Fare Pricing

Pramesh Kumar

IIT Delhi

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Fare policy

Definition (Fare policy (TCRP 10)). Fare policy is defined as the principles, goals, and constraints that influence the management of a transit agency in setting and collecting fares.

- It can be a formal statement by a transit agency.
- It can be used to achieve long-term objectives.
  - maximize ridership
  - maximize social equity
  - maximize revenue
  - Easy to understand and convenient to pay for passengers
  - Low collection cost by agency
- It can be used to achieve short-term objectives.
  - achieve a certain fare recovery ratio
  - achieve a certain ridership target
  - achieve a certain revenue target.
- Some agencies make fare policy decisions on an ad-hoc basis to address short-term problems.
- If the fare policy is completely ignored and agency depends on government subsidies only, then it can lead to extreme dependence on political support resulting in possible financial crisis and inefficient service.

Fare recovery ratio

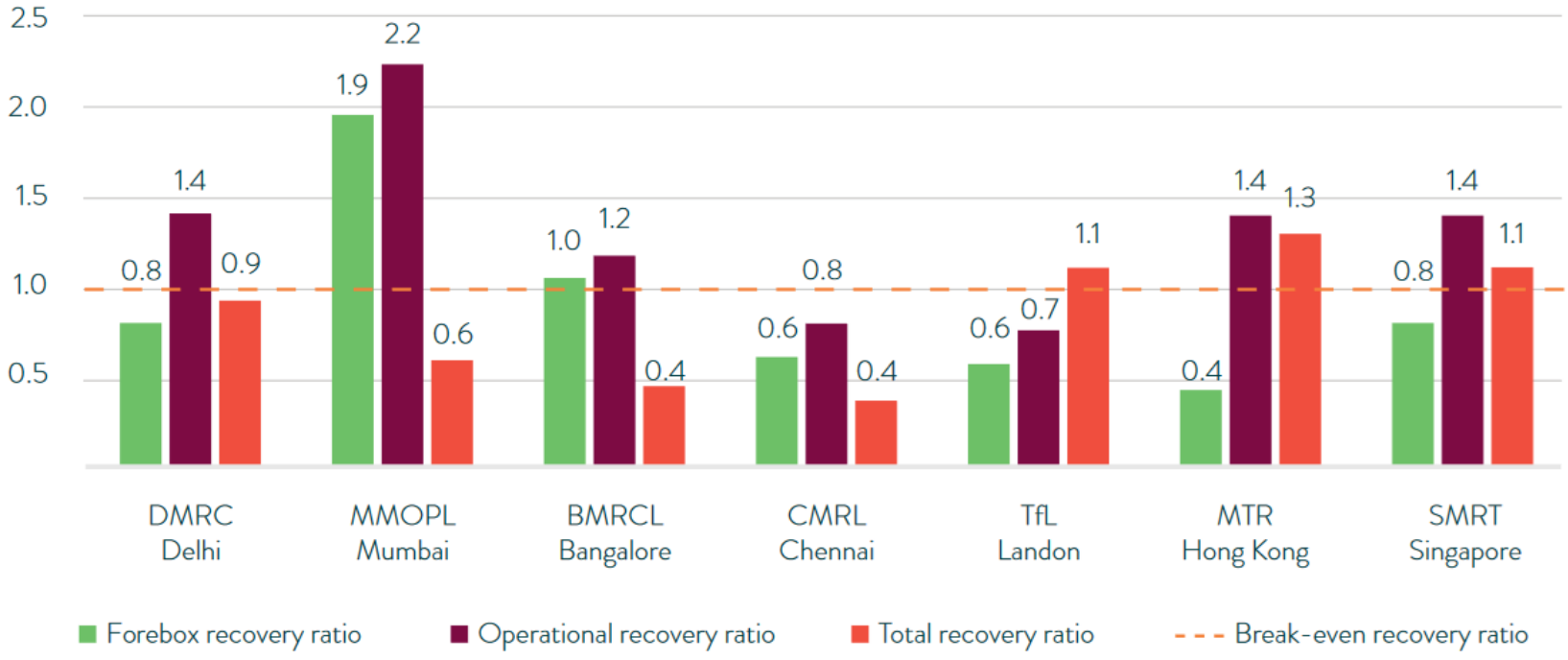

Figure: Revenue Recovery Ratios of Indian metros and international peers
(Source: Knowledge Brief of UITP, the International Association of Public Transport)

