, safety and comfort of the passengers
3. To keep the fares comparable to those in other Metros
4. To keep the fares such that on a commercial basis, it enables servicing obligations towards debt and equity holders of the project

Regulations allowed the Concessionaire to fix their initial fares when they commenced operations. For any further fare revisions, the Central Government is required to constitute a Fare Fixation Committee (FFC) under the Metro Rail Operation and Maintenance Act (2002). The fare fixed by the committee is binding on metro service providers.

The initial HMR fare fixation exercise was carried out by IIM-Bangalore in 2017. The study addressed the issue of fixing the fare to recover the cost with a reasonable return to investors and attract commuters. The cost-based pricing to recover the cost was the first principle in which cost was classified into variable and fixed costs. Variable costs include salary, maintenance and electricity. Fixed costs consist of depreciation and interest. The fare suggested by the study was based

on the distance travelled and covered all operating cost, fixed cost, interest, depreciation and return on equity investments. The cost based fare structure was then compared with the fares of alternative modes of transport and that of other metro rail fares in India. Accordingly, the HMR fares were set as follows (**Table 1.1**):

Table 1.1: Fare Structure for Hyderabad Metro

S.No.	Distance Travelled (Km)	Fare (Rs.)
1	Upto 2	**10**
2	More than 2 and up to 4	**15**
3	More than 4 and up to 6	**25**
4	More than 6 and up to 8	**30**
5	More than 8 and up to 10	**35**
6	More than 10 and up to 14	**40**
7	More than 14 and up to 18	**45**
8	More than 18 and up to 22	**50**
9	More than 22 and up to 26	**55**
10	**More than 26**	**60**

Source: HMR

The fare structure of HMR has remained unchanged for the past five years since the initial fixation. Moreover, in order to induce commuters, HMR offers a discount of 10% on tickets purchased through smart cards. Additional discounts (up to 40%) have also been offered to commuters at various points in time. The current fare structure is comparable with other metros and with the fares fixed by Telangana State Road Transport Corporation (TSRTC) for Hyderabad AC bus services (**Table 1.2**).

Table 1.2: Comparative fare structure of Hyderabad and other Metros of India and Hyderabad AC Bus Services

Distance (Km)	Hyderabad (Rs.)	Mumbai (Rs.)	Bangalore (Rs.)	Delhi (Rs.)	Lucknow (Rs.)	Kochi (Rs.)	Hyderabad AC Bus (Rs.)
1	10	10	10	10	10	10	20
2	10	20	10	10	10	10	20
3	15	20	15	20	15	20	25
4	15	20	15	20	20	20	25
5	25	30	18	20	20	20	30
6	25	30	18	30	20	20	30
7	30	30	20	30	20	30	35
8	30	30	22	30	30	30	35
9	35	40	25	30	30	30	40
10	35	40	28	30	30	30	40
11	40	40	30	30	40	40	45
12	40		32	30	40	40	45
13	40		34	40	40	40	50
14	40		36	40	40	40	50

Distance (Km)	Hyderabad (Rs.)	Mumbai (Rs.)	Bangalore (Rs.)	Delhi (Rs.)	Lucknow (Rs.)	Kochi (Rs.)	Hyderabad AC Bus (Rs.)
15	45		38	40	50	50	55
16	45		40	40	50	50	55
17	45		42	40	50	50	60
18	45		45	40	50	50	60
19	50		45	40	50	50	65
20	50		45	40	60	60	65
21	50		50	40	60	60	70
22	50		50	50	60	60	70
23	55		52	50	60	60	75
24	55		55	50	60	60	75
25	55		58	50	60		80
26	55		60	50	60		80
27	60		60	50	60		85
28	60		60	50	60		85
29	60		60	50	60		90
30	60		60	50	60		90

Source: Respective operators, as of November 2022:
Hyderabad metro: https://hmrl.co.in/fare.html
Mumbai metro: https://www.reliancemumbaimetro.com/ticket-fares Bangalore metro: https://english.bmrc.co.in/#/
Delhi metro: https://www.delhimetrorail.com/fare
Lucknow metro: https://lmrcl.com/passengerinfo/fare-information/ Kochi metro: https://kochimetro.org/fare-chart/

A comparison of fares on HMR with other modes of transport within the Hyderabad city reveals that commuting via metro is one of the cheapest options for commuters, especially in consideration of the "value of time" (**Table 1.3, Annexure 2**). On average, hired two-wheelers fares are 3.4 times metro fares, auto fares are 5.4 times metro fares, and cab fares are 8.4 times metro fares for the same route of travel. Although bus fares are slightly cheaper, yet the time taken by bus is 2.2 times more than metro, time taken by hired two-wheelers is 1.3 times more than metro, time taken by auto is 1.6 times more than metro, and that by cab is 1.5 times more than metro for the same route of travel.

Table 1.3: Time-Cost Comparison for Different Transport Modes in Hyderabad

	Fare Ratio Mode fare (Rs.) / Metro fare (Rs.)	Duration Ratio (Time taken by the mode (min) / Time taken by metro (min)
Hired two- wheelers	3.4	1.3
Auto	5.4	1.6
Cab	8.4	1.5
Metro Bus	0.9	2.2
Ordinary Bus	0.7	2.2

Source: NCAER Survey October 2022

Note: The fare and time taken by all modes (hired two-wheelers, auto, cab, bus and metro) is averaged over a sample of 15 routes (distances varying between 6 to 34 km). See **Annexure 2** for details.

II) OBJECTIVES AND STRUCTURE OF THE REPORT

The Concessionaire set the initial fare structure of HMR, and any subsequent fare revision needs to be approved by a Fare Fixation Committee (FFC) appointed by the Government of India in accordance with the Metro Railways (Operation and Maintenance) Act 2002. In their fare revision recommendations, the FFC takes due consideration of the following:

- Recovery of cost to operate the system including repayment of loan
- Comparative fares of other modes of transport
- Comparison of recommended fares with other metros in India
- Riding comfort provided and time saved
- Affordability of fare
- Annual fare revision by having a transparent formula

The purpose of the present study is to arrive at a revised fare structure for HMR while keeping the above principles for fare revision in view.

National Council of Applied Economic Research (NCAER), New Delhi has been appointed with an objective to assist the Fare Fixation Committee in the fare revision exercise, through:

1. Conducting an on-ground passenger survey of metro and non-metro commuters.
2. Ascertaining the degree of sensitivity to the proposed higher fare.
3. Assessing substitution in the ridership of the metro system in Hyderabad.
4. Arriving at a 'Hyderabad Factor' that would balance between maximizing revenue and affordability.
5. Recommending a "balanced" formula-based fare structure that could be implemented.

Previously, NCAER has conducted a detailed study for Delhi Metro Rail Corporation (DMRC) in 2001, in which it had proposed the initial fare structure for Delhi metro.

The report is divided into the following sections:

- Section II elaborates on the need for fare revision of HMR
- Section III draws upon best practices to devise the framework for fare revision
- Section IV applies the supply side considerations for preliminary estimates of the revised fare structure
- Section V discusses the approach to demand-side considerations and passenger sensitivity to fare revision
- Section VI reconciles the demand and supply side considerations for fare revision and presents a balanced revised fare structure
- Section VII concludes with a way forward

SECTION II

Need for Fare Revision of HMR

Hyderabad metro began operations in November 2017. Consultancy studies had estimated the ridership and revenue of HMR prior to beginning of operations, on the basis of which the initial fares of HMR were fixed over the existing distance-wise fare slabs. However, various factors have impacted the ability of HMR to generate revenue. Cost pressures have simultaneously increased. In turn, the optimality of initial fares, over the existing distance- wise slabs, may too be questioned.

The key reasons, which provide insights into the imbalance between the costs and revenue of HMR are:

i) Delays in generating revenue due to delays in project completion
ii) Total traffic revenue per km declined steeply in the first quarter of 2021; lower than operation cost per km
iii) Over the last five years of metro operations, actual ridership has been far below projected ridership
iv) Cash inflow as a percentage of cash outflow is only 19% in 2021-22
v) Total revenue up to 2021-22 constituted only 40.23% of debt servicing (interest and capital repayment) of HMR
vi) Metro fares have remained unchanged since 2017, while in the last five years the Consumer Price Index of Telangana (Urban) has increased by 24.50%

Each of the above points is elaborated as follows.

i) Delays in generating revenue due to delays in project completion

At the time of financial closure for HMR project construction, it was expected that the entire network will be operationalized by July 2017. Even as the first 30 km segment of the project was put into operation in November 2017, the balance was expected to be completed by September 2018. However, the same was delayed further mainly due to delays in receiving right-of-way and permissions from various Central Government organizations, resulting in the entire network becoming operational only by February 2020. The cumulative delay of 33 months led to an increase in the cost of the project, while at the same time affecting ridership growth. The advent of COVID-19 pandemic in March 2020 further affected the passenger traffic levels in HMR, thereby bringing in challenges to the overall financial viability of the Hyderabad metro system because of under-recoveries of the cost of the Project.

Considering that traffic revenue is highly correlated with ridership (**Table 2.1**), the delays have significantly affected HMR's ability to generate revenue.

Table 2.1: Correlation Matrix: Operation Cost per Km, Traffic Revenue per Km, Average Ridership per Km

	Operation Cost per KM	Traffic Revenue per KM	Average Ridership per KM
Operation Cost per KM	1.00	0.71	0.55
Traffic Revenue per KM	0.71	1.00	0.95
Average Ridership per KM	0.55	0.95	1.00

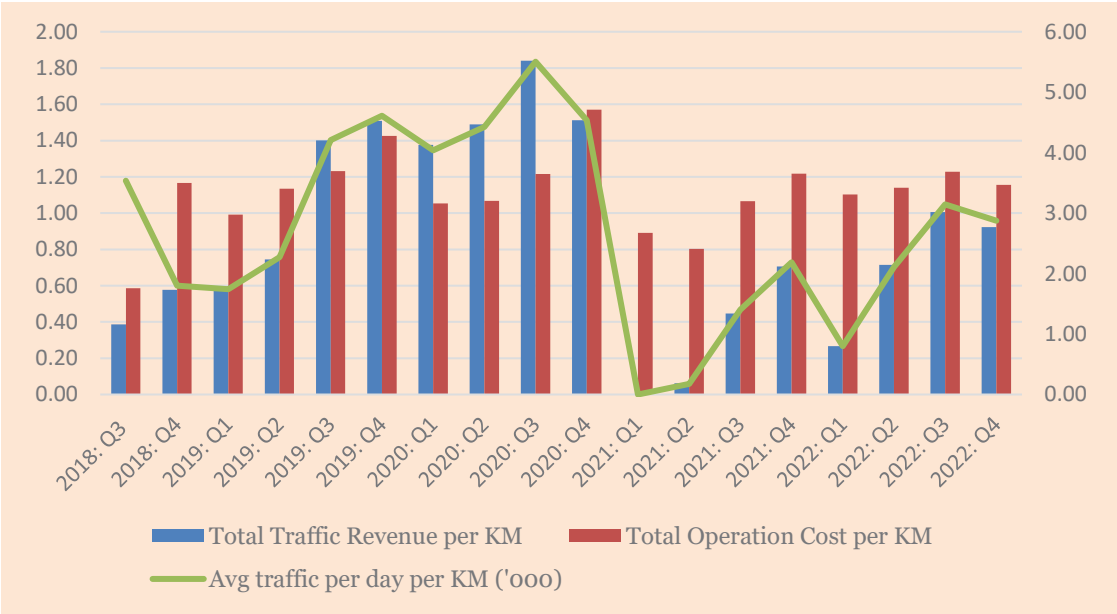
Source: NCAER estimation using HMR data
Notes: 1 represents perfect correlation between parameters. Traffic revenue is highly correlated with average ridership (0.95)

ii) Total traffic revenue per km declined steeply in the first quarter (Q1) of 2021; lower than operation cost per km

The need for fare revision generally stems from the discussions of revenue and cost, at least for traffic operations of HMR. The operational costs are the variable costs that should at least be safeguarded for sustainable operations. An analysis of the quarterly movement of revenue and cost per kilometer of route length, based on audited data, is important to gauge the performance parameters and the latest scenario. A simultaneous look into ridership per km shows that the ridership level achieved in the pre-pandemic period is yet to be achieved and the challenges of durability success continue. **Figure 2.1** below shows the trend.

Traffic revenue per kilometer was above the total operational expenses per kilometer from Quarter 3 (Q3) of 2019 to the same quarter of 2020 and went down steeply in Q1 of 2021. Though the gap is closing gradually after the recovery in ridership in the post-pandemic period, the question of viability of operation remains a concern till the end of the financial year 2022.

Figure 2.1: Quarterly trend of traffic revenue, total operation expenses per kilometer (Rs. Crore), and average daily ridership per km ('000)

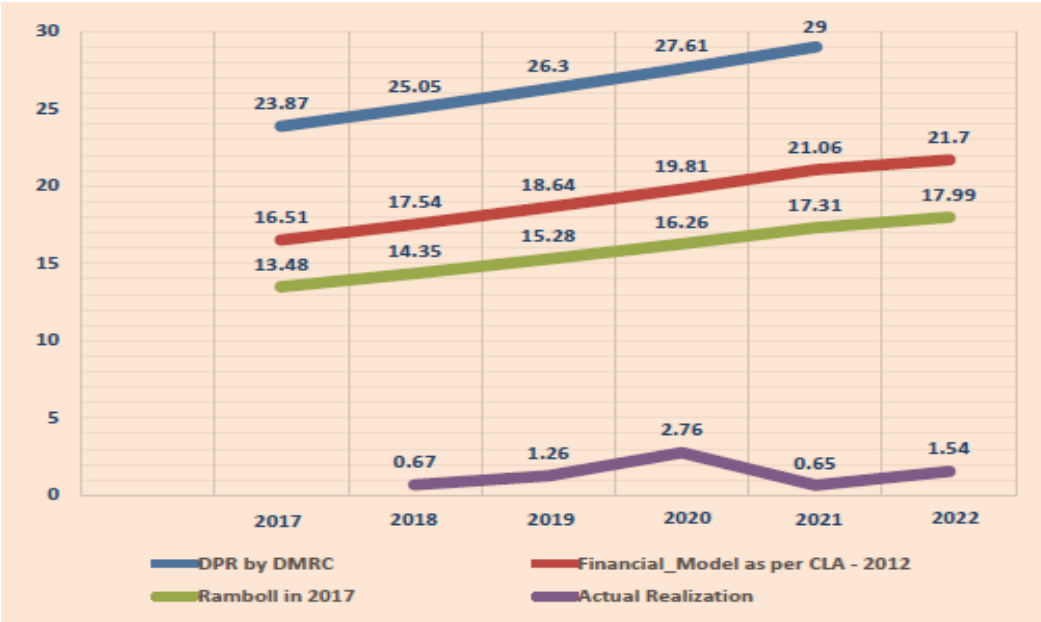


Source: Audited financials of HMR

iii) Over the last five years of metro operations, actual ridership has been far below projected ridership

The average daily traffic in Hyderabad Metro, for each year since the start of operations in November 2017, is shown in **Figure 2.2** below. The average daily traffic increased from 67,000 passengers during 2017-18 to 154,000 during 2021-22. This actual ridership however has been far below the ridership projected for HMR in the Detailed Project Report (DPR) prepared by Delhi Metro Rail Corporation (DMRC), according to the financial model, and the study conducted by Ramboll in 2017.

Figure 2.2: Average traffic per day (in lakhs)

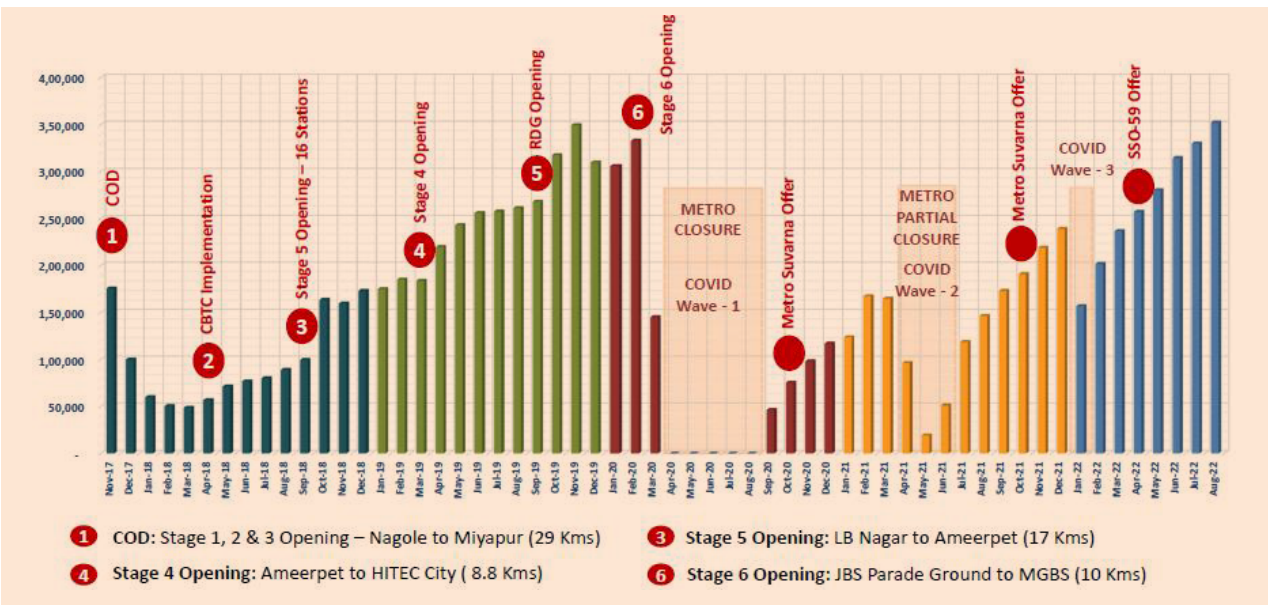


Source: HMR

The ridership projections for HMR involved several assumptions. For instance, the study by Ramboll assumed: i) metro fares to be competitive with other modes of transportation in Hyderabad city, and ii) availability of last mile connectivity – resulting in their projection of a massive shift to the metro from other modes of transportation and average daily ridership increasing from 13.48 lakh passengers in 2017-18 to 19.99 lakh passengers in 2021-22. However, Ramboll's estimate is still conservative in comparison to the other projections, as is evident in **Figure 2.2** above.

Delay in completion of the entire metro network, pandemic, and work-from-home trend impacted ridership growth (**Figure 2.3**).

Figure 2.3: Ridership Trend (Nov 2017 – August 2022)



Source: HMR

iv) Cash inflow as a percentage of cash outflow is only 19% in 2021-22

Metro Rail operations need two basic accomplishments for a sustainable presence:

- Policy achievement to decongest urban agglomeration to serve the larger interest of commuters and the population of the city in general
- Durability success of operation where at least the cash inflow is balanced with the cash outflow

A large number of passengers travel by Metro in Hyderabad. With daily commuters exceeding 300 thousand is a testimony of the fact that the system has brought in a radical shift in the transportation dynamics of the city. The city population is growing with increased commercial activities and Metro expansion is an efficient option to cater to the demand for transport.

The old city residents demand expansion of the Metro in their area while Metro services are all set to go in for Airport connectivity. All these adequately demonstrate the importance of the Metro in the city of Hyderabad.

However, as regards durability success, it is noted that the cash inflow as a percentage of cash outflow is only around 19% in 2021-22 (**Table 2.2**). Reasonable fare revision that helps reduce the gap between cash inflow and cash outflow would give a window of opportunity to HMR to achieve durability success in the future.

Table 2.2: Cash Inflow and Cash Outflow of HMR (2017-18 to 2021-22)

Year	Cash Inflow (Rs. Cr)			Cash Outflow (Rs. Cr)			Cash Inflow/ Cash Outflow (%)
	Fare box Revenue	Non-fare box Revenue	Total	O&M Expenses*	Debt Servicing (Repayment with Interest)	Total	
2017-18	28.60	34.05	62.65	60.60	50.59	111.19	56.34
2018-19	166.41	146.62	313.03	188.43	215.38	403.81	77.52
2019-20	370.04	217.24	587.28	292.08	542.79	834.86	70.34
2020-21	83.98	105.64	189.62	271.72	1421.07	1696.20	11.18
2021-22	201.39	137.25	338.64	320.16	1476.56	1796.72	**18.85**

Source: Audited financials of HMR
Note: * O&M Expenses are the sum of Operating Expenses, Employee Benefits Expenses, and Administration and Other Expenses

v) Total revenue up to 2021-22 constituted only 40.23% of debt servicing (interest and capital repayment) of HMR

Debt servicing is a major component of HMR's fixed costs, which currently are not being met by tariff and non-tariff revenue (**Table 2.3**). If debt servicing is not compensated, at least partially, the quality of metro service may suffer considerably.

Table 2.3: Revenue and debt servicing liability of HMR (2017-18 to 2021-22)

Year	Tariff Revenue (Rs. Cr)	Non-Tariff Revenue (Rs. Cr)	Total Revenue (Rs. Cr)	Debt Servicing (Rs. Cr)
2017-18	28.60	34.05	62.65	50.59
2018-19	166.41	146.62	313.03	215.38
2019-20	370.04	217.24	587.28	542.79
2020-21	83.98	105.64	189.62	1421.07
2021-22	201.39	137.25	338.64	1476.56
Total	**850.42**	**640.80**	**1491.22**	**3706.39**
% Total revenue/Debt servicing				**40.23**

Source: Audited financials of HMR

vi) Metro fares have remained unchanged since 2017, while in the last five years the Consumer Price Index of Telangana (Urban) has increased by 24.50%

This indicates that inflation in the state of Telangana (Urban) – which includes food and beverage, clothing and footwear, housing, fuel and light, and other components including household goods and services, health, transport and communication, education etc – has increased the cost pressures for HMR (**Table 2.4**).

Table 2.4: Consumer Price Index, Telangana-Urban (2017-18 and 2021-22)

CPI- Telangana (Urban)	
FY 2017-18	**FY 2021-22**
134.3	167.2

Source:MoSPI
Note: Increase in average CPI from 134.3 to 167.2, over 2017-18 to 2021-22, equals 24.50%.

In Sum:

The two year delay in project completion (2018-2020), metro closures due to the COVID-19 pandemic (2020-2021), and the work-from-home trend popularized during the pandemic have disturbed the ridership and revenue projections of HMR – thereby directly impacting revenue generation and the ability of HMR to meet its cost liabilities. The accumulated loss of the operator since the commencement of operations stands at Rs.4,751 crore, as of first half of FY 2022-23 (**Annexure 3**).

The operational difficulties being faced by HMR is therefore a matter of concern. A suitable fare revision and rationalization, which can help recover the actual operating expenses of HMR at the least, can help the metro services achieve durability success.

In light of the above, the Concessionaire is seeking a fare revision for HMR. Section III discusses fare revision frameworks adopted by popular metro systems in the World, to assist in the formulation of a fare revision formula for HMR.

SECTION III

Framework for Fare Revision

At the international level, Hong Kong and Singapore metro systems conduct an annual review of their fare structure, in accordance with their respective fare adjustment formulae. In the case of Delhi as well, the 4th Fare Fixation Committee (2016) recommended a formula-based fare increase on an annual basis. Delhi metro fares were revised in two phases in May and October 2017. Fares increased by 25% to 80% in the first phase and 20% to 50% in the second phase, such that the minimum fare rose to Rs.10 from Rs.8, all journeys over 5 km cost Rs.10/- or more, and journeys over 32 km incur a maximum fare of Rs.60, up from Rs.28 then the existing fare for these trip lengths. These fare rates are still continuing. In the case of Mumbai, the matter of fare increase is currently sub-judice. Bangalore Metro had set its fares initially in 2012 when they had opened the first segment. Their fares were comparable to the DMRC fare structure prevailing at that time. Bangalore Metro is currently in the process of constituting its own Fare Fixation Committee to increase their fares.

Lately, fares across all modes of transportation in Hyderabad have seen a rise. Telangana State Road Transport Corporation (TSRTC) implemented a fare increase of Rs.0.20/km in December 2019. In June 2022, TSRTC increased its bus pass charges across the board. Ordinary bus pass charges increased from Rs.700 to Rs.950, metro / deluxe metro bus pass charges increased from Rs.880 / Rs.990 to Rs.1,070 / Rs.1,180, and student bus pass charges increased from Rs.390 to Rs.495. Due to hike in fuel prices, since April 2022, trip fares for Uber and Ola have also increased by 15 percent in Hyderabad city.

We draw upon the best practices being followed by progressive metros like Hong Kong Metro, Singapore Metro and Delhi Metro, as well as public transport corporations like KSRTC, to understand their fare revision mechanisms. This section also presents the fare revision framework of Hyderabad Metro Rail Project which was incorporated in the Concession Agreement. The existing fare revision formulae provide insights into the factors which may be considered and incorporated in the suggested fare revision formula for HMR.

I) HONG KONG METRO

Hong Kong has a world class public transportation system. Their transport planning is envisaged towards better integration of transport and land use planning, better use of railways as the back-bone of passenger transport system, better public transport services and facilities, better use of advanced technologies in transport management, and better environmental protection (LEA 2013, Table 6-3).

Until 2007, two railway corporations - Mass Transit Railway (MTR) and Kowloon-Canton Railway (KCR)[1] – operated the rail system in Hong Kong. Passenger fares were set autonomously by the two corporations, taking into account commercial principles, economic conditions, competition from other transport modes, and whether services were value for money. The corporations were also free to undertake any revision in the rail fares, without the need for any approval from the Executive Council (unlike the bus fares, which required such approval).

