International Journal of Business and Management Invention (IJBMI)
ISSN (Online): 2319 – 8028, ISSN (Print): 2319 – 801X
www.ijbmi.org || Volume 15 Issue 7 || July, 2026 || PP—11-19

Pricing the Jam: Congestion Charging as a NonDebt Urban Infrastructure Finance Instrument for Indian Cities

Dr. Sarita Admune
Assistant Professor, Veermata Jijabai Technological Institute, Mumbai.

Abstract
The Indian cities typically react to traffic congestion by widening roads, building flyovers, underpasses, and parking lots among other supply-side measures. Although this can temporarily raise the capacity of the road, it does not directly solve the economic issue posed by the limited road space being occupied at close to zero marginal price during peak times. This paper focuses on congestion charging as a non-debt urban infrastructure finance tool to Indian cities. Congestion charging refers to a time specific and place specific charge on road users that is charged to vehicles entering or using congested urban zones. The paper contends that congestion charging cannot be perceived as simply a tax on drivers, but rather as a road space management tool that internalizes the congestion externalities, minimizes inefficient peak period traffic and generates revenue that can be used to fund sustainable mobility. The paper is based on the international experience and Indian urban transport policy issues and elaborates a pilot based methodological framework of Indian metropolitan cities. The suggested design is a combination of ex-ante traffic and revenue simulation and ex-post quasi-experimental evaluation based on difference indifferences, event study analysis, boundary regression discontinuity and equity incidence assessment. The research identifies the applicable variables, outcome measures, model equations, and revenue logic and implementation protection needed by a plausible Indian pilot. It concludes that congestion charging can become an innovative and fiscally responsible urban finance tool only if it is introduced gradually, supported by digital enforcement, linked with public transport improvement, protected by equity safeguards and governed through transparent revenue recycling.
Keywords: *Congestion charging, congestion pricing, urban infrastructure finance, roaduser charge, sustainable mobility, public transport, India.*

Date of Submission: 08-07-2026 Date of acceptance: 20-07-2026

I. Introduction

Traffic congestion has become one of the most visible economic and governance challenges in large Indian cities. Metropolitan regions such as Mumbai, Delhi, Bengaluru, Pune, Hyderabad, Chennai, Kolkata and Ahmedabad experience slow travel speeds, long commuting time, fuel wastage, air pollution, parking pressure and productivity losses. Congestion does not affect only private vehicle users. It also reduces bus speeds, delays emergency vehicles, increases exposure to pollution for pedestrians and cyclists, and raises the time cost of mobility for workers, students, traders, delivery personnel and commuters.

The conventional urban response to congestion has been supply expansion. Cities expand roads, erect flyovers, enhance crossroads, develop underpasses, increase parking space and develop elevated corridors. Such interventions can give temporary relief, but in many cases they fail to address the structural issue of too much road space in high value urban areas. The increase in road capacity can lead to more private trips, longer trips, route changes and travel behaviour changes when it lowers the immediate cost of vehicle use. The additional capacity may once again be congested with time. The outcome is that the city will keep funding road expansion without controlling the underlying demand of the limited road space.

This paper assumes a different stance. It maintains that congestion is not merely an engineering issue but also an economic allocation issue. Road space is a limited public resource in the high density urban environment. Scarcity of road space when supplied at a very low marginal price during peak periods is prone to overuse. Every extra vehicle that gets into a congested road causes delay, pollution and crowding expenses to other users. But the personal cost to the individual driver is usually limited to personal expenses like fuel, vehicle operation and parking, but the broader social cost is shared among all road users and the general population. This disparity between social cost and private cost gives the fundamental justification to congestion charging.

Congestion charging refers to a road user charge imposed on vehicles entering or using a defined congested area, corridor or time window. Its purpose is not only to collect revenue. It is also to reduce inefficient trips, shift some travel to less congested times or modes, improve travel speeds, strengthen public transport viability and generate dedicated resources for urban mobility improvement. In this sense, congestion charging differs from an ordinary tax. A well designed congestion charge works as a price signal for scarce road space.

The idea has strong theoretical and policy roots. Pigou's analysis of external costs provides the economic foundation for corrective taxation, while Vickrey's work on congestion theory shows how road pricing can improve the allocation of transport infrastructure under peak period crowding (Pigou, 1920; Vickrey, 1969). International examples such as Singapore, London, Stockholm and Milan demonstrate that urban road pricing can be operationalized through different institutional and technological models. These cities vary in their design, charge rates, exemptions and political procedures, yet they all have one thing in common: congested urban road space is not to be considered as free.

Congestion charging in India has been a subject of policy debate but has not been adopted on large scale as an urban finance and demand management tool in cities. This lack leaves a policy gap and a research opportunity. Indian cities are experiencing increasing congestion, constrained municipal fiscal space and high bus, metro feeder, pedestrian, cycling, parking reform and air quality demands. Meanwhile, India has a more robust digital payment system, electronic tolling, vehicle databases, traffic cameras and urban mobility data systems than before. Under these conditions, it is possible to design and test a well constrained congestion pricing pilot.

This paper has a methodological and policy oriented contribution. It does not purport that congestion charging will necessarily work in Indian cities. Rather, it suggests the way it can be credibly tested. The paper constructs an analytical model of pilot selection, variable identification, revenue estimation, equity assessment and causal evaluation. The central argument is that congestion charging should be designed as a "mobility dividend" instrument. The charge must deter unnecessary peak period vehicle travel, and the revenue must be publicly reinvested in buses, metro feeder services, footpaths, cycling infrastructure, parking management, road safety and air quality enhancement. In the absence of such recycling, congestion charging can be seen as a penalty. It can be a fair and efficient non-debt urban finance mechanism with transparent revenue use and equity protection.