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1. Farebox revenue recovery ratio measured as the ratio of fare revenue and operational expenditure.
2. Operational revenue recovery ratio measured as the ratio of total operational revenue and operational expenditure.
3. Total revenue recovery ratio measured as the ratio of total revenue and total expenditure.

Fare increase

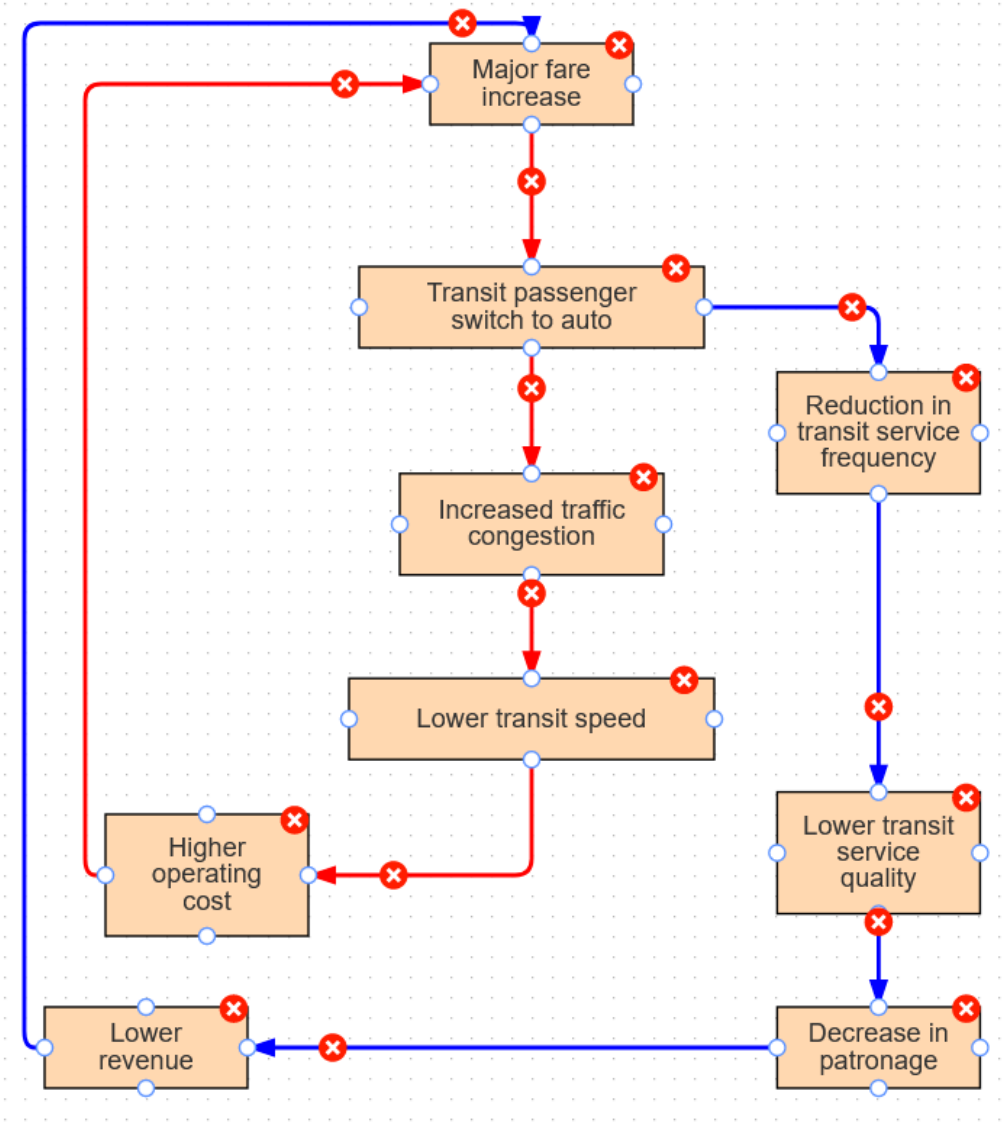


Figure: Two vicious cycles caused by fare increase (Figure credits: Vuchic)