Discussions for a possible merger of the two corporations began in 2004, when the erstwhile Government of

[1]MTR was established in 1975 with the Government as sole shareholder to construct and operate an urban metro system to help meet Hong Kong's public transport requirements. It was listed in October 2000, as the MTR Corporation Limited (MTRCL), with the Government currently owning about 77% of MTR shares. The KCR came into service in 1910 providing rail service from Tsim Sha Tsui in Kowloon through the New Territories. KCR was corporatized in 1982, as KCR Corporation (KCRC).

Hong Kong set several parameters for discussions including an adoption of an objective and transparent fare adjustment mechanism (FAM). The merger was passed through a legislative ordinance in June 2007, and took effect in December 2007, allowing Mass Transit Railway Corporation Limited (MTRCL) to operate Hong Kong's railway system. The merger took away the fare autonomy enjoyed earlier by the railway corporations, and henceforth introduced a 'formula-based FAM' with due recognition of its advantages: including de-politicization of future rail fare revisions and making fare adjustments automatic and easy to understand by the public.

The metro rail fares are reviewed once per calendar year based on the FAM, and the formula itself is reviewed and modified (if required) every five (5) years. The FAM has therefore undergone two rounds of reviews and revisions in 2012 and in 2017. The prevailing formula for Hong Kong metro is as follows[2]:

Fare adjustment = 0.5 x Change in CCPI +0.5 x Change in NWI(TS) – Cost Mitigating Factor

Where,

Change in CCPI : Year-on-year percentage change in Composite Consumer Price Index (CCPI) in December of the previous year

Change in NWI(TS) : Year-on-year percentage change in Nominal Wage Index (Transport Services) in December of the previous year

Cost Mitigating Factor : A pre-determined 'special adjustment', set to be 0% before 2013 and 0.1% for 2013-17, but subsequently revised upwards to 0.6%

There are two additional safeguards in determining the fare adjustment rate:

Affordability linked arrangement: Increase in overall fare adjustment rate cannot be higher than the Median Monthly Household Income (MMHI) yearly percentage change

If the overall fare adjustment rate lies within the range of ±1.5%, there is no fare revision, and the adjustment rate is rolled over to the next annual fare revision

The data for CCPI and NWI is based on the data published by Hong Kong's Census and Statistics Department.

Background to Hong Kong Metro's Fare Adjustment Mechanism

Fare adjustment through the Fare Adjustment Mechanism (FAM) was brought into effect in 2009[3], and since 2010 there have been annual fare increases in the fares of Hong Kong Metro.

However, fare increase of 5.4% in 2012 far exceeded the affordability of the general public - as the wage increase of many sectors could not catch up with the fare increase.

The Government and MTRCL conducted a joint review of FAM in August 2012, i.e. after 5 years since the merger of railway corporations, to consider incorporation of additional factors such as service performance and profitability of MTRCL, as well as public affordability. Approved by the Executive Council, key features included in the fare revision exercise from 2013 were:

- Cost mitigating factor 'improved' from 0.1% to 0.6%. This revision brought down the fare adjustment rate in 2013, from 3.2% to 2.7%
- Monthly rail pass schemes enhanced to benefit frequent, medium and long journey rail passengers
- Public affordability cap: this is based on the change in 'Median Monthly Household Income' (MMHI). Any fare increase should not be higher than the change in MMHI for that year. Any shortfall would be made up in two phases in the years when fare increase is lower than the rise in MMHI

[2] The formula and its details are as of 6th October 2022. Please refer to the MTR webpage for all information on Hong Kong metro FAM: https://www.mtr.com.hk/fare-adjustment- mechanism/eng/#FareFormula

[3] For 2009, the overall fare adjustment rate of +0.7% was below 1.5%, hence there was no fare increase that year. The rate of +0.7% was carried forward for inclusion in the 2010 fare adjustment.

- Profit sharing mechanism: A pre-determined share of MTRCL's profits (about 1.5% of overall business profits each year), including profits from property development and overseas ventures, to be apportioned to an account which supports time-limited fare concessions, such as the 10% same day second trip discount.
- Service performance arrangement: service disruptions lasting 31` minutes or more, except those outside of MTRCL's control, would result in the corporation being fined (ranging from HK$1 million to HK $15 million) and the amount put in the fare concessions account to finance the '10% same day second trip discount' scheme

Three components namely the public affordability cap, the profit sharing mechanism and the service performance arrangement (or service disruption-linked penalty) are not explicitly included in the formula. These factors were maintained in the subsequent review of FAM in 2017, i.e. 5 years after the 2012 review, and continue to apply as per the details provided on the MTR website[4]. MTR also provides several concession schemes, with regular fare discounts for the elderly, disabled, students and children, and other concessions for off-peak travel, long journeys and frequent travelers.

In line with the FAM formula and its safeguards, since 2017 MTR has reduced fares once, frozen fares three times and increased them twice (**Table 3.1**).

Table 3.1: Hong Kong Metro Fare Adjustment Rate (2017-2022)

Year	Fare Adjustment Rate
2017	No change
2018	+ 3.14 %
2019	+ 3.33 %
2020	No change
2021	- 1.85 %
2022	No change

Source: Mass Transit Railway (MTR), October 2022

As is evident in **Table 3.1**, there was no fare increase over the course of the COVID-19 pandemic, despite the drop in ridership and passenger revenues for Hong Kong metro. Rather, along with other fare concessions, a fare rebate of 3% on contactless Octopus cards and QR code tickets was in increased to 3.8% for 2022.

At the same time, MTRCL registered a 77% increase in its profits in the first half of 2022, attributed to its property development business (non-fare box revenue), despite registering a loss for the first time in 2020 because of the effects of the social-unrest in 2019 and the economic downturn due to the COVID-19 pandemic[5].

FAM is due for its next round of review in 2023 with the objective of making it more comprehensive and transparent. There is a possibility of also including the cost of operations in the fare adjustment calculation[6].

II) SINGAPORE METRO

Public Transport Council (PTC) was established in 1987 to regulate and integrate fares for Singapore's metro and bus systems, gather public feedback through regular customer satisfaction surveys, and advise the Minister for Transport on public transport matters. The public transport system in Singapore, including the Singapore metro system, is run by two operators – SMRT Corporation Ltd (SMRT) and SBS Transit (SBS).

PTC conducts an annual fare review exercise, taking into account factors such as energy cost, inflation, as well as metro ridership. It is envisaged that the fare adjustment formula is responsive to changes in the costs of operating the public transport system. The review is performed while keeping in view the following principles[7]:

- Effectiveness of the current fare adjustment formula and mechanism, while considering the changes in public transport industry and commuting patterns.

[4]As of 6th October 2022. Please see Appendix 2 and 3 on the MTR webpage: https://www.mtr.com.hk/fare-adjustment-mechanism/eng/#FareFormula

[5]Article in South China Morning Post: https://www.scmp.com/news/hong-kong/hong-kong- economy/article/3188541/hong-kong-rail-giant-mtr-corporation-posts-77-cent

[6]Article in South China Morning Post: https://www.scmp.com/news/hong-kong/hong-kong- economy/article/3172144/hong-kongs-mtr-corporation-set-freeze-ticket

[7]PTC: https://www.ptc.gov.sg/newsroom/news-releases/newsroom-view/ptc-commences-review-of- public-transport-fare-adjustment-formula-and-mechanism-150822

- Balancing between affordability and financial sustainability, i.e. keeping public transport fares affordable while ensuring financial sustainability of the public transport system
- Consulting and engaging with key stakeholders, including commuters, public transport operators, and the labour movement and transport experts, in the course of the review.

Based upon the review exercise undertaken during 2017-18, the fare adjustment formula applicable for the period 2018 – 2022 is provided below.

Maximum fare adjustment= 0.5 cCPI + 0.4 WI + 0.1 EI - 0.1 percent + NCF

Where,

cCPI : Year-on-year change in the 'core consumer price index' (cCPI). There was an increase in the weightage of cCPI from 0.4 to 0.5 in the 2017-18 review exercise

WI : Year-on-year change in the wage index (WI), measured by the average monthly earnings (national average), and adjusted for any change in the employer's Central Provident Fund (CPF) contribution rate

EI : Year-on-year change in the energy index (EI), a composite index derived from diesel prices and electricity tariffs. There was a decrease in the weightage of EI, from 0.2 to 0.1, in the 2017-18 review exercise

NCF : Year-on-year change in the network capacity factor (NCF), which measures capacity provision relative to passenger demand for the entire public transport system. NCF was introduced in 2018 "to better reflect the cost movements due to changes in public transport network capacity and commuter usage."

Cost mitigating factor: 0.1 per cent in the 2018 formula, which is based on half of the productivity gain achieved by public transport operators

NCF was included to reflect the recurrent operating costs due to capacity adjustments, such as operating more trains for less crowded and more convenient metro rides. If network capacity exceeds ridership, NCF rises – implying a more comfortable ride for the commuter, causing an upward pressure on fare prices. On the other hand, if ridership outweighs capacity, NCF falls or becomes negative – implying overcrowding. Ridership in Singapore metro fell drastically during the pandemic, and ridership recovery was slow. This drop in ridership affected NCF, which measures ridership against the capacity added by expansion of the transport network. NCF was excluded between February and December 2020, due to the "exceptional circumstances" of 2020.

Background to Singapore Metro's Fare Adjustment Mechanism

PTC has been fixing and revising the public transport fares in Singapore since its establishment[8]. At the same time, Singapore metro provides several concession schemes to metro travelers, including discounts to low wage workers and people with disability, concessionary fares for students and senior citizens, and off-peak travel discounts. Operators are required to make a one-off contribution to the Public Transport Fund, as a form of "sharing their gains" with commuters[9]. PTC utilizes the fund to provide public transport vouchers – to either top up fare cards or buy monthly concession passes – for households who are unable to cope with fare increase (monthly household income per person ≤ S$1600).

Within the last decade, fares for Singapore metro were reduced during 2015-2017 due to subdued energy prices. However, between 2012 and 2016, annual operating costs increased by over $900 million[10]. Over the same period, growth in ridership led to an increase in annual fare revenue by around $230 million – covering only about 25% of the increase in annual operating costs. The Singapore Government provided substantial subsidies to cover the operating expenditure shortfall, although a widening gap between cost and fares was found to be unsustainable for the metro transport network. To address this issue,

[8]Timeline of all fare adjustments in Singapore (since 1990- present) is available on the PTC website: https://www.ptc.gov.sg/fare-regulation/bus-rail/fare-milestones

[9]According to an article by Channel News Asia (2021), SBS Transit - which operates the North East and Downtown MRT lines as well as the Sengkang-Punggol LRT line - will have to contribute S$230,000. Meanwhile SMRT, which runs four of Singapore's six MRT lines in addition to the Bukit Panjang LRT line, will have to give S$2 million to the fund.

[10]PTC Fare Regulation Framework: https://www.ptc.gov.sg/fare-regulation/bus-rail/fare-regulation- framework; as of 10th October 2022

PTC introduced a new factor, called NCF, in the fare adjustment formula to better reflect cost movements due to public transport capacity changes and commuter usage. Addition of NCF was envisaged to allow the fare formula to better reflect the increase in costs incurred by the operators to provide additional services, should it be necessary to meet demand.

Following the adoption of a new formula in 2018, metro fares increased by 7% in 2019, resulting in an increase of 9 cents per journey for adult commuters using travel cards. Due to the COVID-19 crisis and its economic impact on the country, PTC waived any transport fare increase in 2020, but rolled over the full quantum of fare adjustment to 2021.

In December 2021, after a two year gap, bus and metro fares in Singapore increased[11]. This decision was taken due to rising operating costs (primarily energy and wage costs), and drop in ridership of public transport systems, amidst the COVID-19 pandemic. In particular, fare revenue decreased because of lower ridership, at the same time energy prices increased by more than 30 per cent in the first half of 2021. To help operators mitigate the costs of running public transport services, PTC granted a maximum allowable fare adjustment of 2.2%. This resulted in the fares up to 14.2 km to increase by 3 cents and for more than 14.2 km by 4 cents. For students and senior citizens, the concessionary fares increased by 1 cent per journey. The fare adjustment was expected to translate to an increase in fare revenue of about S$34.2 million a year – with S$4.6 million increase in annual revenue for SBS Transit, and S$10 million increase in revenue for SMRT.

Considering that the fare adjustment formula is reviewed every five years, PTC commenced its review of the mechanism and the formula in August 2022, and it is likely to be completed by mid-2023[12]. The review is likely to take into account the changing ridership trends, considering that ridership levels have fallen below their pre-pandemic levels. The review outcome will be applicable to 2023 fare review exercise.

III) KARNATAKA STATE ROAD TRANSPORT CORPORATION (KSRTC)

Road transportation in Karnataka was solely under Karnataka State Road Transport Corporation (KSRTC) until 1996-97. With the aim of providing high quality transportation service and increasing operational efficiency, Government of Karnataka ordered a bifurcation of KSRTC into four corporations. Since then, road transportation in Karnataka is undertaken by KSRTC and its three subsidiaries, namely Bangalore Metropolitan Transport Corporation (BMTC) (established in 1997), North West Karnataka Road Transport Corporation (established in 1997), and North East Karnataka Road Transport Corporation (established in 2000)[13]. All transport operators are state owned, under the Transport Department, Government of Karnataka.

KSRTC implements an automatic, formula-based[14], fare revision depending upon changes in the price of diesel and increase in staffs' dearness allowance (DA). The formula, approved by the Government of Karnataka in 2000, helps reduce the financial stress of state transport operators and prevents them from undertaking losses on account of hikes in diesel price and DA.

Fare increase due to increase in diesel price: F(DPA)=(F – D) +(RPD/BPD) X 100

Where,

F(DPA): Revised fare in terms of paise per passenger KM

F : Average cost per passenger KM at the time of previous fare revision

D : Diesel cost per passenger KM, at the time of previous fare revision

RPD : Revised price of diesel

BPD : Base price of diesel at the time of previous fare revision

[11]Channel News Asia article: https://www.channelnewsasia.com/singapore/bus-train-fares-increase- 4-cents-dec-26-public-transport-council-2287881

[12]See articles: https://www.channelnewsasia.com/singapore/public-transport-fare-adjustment- formula-mechanism-review-ptc-2881496; https://www.todayonline.com/singapore/public-transport- fares-formula-review-ptc-1969796

[13]Official webpage of KSRTC: https://ksrtc.karnataka.gov.in/info-1/About++KSRTC/en (as on 12 Oct 2022)

[14]Details of the KSRTC fare revision formula are as provided in the 4th FFC report for DMRC.

Fare increase due to increase in DA : FR = F + CPKM(L) / CPKM X P X F/10

Where,

FR : Revised fare per KM

F : Current fare per KM

CPKM(L) : Staff cost per KM at the time of previous fare revision

CPKM : Total cost per KM at the time of previous fare revision

P : Percentage increase in staff cost due to DA increase over staff cost at the time of previous fare revision

A safeguard has been put in place to prevent frequent fare increases and to help pass the efficiencies of the transport system to the public. According to this safeguard, if the combined burden of diesel and DA increase is less than 0.25 paise per passenger km, KSRTC does not undertake any fare increase. Fare increase is only implemented when accumulated effects over the previous fare revisions exceed 0.25 paise per passenger km.

IV) DELHI METRO

Delhi Metro Rail Corporation (DMRC) was established in 1995, with equal equity participation from Government of India and Government of National Capital Territory of Delhi (GNCTD), to construct and operate the Delhi metro rail system.

Delhi metro, the first world-class metro system in India, began operations in December 2002 over a 7.92 km section. As of October 2022, Delhi metro operates over a network length of 391 km (including Noida-Greater Noida Aqua Line, and Rapid Metro Gurugram), 286 stations, and 12 lines. DMRC has over 300 train sets of four, six and eight coaches. Along with providing the residents of Delhi with a comfortable public transportation system, the Delhi Metro is also contributing significantly towards controlling pollution as well as reducing vehicular congestion on the roads[15].

Tickets on the Delhi metro can be purchased as tokens, and frequent travelers can opt for Smart Cards for 10% discount on every journey and an additional discount of 10% for travelling during off peak hours from Monday to Saturday. Commuters can also opt for QR based ticketing for travelling on the airport express line. A discount of Rs.10 is offered on all fare slabs on Sundays and National Holidays (**Table 3.2**). In a recent move, for integrating metro with other modes of transportation in the city, metro cards can also be used to travel in Delhi Transport Corporation (DTC) buses and in DMRC's metro feeder buses.

Table 3.2: DMRC Fare Structure

Distance (km)	Monday to Saturday Fare (Rs.)	Sunday and national Holidays Fare (Rs.)
0-2	10	10
2-5	20	10
5-12	30	20
12-21	40	30
21-32	50	40
More than 32	60	50

Source: DMRC (https://www.delhimetrorail.com/fare), October 2022

DMRC provides last mile connectivity through air-conditioned metro feeder buses[16]. Other last mile options available at selective metro stations, throughout the metro operation hours, include e-rickshaws, e-scooters, cycle sharing services, cab aggregator services, and auto- rickshaw e-booth.

Metro rail fares in India are governed by the Metro Rail Operation and Maintenance Act 2009, under which any fare revision is to be reviewed and approved by a Fare Fixation Committee (FFC) nominated by the Central Government. For the Delhi metro, four

[15]Details are as of 10 October 2022. About Delhi metro: https://www.delhimetrorail.com/pages/en/introduction#:~:text=The%20Delhi%20Metro%20Rail%

[16]Information available at: https://www.delhimetrorail.com/last-mile-connectivity. DMRC has 47 feeder buses. These operate along five routes: Kashmere Gate metro – Harsh Vihar, Shastri Park metro – Mayur Vihar-III, Mayur Vihar-III – Harsh Vihar, Vishwavidyalaya Metro – Shankarpura, Udyog Bhawan – Vanijya Bhawan. Available at 9 metro stations: Kashmere Gate, Shastri park, East Vinod Nagar Mayur Vihar-II, Dilshad Garden, GTB Nagar, Gokalpuri, Laxmi Nagar, Anand Vihar, Vishwavidyalaya. Timings: 6 AM – 11 PM. Fare: Upto 4 km= Rs. 10; 4-8 km= Rs.15; 8-12 km= Rs.20; Above 12 km= Rs.25.

fare fixation committees have been incorporated thus far, and each of them submitted their reports in 2004, 2005, 2009 and 2016 respectively. Fares have been revised keeping in view the twin objectives of affordability to the commuters and financial sustainability of the metro system.

The fare revision formula proposed by Delhi Metro Rail Corporation (DMRC) in 2016, and approved by the 4th Fare Fixation Committee, includes a weighted average of energy, staff and other operating expenses, to allow metro fares to increase in proportion to increasing costs of operating and maintaining the metro system.

The percentage increase in the fare of each slab is calculated using the following formula:

$$= \{(W_1[FE_N - FE_0]/FE_0)+(W_2[CPI_N - CPI_0]/CPI_0)+(W_3[AMC_N - AMC_0]/AMC_0)\}X\ 100$$

Where,

W_1, W_2, W_3: Weightage for energy, staff cost and maintenance and other expenses based on audited accounts of previous financial year i.e., proportion of each item of expense with reference to energy + staff + maintenance and other cost

FE_N : Average unit cost of energy at the time of current fare revision (As per previous year audited accounts)

FE_0 : Average unit cost of energy at the time of last fare revision (As taken from the audited accounts)

CPI_N : Latest consumer price index at the time of current fare revision

CPI_0 : Consumer price index at the time of last fare revision

AMC_N : Latest per KM maintenance and other cost (operating expenses excluding energy and staff cost) at the time of current fare revision as per previous year audited accounts

AMC_0 : Per KM maintenance and other cost (operating expenses excluding energy and staff cost) at the time of last fare revision as per the audited accounts.

The earlier three FFCs for Delhi metro recommended fare revisions to DMRC based on changes in the Consumer Price Index (CPI). However, it was felt that CPI did not cover all items under operation and maintenance (O&M). On the request of DMRC, the fourth FFC was set up after a gap of 7 years, to suggest a fare revision which is more representative of the O&M costs. The fare structure followed a 'telescopic fare policy', i.e. lesser fare over longer distances, to encourage long distance travelers to use public transportation. According to the fare revision recommended by the 4th FFC, cost per km is Rs.5 for the first slab, and Rs. 1.56 and 1.88 for the last fare slab (under the two phases of fare revision respectively). A summary fare revisions implemented by DMRC is provided in **Table 3.3**.

Table 3.3: FFCs' Fare Revisions for Delhi Metro

FFC, Year	Fare Slabs (No.)	Min Distance Slab (km)	Max Distance Slab (Km)	Min. Fare (Rs.)	Max. Fare (Rs.)
Initial fare, 2002	5	0 - 2	> 12	4	8
1st FFC, 2004	9	0-2	21 - 24	6	15
2nd FFC, 2005	15	0-2	>39	6	22
3rd FFC, 2009	15	0-2	>44	8	30
4th FFC, 2016	6	0-2	>32	10	50
4th FFC, 2017	6	0-2	>32	10	60

Source: Delhi Metro Fare Fixation, Report of 4th FFC

Note: Fare structure recommended by 2nd FFC involved an increase of Re.1 for every subsequent fare slab (except for second and fourth slabs for which fare was increased by Rs.2. The 4th FFC drastically reduced the number fare slabs from 15 to 6, to reduce complexity, "improve passenger convenience, simplify fare collection, as well as DMRC's accounting". Since the fare increase recommended by the 4th FFC was substantial (average 91% increase over the existing fares), the fare increase was implemented in two phases over 2016 (averaging 51% increase over existing fares) and 2017 (averaging 27% increase over phase 1 fares).

Although the 4th FFC permitted annual fare revisions utilizing the above formula, a safeguard was also put in place. The fare increase for each slab may either be by the value arrived at through the formula, or by 7%, whichever is lower. It may be noted that DMRC has not implemented a fare increase since its last revision in 2017.

V) FARE REVISION ACCORDING TO THE CONCESSION AGREEMENT FOR HYDERABAD METRO RAIL (MRTS) PROJECT

The concession agreement (CA), signed in 2010 between the erstwhile Government of Andhra Pradesh and L&T Hyderabad Metro Rail Private Limited, suggested annual revisions[17] in the fares of HMR according to the following formula:

Fare= b + (b* WPI_N/WPI_O - b) *0.6

Where,

b : Basic fare

The basic fare should be increased annually, without compounding, by 5% thereof for a period of 15 successive years commencing from 1 April 2014

The applicable base fare should be revised annually with effect from April 1 each year to reflect the variation in Wholesale Price Index (WPI) between the years in which such revision is undertaken. But such revision should be restricted to 60% of the increase in WPI

WPI_N : Wholesale Price Index (WPI) of the year in which the revision is undertaken

WPI_O : Wholesale Price Index (WPI) of the base year

The fare chart according to the CA formula is given in **Annexure 4.**

VI) DISCUSSION

It is evident that changes in input costs, particularly energy costs, staff costs and other operating expenses, form the basis for fare revision of public transport systems. Additionally, in the Singapore and Hong Kong metro fare revision frameworks, the aspect of cost and inflation is mitigated through incorporating a 'cost mitigating factor', which is a factor of efficiency achieved through utilization of the transport system by the public.

DMRC does not explicitly utilize such a cost-mitigating factor. According to the 4th FFC report of Delhi metro, the aspects of productivity (or cost mitigating factors) proposed by DMRC in its fare revision proposal included:

"On the lines of MTR Hong Kong Metro, some increase in the fare should be met by increase in efficiencies of DMRC. In view of the fact that adequate coins are not available from the RBI and the fare structure proposed by the DMRC is in multiple of Rs.10/- and the revised fare based on the automatic fare revision formula should also be in multiples of Rs.10/-. In this process, the fare in some slabs will be get rounded to the next multiple of Rs.10/- after 3 to 4 years. Therefore, the efficiency of DMRC is passed on to the passengers through this rounding off mechanism." (Section 3.6.3, p.15)

"In view of the above DMRC proposes that no increase in the fare of a slab shall be made where the effect of the increase is <Rs.5. However, the cumulative effect of changes shall be taken into account in each slab in the succeeding year(s). When the effect of the increase is ≥ Rs.5 in a slab, the fare of the concerned slab is to be revised to the next multiple of Rs.10 so as to have the fare in each slab in multiple of Rs.10." (Section 3.6.4, p.15)

The final recommendation made by Delhi metro's 4th FFC, regarding productivity factor, was:

"On the lines of MTR Hong Kong Metro, some increase in the fare should be met by increase in efficiencies of DMRC. In view of the fact that no such Productivity Factor (PF) was recommended by the earlier committees, it is recommended to apply the same at 0% as of now. However, the next FFC may consider a suitable percentage for applying the PF on the lines of MTR Hong Kong as explained in paras 5.9.13 to 5.9.15 of Chapter 5 of the report by taking into account the historical audited financial data of DMRC for the past 5 years."(Section 8.5, pp.71-72)

[17]See Concession Agreement Section 27.2 (Revision of Fare, p.87); Schedule-R Fare Notification, Section 5 (Annual Revision of Basic Fares, p.285)

While rounding off the fares for each slab to the closest multiple of Rs.5 and Rs.10 is a standard practice across all metro rail systems, it may be questionable if the same can be an aspect of 'productivity' that is passed on to the consumers. Rather, the efficiencies of the Delhi metro may still be getting passed on to the consumers due to the 'economies of scale' and its reflection in a decline in year-on-year percentage change in per km maintenance and other costs (AMC component in the Delhi metro fare revision formula). The Delhi metro rail system is widely spread across Delhi and NCR (including Noida, Ghaziabad, and Gurugram), with a total network length of 391 km.