Definition (Fare strategy (TCRP 10)). Fare strategy refers to a general fare collection and payment structure approach; possible approaches include flat fare, differential pricing, market-based or discounted payment options, and transfer pricing.

Definition (Fare structure (TCRP 10)). The fare structure is the combination of one or more fare strategies with specific fare levels.

Definition (Fare technology (TCRP 10)). Technology refers to the type of fare payment media (i.e., cash, token, paper ticket, or advanced payment media) and equipment used for fare collection and sale and distribution of media.

Types of fare strategies

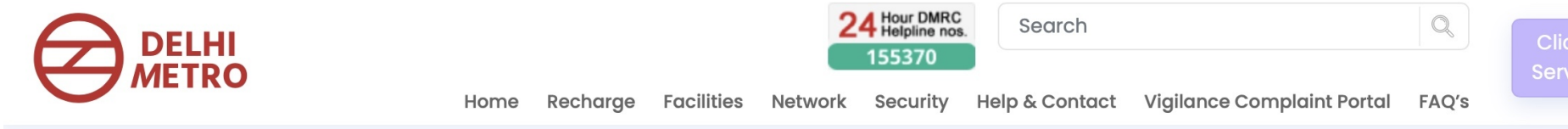
Two basic categories: flat and differentiated.

1. Flat fare: Riders are charged the same fare, regardless of the length of trip, time of day, or speed or quality of service.
   Example(s). Metro Transit (Minneapolis-St. Paul), MTA (NYC)
   - easy to communicate
   - may not be fair (long versus short trips) and good for revenue collection
2. Distance-based: Riders are charged based on the length of their trip.
   Example(s). Delhi Metro
   - complex to calculate the fare for passengers
   - fair
3. Zone-based: The service area is divided into zones and a flat fare is charged within the zone. Riders are charged based on the number of zones they cross during their trip.
   Example(s). Transport for London
   - More transparent

Types of fare strategies

4. Sectional: Transit routes are divided into sections or fare stages. Each section has a fare value. Riders are charged based on the number of fare stages they cross during their trip on the route.
   Example(s). New Delhi (DTC), Bengaluru (BMTC), Chennai (MTC)
   - more complicated to compute, collect, and control
5. Temporal: Peak versus off-peak fare
   Example(s). Metro Transit (Minneapolis-St. Paul), DC Metro
   - Used to relive congestion during peak hours
6. Service-based: Bus vs rail, AC vs non-AC, regular vs express
7. Market segments : students, senior citizens, disabled, and other social programs
8. Pre-paid (Willingness to pre-pay): Daily, Weekly, Monthly, etc. passes (usually discounted based on the idea of fare capping)
   - reduces cash handling
9. Free

Example: DMRC



Fare

For DMRC

Distance (in KMs)	FARE		Time Limit (in Mins
	Monday to Saturday	Sunday & National Holidays	
0-2	Rs 10/-	Rs 10/-	65
2-5	Rs 20/-	Rs. 10/-	
5-12	Rs 30/-	Rs 20/-	
12-21	Rs. 40/-	Rs. 30/-	100
21-32	Rs 50/-	Rs 40/-	180
More than 32	Rs 60/-	Rs 50/-	

Example: MTC

METROPOLITAN TRANSPORT CORPORATION (CHENNAI) LTD

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தீமை இலாத சொலல்

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Customer Care No.: +91-9445030516 Toll Free : 149

BUS FARES

Stage-wise fare (For 1 Adult)

[Effective from 29-01-2018] [G.O (Ms.) No.48 Dated 28.01.2018]

Ordinary Services | Express Services | Deluxe Services | A/C Service

Start ₹	1 ₹5.00	2 ₹6.00	3 ₹7.00	4 ₹8.00	5 ₹9.00	6 ₹10.00	7 ₹11.00	8 ₹12.00	9 ₹13.00	10 ₹14.00	11 ₹15.00
12 ₹15.00	13 ₹16.00	14 ₹16.00	15 ₹17.00	16 ₹17.00	17 ₹18.00	18 ₹18.00	19 ₹19.00	20 ₹19.00	21 ₹20.00	22 ₹20.00	23 ₹21.00
24 ₹21.00	25 ₹22.00	26 ₹22.00	27 ₹23.00	28 ₹23.00	29 ₹24.00	30 ₹24.00	End ₹				

Example: MTA

Everything you need to know about fares in New York

Find out how much it costs to ride the subway and bus, how transfers work, your options for reduced fares, and how to tap to pay or buy an OMNY card or MetroCard.

Subways and buses

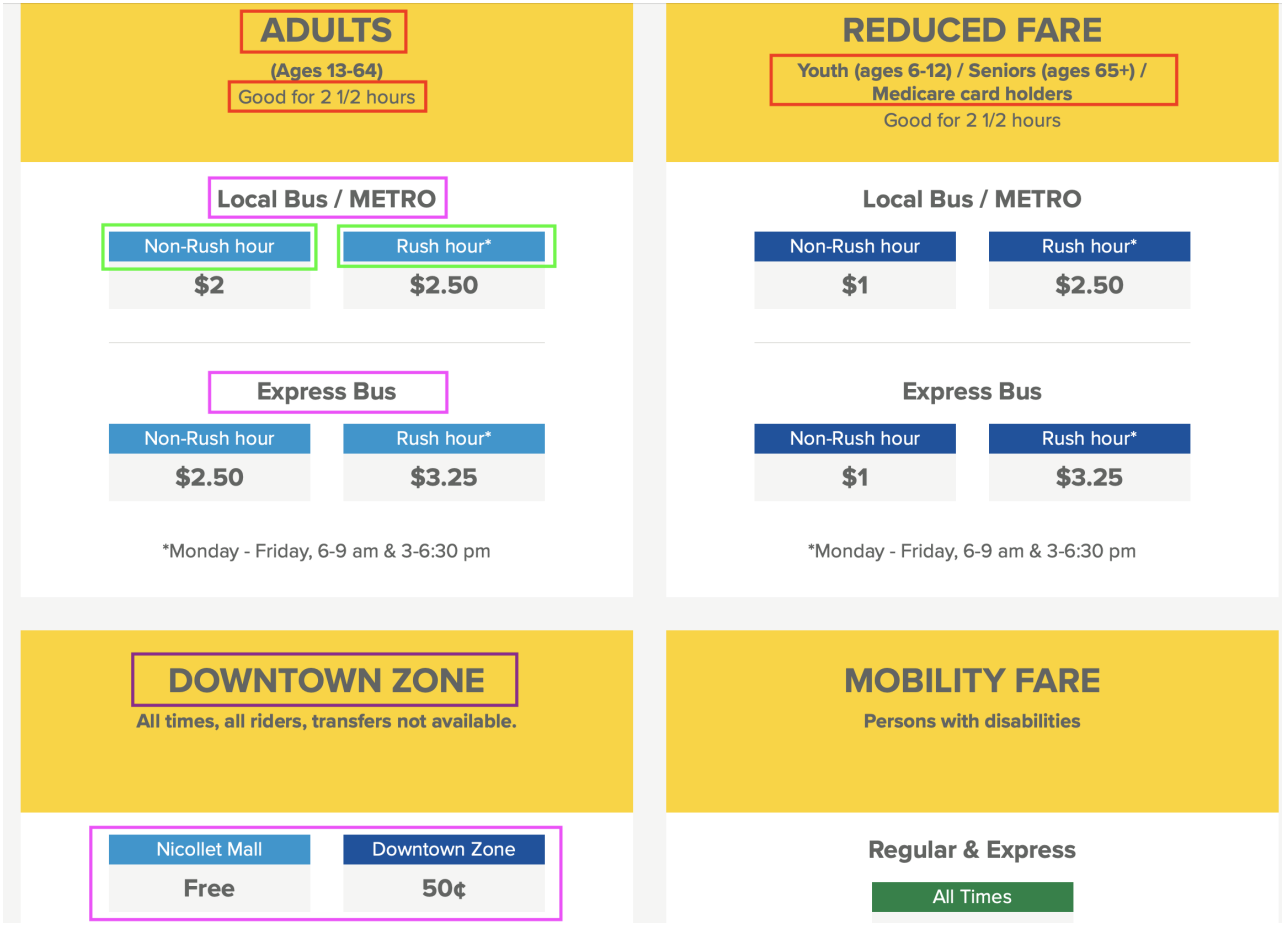
- Fare for most riders on **subways** and **local, limited, and Select Bus Service buses: $2.90.**
- **Express buses** cost **$7.**
- Tap to pay your fare with your contactless credit/debit card, smartphone, or OMNY card, or pay with a MetroCard.