Simply put, 'productivity' is the output of a system divided by the input. It is therefore a factor of efficiency, which in the context of a transport mode is achieved through the utilization of the transportation system by the public – in the form of ridership or revenue. Therefore, in our view, the aspect of the cost incurred in running the metro system must also be reconciled with an appropriate 'factor', which is i) specific to the Hyderabad metro rail system; and ii) derived from the usage of the metro services by the general public.

The basis of fare revision according to the Concession Agreement for Hyderabad Metro Rail Project is WPI, i.e., the wholesale price movements of all commodities. One of the key disadvantages of WPI is that it only considers the impact of goods that are supposed to represent the entire population of goods. It does not include items pertaining to services, which are the crucial components of Metro operations. According to an RBI report:

"*Owing to the wide variety of sources, centres, and specifications and due to the practical compulsion of collecting data by the voluntary method, it is difficult to maintain uniformity in the concept of wholesale price in the collection of price data. In many cases, these prices correspond to farm-gate, factory-gate or mine-head prices; and in many other cases, they refer to prices at the level of primary markets, secondary markets or other wholesale or retail markets.*" (Reserve Bank of India (RBI) Report 1276, Measurement of Inflation in India: Issues and Associated Challenges for the Conduct of Monetary Policy)

On the other hand, Consumer Price Index (CPI) is incorporated in all the calculations for fare fixation used by Hong Kong metro, Singapore metro, and DMRC. Moreover, the model proposed by NCAER takes CPI of Telangana, faced by the urban population, which is more realistic and linked to the ground scenario of Hyderabad city.

Depending upon the fare increase estimated using an appropriate formula for HMR, an appropriate safeguard would also be deliberated such that future fare revisions are reasonable and continue to factor in public affordability.

With due consideration to the above discussion, the framework for fare revision of Hyderabad metro is explicated in Section IV.

SECTION IV

Supply Side Considerations for Fare Revision

In the approach adopted at the time of initial fare fixation, total cost is distributed based on the distance travelled. Thus, commuters pay based on the distance travelled in an Origin- Destination (O-D) space.

Annual costs consist of variable and fixed costs. Fixed costs consist of servicing obligations towards debt and equity holders of the Project. Variable costs include salary, maintenance, housekeeping, electricity, etc. The Concessionaire had done the initial fare fixation taking into account the total costs which included the fixed and variable costs based on estimates of ridership prior to the start of operations.

For a public-private metro project like HMR, fixed cost is the largest component in the overall cost structure since it factors in commercial rates of returns for both debt and equity investors, which have to be recuperated within a limited timespan linked to the concession period. This is unlike the case of all other metros in India, which have been funded through sovereign-guarantee backed foreign currency borrowings (with exchange rate risks being borne by the Government), and the Government as a shareholder can also exhibit unrestricted endurance to recover costs in the name of public service.

There are two concepts that govern fare revision:

i) Durability success, where the metro operator is able to recover the variable operating cost

ii) Sustainability success, where the metro operator is able to recover variable operating costs and fixed costs including debt and equity

It is possible to achieve sustainability success for any metro project, such as HMR, only if it is able to recover both variable and fixed costs. The fare revision process is an enabler to make the metro services sustainable.

Therefore, the fare revision proposed to the Committee would be to consider at least such change in the fare structure which is in line with the year-on-year percentage changes in operating costs of the project. In view of the approaches adopted by other metros and KSRTC (discussed in Section III), adopting a similar formula for annual fare revisions has been considered for this project.

However, there is a caveat to this approach. Since the fixed cost is much more than the operating and other variable costs, fare revision primarily focusing on changes in the variable costs may result in major divergence between total annual costs and total annual revenue unless (i) the ratio between fixed and variable costs remains stable, and (ii) the initial fare fixation has taken into considerations all these costs (**Annexure 5** provides estimates of revenue as a fraction of cost for HMR).

I) APPROACH AND FRAMEWORK

There are 3 major components of operating cost – electricity costs, employee expenses, and maintenance costs. Based on these elements, a formula-based approach can be adopted such that changes in fares can be implemented transparently and fairly. A simple measure like the

Wholesale Price Index or Consumer Price Inflation (CPI) (used widely as a benchmark for annual tariff increases) does not cover all the items of operating expenses in the project and therefore, it may be appropriate to adopt a formula that is more representative of the various elements within the operating expenses. Similar approach was also adopted by the 4th FFC of DMRC.

1. **Electricity costs** are directly linked to the per unit rate of electricity charged by the state Discoms.
2. Changes in **staff costs** generally move in close tandem with consumer price inflation.
3. **Maintenance and other costs** consist of operating expenses excluding electricity and staff costs. These costs remain fairly consistent on a per kilometer basis, and the actual cost incurred by the Concessionaire over the years of operating HMR can be used to transparently arrive at this parameter.
    - ***Note:*** If HMR provides last mile connectivity and parking services in the future, then the cost incurred on these items will form a part of maintenance costs.

To have a fare revision that closely reflects changes in cost considerations for the Concessionaire, inflationary pressures for Hyderabad city, and a 'factor' linked to usage of metro services by the general public, we utilize:

1. Per unit cost of electricity, to estimate the percentage change in electricity costs
2. Consumer price inflation of Telangana (Urban), to estimate the percentage change in staff costs
3. Actual audited financial accounts of the Concessionaire, to assign relevant weightage to electricity, staff, and maintenance costs, as well as to estimate the per kilometer percentage change in maintenance and other costs
4. Results from a primary survey of metro commuters, to estimate an appropriate 'factor' which reflects the usage (demand) of the metro system by the general public and their willingness to pay

This section focuses on the supply-side 'cost considerations' of HMR, based on which we propose a percentage increase in each fare slab = SS% = $\{(W_1\ [FE_N - FE_0]/FE_0) + (W2\ [CPI_N - CPI_0]/\ CPI_0) + (W_3\ [AMC_N - AMC_0]/AMC_0)\}$ X 100

Where,

W1, W2, W3:	Weightage for energy, staff cost, and maintenance and other expenses based on audited accounts of the previous financial year of HMR i.e., the proportion of each item of expense with reference to energy + staff + maintenance & other costs
FEN:	Average unit cost of electricity at the time of current fare revision (As per TSERC per unit electricity tariff)
FE0:	Average unit cost of electricity at the time of last fare revision (As per TSERC per unit electricity tariff)
CPIN:	Latest consumer price index of Telangana (Urban) at the time of the current fare revision (As per Central Statistical Organization)
CPI0:	Consumer price index of Telangana (Urban) at the time of last fare revision (As per Central Statistical Organization)
AMCN:	Latest per KM maintenance & other costs (operating expenses excluding energy and staff cost) at the time of current fare revision (As per audited accounts)
AMC0:	Per KM maintenance & other costs (operating expenses excluding energy and staff cost) at the time of last fare revision (As per audited accounts)

'Hyderabad Acceptance Factor (H_A)' is an estimated component derived from the survey results of NCAER. It is a demand side consideration for fare revision which is explicated in Sections V and VI of this report. By incorporating this factor in the fare revision formula, the willingness to pay aspect of the commuters would be reasonably factored in the revised HMR fare structure.

II) FARE REVISION- SUPPLY SIDE CONSIDERATIONS

The application of the above-mentioned formula to the audited financials of the Concessionaire works out as follows (**Table 4.1**):

Table 4.1: Fare Revision Calculations

Step 1: Weights derived from audited financial accounts

Particulars	Weight	Audited accounts (2017-18) for reference only		Audited accounts (2021-22)	
		(Rs.)	%	(Rs.)	%
Energy Cost	W1	5,05,43,381	8.3%	54,06,82,313	16.9%
Staff Cost	W2	5,06,80,056	8.4%	86,86,12,914	27.1%
Maintenance & Other expenses	W3	50,47,94,089	83.3%	179,22,88,156	56.0%
	Total	60,60,17,526	100%	320,15,83,383	100%

Step 2: Change in indices

Particulars	Notation	FY 2017-18	FY 2021-22	% Change
Per unit cost of electricity (Rs. / unit)	FE	3.95	4.95*	25.32%
Consumer price inflation (yearly average)	CPI	134.3	167.2	24.50%
Per km maintenance & other cost (excl. energy & staff cost) (Rs. Cr / km)	AMC	1.68	2.59	54.17%
Operational network length	km	30	69.2	

Note: (*) Electricity costs were Rs.3.95/kVA from 2017-18 until 2021-22, implying a 0.0% change in the Electricity Cost index over this period. However, beginning 1 April 2022, Telangana State Electricity Regulatory Commission has increased the per-unit cost of electricity to Rs.4.95/kVA[18]. Going forward, the electricity rate of Rs.4.95/kVA (applicable from FY 2022-23) will be more representative of the cost incurred by HMR, considering that this new electricity tariff will be charged at the time the FFC deliberates on HMR fare revision.

Step 3: Multiplying the weights with respective change in indices

Cost head	Weightage in FY22 (A)		% Change in index (B)		Product (A*B)
Energy Cost	16.9%	W1	25.32%	$(FEN - FE_0)/FE_0$	4.28%
Staff Cost	27.1%	W2	24.50%	$(CPIN - CPI_0)/CPI_0$	6.64%
Maintenance & Other expenses	56.0%	W3	54.17%	$(AMCN - AMC_0)/AMC_0$	30.34%
Weighted sum of cost components					41.25%

Source: Audited financial accounts of the Concessionaire; Electricity cost from Telangana State Electricity Regulatory Commission (link provided in footnote 18); Consumer price inflation index (CPI Telangana, Urban) from Central Statistical Organization, Ministry of Statistics and Programme Implementation (https://mospi.gov.in/web/mospi/press-release1). Supporting documents and data provided in **Annexure 6.**

According to the above calculations, fare per slab can be increased by 41.25%, implying a 7.15% compounded annual increase (y-o-y) for the intervening period from the last fare fixation in FY 2017-18 till FY 2021-22 (**Table 4.2**).

[18] Telangana State Electricity Regulatory Commission's Public Notice, released on 23 March 2022. In the link below, see p.14 (of 18) under HT V (B) HMR: Energy charge has gone up from Rs.3.95/kVA to Rs.4.95/kVA.
(https://tserc.gov.in/file_upload/uploads/Public%20Notice/Public%20Notices/2022/Press%20Note%20and%20schedule%20Retail%20Supply%20Tariffs%20for%20FY%202022-23.pdf)

Table 4.2: Supply Side Revised Fare (with 41.25% Fare Increase per Slab)

S.No.	Distance Travelled	Existing Fare (Rs.)	Supply Side Revised Fare (Rs.)
	km	P1	SS= 41.25% increase on P1
1	Up to 2	10	14.1
2	> 2 to 4	15	21.2
3	>4 to 6	25	35.3
4	> 6 to 8	30	42.4
5	> 8 to 10	35	49.4
6	> 10 to 14	40	56.5
7	> 14 to 18	45	63.6
8	> 18 to 22	50	70.6
9	> 22 to 26	55	77.7
10	> 26	60	84.8
	Avg. fare	**36.5**	**51.6**

Source: Calculations on existing HMR fare slabs

III) EXPLANATION OF THE SUPPLY-SIDE FARE REVISION FORMULA

- The change in energy index (i.e. electricity tariff) over 2017-2022 refers to the growth in energy costs over this period= 25.32%
- The change in CPI (Telangana-Urban) over 2017-2022 refers to the growth in staff costs over this period= 24.50%
- The change in AMC per km over 2017-2022 refers to the per km growth in other operating costs (excluding energy and staff costs) over this period= 54.17%

If each of the three components are given equal weightage (i.e. 1 divided by 3= 0.33), the total percentage growth in operating costs which must be incorporated in fare increase equals:

= (0.33 X 25.32%) + (0.33 X 24.50%) + (0.33 X 54.17%)

= 8.3556 + 8.085 + 17.8761

= 34.3167 = 34.32%

However, each of the three components do not have the same weightage in the operating expenses of HMR. In 2021-22, the total operating expenses were= Rs. 320.16 crore. Of this:

- Share of energy costs was= 16.9%
- Share of staff costs was= 27.1%
- Share of other maintenance costs was= 56%

Therefore, if the above shares are denoted as weights (0.169,0.271,0.56=which total to 1), the weighted sum of the growth in energy, staff and other maintenance costs equals:

= (0.169 X 25.32%) + (0.271 X 24.50%) + (0.56 X 54.17%)

= 4.27908 + 6.6395 + 30.3352

= 41.25378 = 41.25%

Therefore, the weighted sum of 41.25% denotes the total percentage growth in operating costs which must be incorporated in the fare increase.

IV) NOTE ON OPERATIONAL EFFICIENCY

Since the above mentioned formula and calculations only include the costs of the system, which are increasing over time, there can be concerns if a cost based formula may pass the burden of inefficiencies (and therefore the increasing costs) of the system onto the commuters.

However, the internal operational efficiency of HMR is found to be better as compared to Delhi and Bangalore metros **(Table 4.3).** The efficiency ratios (which measure expenses incurred to earn a unit of income) show that the performance of HMR is better in comparison to Bangalore metro, which has a similar route length (56 km) and even Delhi metro, the largest metro in India (391 km).

Therefore, penalizing commuters by increasing Hyderabad metro fares, due to inefficiency of the metro system, is out of the question for HMR. Delhi and Bangalore metros are also efficient performers, yet they have gone for fare revision – as this efficiency is not enough to cover operating expenses.

Table 4.3: Efficiency Ratio (Expense/Revenue) of HMR, DMRC, NAMMA

	HMR	DMRC	NAMMA
2017-18	0.96	0.71	0.77
2018-19	0.60	0.70	0.80
2019-20	0.50	0.71	0.86
2020-21	1.43	1.35	3.87
2021-22	0.95		1.72
2022-23*	0.62		

Source: Audited financial accounts of HMR, DMRC and NAMMA Bangalore

In Sum

The aforementioned formula and calculations are on the basis of the operating cost considerations for HMR – i.e. the '**supply side**' considerations. However, the supply side constitutes one aspect of the view. Since the metro has tremendous external (social) benefits which accrue to the people at large, imposing the burden of the entire cost on the commuters will result in inefficiency. After all, choice of travel mode is sensitive to the cost of the commute.

Relevant fares can therefore be arrived at based on a field survey of commuters regarding their willingness to pay. These demand side considerations are taken up in detail in Section V.

SECTION V

Demand-Side Considerations

While supply side cost considerations are commonly the base for fare revisions, we also assess the demand considerations through utilizing a 'Hyderabad Acceptance Factor', which will be derived from the field survey of commuters in Hyderabad.

This section elaborates on the survey objective, approach and methodology, and the demand side fare revisions based on the survey results.

I) OBJECTIVE

Large metropolitan cities across the World offer a variety of transport modes for commuting within the city. These include a combination of public and private modes of transportation, such as bus, autos, taxis, metro rail, etc. Individuals choose to commute by any of the transportation modes depending on the time and cost incurred for undertaking their commute, as well as if the mode is convenient to reach their destination.

The law of demand in economics, applied to the present instance of demand for a specific transport mode, suggests that increasing the transaction cost of travel (both time and fare) of a particular mode of transport will reduce its attractiveness to a commuter and therefore reduce its demand – which will be visible through a fall in ridership, and possibly even revenue, of that mode of transport. This reasoning assumes that all modes of transport are perfect substitutes and individual preferences are the same across all city residents. These assumptions, however, are not realistic and therefore necessitate an empirical investigation into assessing the impact of change in transaction costs on the choice of transport mode. The investigation can help highlight why commuters may (or may not) prefer a particular transport mode over the others for their specific travel, and whether their preference for a mode is susceptible (or not susceptible) to change if there is a change in their time-cost of travel.

If the preference to travel by a mode is not susceptible to change, despite the increase in fares, the demand for the mode is inelastic – i.e., demand is not affected due to an increase in prices. This could indicate that either i) there are no alternative transportation options available to the commuter to substitute their present mode of transport, or ii) there are other benefits received by the commuter from using the preferred mode, which is independent of the time- cost of travel. Yet, this does not imply that transportation modes should be free to increase fares since it reduces consumer welfare by straining the income and travel budget of regular commuters.

Therefore, it is equally important to assess the public's affordability and willingness to pay whenever any fare hikes are proposed.

In the city of Hyderabad, the different modes of transport include metro, bus (AC/non-AC), autos, taxis and app-based cabs (four-wheeler and two-wheeler), and private vehicles. Factors such as inflation, the rising cost of fuel, and increasing passenger and vehicle traffic have affected the time-cost of commuting by bus, auto, cabs, and private vehicles. With Hyderabad Metro Rail under a financial strain, the metro fares are also proposed to be increased. In light of these changes, a survey was conducted in Hyderabad. Statistical analysis of the survey data helps gather insights on the following:

- Commuters' willingness to pay
- Willingness to shift to metro from other modes, in light of the simultaneously increasing time-cost of travel by bus, taxi, auto, car and 2 wheelers
- Elasticity of metro demand, to draw implications on expected changes in ridership and the fare based revenue of Hyderabad metro

II) SURVEY APPROACH AND METHODOLOGY

A survey was conducted in Hyderabad city in the month of September 2022. The survey was administered to a random sample of metro and non-metro commuters to assess their mode choice before and after the proposed increase in metro fare. The approach is discussed as follows:

- Sample 1: 'Individuals commuting by metro every day for work/education'
    - Target population: Individuals for whom metro is the primary mode of commute (3 or more round trips in a week[19]). Survey was conducted at metro stations.
    - The survey was directed to daily metro travelers who travel by metro every day, as they are the individuals who are responsible for generating the regular and bulk revenue stream for the Concessionaire. The substitution of concern is 'whether those who choose metro over other modes (given the present scenario), will continue to take it if metro fares increase.'
- Sample 2: 'Individuals commuting everyday by modes other than metro'
    - Target population: Individuals who commute by transport modes other than the metro, and have their destination close to a metro station. The survey was conducted at locations such as bus stops, petrol pumps, auto/taxi stands, which lie along the metro corridor.
    - Given the present conditions, non-metro commuters do not choose to take the metro. However, the time-cost of travel across modes is changing and it is possible that such commuters may choose to shift to metro in the future. The questions try to gather why they choose their preferred mode over the metro at present, and if they may choose to take the metro for their daily commute in the future. Such respondents may be seen as potential metro travelers, whose ridership in the metro will contribute towards increasing the footfall and therefore the fare revenue for Hyderabad metro.

Questionnaires for metro and non-metro commuters include 12 questions each, and attempt to gather mode choice for a random sample of commuters in two time periods– i) at present (given the prevailing time, cost, and other conditions), and ii) in the future (under changing time-cost of travel, and other conditions remaining same). Attempt has been made to make the questions comparable, thus facilitating data entry in excel and further statistical analysis.

Survey was administered in-person by a survey team in Hyderabad and responses were recorded using Google forms. By this method, responses were collected securely, in real-time, and directly reached the principal investigator of the survey at NCAER with date and time- stamp – who could therefore constantly monitor the progress of the survey.

The survey team was given extensive training at Mount Nasir Complex, Saifabad, Hyderabad, on 19 September 2022 to conduct the survey. The interviewers were capable of explaining the questionnaires in four languages, i.e., Hindi, English, Telugu, and Urdu. They elaborated on the context and requested the commuters to participate in a short survey regarding the proposed hike in Metro fares.

Prior to official commencement of the survey, the survey methodology and questionnaires were pre-tested on a sample of metro and non-metro commuters in Hyderabad. The respondents' name was asked as a part of the survey. No other personal identifiers were recorded. The collected information has been kept confidential and anonymized for further analysis. There was no pressure on the respondents and the responses were recorded with their consent[20].

[19]Taking due consideration of the changing work culture in companies with the advent of work-from- home. We are informed that a large number of IT companies in Hyderabad are operating in Hybrid mode, requiring employees to be in office three days a week.

[20]Consent was verbal. Any other personal identifier (mobile number, address, or signature) was not collected. Responses were filled by the interviewers – These are acceptable procedures: i) to prevent responses being linked to any legal action or harm to the respondent due to breach of confidentiality; ii) to capture views of people from all socio-economic backgrounds, some of whom may not know how to read or write.

NCAER was constantly in touch with the Hyderabad Metro Rail officials while conducting the survey. The survey process and methodology was deliberated in detail and accepted by the senior Hyderabad Metro Rail officials.

The survey procedure, questionnaires, and data analysis have been validated by NCAER's Internal Review Committee**.** The sampling methodology, participant information sheets, and questionnaires are provided in **Annexures 7** and **8** respectively[21].

III) FARE REVISION- DEMAND SIDE CONSIDERATIONS

As elaborated in Section IV, the formula based calculations indicate that fare per slab can be increased by 41.25%. These calculations are on the basis of the operating cost considerations for HMR – i.e. the 'supply side' (SS) considerations. However, the supply side constitutes one aspect of the view. To be accommodative and sensitive to the public utility nature of the HMR project, the proposed fare revision should also incorporate 'public acceptability' in the new fare structure. Therefore, the '**Hyderabad Acceptance Factor (H_A)**', an estimated component derived from the survey results of NCAER, is a '**demand side' (DD)** consideration for the current fare revision exercise. By incorporating this factor in the current fare revision, the 'affordability' aspect of commuters can be reasonably factored into the new HMR fare structure.

According to the demand side consideration, fare revision for each slab (in Rs.)= **DD = Base fare + H_A**

Where,

Base fare : Current fare for each distance-wise slab (in Rs.)

H_A : Hyderabad Acceptance Factor. It is the average fare increase per slab acceptable to commuters, among those willing to continue travelling by metro if their fares increase (in Rs.)

DD **:** Revised fare for each distance-wise slab, incorporating the average fare increase per slab acceptable to metro commuters (in Rs.)

In the NCAER survey, **81%** of the metro commuters indicated that they are willing to pay a higher fare for their metro commute (**Table 5.1; Table 5.2 below in this section**). The acceptance rate to an increased fare was high and comparable across all profiles of metro commuters surveyed, be it by their monthly household income, monthly household transport expenditure, affordability, distance travelled, years of commuting via metro, age, gender, or profession (profiling of metro commuters is performed in **Annexure 9C, Figures A1 to A9**).

The respondents were distributed over the ten fare slabs of HMR, as shown in **Table 5.1** below. The survey asked respondents, who are willing to travel at a higher fare, about the amount of fare increase that would be acceptable to them. The average value of the amounts of fare increase, stated by all such respondents, for each fare slab, is the Hyderabad Acceptance Factor **(H_A)**.

According to the law of demand, any increase in the price of a product will cause its demand to fall. As seen in the survey results too, the possibility of a metro fare increase (i.e. increase in the price of metro travel) results in 19% of the respondents stating that they would not travel by metro (i.e. fall in ridership or demand). If ridership falls, then it is possible that despite higher fare per slab, fare revenue may also fall.

The concept of 'price elasticity of demand' is, therefore, an important consideration, which is a ratio of the percentage change in ridership (i.e. change in demand) to the percentage change in fare (i.e. change in price). Given the inverse relationship between price and demand, the value of elasticity is negative. Its implications on revenue are as follows:

- If elasticity is less than -1: highly elastic demand, i.e. the percentage decline in demand (i.e. ridership) is greater than the percentage increase in price (i.e. fare), such that the revenue (i.e. tariff revenue for HMR) falls
- If elasticity is equal to -1: perfectly elastic demand, i.e. the percentage decline in ridership is equal to the percentage increase in fare, such that tariff revenue for HMR remains the same

[21]The survey sample was found to be representative of population (see **Annexure 9C, Figures A5 and A6** for metro respondents; and **Annexure 9D, Table A2** for non-metro respondents).

- If elasticity is between -1 and 0: inelastic demand, i.e. the percentage decline in demand is less than the percentage increase in price, such that tariff revenue for HMR is likely to rise

The ideal condition is when elasticity is close to zero.

From the side of commuters, it reflects the minimum possible decline in ridership despite an increase in fares. From the side of the metro operator, it reflects the appropriate fare increase, which is acceptable to a majority, and therefore helps the operator generate higher tariff revenue. The implications of average fare increase per slab on elasticity and revenue are provided in **Table 5.1**.

Table 5.1: Survey Results- Fare Increase per Slab, Elasticity, and Revenue

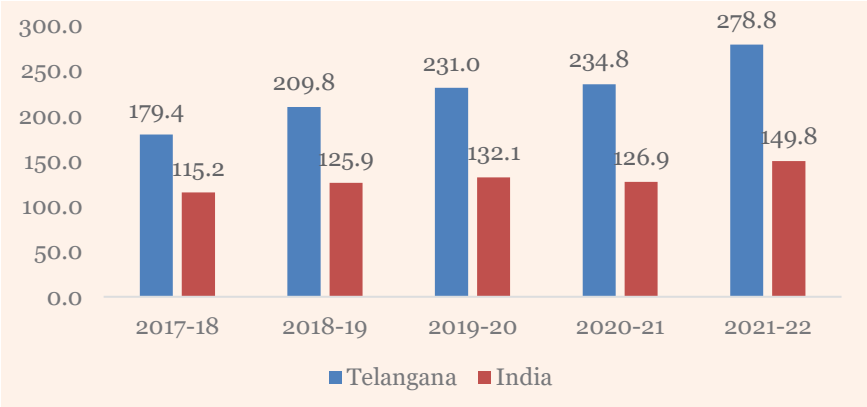
Distance-wise Slabs	Existing Fare (Rs.)	Total Respondents Surveyed (No.)	Those Willing to Travel at a Higher Fare (No.)	Acceptance Rate of Higher Fare (%)	Average Fare Increase Acceptable (Rs.)	New Fare (Rs.)	Existing Revenue (Rs.)	New Revenue (Rs.)	Elasticity
Km	P1	Q1	Q2	(Q2/Q1) *100	**HA**	P2= P1+ **HA**	R1= P1*Q1	R2= P2*Q2	e= %dQ/% dP
<2	**10**	86	68	79.1	**3.1**	**13.1**	860	**892.8**	-0.669
2 to 4	**15**	161	128	79.5	**4.7**	**19.7**	2415	**2520.3**	-0.656
4 to 6	**25**	151	129	85.4	**5.2**	**30.2**	3775	**3894.5**	-0.702
6 to 8	**30**	143	115	80.4	**5.6**	**35.6**	4290	**4091.7**	-1.053
8 to 10	**35**	160	133	83.1	**7.6**	**42.6**	5600	**5664.5**	-0.778
10 to 14	**40**	279	232	83.2	**8.1**	**48.1**	11160	**11163.8**	-0.830
14 to 18	**45**	154	122	79.2	**9.1**	**54.1**	6930	**6599.0**	-1.029
18 to 22	**50**	117	87	74.4	**10.5**	**60.5**	5850	**5260.0**	-1.226
22 to 26	**55**	73	59	80.8	**11.8**	**66.8**	4015	**3941.2**	-0.894
>26	**60**	59	46	78.0	**13.4**	**73.4**	3540	**3374.1**	-0.990
Total		**1383**	**1119**	**80.9**					-0.88

Source: NCAER Calculations from the survey conducted in Hyderabad in September 2022

Note: It is assumed that all respondents who are willing to travel at a higher fare are willing to pay the average accepted fare increase for each slab.

The affordability aspect may be compared with Telangana's trend in per capita income (PCI), which measures the amount of money that would be available per person if the total value of all goods and services produced in the economy were to be divided equally among all citizens. Since the survey-based opinion on the fare of HMR by the commuters is based on current prices, we may have a look at the overall macroeconomic development of the state and the purchasing ability of its inhabitants. In 2021-22, the per capita income (PCI) at current prices (advance estimate) in Telangana is Rs. 2.8 lakh, which is Rs. 1.3 lakh higher than the national per capita income in 2021-22 (second advance estimate) (Rs.1.5 lakh) as shown in **Figure 5.1** below.

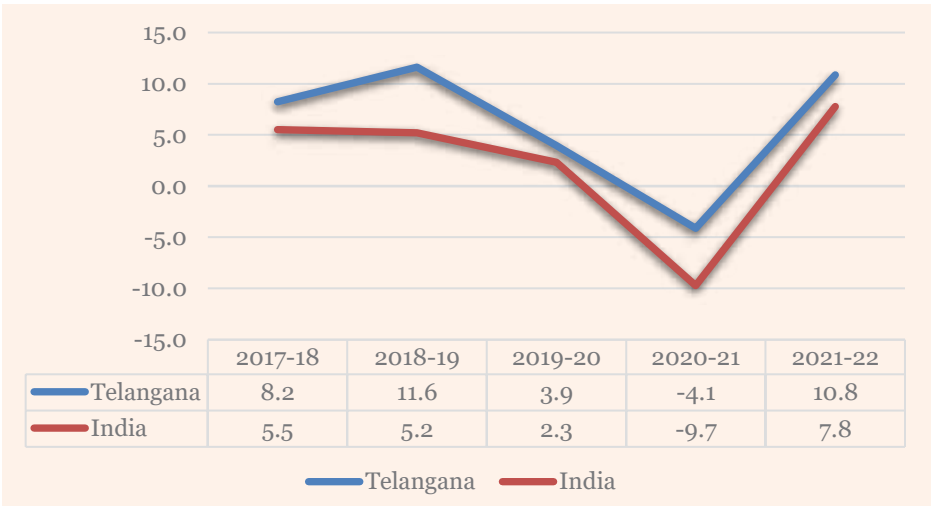
Figure 5.1: Per Capita Income of Telangana and India from 2017-18 to 2021-22 (Rs.'000 at current prices)



Source: Socio-Economic Survey of Telangana, 2021-22, Government of Telangana

Despite the challenges caused by the COVID-19 pandemic, Telangana still managed to achieve an increase in PCI at current prices in 2020-21 as compared to the previous year, and its growth rate of PCI in 2020-21 was higher than the national growth rate of PCI (**Figure 5.2**). It may be noted that between 2016-17 and 2021-22, the Compounded Annual Growth Rate (CAGR) of PCI of Telangana increased by 11.8%, while during the same period, India's PCI grew by 7.4%. This justifiably reflects the ability of the urban citizens of Telangana to accommodate a reasonable increase in the fare of HMR.

Figure 5.2: Per Capita Income Growth of Telangana and India from 2017-18 to 2021-22 (Rs.'000 at constant 2011-12 prices)



	2017-18	2018-19	2019-20	2020-21	2021-22
Telangana	8.2	11.6	3.9	-4.1	10.8
India	5.5	5.2	2.3	-9.7	7.8

Source: Socio-Economic Survey of Telangana, 2021-22, Government of Telangana

IV) METRO COMMUTERS AND SUBSTITUTION FROM OTHER MODES

An important qualitative aspect of the research has been: i) to understand from the metro commuters about their reasons for why they prefer to travel by the metro, and ii) to simultaneously understand from the non-metro commuters the reasons for why metro is not suitable to them at present, and iii) the conditions under which they would shift to the metro. This data provides insights on the steps Hyderabad metro can take to increase ridership and therefore its revenue.

However, let us begin with introducing the random samples[22] of metro and non-metro commuters surveyed, along with their acceptance rate to a higher metro fare and the possibility of substitution by non-metro metro commuters from other modes of transport to the metro – both at the existing and higher metro fares.

The survey sample includes 2,517 respondents in total, with 1,383 metro commuters and 1,134 non-metro commuters (**Table 5.2)**. At the existing metro fares, 590 non-metro commuters (i.e. 52% of the non-metro commuters) have considered travelling by the metro for their regular commute – considering the rising congestion on roads, and fare hikes across all other modes of transport (see further analysis in **Annexure 9D, Table A2**).

However, at higher metro fares, 1,119 metro commuters of 1,383 metro commuters will be willing to continue travelling by the metro – indicating an 81% acceptance rate to a higher metro fare. However, 264 current metro commuters indicated their preference for another transport mode if metro fares increase.

The loss in ridership of 264 metro commuters is made up by 263 non-metro commuters who report their willingness to travel by metro at a higher fare. Since 590 non-metro commuters are willing to travel by metro at existing fare, and 263 of them are even willing to travel if metro fares increase, the acceptance rate of non-metro commuters of travelling by metro at a higher fare stands at 45% (see further analysis in **Annexure 9D, Table A2**).

Therefore, upon fare increase of Hyderabad metro, HMR may experience some fall in ridership. It may however be overcome by some substitution from other modes of transport, considering the issue of increasing time and cost of travel by road-based modes of transport.

Table 5.2: Survey Respondents- Metro and Non-Metro

Type of Respondent	Total Surveyed (No.)	Those willing to Travel by Metro at Existing Fare (No.)	Those NOT willing to Travel by Metro at Existing Fare (No.)	Those willing to Travel by Metro at a Higher Fare (No.)	Those NOT willing to Travel by Metro at a Higher Fare (No.)	Acceptance Rate of Existing Metro Fare (%)	Acceptance Rate of Higher Metro Fare (%)
By Preferred Mode of Travel	**A**	**B**	**C=A-B**	**D**	**E=B-D**	**=B/A*100**	**=D/B*100**
Metro Commuters	**1,383**	**1,383**	0	**1,119**	**264**	100%	**81%**
Non-metro Commuters	**1,134**	**590**	**544**	**263**	**327**	**52%**	**44.6%**
Total	**2,517**	1,973	544	1,382	591	78%	70%

Source: NCAER Survey, September 2022

a) Metro Commuters: Why they prefer the metro for their regular commute

Metro commuters were asked to provide the reasons for preferring to travel by the metro (**Figure 5.3**). 'Faster than other modes of transport', 'convenient to reach', 'safety' and 'non- polluting' were the prominent reasons, across all metro commuter profiles, considering that these were reported by 68%, 64%, 49% and 27% of the metro respondents respectively.

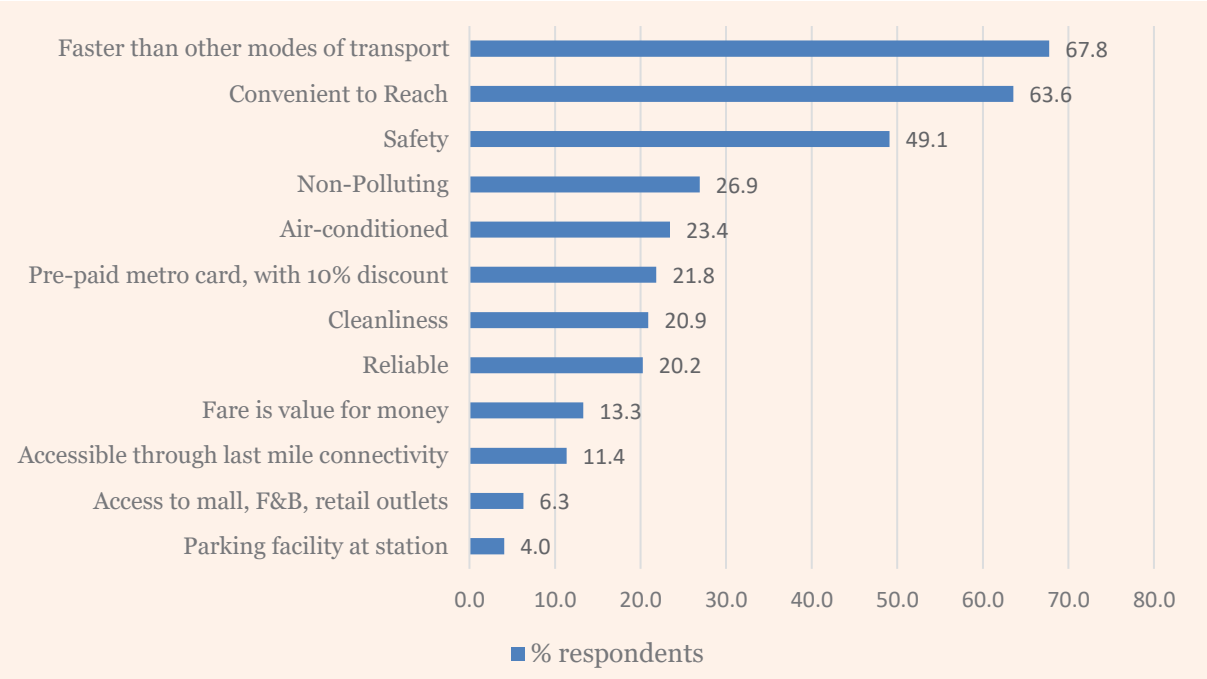
Among female respondents, 66% of them stated that they prefer metro because of safety reasons.

[22]Random sampling implies that each commuter in the population has an equal chance to be surveyed. On expectation, the sample will thus be representative of the population. The key advantage is that data analysis is unbiased, and the results attained are justified to hold true for the population.

One may note that 'last mile connectivity' and 'parking facility' do not appear among top reasons for preferring the metro. This indicates that those currently taking metro are not dependent on these services, or rather that they have easy access to the metro stations without the need of last mile connectivity or parking facility. After all, that the metro is 'convenient to reach' is a key reason for why metro commuters prefer the metro for their regular commute.

The above may be connected to the findings for non-metro commuters elaborated below, regarding their reasons for why their preferred mode of travel is suitable for regular commute (**Table 5.3**), why the metro is not suitable (**Table 5.4**), and the conditions under which they would shift to travelling by the metro (**Table 5.5**).

Figure 5.3: Metro commuters- Why do they prefer metro for regular commute?



Source: NCAER Survey, September 2022

b) Non-metro Commuters: Why their current mode is suitable for regular commute

That their current mode of commute is 'easily accessible', 'reliable', 'safe', 'avoids passenger crowd' are the prominent reasons across all non-metro commuter profiles for choosing their preferred mode of transport (**Table 5.3**).

'Availability of discounted bus ticket' also appears as a prominent reason among those who presently travel by bus (see **Table 5.3**), students (31% of 321 students surveyed), those with monthly household income between Rs.10,000 – Rs.50,000 (30.5% of 487 surveyed), those with household transport expenditure <Rs.3,000 (30% of 410 surveyed).

Table 5.3: Non-metro commuters- Why is current mode suitable for regular commute?

Mode	Total surveyed	Safety	Easily Accessible	Cleanliness	Airconditioned	Reliable	Non-polluting	Bus Pass for Discounted Ticket	Avoid Passenger Crowd	Travel Cost is Value for Money	Less Time Consuming than Other Modes	Less Costly than Other Modes
Auto	222	40.1	75.7	9.9	6.3	50.0	2.7	1.4	35.1	5.9	17.6	7.7
Bus (A/C)/ Metro deluxe/ Metro express	171	35.7	75.4	7.6	15.2	44.4	4.7	**46.8**	21.1	8.2	24.6	11.1
Bus (Non- A/C)	243	31.3	77.4	7.8	3.7	44.9	2.5	**50.2**	15.2	9.5	17.3	17.7
Cab services	27	81.5	48.1	37.0	70.4	40.7	40.7	7.4	29.6	3.7	7.4	0.0
Four wheeler	182	46.2	91.8	15.9	25.8	48.4	22.5	1.6	49.5	3.8	34.6	5.5
Two wheeler	289	34.6	89.3	7.3	3.5	55.4	3.8	1.4	37.0	7.3	35.6	12.5
All	1134	**38.1**	**81.4**	10.1	11.0	**48.9**	7.3	18.9	**31.4**	7.0	25.7	11.0

Source: NCAER Survey, September 2022

c) Non-metro Commuters: Why the metro is not suitable for their regular commute

The non-metro respondents were asked 'why metro is not suitable for their regular commute' (**Table 5.4**). 'Absence of last mile connectivity' and 'metro is crowded' are the prominent issues reported across all non-metro commuter profiles. Parking issues, including inadequate parking and high parking charges, are reported by 28.4% respondents (16.9% + 11.5%).

Table 5.4: Non-metro commuters- Why is metro not suitable for regular commute?

Mode	Total surveyed	Absence of Last Mile Connectivity	Parking not Available / Inadequate at Metro Stations	Parking Charges are High	Metro Fare is High	Metro is Crowded	Travel Outside Metro Operating Hours
Auto	222	70.3	10.4	5.4	26.1	48.6	27.5
Bus (A/C)/ Metro deluxe/ Metro express	171	67.3	11.7	12.3	27.5	45.0	25.1
Bus (Non-A/C)	243	72.0	10.3	5.8	39.1	36.6	21.4
Cab services	27	51.9	11.1	7.4	7.4	18.5	51.9
Four wheeler	182	63.7	27.5	18.1	20.9	50.0	28.0
Two wheeler	289	70.2	24.6	16.6	29.1	46.7	25.3
All modes	1134	**68.7**	16.9	11.5	28.6	**44.5**	25.9

Source: NCAER Survey, September 2022

d) Non-metro Commuters: On what condition will they choose to travel by the metro

Non-metro respondents who do not choose to travel by the metro, either at the existing fares or at the higher fares, were asked the conditions under which they will choose to commute by metro (871 respondents**, Table 5.5**). 'Better last mile connectivity', 'less crowd through more coaches/higher frequency', and 'availability of parking facility' appeared as the prominent conditions across all non-metro commuter profiles, thereby corroborating the findings of **Table 5.4** regarding the reasons why metro is presently not suitable for regular commute.

'Lower metro fares' also appears as a condition among those travelling by bus (35% of 331 respondents), students (38% of 243 respondents), and those with household transport expenditure <Rs. 3,000 (39% of 297 respondents).

This finding may be connected to the results noted in **Table 5.3**, wherein 'availability of discounted bus ticket' appeared as a prominent reason for choosing their current travel mode among those who presently travel by bus (see **Table 5.3**), students, and those with household transport expenditure <Rs.3,000 surveyed).

Table 5.5: Non-metro commuters- On what condition will you choose metro?

Mode	Total surveyed	Better last mile connectivity	Lower fare	Parking facility	Lower parking fares	Longer operating hours	Less crowd (more coaches or higher frequency)
Auto	150	77.3	28.7	30.0	8.0	24.7	50.0
Bus (A/C)/Metro deluxe/Metro express	135	64.4	34.1	31.1	15.6	20.7	53.3
Bus (Non-A/C)	196	77.6	35.7	25.5	10.2	17.9	43.9
Cab services	20	30.0	15.0	0.0	5.0	55.0	45.0
Four wheeler	138	68.8	22.5	42.8	21.7	21.0	55.1
Two wheeler	232	76.7	30.2	38.8	22.8	17.2	47.4
All	871	**72.8**	30.2	**32.8**	15.7	20.7	**49.1**

Source: NCAER Survey, September 2022

In Sum

This section presented an estimate of fare increase per slab, depending on the willingness to pay of metro commuters who travel in the respective fare slabs and will continue to travel by the metro if HMR fares increase.

Up on fare increase of Hyderabad metro, HMR may experience some fall in ridership. It may however be overcome by some substitution from other modes of transport, considering the issue of increasing time and cost of travel by road-based modes of transport.

The survey also collated qualitative information from respondents regarding their reasons for choosing their preferred mode of transport and the conditions under which they would substitutive to the metro. It can be inferred that availability of last mile connectivity, parking facility, and less crowd in the metro through better frequency and more coaches can help HMR increase its ridership by becoming attractive to those who presently choose to commute by other modes of transport.

Having discussed the supply and demand side considerations for fare revision, the next section reconciles the cost-based and survey-based fare revisions to present a balanced revised fare structure for HMR.

SECTION VI

Reconciling Demand and Supply Side Considerations for Fare Revision

This section reconciles the fare revision estimates from both the supply side considerations and the demand side considerations, to arrive at the most feasible and conservative fare revision estimate.

First, let us review the supply-side considerations:

As discussed in Section IV, the operating costs of the Concessionaire are included in the fare revision mechanism through a formula, which takes a weighted sum of growth in energy tariff, consumer price index (Telangana- Urban), and per km maintenance and other costs. According to this formula, the rate of supply-side fare increase per slab (SS %) =

SS% = [{(W1 [FEN – FE0]/FE0) + (W2 [CPIN – CPI0]/ CPI0) + (W3 [AMCN – AMC0]/AMC0)} X 100]

Where,

W1, W2, W3:	Weightage for energy, staff cost, and maintenance and other expenses based on audited accounts of the previous financial year of HMR i.e., the proportion of each item of expense with reference to energy + staff + maintenance & other costs
FEN:	Average unit cost of electricity at the time of current fare revision (As per TSERC per unit electricity tariff)
FE0:	Average unit cost of electricity at the time of last fare revision (As per TSERC per unit electricity tariff)
CPIN:	Latest consumer price index of Telangana (Urban) at the time of the current fare revision (As per Central Statistical Organization)
CPI0:	Consumer price index of Telangana (Urban) at the time of last fare revision (As per Central Statistical Organization)
AMCN:	Latest per KM maintenance & other costs (operating expenses excluding energy and staff cost) at the time of current fare revision (As per audited accounts)
AMC0:	Per KM maintenance & other costs (operating expenses excluding energy and staff cost) at the time of last fare revision (As per audited accounts)

According to this formula and associated calculations performed in Section IV, fare per slab should be increased by 41.25%.

Second, let us review the demand side considerations:

As discussed in Section V, an analysis of sensitivity of passenger demand to changes in metro fares, as well as information on the passengers' willingness to pay, has helped NCAER arrive at an appropriate demand side factor for each slab, termed as the 'Hyderabad Acceptance Factor' i.e. $\mathbf{H_A}$. The addition of $\mathbf{H_A}$ to the respective slab-wise base fare provides the value of demand-side (DD) fares.

DD = Base fare + H_A

Where,

H_A = Hyderabad Acceptance Factor. It is the average fare increase per slab acceptable to commuters, among those willing to continue travelling by metro if their fares increase (Rs.)

Base fare = Existing fare per slab (Rs.)

DD = Revised fare per slab (Rs.)

I) FARE REVISION- BALANCING SUPPLY AND DEMAND SIDE CONSIDERATIONS

Fare revisions can be implemented transparently and fairly, utilizing both the cost and affordability aspects. An average of the fare revision estimations – from the supply side and the demand side – can therefore help achieve the desired balance between the cost considerations of HMR and the willingness to pay of the commuters.

Fare revision for each slab= Average (SS, DD) = (SS + DD) / 2

Where,

SS = Supply side fare (in Rs.), after increasing the existing fare in each slab by the percentage derived from the supply-side formula (cost based), i.e. by SS%

DD = Demand side fare (in Rs.), estimated using the survey-based willingness to pay of metro commuters

According to this formula, the revised fare structure is presented in **Table 6.1**. Alternative fare structure with revised distance-slabs is presented in **Table 6.2**.

Table 6.1: Revised Fare Structure Based on Existing Fare Slabs (Option 1)

S.No.	Distance Travelled	Existing Fare (Rs.)	Supply Side Revised Fare (Rs.)	Average Fare Increase Acceptable (Rs.)	Demand Side Revised Fare (Rs.)	Balanced Revised Fare (Rs.)	Rounding-Off (Rs.)
	km	P1	SS= 41.25% increase on P1	HA	DD= P1 + HA	New fare= (SS+DD)/2	Multiple of five
1	Up to 2	10	14.1	3.1	13.1	13.6	15
2	> 2 to 4	15	21.2	4.7	19.7	20.4	20
3	>4 to 6	25	35.3	5.2	30.2	32.8	35
4	> 6 to 8	30	42.4	5.6	35.6	39.0	40
5	> 8 to 10	35	49.4	7.6	42.6	46.0	45
6	> 10 to 14	40	56.5	8.1	48.1	52.3	55
7	> 14 to 18	45	63.6	9.1	54.1	58.8	60
8	> 18 to 22	50	70.6	10.5	60.5	65.6	70
9	> 22 to 26	55	77.7	11.8	66.8	72.2	75
10	> 26	60	84.8	13.4	73.4	79.1	80
	Avg. fare	**36.5**					**50**
						% increase	**37%**

Source: Calculations on existing distance slabs and "**HA**" factor from NCAER survey.
Note: Metro fares are usually rounded off to multiples of 5.

Fare Structure with revised distance-wise slabs

The same method can be used to arrive at a fare structure, with slightly revised distance-wise slabs (**Table 6.2**). The slightly revised distance slabs help to reduce the incremental distance in the longer distances from 4 km to 3 km, thereby helping distribute the fares more evenly in the longer distance slabs. Although in both the cases, average fare increases by 37%.

Here, the supply side fare is arrived at by increasing the base fare for each slab by 41.25%. Hyderabad Acceptance Factor, H_A, is the average fare increase per distance-slab acceptable to commuters, among those willing to continue travelling by metro if their fares increase. The method of arriving at the 'balanced fare', accounting for the supply and demand side considerations, remains the same as that explicated in **Table 6.1** before.

Table 6.2: Revised Fare Structure with Proposed New Fare Slabs (Option 2)

S.No.	Distance Travelled	Existing Fare (Rs.)	Supply Side Revised Fare (Rs.)	Average Fare Increase Acceptable (Rs.)	Demand Side Revised Fare (Rs.)	Balanced Revised Fare (Rs.)	Rounding-Off (Rs.)
	km	P1	SS= 41.25% increase on P1	HA	DD= P1 + HA	New fare= (SS+DD)/2	Multiple of five
1	Up to 2	10	14.1	3.1	13.1	13.6	15
2	>2 to 4	15	21.2	4.7	19.7	20.4	20
3	>4 to 6	25	35.3	5.2	30.2	32.8	35
4	>6 to 9	32	45.0	6.4	38.4	41.8	45
5	>9 to 12	38	53.9	8.0	46.0	49.8	50
6	>12 to 15	41	58.5	8.4	49.4	53.7	55
7	>15 to 18	45	63.6	8.7	53.7	58.6	60
8	>18 to 21	50	70.6	10.7	60.7	65.7	65
9	>21 to 24	53	74.8	11.2	64.2	69.5	70
10	>24	57	80.8	12.9	69.9	75.2	80
	Avg Fare	**36.6**					**50.0**
						% increase	**37%**

Source: Calculations on revised distance slabs and "**HA**" factor from NCAER survey.
Note: Metro fares are usually rounded off to multiples of 5.

II) MODAL TIME-COST COMPARISON: AFTER PROPOSED INCREASE IN METRO FARES

Table 6.3 provides a comparison of HMR fares with other modes of transport in the city, at the existing metro fares and the proposed metro fares with a 37% increase. The results may be compared with Table 1.3, and continue to show that despite a 37% increase in HMR fares on average, commuting by metro will remain the fastest and one of the cheapest options available for commuters in Hyderabad (**Table 6.3**).