Railroads: LIRR and Metro-North

- Buying tickets on your phone with TrainTime is the most convenient option.
- Save on trips within New York City with CityTicket.

See railroad fare details.

Example: Metro Transit



ADULTS

(Ages 13-64)

Good for 2 1/2 hours

Local Bus / METRO

Non-Rush hour	Rush hour*
$2	$2.50

Express Bus

Non-Rush hour	Rush hour*
$2.50	$3.25

*Monday - Friday, 6-9 am & 3-6:30 pm

REDUCED FARE

Youth (ages 6-12) / Seniors (ages 65+) / Medicare card holders

Good for 2 1/2 hours

Local Bus / METRO

Non-Rush hour	Rush hour*
$1	$2.50

Express Bus

Non-Rush hour	Rush hour*
$1	$3.25

*Monday - Friday, 6-9 am & 3-6:30 pm

DOWNTOWN ZONE

All times, all riders, transfers not available.

Nicollet Mall	Downtown Zone
Free	50¢

MOBILITY FARE

Persons with disabilities

Regular & Express

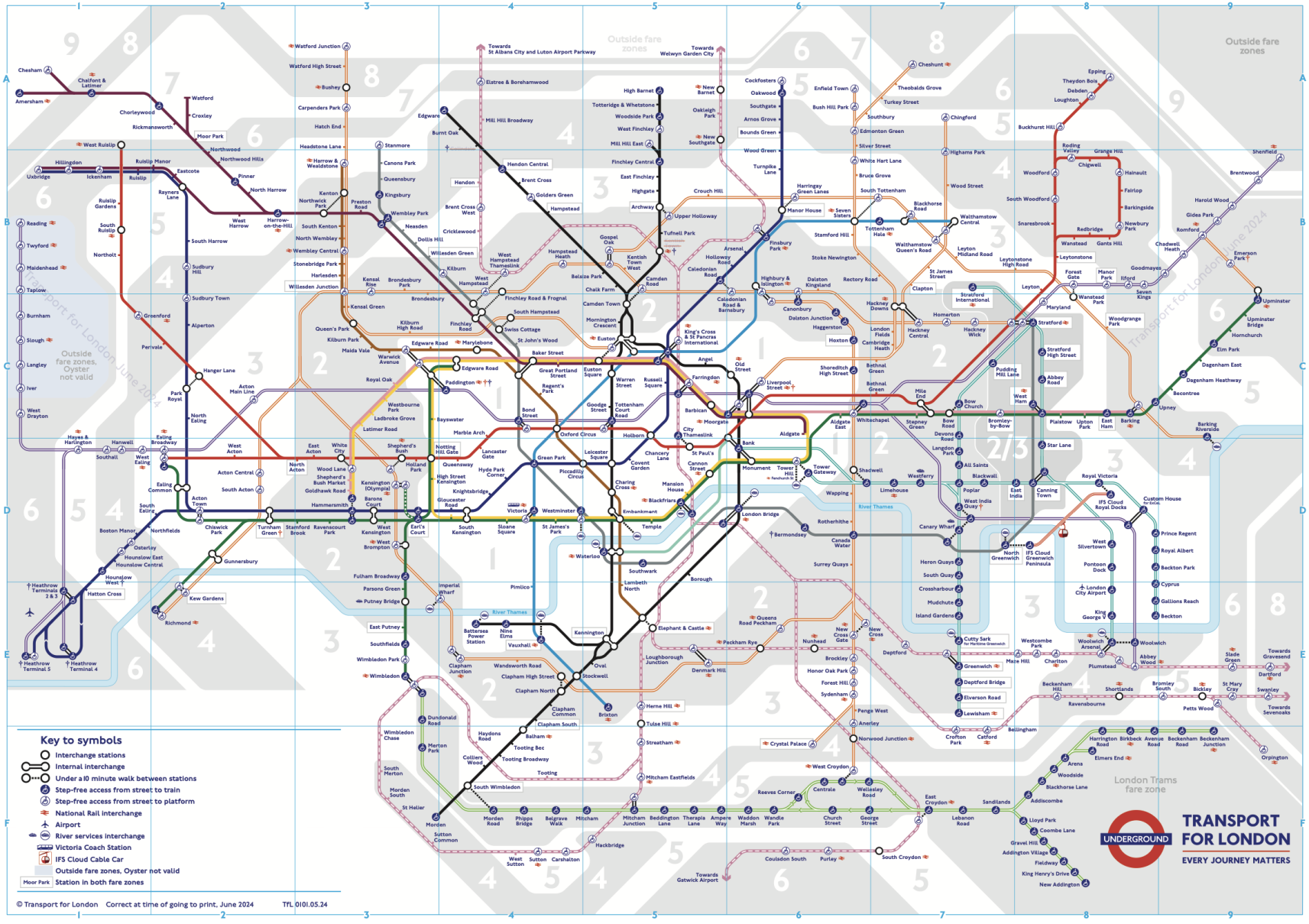
All Times

All-Day Passes

Valid on buses and light rail from time of purchase from a METRO ticket machine or activation on the Metro Transit app until 2 a.m. the next day.

Monday - Friday			Weekend		
Adults	Reduced Fare	Mobility	Adults	Reduced Fare	Mobility
$4 - $5	$2 - $5	$2	$4	$2	$2

Example: TfL


Key to symbols
Interchange stations
Internal interchange
Under a 10 minute walk between stations
Step-free access from street to train