- Hired two-wheeler fares will be 2.5 times metro fares, auto fares 3.9 times metro fares, cab fares 6.1 times metro fares, on average.
- Bus fares will remain cheaper, yet the time taken by bus will be 2.2 times more than metro (maybe more if road congestion increases too)
- Time taken by hired two-wheelers will remain 1.3 times more than metro, by autos 1.6 times more than metro, and cab is 1.5 times more than metro, on average (maybe more if road congestion increases too).

Table 6.3: Time-Cost Comparison for Different Modes of Transport in Hyderabad

Mode	Fare Ratio Mode fare (Rs.) / Metro fare (Rs.) (At existing metro fare)	Fare Ratio Mode fare (Rs.) / Metro fare (Rs.) (with **37%** increase in metro fare)	Duration Ratio (Time taken by the mode (min) / Time taken by metro (min)
Hired two-wheelers	3.4	2.5	1.3
Auto	5.4	3.9	1.6
Cab	8.4	6.1	1.5
Metro Bus	0.9	0.7	2.2
Ordinary Bus	0.7	0.5	2.2

Source: NCAER Survey October 2022
Note: The fare and time taken by all modes (hired two-wheelers, auto, cab, bus and metro) is averaged over a sample of 15 routes (distances varying between 6 to 34 km).

III) DISCUSSION ON NON-FARE BOX REVENUE

Along with suggesting appropriate fare increases, the study also reviews non-fare box (i.e. non- tariff) revenue generating sources, which could be considered by the Concessionaire to achieve better operational and overall financial viability.

Mass Rapid Transit System (MRTS) is constructed as per the rules of at least Rs. 100 crore, Rs. 200 crore and Rs. 300 crore per km for at-grade, elevated, and underground metro networks in India, respectively, which is exorbitantly high. Recovering the entire cost of construction, operation, and maintenance from fare revenues would entail huge fares being collected from the commuters, much beyond reasonable fares, which becomes self-defeating for the purpose for which the metro has been developed. The metro is expected to offer faster, safe, sustainable, and reliable travel for commuters at a reasonable fare, while aiming to bring economic and social benefits in terms of reduced oil dependency, noise pollution, air pollution, congestion and accidents on the roads.

The Return on Investment (RoI) of any metro system therefore cannot be met with fare box revenue alone. Hence, non-fare box revenue generation has been an important source of income of many successful metro systems worldwide.

Performance matrix for non-fare box collection among metros

It is a fact that the financial burden of a metro would reduce substantially when the share of non-fare box revenue in the total revenue increases. There are no hard and fast rules to decide how far a metro system can generate non-fare box revenue out of its total revenue year-on-

year. Empirically, however, metro systems may be ranked for their non-fare box revenue generation into one of the following categories, based on its share of non-fare revenue in total revenue (**Table 6.4**).

Table 6.4: Non-Fare Box Performance

Share of non-fare box revenue in total revenue (%)	Metro's Performance	Remarks
>50%	Outstanding	Sustainability is the key as little more can be achieved in increasing non-fare box revenue.
40%-50%	Excellent	Although retaining the existing level of revenue is important, it is possible to increase the share of non- fare box revenue in total revenue up to 10%
30% - 40%	Good	Here non-fare box revenue is a good source of income. There is scope to increase the share of non-fare box revenue in total revenue up to 20%
20% -30%	Aspirational	Aiming to generate more non-fare box revenue and hence it is aspirational. There is a big scope to increase the share of non-fare box revenue in total revenue up to 30%
10% - 20%	Less Aspirational	Non fare box collection has picked up but a long way to go
<10%	Non-starter	Non fare box collection is at a nascent stage and hence a long way to go

Source: NCAER Analysis

There are essentially two sources of non-fare box revenue for Metro rail systems worldwide: the source of income from real estate development and commercial sources such as advertisements. While there are huge differences across metros on how much non-fare box revenue contributes to the total revenue; it is about 25% to 60% globally and about 10% -20% in India.

Performance of Hyderabad metro in non-fare box collection

Hyderabad metro began operations in November 2017. Within two and a half years of its operations, metro operations had to be scaled down for two consecutive years due to the COVID-19 pandemic. For generating revenue from fare box and non-fare box sources, a continuous ramp-up period of three to five years is required. Since HMR did not get such a continuous ramp-up period, the performance of HMR in generating non-fare box revenue is to be seen in that context.

For instance, HMR's average traffic per day increased to 2.76 lakh in FY 2019-20 when the entire network of 69.2 km was opened for operations, falling to 1.15 lakh in FY 2020-21 and picking up to 1.55 lakh in FY 2021-22. In this backdrop, it is not wise to measure the growth of non-fare box revenue since the beginning of operations, as this would give a distorted picture.

According to the data provided by HMR, non-tariff revenue was Rs. 137.25 crore against the tariff revenue of Rs. 201.39 crore in FY 2021-22. Non-tariff revenue therefore constituted 40.53% of the total revenue in FY 2021-22. Considering the non-tariff revenue collections until the first half of FY 2022-23, non-tariff revenue for the current financial year may reach Rs. 200 crore. With the revision of fares and expected increase in ridership in the last two quarters

of FY 2022-23, the contribution of fare box and non-fare box revenue may increase significantly and change their proportion of contribution to the overall revenue considerably.

Detailed analysis of HMR's non-fare box revenue generation

There are essentially three areas from which HMR generates its non-fare box revenue: Transit Oriented Development (TOD), advertisements, and station retailing. Based on the data of the first six months of FY2022-23, HMR is projected to generate a revenue of about Rs. 112 crore, Rs. 60 crore, and Rs. 7 crore from TOD, advertisements, and station retailing respectively.

a) Non-fare Box Revenue from Transit Oriented Development (TOD)

The space available for HMR's Transit Oriented Development is up to 18.5 million square feet on all land parcels (**Annexure 10**), out of which 30% is allotted next to depots located in peripheral areas of the city where real estate demand is very low. The usable space for development is only about 12 million square feet. HMR has spent Rs. 1100 crore to develop 1.85 million square feet of TOD, from which it generates an Internal Rate of Return of 14% - 15%. Details of TOD and revenue in the first half of FY 2022-23 are given below (**Table 6.5**).

Table 6.5: Transit Oriented Development (Apr – Sept 2022)

	Revenue (in Rs. Crore)						
MALL NAME	**Apl'22**	**May'22**	**June'22**	**July'22**	**Aug'22**	**Sept'22**	**Total**
Punjagutta Mall & Office	5.15	5.19	4.98	5.09	5.12	5.55	31.08
HITEC City Mall	0.81	0.82	0.84	0.85	0.84	0.85	5.01
Irrum Manzil Mall	1.73	1.65	1.74	1.72	1.70	1.68	10.22
Musarambagh Mall	1.60	1.66	1.65	1.71	1.63	1.46	9.71
	9.29	**9.32**	**9.21**	**9.37**	**9.29**	**9.54**	**56.02**

Source: HMR

To create additional TOD of about 10 million square feet, HMR may have to invest about Rs. 10,000 crore, given the double digit wholesale price index (WPI) inflation in FY2020-21 and FY2021-22, and first half of FY2022-23.

There are essentially two dimensions to developing additional TOD:

1. The first dimension is the appetite for physical space for retailing and office work, given the drastic changes in the way people shop and work after the pandemic, and hence the sustainability of this method of generating revenues.
2. The second dimension is in terms of the huge investment to be made by HMR, which has already invested about Rs. 1100 crore to develop Hyderabad metro, while debt servicing remains a major concern.

b) Non-fare Box Revenue from Advertising

HMR's efforts to generate non-fare box revenue from various advertising avenues is given in Table 6.6.

Table 6.6: Advertising Revenue for FY 2022-23

Categories	Advertising Medium	Revenue Budget FY'22-23 (Rs. Cr.)	Revenue Apr-Sep'22 (Rs. Cr.)	% of Total Inventory Contracted	Estimated Annual Revenue from Balance Inventory (Rs. Cr.)
Standalone Advertising	Piers	22.26	12.7	92%	1.1
Outside Station	Portals & Point of Beginning	4.38	2.8	100%	0.0
Rights Business	Viaduct Parapet	2.99	0.0	100%	0.0
Ambient Media	Central Medians	0.15	0.1	100%	0.0
Inside Station	Station Exteriors (Lift Walls, Station Façade, Station Piers, Foot over bridges, Walkways, Staircase Pillars (Street Level))	13.83	2.1	100%	0.0

Train Advertisement	Station Naming Rights	13.97	2.0	5%	38.9
Inside Station	Pouring Rights	0.57	0.3	100%	0.0
Train Advertisement	Inside Station	0.75	0.0	2%	0.9
Train Advertisement	Outside Station	0.75	0.0	0%	0.9
	Inside Station Static Advt.	3.00	1.5	100%	0.0
	Inside Station Digital	3.85	1.1	30%	2.6
	Experiential Marketing	0.36	0.1	100%	0.0
	Train Wraps	15.16	6.0	100%	0.0
	Inside Train Static				
	Inside Train Digital	4.81	1.4	100%	0.0
	Audio Advertisement	1.51	0.1	3%	3.0
		88.35	**30.21**		**47.35**

Source: HMR
Note: HMR is expecting to lease 100% balance inventory in 5- 6 years' time.

The above table shows that HMR has already tapped most of the advertising avenues for non- fare box revenue. Significant sources of revenue include advertising on piers and through train wraps. Station naming rights is a tricky avenue, as only when a well-established firm in the vicinity of the station finds value, in addition to its firm's branding, it may come forward to adopt the station.

With the change in people's habits, where most of them are screen-locked even during travel and outings, the sustainability of physical advertising is to be seen over the next few years. Given that the revenue generated is expected to reach about Rs. 60 crore in FY2022-23 (unless otherwise there is an appetite on station naming from firms), the maximum potential for revenue generation from advertising has almost been reached.

c) Non-fare Box Revenue from Station Retailing

Revenue from station retailing may reach Rs. 7 crore in FY 2022-23 (**Table 6.7**). The existing regulations restrict station retail space to 20 per cent of the total station space, to ensure clear and broad passage for passengers to enter and exit without congestion. Although station retailing developed by LTMRHL is essentially outside the entry and exit points and can therefore be accessed by everyone (including non-metro commuters); by developing retail space on street level below stations, HMRL has been competing with LTMRHL in the retail space.

When ridership increases substantially, revenue from retailing may also increase.

Table 6.7: Non-fare Box Revenue from Station Retailing

Station Retail	Revenue Budget FY'22-23 (Rs. Cr.)	Revenue Apr-Sep'22 (Rs. Cr.)	% of Total Inventory Contracted	Estimated Annual Revenue from Balance Inventory (Rs. Cr.)
Paid Area	8.89	3.35	59.3%	14.8
Unpaid Area			7.9%	

Source: HMR

Performance of HMR VS other Metros for non-fare box revenue generation

The performance of HMR with some other Metros in India and across the globe would give the right perspective of where HMR stands in terms of its performance in non-fare revenue generation, and to chart out a future course of action on enhancing non-fare box revenue (**Table 6.8**).

Table 6.8: Non-fare Revenue Generation of HMR VS Other Metros

Share of non-fare box revenue in total revenue (%)	Metro's Performance	Metro System (% share of Non-Fare Box Revenue and year)
>50%	Outstanding	Hong Kong (56% for FY 2019)
40%-50%	Excellent	Hyderabad (40.50% for FY 2021-22)
30% - 40%	Good	Delhi (37% for FY 2019-20)
20% -30%	Aspirational	Singapore (28% for FY 2016)
10% - 20%	Less Aspirational	Chennai (16%), Mumbai (14%) & Transport for London (11%) (all for FY 2019-20)
<10%	Non-starter	Bengaluru (9% for FY 2019-20)

Source: NCAER Analysis using data from UTIP 2021

HMR may be ranked in the category of 'Excellent' and has scope to move towards 'Outstanding' by generating non-fare box revenue of more than 50%.

Way forward for non-fare revenue generation

HMR has achieved spectacular success in generating non-fare box revenue, with its efforts in all three avenues of non-fare box generation: TOD, advertising, and station retail. There are some constraints, such as the new Greater Hyderabad Municipal Corporation (GHMC) rules limiting the height of advertisements to 15 feet from ground level and higher advertisement fees/tax for advertising on Hyderabad metro's advertising media.

Since HMR is designed and operated as an elevated system, the new GHMC rule affects the opportunity for augmenting its non-fare box revenue generation and the fare fixation committee should consider relaxing the rule for Hyderabad metro.

HMR can strive for a balance between fare box revenue and non-fare box revenue evenly at about 50:50. Trying to generate significantly more than 50 per cent from non-fare box revenue can entail huge additional upfront investment and thereby increasing the debt burden and debt servicing of HMR.

The better way forward for is to ramp-up ridership by achieving significant improvement in first and last mile connectivity[23], providing parking facilities at more stations and enhancing parking at existing stations, and running metro trains at a higher frequency or introducing more coaches to the existing three coach trains to help reduce over-crowding in the metro. As seen in the survey results too, the aforementioned three points are the top conditions on which the non-metro commuters will be willing to shift to travelling by the metro for their regular commute (data analysis detailed in **Section V (iv)** and in **Annexure 9**). HMR can even consider introducing first-class seater coach with higher fares.

These measures would help increase metro ridership, and the increased footfall will in turn help increase non-fare box revenue. The way forward for HMR is to gradually ramp-up non- fare box revenue so that it does not fall back below 50 per cent of the total revenue it generates.

[23]Either buses run by HMR, or even e-rickshaws run by self-help women groups supported by Telangana government.

SECTION VII

Conclusion and Way Forward

Benefits of the metro system go beyond its direct users, which enhances social paybacks (reducing pollution and road congestion). Increased passenger kilometers travelled per unit length (km) of the operational track enhances efficiency gains in terms of mitigating overall cost and increases the social benefit.

Since the commencement of metro operations in Hyderabad, there has been no revision in the fare structure of HMR, while the costs of operations have significantly increased.

Consultancy studies had estimated the ridership and revenue of HMR prior to beginning of operations, on the basis of which the initial fares of HMR were fixed over the existing distance- wise fare slabs. However, various factors have impacted the ability of HMR to generate revenue. Cost pressures have simultaneously increased. In turn, the optimality of initial fares, over the existing distance-wise slabs, may too be questioned. The operational difficulties being faced by HMR is therefore a matter of concern. A suitable fare revision and rationalization, which can help recover the actual operating expenses of HMR at the least, can help the metro services achieve durability success.

In light of the above, HMR is seeking a fare revision for Hyderabad metro.

Utilizing the audited financial accounts of the Concessionaire and the estimates of consumer price inflation and electricity tariffs, the suggested formula reveals the percentage increase in fares which should be applicable for HMR.

To assess acceptability with the commuters, a primary survey was conducted in Hyderabad.

Comparison and reconciliation of the fare revision estimates derived from the supply side (i.e. NCAER fare revision formula discussed in **Section IV**) and the demand side (i.e. survey results and affordability aspects discussed in **Section V**) have helped arrive at a conservative and balanced revised fare structure for HMR (**Section VI**).

We hope that this exhaustive exercise will help HMR in generating higher tariff (and non-tariff revenue) to meet their costs, while not putting excessive burden on the commuters, else the metro may no longer remain affordable for the general public.

I) SUGGESTION FOR FUTURE FARE REVISIONS

Fare revision for period 2017-18 to 2021-22

'Hyderabad Acceptance Factor' has been incorporated in the proposed first round of fare revision for HMR. According to the rounded-off revised fare structure, the average fare is Rs.50 (see **Section VI (i), Tables 6.1 and 6.2**). This represents an increase of 37% over the existing average fare of Rs.36.5.

Therefore, for first round of fare revision, for the period from 2017-18 to 2021-22, it is proposed to increase the fare by 37% over the existing average fare (36.5), which corresponds to about 6.5% (CAGR) increase on year-on-year basis.

Future fare revisions for the period 2022-23 to 2027-28

A fare increase of 37% over five years (2017-2022) translates into a Compounded Annual Growth Rate (CAGR) of 6.5% (rounded-off to 7%). As noted in **Section V**, during the same comparable period, CAGR of per capita income of Telangana was 11.8%.

Considering that the CAGR of 7% represents an annual rate of fare increase, which subsumes both the supply and demand side aspects, future fare revisions may be undertaken as follows:

1. Calculate fare increase per slab using the supply side formula (see **Section IV**), which incorporates weighted changes in energy, staff, and O&M costs. Say this value is SS%.

   $SS\% = \{(W_1 [FE_N - FE_0]/FE_0) + (W2 [CPI_N - CPI_0]/ CPI_0) + (W_3 [AMC_N - AMC_0]/AMC_0)\} X 100$

2. Compare SS% with CAGR of 7%

3. Fare revision rate = Minimum of (SS%, CAGR of 7%)

The above implies that HMR fares may be revised using the percentage increase derived from the supply side formula, or by maximum CAGR of 7%, whichever is lower. The safeguard (which is the upper bound of 7%), is suggested to be valid for five years, i.e. until FY 2027-28.

Annual revision of fares based on the suggested formula would help to keep any changes in the fare structure small and more or less in line with the underlying inflation in the city – thereby not affecting the commuters significantly, while also keeping pace with changes in operating costs of the metro system.

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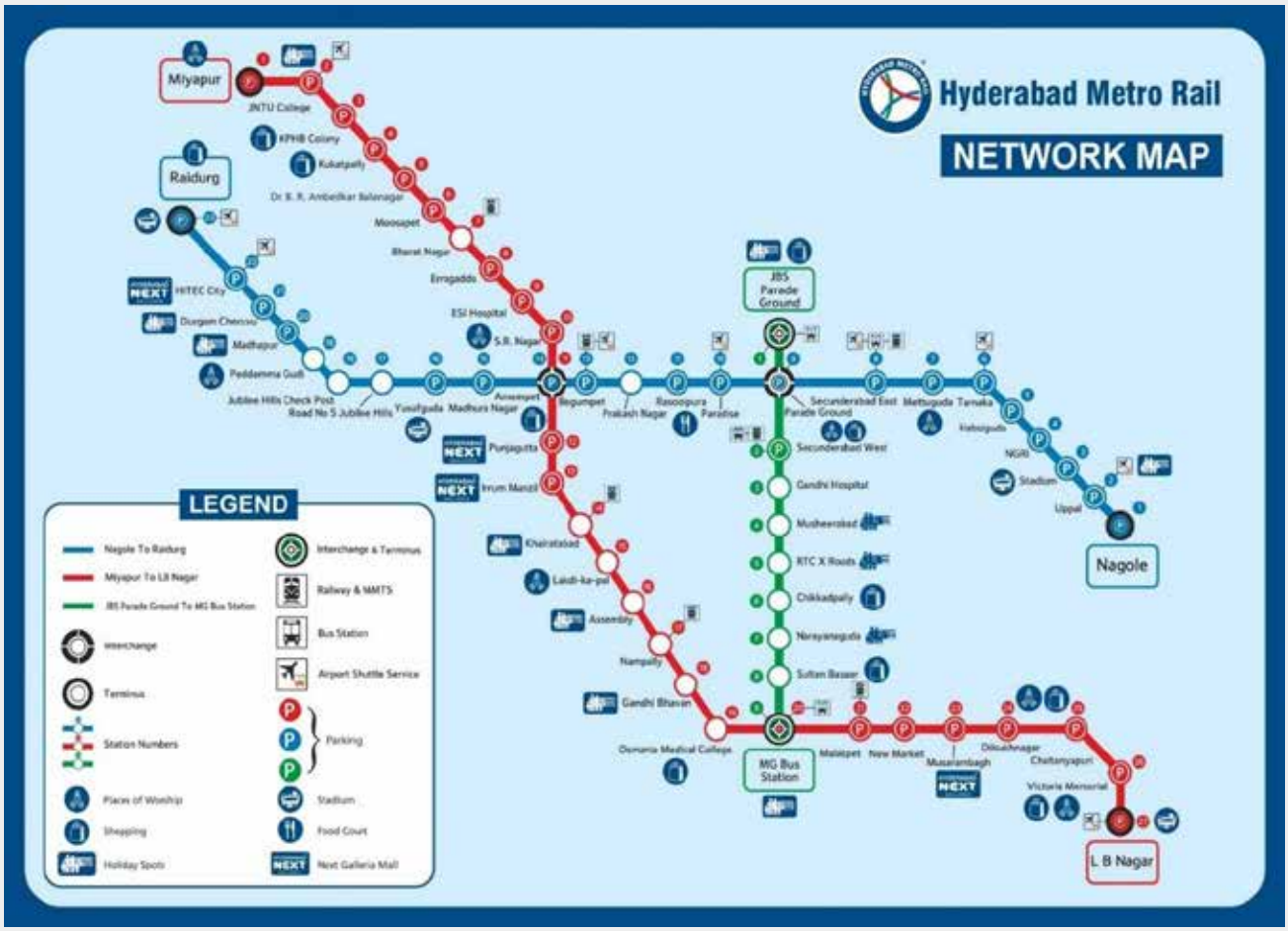
Annexures

ANNEXURE 1: HYDERABAD METRO RAIL NETWORK MAP



Source: HMR (Data as of Aug. 2022)

Daily Average Ridership

3,52,000 passengers

Metro Connectivity

Nagole – Raidurg	27.5 km
LB Nagar – Miyapur	29.2 km
MGBS – JBS Parade Ground	9.6 km

- Maximum Train Speed 80 kmph
- Average Train Speed 35 kmph

Multimodal Integration

1. Skywalks : Malls, SEZs, Railways
2. Parking Development
3. First & Last Mile Solutions

Ongoing Offer

Super Saver 59 Offer : Metro HOLIDAY Card

ANNEXURE 2A: MODE-WISE COMPARISON- COST AND TIME

Route	Corridor	Fare (Rs.)						Duration (Minutes)				
Origin-Destination	Metro Line	Two-wheeler	Auto	Cab	Metro	Metro bus	Ordinary Bus	Two-wheeler	Auto	Cab	Metro	Bus Metro/ ordinary
Sultan Bazar- Secunderabad West	GREEN	63.2	125.2	212.4	30	30	20	23.0	27.8	25.5	10	25
Ameerpet-Secunderabad	BLUE	64.2	136.2	225.6	30	25	15	20.3	23.5	22.5	16	36
Secunderabad West- MGBS	GREEN	68.6	143.3	237.7	30	30	20	26.0	30.3	28.8	14	51
Parade Ground-MGBS	GREEN	79.4	155.3	242.1	35	30	20	29.5	35.8	33.5	34	56
Ameerpet-Raidurg	BLUE	97.1	168.8	282.2	40	30	20	27.0	33.8	30.5	23	67
LB Nagar-Lakdikapool	RED	128.4	197.5	297.3	40	40	30	35.8	43.5	41.0	27	51
Secunderabad-KPHB Col	INTER	149.8	225.6	353.2	45	35	30	38.8	46.3	44.5	32	72
LB Nagar-Khairatabad	RED	134.6	198.1	336.2	40	40	35	42.3	49.8	47.3	29	61
LB Nagar-Punjagutta	RED	156.5	232.7	377.9	45	45	40	47.5	57.5	53.3	33	69
JNTU College- Secunderabad	INTER	160.4	230.9	354.4	45	40	30	41.0	47.5	46.5	34	69
Secunderabad-Raidurg	BLUE	164.4	249.2	408.0	45	35	30	47.0	57.5	54.8	36	78
Secunderabad-Miyapur	INTER	184.2	278.6	417.8	50	45	35	48.8	56.3	55.8	38	76
LB Nagar-Miyapur	RED	297.9	447.7	592.2	60	60	50	75.5	81.8	82.3	58	108

Source: NCAER Survey, October 2022

Notes: For the same route, metro fares are comparable to metro bus, and are lower than hired two/four wheelers and autos. Time taken by metro is lesser than road based modes. Ordinary bus is cheaper than metro, but time taken by bus is longer. **AC Bus fare is 2 times as expensive as Metro though presently Operations are curtailed.**

ANNEXURE 2B: MODE-WISE COMPARISON-DISTANCE AND TIME-VALUE

Route	Corridor	Distance (km)		Value of Time (Rs. / hour)			
Origin-Destination	Metro Line	By Road	By Metro	Two Wheeler	Auto	Cab	Metro
Sultan Bazar-Secunderabad West	GREEN	7.5	6.4	164.9	270.7	499.8	180.0
Ameerpet-Secunderabad	BLUE	8.0	8.0	190.2	347.8	601.7	112.5
Secunderabad West-MGBS	GREEN	9.0	7.1	158.3	284.3	496.2	128.6
Parade Ground-MGBS	GREEN	9.6	8.4	161.5	260.6	433.6	61.8
Ameerpet-Raidurg	BLUE	9.7	10.0	215.8	300.1	555.1	104.3
LB Nagar-Lakdikapool	RED	13.3	12.3	215.5	272.5	435.1	88.9
Secunderabad-KPHB Col	INTER	14.0	16.1	232.0	292.6	476.2	84.4
LB Nagar-Khairatabad	RED	14.4	13.4	191.1	239.0	426.9	82.8
LB Nagar-Punjagutta	RED	16.4	15.5	197.7	242.8	425.8	81.8
JNTU College-Secunderabad	INTER	16.4	17.5	234.8	291.7	457.3	79.4
Secunderabad-Raidurg	BLUE	17.1	17.9	209.9	260.0	447.1	75.0
Secunderabad-Miyapur	INTER	18.9	19.3	226.7	297.2	449.7	78.9
LB Nagar-Miyapur	RED	33.1	28.0	236.7	328.6	432.0	62.1

Source: NCAER calculations based on survey conducted in Hyderabad in October 2022

Notes: For comparable distance, time taken by metro is lesser than road based modes. Yet, the time value (Rs/ hour) is lesser than two/ four wheeler cabs or auto – implying that metro is cheaper. **Bus is slightly cheaper than metro, but time taken by bus is much longer. Comfort is also lower. Hence, ordinary and Metro bus services comparison not considered**.