Step-free access from street to platform
National Rail interchange
Airport
River services interchange
Victoria Coach Station
IFS Cloud Cable Car
Outside fare zones, Oyster not valid
Moor Park
Station in both fare zones
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Outside fare zones
Transport for London June 2024
London Trams fare zone
UNDERGROUND
TRANSPORT FOR LONDON
EVERY JOURNEY MATTERS

Transfer fare

- Full fare
  Example(s). DMRC, DTC, MTC, BMTC
- Reduced fare
  Example(s). LA Metro
- Free
  - Limited time
  - Limited trips

  Example(s). CTA

Example: CTA

Fare chart

effective February 20, 2023

REGULAR FARES (as deducted from a Ventra Transit Account or paid via Pay-as-you-go† direct contactless payment)	Full	Reduced	Student
'L' train fare	$2.50 *	$1.25	$.75
Bus fare	2.25	1.10	.75
Transfer‡ Up to 2 additional rides within 2 hrs	Free	Free	Free
PASSES Unlimited rides for a period of time from first use. 1-Day = 24 hrs, etc. Valid on CTA and Pace. (load onto Ventra account)	**Full**	**Reduced**	
1-Day CTA/Pace Pass	$5		
3-Day CTA/Pace Pass	15		

Example: LA Metro

Regular Ride **$1.75**

Pay with a TAP card, Apple Wallet, TAP app or cash. 50¢ transfer fee

Buy Fare

Fare media

(a) Cash[a]

[a]www.istockphoto.com

(b) Paper ticket[a]

[a]r/mumbai

(c) Ticket with magnetic stripe[a]