ANNEXURE 3: FINANCIAL PERFORMANCE OF THE OPERATOR (LTMRHL)

Particulars (Rs. Cr)	FY18	FY19	FY20	FY21	FY22	H1 FY23	FY23 (E)	FY24 (E)
Average Ridership Per Day	*67,346*	*126,208*	*275,514*	*67,168*	*154,633*	*320,342*	*357,168*	*431,206*
Revenue	**70**	**318**	**598**	**228**	**357**	**317**	**711**	**690**
Operating Cost	**61**	**188**	**292**	**272**	**320**	**193**	**419**	**454**
Energy Cost	5	35	59	39	54	40	74	62
Staff Expenses	5	52	71	78	87	52	112	128
Other O&M Cost	51	101	162	155	179	101	233	265
Operating Profit	**9**	**130**	**306**	**-44**	**37**	**124**	**292**	**236**
Depreciation & Amortization	17	62	146	299	307	157	314	276
PBIT	**-8**	**68**	**160**	**-342**	**-270**	**-33**	**-22**	**-40**
Interest & taxes	51	215	543	1,425	1,477	617	1,374	1,140
PAT	**-58**	**-147**	**-382**	**-1,767**	**-1,746**	**-651**	**-1,396**	**-1,180**
Cumulative PAT	**-58**	**-205**	**-587**	**-2,354**	**-4,100**	**-4,751**	**-5,496**	**-6,676**

Source: Operator's financials (L&T Metro Rail (Hyderabad) Limited, LTMRHL)
Note: Accumulated loss since commencement of operations= Rs. 4,751 crore (until first half, i.e. H1, of FY 2022-23) PBIT: Profit before Interest and Taxes; PAT: Profit after Tax; E: Estimated figures (for FY 2023 and FY 2024)

ANNEXURE 4: FARE REVISION AS PER CONCESSION AGREEMENT (CA) (IN RS.)

Distance Travelled (Km)	Actual Fare Implemented in 2017	25% increase in Base fare @ 5% escalation each year (b)	Fare to be charged as per CA Formula in FY 23	Modified fare as per CA formula Nearest off "5"
Upto 2	10	13	15	15
More than 2 and up to 4	15	19	23	25
More than 4 and up to 6	25	31	38	40
More than 6 and up to 8	30	38	45	45
More than 8 and up to 10	35	44	53	55
More than 10 and up to 14	40	50	60	60
More than 14 and up to 18	45	56	68	70
More than 18 and up to 22	50	63	75	75
More than 22 and up to 26	55	69	83	85
More than 26	60	75	90	90

Source: NCAER calculations, using the fare revision formula provided in the concession agreement

CA Formula:

Fare= b+ {b* (WPI_N/WPI_O) - b} *0.6

Where,

b: fare rates with 25% increase on the actual fares implemented in 2017 WPI_N: 153.8 (Jul-22 for year of current fare revision)

WPI_O: 114.8 (Aug-17 for base WPI reference)

ANNEXURE 5: COST VS REVENUE OF HYDERABAD METRO RAIL (IN RS. CRORE, 2021-22)

Operating Cost	Net Outflow	Total Recoverable Cost	Total Revenue	Non-Tariff Revenue	Tariff Revenue
320.16	1072	1438	338.64	137.25	201.39

Source: Audited financial accounts of the Concessionaire

Notes: Net outflow= Operating cost + Repayment with interest – Non tariff revenue - Tax shield; Total recoverable cost= Net outflow + cost of equity; Total revenue= Tariff + non-tariff revenue

Observations:

- Total revenue (tariff and non-tariff revenue) exceeds operating costs
- Tariff revenue covers 18.78% of net outflow. If fare is doubled, assuming perfectly inelastic passenger demand, tariff revenue will double but will still be a fraction of the net outflow
- Tariff revenue covers only 14 % of total recoverable cost

ANNEXURE 6: SUPPORTING DATA FOR SUPPLY SIDE FARE REVISION CALCULATIONS

Annexure 6A: Audited Financials 2017-18: Schedules 25, 26, 27

L&T Metro Rail (Hyderabad) Limited
Statement of Profit and loss for the year ended March 31, 2018

Particulars	Note No	2017-18	2016-17
INCOME			
Revenue from Operations	23	62,65,78,342	10,05,54,747
Construction contract revenue		13,46,05,28,715	15,62,93,87,902
Other income	24	6,86,91,251	9,12,63,589
Total Income		**14,15,57,98,308**	**15,82,12,06,238**
EXPENSES			
Construction contract expenses		13,46,05,28,715	15,62,93,87,902
Operating expenses	25	41,06,60,612	1,96,35,197
Employee benefit expenses	26	5,06,80,056	2,20,17,143
Administration and other expenses	27	14,46,76,858	4,97,79,147
Finance costs	28	50,58,66,760	4,90,23,585
Depreciation and amortisation		16,69,85,670	1,60,05,920
Total Expenses		**14,73,93,98,671**	**15,78,58,48,895**
Profit/(loss) before tax		(58,36,00,362)	3,53,57,344
Tax Expense:			
Current tax		-	80,88,253
Income tax of previous year		-	8,89,732
Deferred tax		(23,238)	(18,28,707)
		(23,238)	71,49,278
Profit/(loss) after tax for the year		**(58,35,77,124)**	**2,82,08,066**
Other Comprehensive Income			
Items that will be reclassified to Profit & Loss			
Changes in fair value of cash flow hedges		19,14,80,110	(25,91,89,873)
Total Comprehensive Income for the year		**(39,20,97,014)**	**(23,09,81,808)**
Earnings per equity share (Basic and Diluted)	29.8	(0.195)	0.014
Face value per equity share		10.00	10.00
Other notes forming part of accounts	29		
Significant accounting policies	30		

As per our report attached
For M.K Dandeker & Co.,

Firm registration number : 000679S
Chartered Accountants
by the hand of

S.Poosaidurai
Partner
Membership No : 223754

Place : Hyderabad
Date : 30-05-2018

For and on behalf of the board of directors of L&T Metro Rail (Hyderabad) Limited

K.V.B.Reddy
[Managing Director & Chief executive officer]
DIN No: 01683467

R. Shankar Raman
[Director]
DIN No: 00019798

J.Ravi Kumar
[Chief Financial Officer]
Membership No: 023240

CHANDRACHUD D PAUNAL
[Company Secretary]
Membership No: F5579

Place : Hyderabad
Date : 02-05-2018

Source: LTMRHL Financial Report 2017-18, p.2

Note: The sum of schedules 25, 26 and 27 equals the total operating costs for FY2017-18, including energy, staff and O&M costs, used in Table 3. The sub-schedules are available on p.19.

ANNEXURE 6A: AUDITED FINANCIALS 2021-22: SCHEDULES 21, 22, 23

L&T Metro Rail (Hyderabad) Limited
Statement of Profit and loss for the year ended March 31, 2022

₹ Crore

Particulars	Note No	2021-22	2020-21
INCOME			
Revenue from operations	19	338.64	189.61
Construction contract revenue		118.23	158.08
Other income	20	18.50	38.33
Total Income		475.37	386.02
EXPENSES			
Construction contract expenses		118.23	158.08
Operating expenses	21	259.64	211.93
Employee benefit expenses	22	27.30	28.31
Administration and other expenses	23	33.22	31.48
Finance costs	24	1,476.56	1,424.48
Depreciation and amortisation		306.63	298.49
Total Expenses		2,221.58	2,152.77
Profit/(loss) before tax for the year		(1,746.21)	(1,766.75)
Tax Expense:			
Current tax		-	-
Adjustments relating to earlier years		(0.36)	
Deferred tax		-	-
		(0.36)	-
Profit/(loss) after tax for the year		(1,745.85)	(1,766.75)
Other Comprehensive Income			
Items that will not be reclassified to Profit & Loss			
Gain/(loss) on remeasurement of defined benefit plans		0.51	-
Total Comprehensive Income for the year		(1,745.34)	(1,766.75)
Earnings per equity share	25.9		
Basic & Diluted		(7.16)	(7.24)
Face value per equity share		10.00	10.00
Notes forming part of the Financial Statements	1 to 25		
Significant accounting policies	26		

As per our report attached
For M.Bhaskara Rao & Co.,
Chartered Accountants
Firm registration number : 000459S

M.V.Ramana Murthy
Partner
Membership No.206439

Place : Hyderabad
Date : 25.04.2022

For and on behalf of the Board of Directors of
L&T Metro Rail (Hydcrabad) Limited

K.V.B.Reddy
[Managing Director &
Chief Executive Officer]
DIN No: 01683467

Rahul Nilosey
[Chief Financial Officer]

[Director] N.V.S.Reddy
DIN No: 01414254

Chandrachud D Paliwal
[Company Secretary]
Membership No: F5577

Place : Hyderabad
Date : 25.04.2022

Source: LTMRHL Audited Financial Report 2021-22, p.2

Note: The sum of schedules 21, 22 and 23 equals the total operating costs for FY2021-22, including energy, staff and O&M costs, used in Table 3. The sub-schedules are available on p.17 (LTMRHL has informed that expenses incurred on Keolis staff are also included in staff costs, and are accounted under schedule 21).

ANNEXURE 6B: ELECTRICITY TARIFF RATE

TSERC

Schedule 1

Consumer Category	Current Tariffs			Proposed Tariffs			Commission determined Tariffs		
	Fixed/Demand Charge		Energy Charge	Fixed/Demand Charge		Energy Charge	Fixed/Demand Charge		Energy Charge
	Unit	Rs./Unit/ Month	Rs./kWh / Rs./kVAh	Unit	Rs./Unit/ Month	Rs./kWh / Rs./kVAh	Unit	Rs./Unit /Month	Rs./kWh / Rs./kVAh
33 kV			7.85			8.85			8.85
132 kV and above			7.45			8.45			8.45
HT III: Time of Day Tariffs (10 PM to 6 AM)									
11 kV			6.50			8.00			7.50
33 kV			5.85			7.35			6.85
132 kV and above			5.45			6.95			6.45
HT IV (A): Irrigation and Agriculture									
11 kV	kVA	165	5.80	kVA	275	6.30	kVA	275	6.30
33 kV	kVA	165	5.80	kVA	275	6.30	kVA	275	6.30
132 kV and above	kVA	165	5.80	kVA	275	6.30	kVA	275	6.30
HT IV (B): CPWS Schemes									
11 kV	kVA		5.10	kVA		6.10	kVA		6.10
33 kV	kVA		5.10	kVA		6.10	kVA		6.10
132 kV and above	kVA		5.10	kVA		6.10	kVA		6.10
HT V (A): Railway Traction	kVA	390	4.05	kVA	475	5.05	kVA	475	5.05
HT V (B): HMR	kVA	390	3.95	kVA	475	4.95	kVA	475	4.95
HT VI: Townships and Residential Colonies									
11 kV	kVA	60	6.30	kVA	260	7.30	kVA	260	7.30
33 kV	kVA	60	6.30	kVA	260	7.30	kVA	260	7.30
132 kV and above	kVA	60	6.30	kVA	260	7.30	kVA	260	7.30
HT VII: Temporary									
11 kV	kVA	500	10.80	kVA	500	11.80	kVA	500	11.80
33 kV	kVA	500	10.00	kVA	500	11.00	kVA	500	11.00
132 kV and above	kVA	500	9.80	kVA	500	10.80	kVA	500	10.80

Source: Telangana State Electricity Regulatory Commission's Public Notice, released on 23 March 2022, p.14. Under HT V (B) HMR: Energy charge has gone up from Rs.3.95/kVA to Rs.4.95/kVA. (https://tserc.gov.in/file_upload/uploads/Public%20Notice/Public%20Notices/2022/Press%20Note%20and%20schedule%20Retail%20Supply%20Tariffs%20for%20FY%202022-23.pdf)

ANNEXURE 6C: CONSUMER PRICE INFLATION (CPI), TELANGANA- URBAN

Month	FY 2017-18	FY 2021-22
Apr	132.1	161.6
May	131.9	163
Jun	131.9	163.6
Jul	134.7	165.6
Aug	134.6	166.5
Sep	133.5	166.8
Oct	134.8	168.8
Nov	136.9	170.2
Dec	135.4	169.6
Jan	135.3	169.3
Feb	135.6	169.8
Mar	134.8	171
Average	**134.3**	**167.2**

Source: Ministry of Statistics and Programme Implementation, Central Statistical Organization (https://mospi.gov.in/web/mospi/press-release1)

Note: Percentage change in average value of CPI over 2017-18 and 2021-22 is 24.5%.

ANNEXURE 7: SAMPLING METHODOLOGY ADOPTED BY NCAER

Based on passenger footfall, we have stratified all 57 metro stations into three groups:

1. Highly crowded
2. Medium crowded
3. Less crowded

A total of 10 stations have been allocated among these three categories in the following manner:

1. Highly crowded: 4 metro stations
2. Medium crowded: 3 metro stations
3. Less crowded: 3 metro stations

S.No.	Corridor No.	Description	Station Name
1	3	Highly crowded	Parade Ground
2	1		KPHB Colony
3	3		Raidurg
4	Interchange of 1 & 3		Ameerpet
5	3	Medium Crowded	Nagole
6	1		Irrum Manzil
7	3		Paradise
8	3	Less crowded	Jubilee Hills Checkpost
9	2		RTC X Road
10	2		Narayanaguda

For Metro commuters

We did the survey in 4 days (2 peak days + 2 lean days) in a week. The selected days were Monday, Tuesday, Friday, and Sunday.

On a particular day, the survey was conducted in 4-time slots (2 peak hours + 2 lean hours)

	Timings	
Peak-hours	8.30 am to 10.30 am	6pm to 8 pm
Lean-hours	6.00 am to 8 am	12.30 pm to 2.30 pm

In each time slot (for all selected stations), 8 to 9 passengers were surveyed.

- 4 to 5 exit passengers and 4 to 5 boarding/inbound passengers.
- So, altogether from 10 stations, there were **1383** passengers

The sample design for metro commuters' survey can be summarized as follows:

Number of stations	Number of days	Number of time slots	Number of passengers per time slot [4/5 entry (2 male and 2 female) and 4/5 exit (2 male and 2 female)]	Total Survey Sample (No.)
10	4	4	8 to 9	1383

For Non-Metro commuters

We also conducted a survey of individuals whose regular mode of travel is:

1. Two wheeler
2. Four wheeler
3. Bus (AC)
4. Bus (Non-AC)
5. Auto
6. Cab services

Here too, we decided to do the survey in 4 days (2 peak hours + 2 lean hours) in a week.

On a given day from a particular station route (out of 10 selected stations), 4 to 5 individuals were surveyed from each mode of travel. Altogether from 10 stations, we had **1134** respondents.

The sample design for the non-metro commuters' survey can be summarized as follows:

Number of stations	Number of days	Number of options for mode of travel	Number of passengers for each mode of travel 4 [2 male, 2 Female]	Total Survey Sample (No.)
10	4	6	4 to 5	1134

ANNEXURE 8: SURVEY QUESTIONNAIRES

8A) Survey- Metro Commuters

Participant Information Sheet

You are invited to participate in a survey to assess mode choice of commuters in Hyderabad. This is being conducted in the background of a proposed fare revision of Hyderabad metro rail and the changing time-cost of travel across different modes of transport in Hyderabad.

The survey is being conducted by National Council of Applied Economic Research (NCAER), a premier economic policy think-tank based in New Delhi. NCAER has imparted extensive training to the interviewers who will be conducting this survey.

The names and contact details of all interviewers are available with NCAER. Each of them is authorized by Hyderabad Metro Rail to conduct this survey, and carry an identity card which you may request to check.

This short survey includes 12 questions. The information will help us understand commuter's profile, their reasons for commuting by their preferred mode of transport, and how the change in time-cost of travel affects the commuter's choice of transport mode. Your answers will be recorded electronically, using Google form. By this method, the data will be collected securely, in real-time, and will directly reach the principal investigator of the survey at NCAER.

Your name will be asked as a part of the survey. No other personal data or identifiers will be recorded. The information you provide will be kept confidential and anonymized for further analysis.

Participation in the survey is voluntary and the responses will be recorded with your consent. You may withdraw your consent to participate anytime during the survey.

For further information, you may contact NCAER. Their contact details are available on their website www.ncaer.org

QUESTIONNAIRE: METRO COMMUTERS

Date: ……..…. Day: ……..…. Time: ……..….

Corridor: ……..... Station: ……..... Direction of travel: Home-bound / work-bound

Name of the Enumerator: ……..……..…… ……..….

Mobile no.: ……..... Name of the Respondent: ……..…….

1. Since when have you been using the metro (Note: metro operations commenced in Nov.2017)

   a. 2017 b. 2018 c. 2019 d. 2020 e. 2021 f. 2022

2. What are your start and end stations for daily commute?

   a. Origin station (drop down menu with all stations)

   b. Destination station (drop down menu with all stations)

   c. Cost of one-way travel (drop down menu with slab-wise fare rates)

3. Why do you prefer the metro? (Multiple selection question)

   a. Safety
   b. Convenient to reach
   c. Accessible through last mile connectivity
   d. Cleanliness
   e. Air-conditioned
   f. Reliable
   g. Non-polluting
   h. Pre-paid metro card facility with 10% discount
   i. Parking facility at station
   j. Access to mall / retail / F&B outlets
   k. Fare is value for money
   l. Faster than other modes of transport
   m. Other, please specify ……..……

4. The fare of all transport modes is increasing, price of fuel is rising, and so is traffic congestion on the roads. Has this encouraged you to continue travelling by metro?

   a. Yes b. No

5. In June, bus pass charge increased from Rs.700 to Rs.950, metro/deluxe metro pass from Rs.880/990 to Rs.1,070/1,180, student pass from Rs.390 to Rs.495, and Uber/Ola trip fares increased by 15%. But, metro fares have NOT increased in the last 5 years. To maintain its high quality service, increasing the fare rates is becoming necessary for the metro. Will you continue to travel by metro if your fare increases?

   a. Yes b. No

6. If yes, how much fare increase on your one-way travel cost is acceptable to you? (current one-way travel cost is provided by the respondent in Q.2)

   a. Fill value in Rs.

7. If no, which mode would you prefer?

   a. AC Bus
   b. Non-AC Bus
   c. Auto
   d. Cab (including taxi/Ola/Uber)
   e. Bike taxi (Rapido/Mopedo)
   f. MMTS
   g. Own two-wheeler
   h. Own car
   i. Cycle / walk

8. Gender:

a. Male b. Female c. Other

9. Age:

a. Fill in age

10. Profession:

a. Self-employed b. IT company c. Non-IT private company

d. Government service e. Student f. Other, Please specify ……

11. What is your monthly household income?

a. Less than Rs.10,000 b. Rs.10,000 – Rs.19,999

c. Rs.20,000 – Rs.29,999 d. Rs.30,000 – Rs.39,999

e. Rs.40,000 – Rs.49,999 f. Rs.50,000 – Rs.59,999

g. Rs.60,000– Rs. 69,999 h. Rs.70,000– Rs. 79,999

i. Rs.80,000– Rs. 89,999 j. Rs.90,000– Rs. 99,999

k. Rs. 1,00,000 or more

12. What is your monthly household expenditure on public transport?

a. Less than Rs.1,000 b. Rs.1,000 – Rs.1,999

c. Rs.2,000 – Rs.2,999 d. Rs.3,000 – Rs.3,999

e. Rs.4,000 – Rs.4,999 f. Rs.5,000 or more

8B) Survey- Non-Metro Commuters

Participant Information Sheet

You are invited to participate in a survey to assess mode choice of commuters in Hyderabad. This is being conducted in the background of a proposed fare revision of Hyderabad metro rail and the changing time-cost of travel across different modes of transport in Hyderabad.

The survey is being conducted by National Council of Applied Economic Research (NCAER), a premier economic policy think-tank based in New Delhi. NCAER has imparted extensive training to the interviewers who will be conducting this survey.

The names and contact details of all interviewers are available with NCAER. Each of them is authorized by Hyderabad Metro Rail to conduct this survey, and carry an identity card which you may request to check.

This short survey includes 12 questions. The information will help us understand commuter's profile, their reasons for commuting by their preferred mode of transport, and how the change in time-cost of travel affects the commuter's choice of transport mode. Your answers will be recorded electronically, using Google form. By this method, the data will be collected securely, in real-time, and will directly reach the principal investigator of the survey at NCAER.

Your name will be asked as a part of the survey. No other personal data or identifiers will be recorded. The information you provide will be kept confidential and anonymized for further analysis.

Participation in the survey is voluntary and the responses will be recorded with your consent. You may withdraw your consent to participate anytime during the survey.

For further information, you may contact NCAER. Their contact details are available on their website www.ncaer.org

QUESTIONNAIRE: NON-METRO COMMUTERS

Date: ……...…… Day: ……...…… Time: ……...…… Location: ……...……

Mode of daily commute: .....Direction of travel: home-bound/ work-bound

Name of the Enumerator: ……..……. Mobile no.: ……..……

Name of the Respondent: ……..……

1. Since when have you been using your preferred mode of daily commute?

a. Before 2012	b. 2012	c. 2013	d. 2014
e. 2015	f. 2016	g. 2017	h. 2018
i. 2019	j. 2020	k. 2021	l. 2022

2. What are your start and end points for daily commute?

a. Fill origin	b. Fill destination
c. Distance: fill in km.	d. Cost of one-way travel: fill cost in Rs.
e. Travel time: fill time in min/hrs	

3. Why is metro not suitable for your daily commute? (Multiple selection)

a. Absence of first mile connectivity	b. Absence of last mile connectivity
c. Parking not available / inadequate at metro station	d. Parking charges are high
e. Metro fare is high	f. Metro is crowded
g. I travel outside metro operating hours	

h. Other, please specify .....……

4. Why do you prefer your chosen mode for daily commute? (Multiple selection)

a. Safety	b. Easily accessible	c. Cleanliness	d. Air-conditioned
e. Reliable	f. Non-polluting	g. Bus pass available for discounted ticket	
h. Avoid passenger crowd		i. Travel cost is value for money	
j. Less time consuming than other modes		k. Less costly than other modes	

l. Other, please specify .....……

5. The fare of all transport modes is increasing, price of fuel is rising, and so is traffic congestion on the roads. In June, bus pass charge increased from Rs.700 to Rs.950, metro/deluxe metro pass from Rs.880/990 to Rs.1,070/1,180, student pass from Rs.390 to Rs.495, and Uber/Ola trip fares have increased by 15%. In light of this, will you choose taking metro for your daily commute?

a. Yes	b. No

6. If yes, will you choose to commute by metro if metro fares marginally increase too? (Note: Metro fares have NOT changed in last 5 years)

a. Yes	b. No

7. If no (to Q.5 or Q.6 or both), on what condition will you choose to commute daily by metro instead of your current mode of transport? (multiple selection)

   a. Better first mile connectivity
   b. Better last mile connectivity
   c. Lower fare
   d. Availability of parking facility
   e. Lower parking fares
   f. Longer operating hours
   g. Less crowd – through more coaches or higher frequency
   h. Other, please specify……..

8. Gender:

   a. Male
   b. Female
   c. Other

9. Age:

   a. Fill in age

10. Profession:

    a. Self-employed
    b. IT company
    c. Non-IT private company
    d. Government service
    e. Student
    f. Other, Please specify …….....……..

11. What is your monthly household income?

    a. Less than Rs.10,000
    b. Rs.10,000 – Rs.19,999
    c. Rs.20,000 – Rs.29,999
    d. Rs.30,000 – Rs.39,999
    e. Rs.40,000 – Rs.49,999
    f. Rs.50,000 – Rs.59,999
    g. Rs.60,000– Rs. 69,999
    h. Rs.70,000– Rs. 79,999
    i. Rs.80,000– Rs. 89,999
    j. Rs.90,000– Rs. 99,999
    k. Rs. 1,00,000 or more

12. What is your monthly household expenditure on public transport?

    a. Less than Rs.1,000
    b. Rs.1,000 – Rs.1,999
    c. Rs.2,000 – Rs.2,999
    d. Rs.3,000 – Rs.3,999
    e. Rs.4,000 – Rs.4,999
    f. Rs.5,000 or more

ANNEXURE 9: SURVEY DATA ANALYSIS

9A) Key Survey Findings- Metro Commuters

81% metro commuters surveyed are willing to travel at a higher fare (**Table A1** below)

- Acceptance rate (AR) is high across commuter profiles (**Figures A1 to A9**)
- AR increases with increasing household (HH) income and HH transport expenditure
- AR increases with declining HH transport affordability
- AR marginally higher for those travelling since 2020
- Highest AR for those travelling 4 – 14 km (current fare Rs. 25, Rs.30, Rs.35, Rs.40), among IT employees, those <21 years of age
- AR higher among female respondents

'Faster than other modes of transport', 'convenient to reach', 'safety' and 'non-polluting' are prominent reasons for regularly commuting by metro, across profiles (**Figure A10**)

- 66% of female respondents stated they prefer metro because of safety reasons
- Last mile connectivity and parking are NOT among top reasons: implying that those currently commuting by the metro are not dependent on these services

19% are unwilling to travel at a higher fare (264 of 1383 respondents) (**Table A1**)

- If not metro, shift is primarily towards own two-wheelers and non-AC bus (42% and 37% respondents respectively) – this finding holds across all commuter profiles (HH income, HH transport expenditure, profession, gender, years of travel, distance travelled) (**Figure A11**)

9B) Key Survey Findings- Non-metro Commuters

Fall in metro commuters' ridership may be overcome by substitution from other modes, especially from autos, four wheelers and premium buses (**Table A2**)

- At existing metro fares: 590 non-metro commuters (52%) have considered travelling by metro, due to rising road congestion and fare hikes across other modes
- At higher metro fares: 263 non-metro commuters are willing to shift to metro (45% of 590 non-metro commuters), making up for the loss of 264 metro commuters upon fare increase

544 individuals (48% respondents) are unwilling to shift to metro, even at existing metro fares (**Table A3**)

- Most presently travel by two wheelers (152) and ordinary non-AC buses (122) – i.e. 53% and 50% of all such non-metro commuters

'Easily accessible', 'reliable', 'safety', 'avoid passenger crowd' are prominent reasons for commuting by their preferred mode, across all non-metro commuter profiles (**Table A5**)

- Availability of discounted bus ticket also a prominent reason among students; those with monthly HH income between 10,000 – 50,000; and those with HH transport expenditure <Rs.3,000

Absence of last mile connectivity', 'metro is crowded' are prominent reasons for NOT commuting by metro, across all non-metro commuter profiles (**Table A6**)

'- Better last mile connectivity', 'less crowd through more coaches/higher frequency', and 'availability of parking facility' are the prominent conditions on which non-metro commuters may shift to metro (**Table A7**).
- Lower metro fares is also a prominent condition among those travelling by bus; among students; and those with HH transport expenditure <3,000

9C) Survey Tables and Figures: Metro Commuters

Table A1: Survey Respondents- Metro and Non-Metro

Type of Respondent	Total Surveyed (No.)	Those willing to Travel by Metro at Existing Fare (No.)	Those NOT willing to Travel by Metro at Existing Fare (No.)	Those willing to Travel by Metro at a Higher Fare (No.)	Those NOT willing to Travel by Metro at a Higher Fare (No.)	Acceptance Rate of Existing Metro Fare (%)	Acceptance Rate of Higher Metro Fare (%)
By Preferred Mode of Travel	**A**	**B**	**C=A-B**	**D**	**E=B-D**	**=B/A*100**	**=D/B*100**
Metro Commuters	**1,383**	**1,383**	0	**1,119**	**264**	100%	**81%**
Non-metro Commuters	**1,134**	**590**	**544**	**263**	**327**	**52%**	**44.6%**
Total	**2,517**	1,973	544	1,382	591	78%	70%

Source: NCAER Survey, September 2022

The survey sample includes 2,517 respondents in total, with 1,383 metro commuters and 1,134 non-metro commuters (**Table A1)**. At the existing metro fares, 590 non-metro commuters (i.e. 52% of the non-metro commuters) have considered travelling by the metro for their regular commute – considering the rising congestion on roads, and fare hikes across all other modes of transport (further analysis in **Table A2**).

However, at higher metro fares, 1,119 metro commuters of 1,383 metro commuters will be willing to continue travelling by the metro – indicating an 81% acceptance rate to a higher metro fare. However, 264 current metro commuters indicated their preference for another transport mode if metro fares increase (profiling of metro commuters is performed in **Figures A1 to A9** below).

The loss in ridership of 264 metro commuters is made up by 263 non-metro commuters who report their willingness to travel by metro at a higher fare. Since 590 non-metro commuters are willing to travel by metro at existing fare, and 263 of them are even willing to travel if metro fares increase, the acceptance rate of non-metro commuters of travelling by metro at a higher fare stands at 45% (further analysis in **Table A2**).

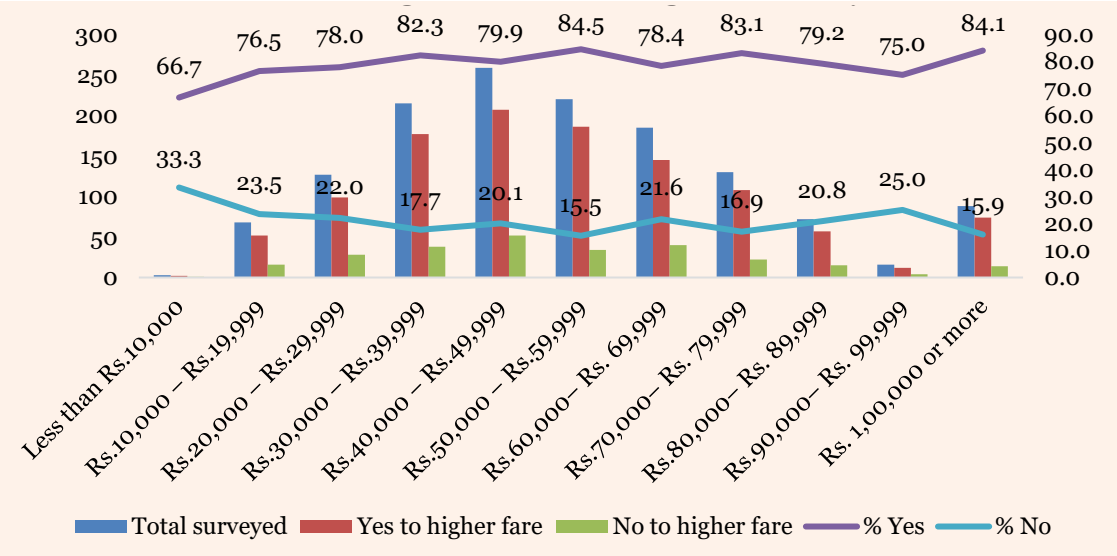
Therefore, upon fare increase of Hyderabad metro, HMR may experience some fall in ridership. It may however be overcome by some substitution from other modes of transport, considering the issue of increasing time and cost of travel by road-based modes of transport.

Non-metro commuters, who neither prefer the metro at existing fares (544 individuals), nor at a higher metro fare (327 individuals), are analyzed further in **Table A3**.

Of the 1383 metro commuters surveyed, 1119 respondents (81 percent of the sample) are willing to travel by metro even if their fares increase. However, 264 individuals drop-out. The following figures provide a profile break-down of the respondents by their:

1. Household income (Figure A1)
2. Household travel expenditure (Figure A2)
3. Transport Affordability (Figure A3)
4. Year since they have been travelling by metro (Figure A4)
5. Distance travelled and current fare (Figure A5) – the distribution of survey respondents is representative of the actual slab-wise ridership (Figure A6)
6. Occupation (Figure A7)
7. Age group (Figure A8)
8. Gender (Figure A9)

Figure A1: Commuters Willing to Travel at a Higher Fare- By Household Income



Household Income Slabs (per month)	Total surveyed	Yes to a higher fare	No to a higher fare	% Yes	% No
Less than Rs.10,000	3	2	1	66.7	33.3
Rs.10,000 – Rs.19,999	68	52	16	76.5	23.5
Rs.20,000 – Rs.29,999	127	99	28	78.0	22.0
Rs.30,000 – Rs.39,999	215	177	38	82.3	17.7
Rs.40,000 – Rs.49,999	259	207	52	79.9	20.1
Rs.50,000 – Rs.59,999	220	186	34	84.5	15.5
Rs.60,000– Rs. 69,999	185	145	40	78.4	21.6
Rs.70,000– Rs. 79,999	130	108	22	83.1	16.9
Rs.80,000– Rs. 89,999	72	57	15	79.2	20.8
Rs.90,000– Rs. 99,999	16	12	4	75.0	25.0
Rs. 1,00,000 or more	88	74	14	84.1	15.9
Total	1383	1119	264	80.9	19.1

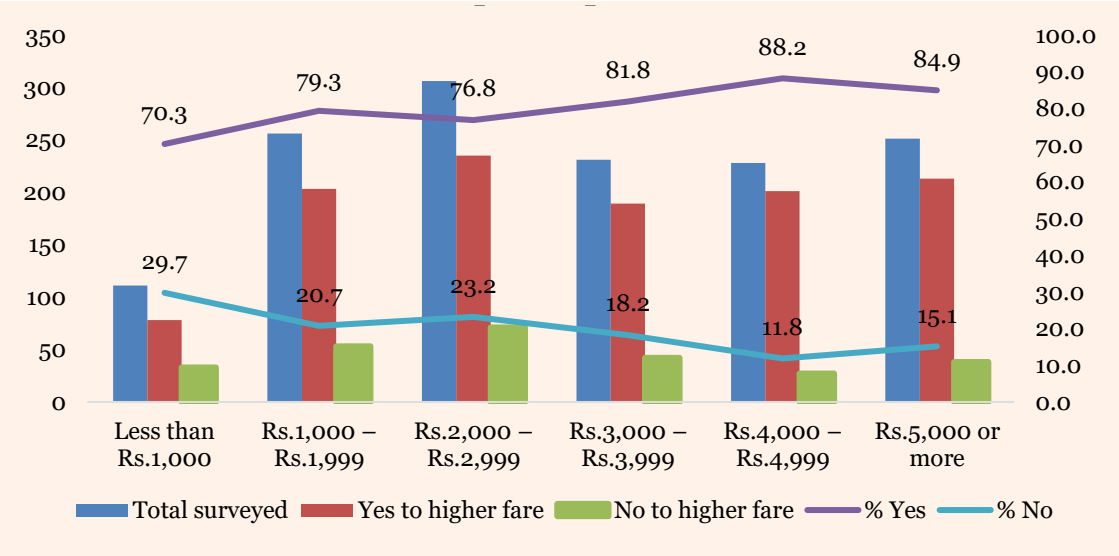
Source: NCAER Survey, September 2022

In the survey, 49% respondents report their household income to be less than Rs.50,000 per month and 51% report their household income to be equal to or higher than Rs.50,000 per month. Maximum number of respondents (64%) lie within the household income range of Rs.30,000 to less than Rs.70,000 per month (**Figure A1**).

The share of respondents who are willing to continue travelling by the metro at a higher fare increases with rising household income levels, and marginally reduces for those reporting the highest household income range. For instance, on an average, 74% respondents with income less than Rs.30,000 per month; 81% respondents with income between 30,000 and less than Rs.70,000 month; and 80% respondents with income above Rs.70,000 per month are willing to travel by metro as the fares increase.

A higher income imparts greater affordability, and thus, those among a higher range of household income are likely to continue travelling by metro despite the fare increase.

Figure A2: Commuters Willing to Travel at a Higher Fare- By Household Transport Expenditure



Household Transport Expenditure (per month)	Total surveyed	Yes to higher fare	No to higher fare	% Yes	% No
Less than Rs.1,000	111	78	33	70.3	29.7
Rs.1,000 – Rs.1,999	256	203	53	79.3	20.7
Rs.2,000 – Rs.2,999	306	235	71	76.8	23.2
Rs.3,000 – Rs.3,999	231	189	42	81.8	18.2
Rs.4,000 – Rs.4,999	228	201	27	88.2	11.8
Rs.5,000 or more	251	213	38	84.9	15.1
Total	1383	1119	264	80.9	19.1

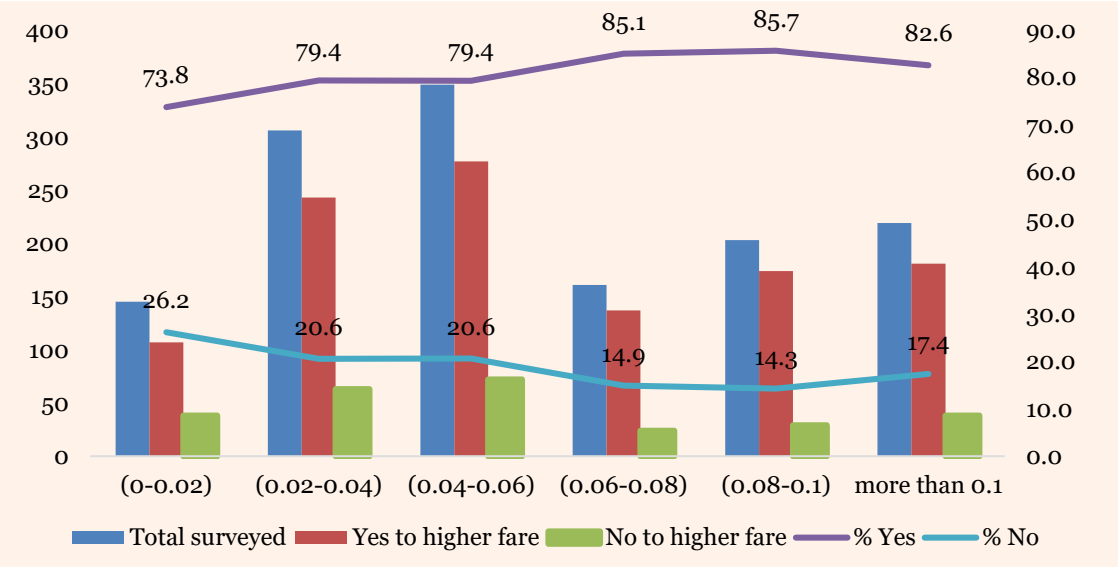
Source: NCAER Survey, September 2022

Among the respondents surveyed, household transport expenditure lies in the range of Rs.2,000 – 2,999 per month for 22% of respondents; in the range of Rs.1,000 – 1,999 per month for 19% of respondents; and more than Rs. 5,000 per month for 18% of respondents (**Figure A2**).

On average, 75.5% of respondents with household transport expenditure less than Rs. 3,000 per month are willing to travel by metro at a higher fare, as against 85% of respondents with a household transport expenditure greater than Rs.3,000.

It is seen through the survey that a higher metro fare is more acceptable to those reporting a higher household travel expenditure, considering that a greater share of respondents in the higher transport expenditure ranges are willing to continue travelling by metro as the fares increase.

Figure A3: Commuters Willing to Travel at a Higher Fare- By Affordability



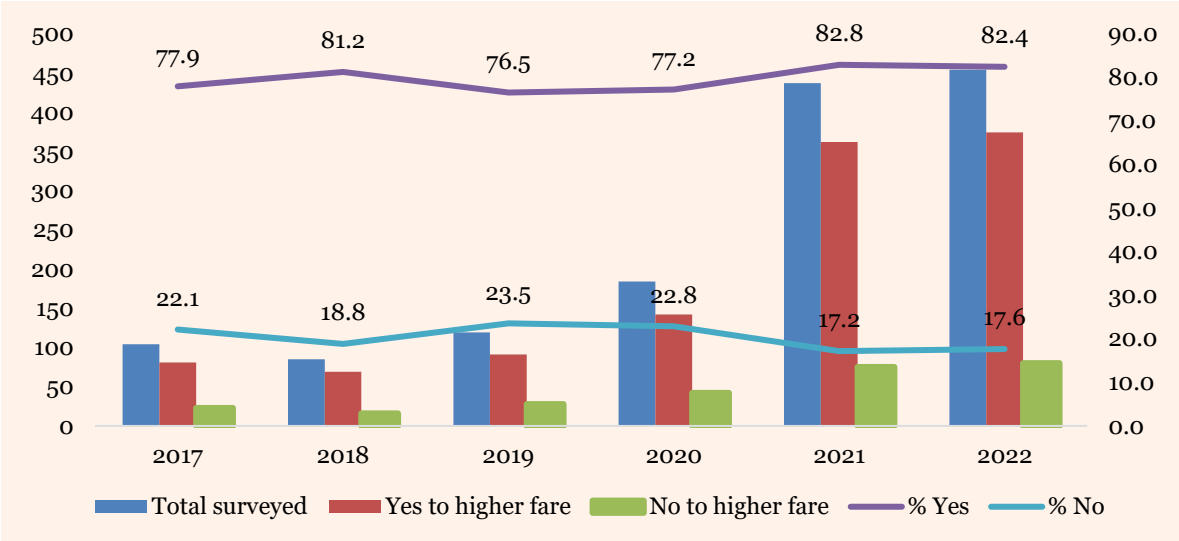
Affordability Index Slabs	Total surveyed	Yes to higher fare	No to higher fare	% Yes	% No
(0-0.02)	145	107	38	73.8	26.2
(0.02-0.04)	306	243	63	79.4	20.6
(0.04-0.06)	349	277	72	79.4	20.6
(0.06-0.08)	161	137	24	85.1	14.9
(0.08-0.1)	203	174	29	85.7	14.3
more than 0.1	219	181	38	82.6	17.4
Total	1383	1119	264	80.9	19.1

Source: NCAER Survey, September 2022
Note: Transport affordability index is a ratio of household transport expenditure to household income. The lower the value of the index, the higher the fare affordability.

Those presently commuting by the metro have different levels of affordability (**Figure A3**). Commuters in the affordability range of 0-0.02 have a higher affordability over those in the range of 0.08-0.1.

However, contrary to expectations, a lesser percentage of those of a higher affordability are willing to travel by the metro at a higher fare. Rather the acceptance rate of a higher metro fare increases with declining transport affordability, which depicts that despite the proposed fare increase, the HMR project will continue to be able to serve the masses (people with lower affordability) with fast, comfortable, highly punctual services at affordable rates when compared to other modes of transport.

Figure A4: Commuters Willing to Travel at a Higher Fare- By the Year since they have been travelling by metro



Year since travelling by metro	Total surveyed	Yes to higher fare	No to higher fare	% Yes	% No
2017	104	81	23	77.9	22.1
2018	85	69	16	81.2	18.8
2019	119	91	28	76.5	23.5
2020	184	142	42	77.2	22.8
2021	437	362	75	82.8	17.2
2022	454	374	80	82.4	17.6
Total	1383	1119	264	80.9	19.1

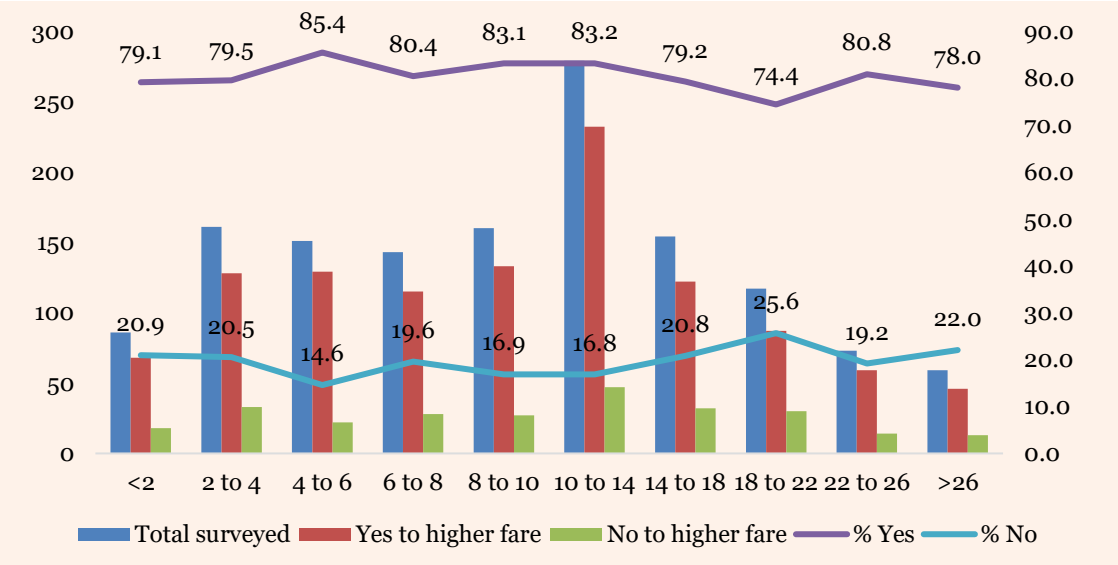
Source: NCAER Survey, September 2022

In the survey, respondents travelling in the metro since 2017, 2018 and 2019 compose 22% of the sample. Those travelling since 2020 form 78% of the sample (**Figure A4**).

The acceptance rate of an increased metro fare is marginally higher for those travelling since 2020 over those who have been commuting over a longer period of time. For instance, the acceptance rate for those travelling since 2017 is 78% and for those who started travelling in 2022 is 82.4%.

It shows that those commuting by metro over a longer period of time are slightly more resistant to fare increase, probably since they have been used to the existing fares. Those who have begun travelling more recently are likely to have either shifted from some other mode or are entirely new commuters in Hyderabad city, who upon realizing certain other advantages from their metro travel are willing to continue commuting even if metro fares increase.

Figure A5: Commuters Willing to Travel at a Higher Fare- By Distance Travelled and Current fare



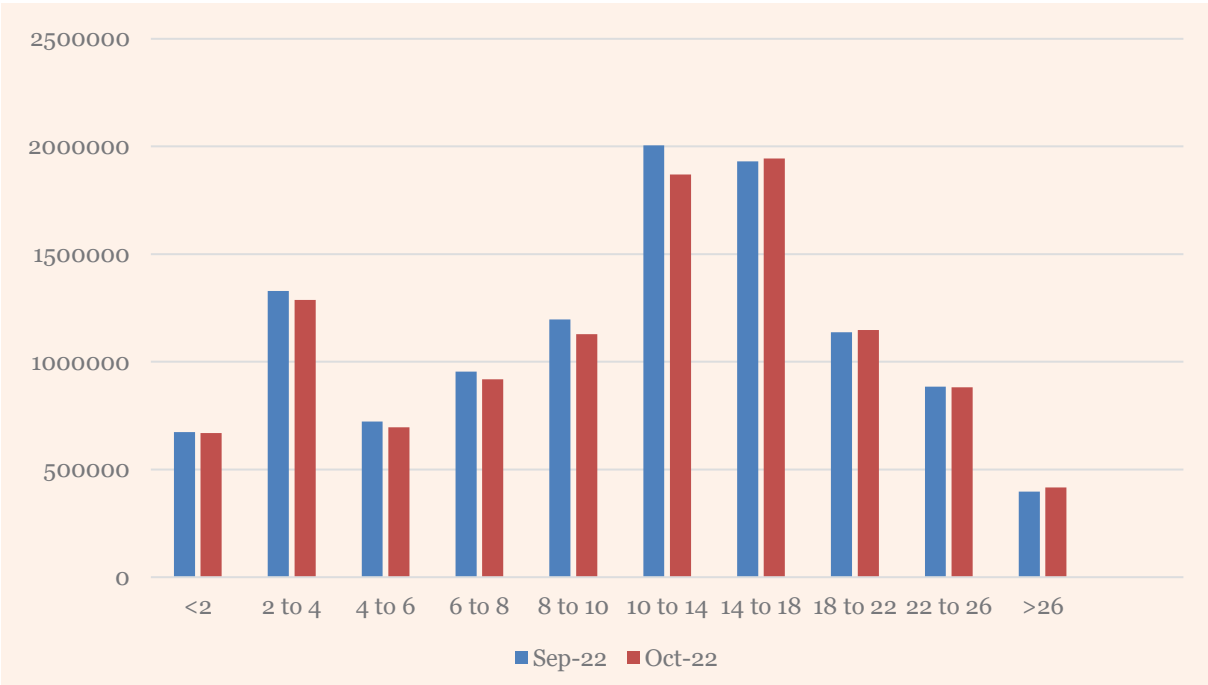
Current fare	Distance (Km)	Total surveyed	Yes to higher fare	No to higher fare	% Yes	% No
10	<2	86	68	18	79.1	20.9
15	2 to 4	161	128	33	79.5	20.5
25	4 to 6	151	129	22	85.4	14.6
30	6 to 8	143	115	28	80.4	19.6
35	8 to 10	160	133	27	83.1	16.9
40	10 to 14	279	232	47	83.2	16.8
45	14 to 18	154	122	32	79.2	20.8
50	18 to 22	117	87	30	74.4	25.6
55	22 to 26	73	59	14	80.8	19.2
60	>26	59	46	13	78	22
	Total	1383	1119	264	80.9	19.1

Source: NCAER Survey, September 2022

In the survey, maximum number of respondents travel a distance of 10-14 km (**Figure A5**). The distribution of respondents over the various distance slabs of the HMR fare structure indicates that the sample is representative of the population, considering that the month-wise origin-destination matrix of HMR shows that the maximum ridership lies in the mid-slabs, and tapers off towards the shorter and longer distance slabs (**see Figure A6 below**).

Acceptance rate for those travelling up to 10 km is 82% on average, while for those travelling more than 10 km is 79% on average. The highest acceptance rate lies for those currently travelling within the distance of 4 – 14 km.