[a]www.go-metro.com

(a) Token[a]

[a]Wiki

(b) Smart card[a]

[a]www.swarajyamag.com

(c) Mobile ticket[a]

[a]www.masabi.comom

Fare technology

(a) Paper ticket[a]

[a]www.etsy.com

(b) Electronic ticketing machine[a]

[a]www.tradeindia.com

(c) Farebox[a]

[a]Wiki

(a) Smartcard reader[a]

[a]www.metrotransit.org

(b) Faregates[a]

[a]www.metrorailnews.in

(c) Fare vending machine[a]

[a]www.web.mit.edu

Fare elasticity

Definition (Fare elasticity e_P). The percentage change in the demand wrt to percentage change in fare.

$$e_P = \frac{\frac{\Delta D}{D_0}}{\frac{\Delta P}{P_0}} \tag{1}$$

- $e_P \leq 0$ (as demand curve is downward slopping)
- $e_P = 0$ means perfectly inelastic demand. This happens when there is no substitute for the current service.
- $e_P = -\infty$ means perfectly elastic demand. This happens when there is a perfect substitute for the current service.
- Fare induces an inelastic demand.
- Typical value range between -0.5 and -0.1.
- Work trips are more inelastic as compared to others because those are essential trips.
- If $\Delta P \to 0$, then $e_P = \frac{\partial D}{\partial P} \times \frac{P_0}{D_0}$

Joint fare pricing and service design

Notation	Description
$\mathbf{d}$	demand vector (based on O-D pairs and/or passenger classes)
$\mathbf{x}$	service design variables (e.g., frequency, etc.)
$\mathbf{p}$	fare vector (for different classes/services)
$\mathbf{c}$	vector of passenger diutilities
$\mathbf{t}$	travel time vector

$$Z = \underset{\mathbf{p},\mathbf{x}}{\text{maximize}} \quad SW(\mathbf{c},\mathbf{d}) - \Phi(\mathbf{x},\mathbf{d}) \text{[Social welfare – agency cost]} \tag{2a}$$

$$\text{subject to} \quad \Phi(\mathbf{x},\mathbf{d}) \leq S + R(\mathbf{p},\mathbf{d}) \text{[Agency cost} \leq \text{subsidy+revenue]} \tag{2b}$$

$$\mathbf{d} = D(\mathbf{c}) \text{[Demand function]} \tag{2c}$$

$$\mathbf{c} = C(\mathbf{p},\mathbf{t}) \text{[Disutility function]} \tag{2d}$$

$$\mathbf{t}(\mathbf{x},\mathbf{d}) \leq \mathbf{t}_0 \text{[System performance standards]} \tag{2e}$$

$$\mathbf{x} \in \mathcal{X} \text{[Design space]} \tag{2f}$$

$$\mathbf{p} \in \mathcal{P} \text{[Fare space]} \tag{2g}$$

Case in favor of free transit[1]

- Encourage transit use helping in reducing congestion and emission
- Can help provide mobility to low-income communities
- Fare collection is expensive (requires technology, personnel, and security)
- Can reduce fare evasion related disputes

[1] Some of the points taken from Human Transit by Jerrett Walker

Case against free transit[2]

- No revenue collection and agency has to depend on political support
- Some people will lose jobs (ticket checker, etc.)
- Studies have shown that ridership is more for higher level of service than low fares.
- Encourage discretionary travel which can cause overcrowding.
- Not charging fare will increase unintended use of transit (e.g., homeless shelter)
- Philosophical view: Free service is not valued by people (one can make counter argument)

[2]Some of the points taken from Human Transit by Jerrett Walker

Final thought

- We calculate the fare recovery ratio for transit, shouldn't we do the same for cars based on fuel tax, registration and other fee? (Credits: T-Score GeorgiaTech)

References

- Fleishman, D., Shaw, N., Joshi, A., Freeze, R., & Oram, R. (1996). TCRP 10: Fare Policies, Structures, and Technologies, Transportation Research Board, National Research Council
- Human Transit Chapter

Thank you!