Figure A6: HMR Slab-wise Actual Ridership (September and October 2022)

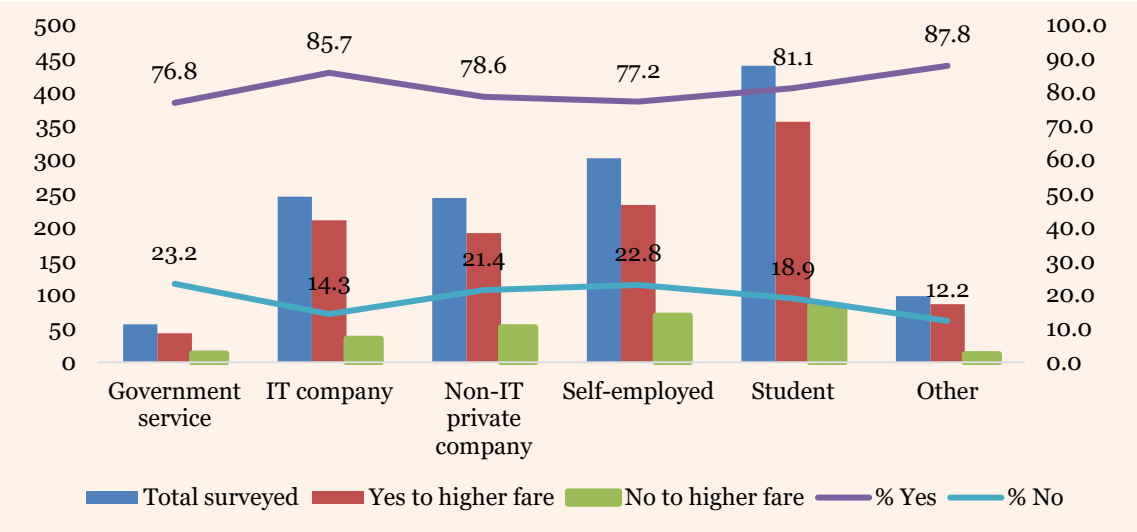


Fare (Rs)	Distance (Km)	Ridership in Sept'22 (No.)	Ridership in Oct'22 (No.)
10	<2	673371	669439
15	2 to 4	1328699	1287626
25	4 to 6	722854	695283
30	6 to 8	954221	919423
35	8 to 10	1197174	1129001
40	10 to 14	2004488	1869567
45	14 to 18	1930262	1943480
50	18 to 22	1137810	1147771
55	22 to 26	885001	882265
60	>26	396769	417142
	Total	11230649	10960997

Source: HMR

Notes: Ridership for both September and October 2022 has been provided. As on date, the latest available monthly ridership data is for October 2022. NCAER survey was conducted in September 2022.

Figure A7: Commuters willing to Travel at a Higher Fare- By Occupation



Profession	Total surveyed	Yes to higher fare	No to higher fare	% Yes	% No
Government service	56	43	13	76.8	23.2
IT company	245	210	35	85.7	14.3
Non-IT private company	243	191	52	78.6	21.4
Self-employed	302	233	69	77.2	22.8
Student	439	356	83	81.1	18.9
Other	98	86	12	87.8	12.2
Total	1383	1119	264	80.9	19.1

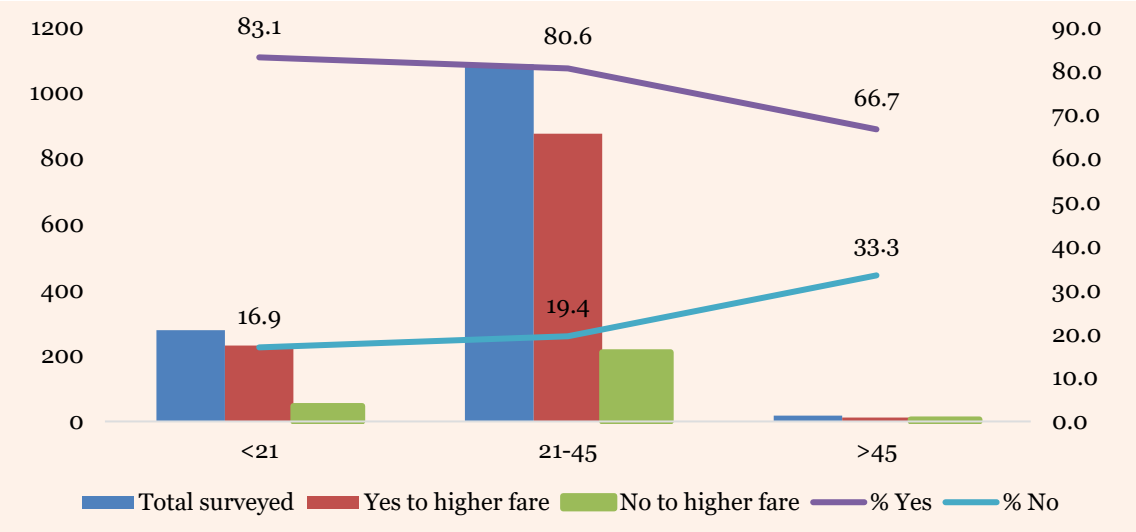
Source: NCAER Survey, September 2022

Maximum number of survey respondents happened to be students (32% of respondents), followed by the self-employed (22%), IT company employees (17.7%), and non-IT private company employees (17.6%). Government service employees formed 4% of the respondents (**Figure A7**).

Acceptability to an increased metro fare is the highest among the IT Company employees – 86% of the IT employees surveyed are willing to travel by metro at a higher fare, followed by the students (81%). Of those in Government service, 77% are willing to travel at a higher fare.

While acceptance rate among all occupation groups is high, IT company employees may especially be preferring the metro because of the longer travel distances and availability of corporate feeder buses to the metro station(s). For students, metro may be a more convenient and a safer way to commute.

Figure A8: Commuters Willing to Travel at a Higher Fare- By Age-Group



Age Range	Total surveyed	Yes to higher fare	No to higher fare	% Yes	% No
<21	278	231	47	83.1	16.9
21-45	1087	876	211	80.6	19.4
>45	18	12	6	66.7	33.3
Total	1383	1119	264	80.9	19.1

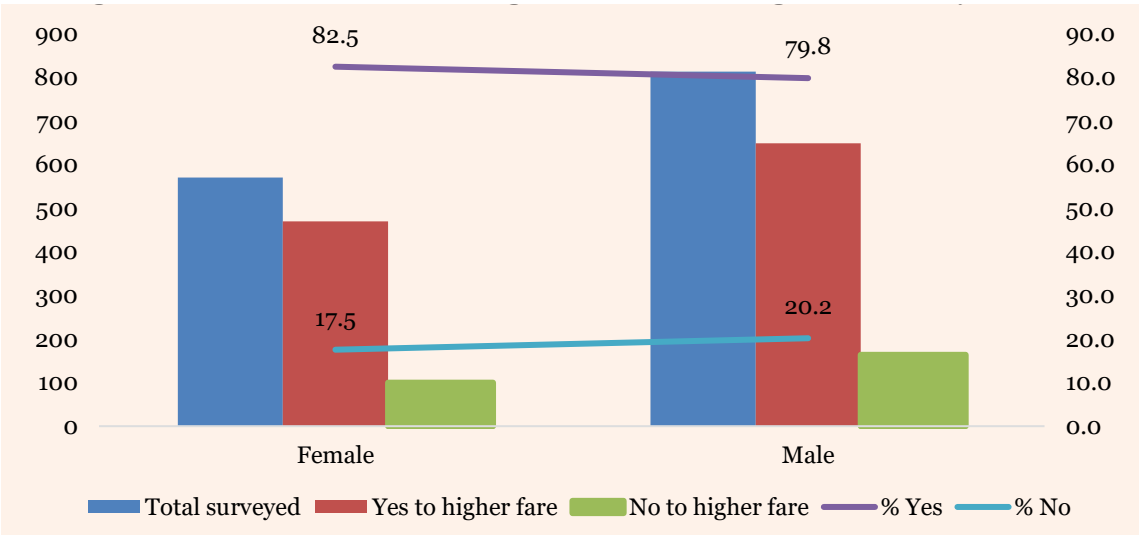
Source: NCAER Survey, September 2022

The survey sample includes a rather large majority of individuals in the age group of 21 – 45 years (79% of respondents). Those up to 20 years of age form 20% of the sample, and those more than 45 years of age form about 1% of the sample (**Figure A8**).

The acceptability to travel at a higher fare is the highest among those aged less than 21 years, considering that 83% are willing to travel by the metro post fare increase. This acceptability falls as the respondents' age, with 81% of those aged 21 – 45 years and only 67% of those over 45 years of age are willing to travel by metro if the fare increases.

The sample includes a large majority of students and IT-company employees for whom metro may be preferable due to reasons stated before. In turn, it is possible that the same is reflected in the metro being preferable to a younger cohort, despite a fare increase.

Figure A9: Commuters Willing to Travel at a Higher Fare- By Gender



Gender	Total surveyed	Yes to higher fare	No to higher fare	% Yes	% No
Female	570	470	100	82.5	17.5
Male	813	649	164	79.8	20.2
Total	1383	1119	264	80.9	19.1

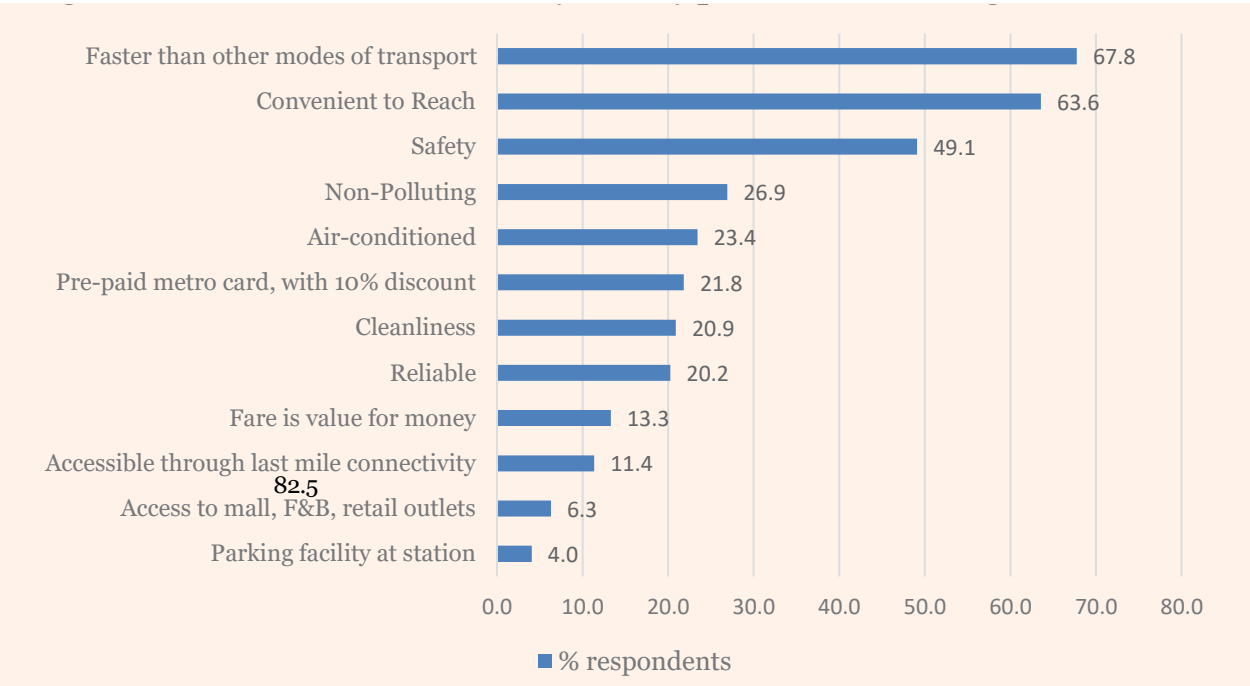
Source: NCAER Survey, September 2022

As far as gender is concerned, females comprise 41% of the sample and males comprise 59% of the sample (**Figure A9**).

The willingness to continue travelling by the metro upon fare increase is higher among the females, considering that 83% of them reported that they would prefer travelling by metro post any fare increase. For males, about 80% of them reported their willingness to continue travelling by metro upon fare increase.

Although acceptability to a higher fare is nearly the same among males and females, it may be higher for the females considering the aspects of safety and reliability in metro commute.

Figure A10: Metro commuters: Why do they prefer metro for regular commute?



Source: NCAER Survey, September 2022

Metro commuters were asked to provide the reasons for preferring to travel by the metro (**Figure A10**).

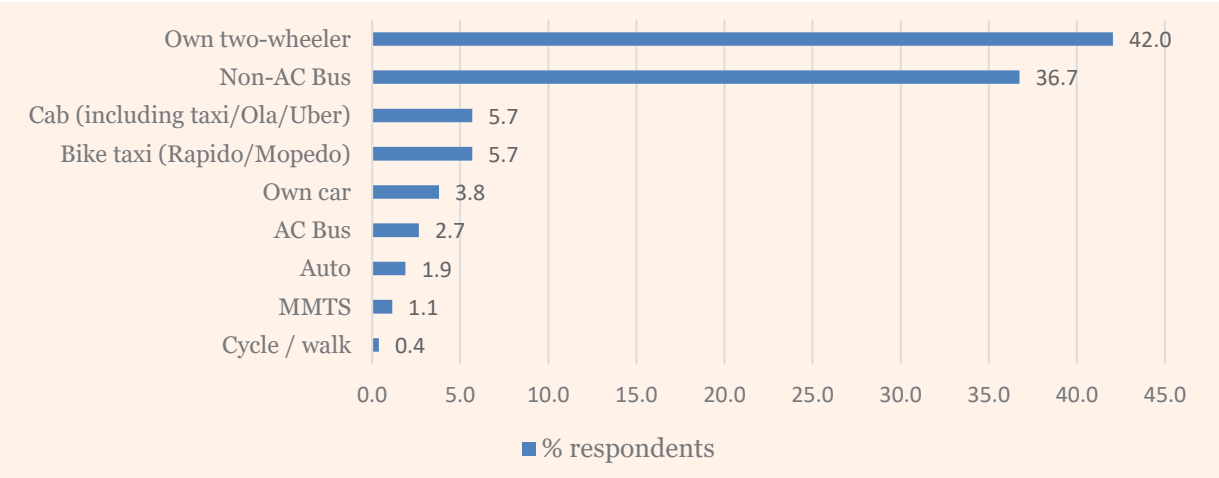
'Faster than other modes of transport', 'convenient to reach', 'safety' and 'non-polluting' were the prominent reasons, across all metro commuter profiles, considering that these were reported by 68%, 64%, 49% and 27% of the metro respondents respectively.

Among female respondents, 66% of them stated that they prefer metro because of safety reasons.

One may note that 'last mile connectivity' and 'parking facility' do not appear among top reasons for preferring the metro. This indicates that those currently taking metro are not dependent on these services, or have easy access to the metro stations without the need of last mile connectivity or parking facility.

The above may be connected to the findings for non-metro commuters, regarding their reasons for why metro is not suitable (**Table A6**) and the conditions they would shift to metro (**Table A7**). Through these results, it can be inferred that availability of last mile connectivity, parking facility, and less crowd in the metro through better frequency and more coaches can help HMR increase its ridership by becoming attractive to those who presently choose to commute by other modes of transport.

Figure A11: Metro commuters: If they do not choose metro at higher fare, which mode will they shift to?



Source: NCAER Survey, September 2022

Of the 1383 metro commuters surveyed, 264 respondents do not choose to travel by the metro if their fares increase.

When asked which mode these individuals would rather choose to commute by (**Table A11**), the modal shift was found to be primarily towards own two-wheelers and non-AC bus (42% and 37% respondents respectively).

9D) Survey Tables: Non-metro Commuters

Table A2: Non-metro Commuters- Willing to Shift to Metro

Current Transport Mode	Sample Size (No.)	Mode Share in Sample (%)	Willing to shift to Metro at Existing Fare (No.)	%	Average Travel Distance (km)	Willing to Shift to Metro at Higher fare (No.)	%	Average Travel Distance (km)
Mode	**A**	**B**	**C1**	**C1/A *100**	**D**	**E**	**E/C1 *100**	**F**
Auto	222	20	142	64.0	9.93	72	50.7	10.65
Bus (A/C)/Metro deluxe/Metro express	171	15	92	53.8	10.92	36	39.1	11.44
Bus (Non-A/C)	243	21	121	49.8	10.55	47	38.8	12.09
Cab services	27	2	7	25.9	11.71	7	100.0	11.71
Four wheeler	182	16	91	50.0	12.08	44	48.4	12.86
Two wheeler	289	25	137	47.4	11.04	57	41.6	11.09
Total	**1134**	**100**	**590**	**52.0**	10.82	**263**	**44.6**	11.51

Source: NCAER Survey, September 2022
Note: Distance travelled is as reported by the respondents in the survey. Actual distance travelled may be lower or higher than that reported by the respondents, and hence actual 'average travel distance' may also be lower or higher.

Of the 1,134 non-metro commuters surveyed, 25% travel by two-wheelers, 21% by non-AC bus, 20% by auto, 16% by four-wheelers, and 15% by premium buses (**Table A2**). The sample closely represents the population, considering that the most popular modes of commute in Hyderabad are private two-wheelers and buses (see Hyderabad transport demand studies by LEA 2021 and Ramboll 2020).

At the existing metro fare structure, 64% of auto commuters have considered travelling by metro, followed by premium bus commuters (54%) and four-wheelers (50%). It appears that those who have considered shifting to the metro for their daily commute presently incur a higher time-cost of travel as compared to other modes.

However, if metro fares increase, 51% of auto travelers who have considered the metro will be willing to pay the higher fare, followed by 48% of four-wheeler commuters, 39% of premium bus commuters and all 7 cab commuters who have considered the metro.

Therefore, upon fare increase of the Hyderabad metro, HMR may experience some substitution from other modes of transport, especially from those who presently travel by auto, four-wheelers, and premium buses.

The distance travelled, on an average, by each of these modes is in the range of 10-12 km (Columns D and F, Table A2). The distance value has been provided by the respondents, and the actual distance travelled may even be lower or higher. Substitution to the metro may therefore be largely in the fare slabs of about 12 km. At the existing fares, 590 non-metro commuters said they have considered shifting to the metro for their commute, of which 263 would be willing to travel by the metro if metro fares increase.

Table A3: Non-metro Commuters- Unwilling to Travel by Metro

Current Transport Mode	Sample Size (No.)	Mode Share in Sample (%)	Unwillin g to shift to Metro at Existing Fare (No.)	%	Average Travel Distance (km)	Unwilling to Shift to Metro at Higher fare (No.)	%	Average Travel Distance (km)
Mode	**A**	**B**	**C2**	**C2/A *100**	**D**	**E**	**E/C1 *100**	**F**
Auto	222	20	80	36.0	8.85	70	49.3	9.19
Bus (A/C)/Metro deluxe/Metro express	171	15	79	46.2	11	56	60.9	10.59
Bus (Non-A/C)	243	21	122	50.2	10.88	74	61.2	9.58
Cab services	27	2	20	74.1	12.05	0	0.0	0.0
Four wheeler	182	16	91	50.0	12.08	47	51.6	11.34
Two wheeler	289	25	152	52.6	9.25	80	58.4	11
Total	**1134**	**100**	**544**	**48.0**	10.39	**327**	**55.4**	10.27

Source: NCAER Survey, September 2022
Note: C1 refers to Table A2 (see column showing the number of non-metro commuters willing to shift to Metro at Existing Fare)

Distance travelled is as reported by the respondents in the survey. Actual distance travelled may be lower or higher than that reported by the respondents, and hence actual 'average travel distance' may also be lower or higher.

Among the non-metro commuters, 544 individuals are unwilling to shift to the metro, even at the existing metro fares (**Table A3**). Maximum number of individuals presently travel by two wheelers (152) and ordinary non-AC buses (122), comprising of 53% and 50% of all such non- metro commuters.

Table A4: Non-metro Commuters- Transport Affordability

Slabs	Sample Size (No.)	Willing to travel by Metro at Existing Fare (No.)	%	Unwilling to travel by Metro at Existing Fare (No.)	%	Willing to travel by Metro at Higher Fare (No.)	%	Unwilling to travel by Metro at Higher Fare (No.)	%
Affordability	A	B	=B/A%	C	=C/A%	D	=D/B%	E	=E/B%
0.01-0.03	154	80	51.95	74	48.05	46	57.50	34	42.50
0.04-0.06	463	227	49.03	236	50.97	115	50.66	112	49.34
0.07-0.1	360	189	52.50	171	47.50	80	42.33	109	57.67
0.12-0.37	157	94	59.87	63	40.13	22	23.40	72	76.60
	1134	590	52.03	544	47.97	263	44.58	327	55.42

Source: NCAER Survey, September 2022
Note: Transport affordability index is a ratio of household transport expenditure to household income. The lower the value of the index, the higher the fare affordability.

At the existing metro fares, a larger share of non-metro commuters in the lower affordability range are willing to travel by the metro (**Table A4**). However, if the fares increase, a greater share of those with a higher affordability are willing to still consider travelling by the metro.

Table A5: Non-metro commuters: Why is current mode suitable for regular commute?

Mode	Total surveyed	Safety	Easily Accessible	Cleanliness	Air-conditioned	Reliable	Non-polluting	Bus Pass for Discounted Ticket	Avoid Passenger Crowd	Travel Cost is Value for Money	Less Time Consuming than Other Modes	Less Costly than Other Modes
Auto	222	40.1	75.7	9.9	6.3	50.0	2.7	1.4	35.1	5.9	17.6	7.7
Bus (A/C)/ Metro deluxe/ Metro express	171	35.7	75.4	7.6	15.2	44.4	4.7	**46.8**	21.1	8.2	24.6	11.1
Bus (Non-A/C)	243	31.3	77.4	7.8	3.7	44.9	2.5	**50.2**	15.2	9.5	17.3	17.7
Cab services	27	81.5	48.1	37.0	70.4	40.7	40.7	7.4	29.6	3.7	7.4	0.0
Four wheeler	182	46.2	91.8	15.9	25.8	48.4	22.5	1.6	49.5	3.8	34.6	5.5
Two wheeler	289	34.6	89.3	7.3	3.5	55.4	3.8	1.4	37.0	7.3	35.6	12.5
All	1134	**38.1**	**81.4**	10.1	11.0	**48.9**	7.3	18.9	**31.4**	7.0	25.7	11.0

Source: NCAER Survey, September 2022

That their current mode of commute is 'easily accessible', 'reliable', 'safe', 'avoids passenger crowd' are the prominent reasons across all non-metro commuter profiles for choosing their preferred mode of transport (**Table A5**).

'Availability of discounted bus ticket' also appears as a prominent reason among those who presently travel by bus (see Table A5), students (31% of 321 students surveyed), those with monthly household income between Rs.10,000 – Rs.50,000 (30.5% of 487 surveyed), those with household transport expenditure <Rs.3,000 (30% of 410 surveyed).

Table A6: Non-metro commuters: Why is metro not suitable for regular commute?

Mode	Total surveyed	Absence of Last Mile Connectivity	Parking not Available / Inadequate at Metro Stations	Parking Charges are High	Metro Fare is High	Metro is Crowded	Travel Outside Metro Operating Hours
Auto	222	70.3	10.4	5.4	26.1	48.6	27.5
Bus (A/C) /Metro deluxe/ Metro express	171	67.3	11.7	12.3	27.5	45.0	25.1
Bus (Non-A/C)	243	72.0	10.3	5.8	39.1	36.6	21.4
Cab services	27	51.9	11.1	7.4	7.4	18.5	51.9
Four wheeler	182	63.7	27.5	18.1	20.9	50.0	28.0
Two wheeler	289	70.2	24.6	16.6	29.1	46.7	25.3
All modes	1134	**68.7**	16.9	11.5	28.6	**44.5**	25.9

Source: NCAER Survey, September 2022

The non-metro respondents were asked 'why metro is not suitable for their regular commute' (**Table A6**). 'Absence of last mile connectivity' and 'metro is crowded' are the prominent issues reported across all non-metro commuter profiles. Parking issues, including inadequate parking and high parking charges, are reported by 28.4% respondents (16.9% + 11.5%).

Table A7: Non-metro commuters: On what condition will you choose metro?

Mode	Total surveyed	Better last mile connectivity	Lower fare	Parking facility	Lower parking fares	Longer operating hours	Less crowd (more coaches or higher frequency)
Auto	150	77.3	28.7	30.0	8.0	24.7	50.0
Bus (A/C)/Metro deluxe/Metro express	135	64.4	34.1	31.1	15.6	20.7	53.3
Bus (Non-A/C)	196	77.6	35.7	25.5	10.2	17.9	43.9
Cab services	20	30.0	15.0	0.0	5.0	55.0	45.0
Four wheeler	138	68.8	22.5	42.8	21.7	21.0	55.1
Two wheeler	232	76.7	30.2	38.8	22.8	17.2	47.4
All	871	**72.8**	30.2	**32.8**	15.7	20.7	**49.1**

Source: NCAER Survey, September 2022

Non-metro respondents who choose not to travel by the metro, neither at the existing fares nor at the higher fares, were asked the conditions on which they will choose to commute by metro (871 respondents, **Table A7**). 'Better last mile connectivity', 'less crowd through more coaches/higher frequency', and 'availability of parking facility' appeared as the prominent conditions across all non-metro commuter profiles.

'Lower metro fares' also appears as a condition among those travelling by bus (35% of 331 respondents), students (38% of 243 respondents), and those with household transport expenditure <Rs. 3,000 (39% of 297 respondents).

ANNEXURE 10: TRANSIT ORIENTED DEVELOPMENT

Snapshot

S.no	Description	Leasable Area
	Total Development (across 17 locations)	18.5 Mn. Sq.ft
A	Operational (4 locations) (Punjagutta, HITEC City, Erramanzil, Musarambagh)	1.28 Mn. Sq.ft
B	Raidurg – 15 acres (0.56 Mn Sft Office Building - Operational)	3.50 Mn. Sq.ft
C	Small Sites – Mixed Use format (10 locations)	1.22 Mn. Sq.ft
D	Depot Locations – Large integrated (2 locations)	12.5 Mn. Sq.ft

Site Map

Source: HMR (Data as of Aug. 2022)

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