II. Conceptual and Literature Background

Congestion occurs when the number of vehicles that are trying to access a road, corridor or zone surpasses the effective service capacity of the road system at a particular time. The physical road still exists, but its service quality degrades with the increase in the traffic density. The same journey can take significantly longer time during peak hours compared to when there is free flow. To a commuter, the expense is in the form of travel delay. For the city, the cost appears through lower productivity, fuel wastage, additional emissions, unreliable bus services, parking spillovers and reduced quality of urban life.

The economic feature of congestion is that it is generated through external costs. A road user entering a congested area does not merely consume road space. The user also increases delay for other users. Let the private cost of a trip be represented as (PC), consisting of fuel cost, vehicle operating cost, direct fee and private time cost. Let the additional cost imposed on other road users and society be represented as (EC). The social cost of the trip can be expressed as:

$$SC = PC + EC$$

In an unpriced congested road system, the user usually makes the trip decision on the basis of (PC), while the relevant social cost is (SC). If ($EC > 0$), private vehicle use in the congested zone will exceed the socially efficient level. Congestion charging attempts to narrow this gap by imposing a charge (C), where the policy objective is not necessarily to make ($C = EC$) exactly, but to move user behaviour closer to the social cost of road use.

Congestion pricing can take different forms. A cordon charge applies when a vehicle enters a defined zone. An area charge applies to movement within a specified zone. A corridor charge applies to a particular congested road, bridge approach, airport corridor or express link. A time varying charge differs by peak and off peak periods. A distance based charge depends on kilometers driven. A parking linked charge uses parking price as a practical proxy for road space demand in commercial areas. For Indian conditions, a simple cordon charge or parking linked congestion charge may be more feasible at the pilot stage than a complex citywide distance based system.

Table 1: Main Congestion Charging Designs and Indian Applicability

Type of charge	Operational logic	Suitable Indian pilot context	Main evaluation concern
Cordon charge	Vehicle pays when entering a defined boundary	Central business districts, dense commercial cores, heritage zones	Boundary diversion and exemption design
Area charge	Vehicle pays for driving within a defined zone	Large central areas with several internal roads	Camera coverage and enforcement cost
Corridor charge	Vehicle pays for using a specific congested road	Airport approach roads, bridge approaches, express links	Route diversion and alternative access

Time varying charge	Higher charge during peak periods	Office hour corridors and central areas	Correct peak period definition
Distance based charge	Charge varies by kilometers driven	Future GPS enabled systems	Privacy and data governance
Parking linked charge	Higher parking fee in congested locations	Markets, commercial streets, municipal parking zones	Informal parking leakage

The available literature confirms the perception that congestion pricing works best when it is coupled with good public transport, clear revenue utilization and effective enforcement. The theory of correcting external costs by pricing is given by Pigou (1920). Vickrey (1969) works out the logic of congestion responsive road pricing. Subsequent urban transport economics studies further rationalize congestion as a bottleneck problem in the peak period, elastic demand and price in capacity constrained markets (Arnott, de Palma, and Lindsey, 1993; Small and Verhoff, 2007).

Empirical and policy studies of London, Stockholm, Singapore and Milan show that congestion pricing can reduce traffic volumes, improve travel reliability and support environmental objectives when the design is administratively credible and politically communicated (Leape, 2006; Eliasson, 2009; Börjesson et al., 2012; Santos, 2017). The experience of Stockholm is particularly relevant because it highlights the role of trial implementation, public learning and post implementation acceptability. London demonstrates the administrative feasibility of a central area charge in a large metropolitan economy. Singapore shows the importance of technology, public transport integration and long term institutional commitment.

Indian urban transport policy has recognized the need to reduce excessive private vehicle dependence and improve public transport, walking and non-motorized mobility (Government of India, 2006, 2014). However, city level congestion charging remains largely at the stage of discussion. Indian cities have experience with highway tolls, bridge tolls, parking fees and electronic tolling, but they have not developed a full urban congestion pricing model that links demand management with dedicated sustainable mobility finance.

This produces a specific analytical gap. India has congested road space, increasing private vehicle pressure and large urban mobility funding requirements, but it lacks a tested congestion charge framework suited to its institutional conditions. Existing discussions often remain normative, describing congestion pricing as desirable or politically difficult. A more rigorous approach requires a pilot design that can answer four empirical questions. To begin with, what level of traffic reduction can be anticipated at various charge levels? Second, what is the net revenue after compliance and operating costs? Third, who pays and who gains in terms of income and commuter groups? Fourth, are the observed changes causally related to the charge and not to unrelated traffic changes? This paper will answer these questions using a systematic empirical model as opposed to making unsubstantiated assertions of anticipated outcomes.

III. Methodology and Analytical Framework

The paper suggests a two-phase empirical research design to investigate the congestion charging in Indian cities. The initial phase is an ex-ante simulation that is done prior to pilot implementation. The second phase is an ex-post analysis that takes place once the pilot has started. This order is required due to the fact that congestion charging is a politically sensitive issue. Before implementation, policymakers require estimates of traffic response, revenue potential, operating cost and equity exposure. Once implemented, they need plausible evidence on whether the policy has in fact altered traffic, speed of travel, use of public transport, pollution and fiscal flows.

The proposed unit of analysis may vary depending on data availability. At a minimum, the study should use a zone entry hour or corridor day unit. A stronger design may use road segment hour, ward day or vehicle class hour observations. The basic panel structure can be written as:

$$(i, t) = \text{area, road segment, entry point or corridor observed at time } t$$

Where (i) denotes the spatial unit and (t) denotes the hour, day, week or month of observation. For Indian pilots, hourly data are preferable for traffic and speed outcomes because congestion is highly time sensitive. Daily or weekly data may be sufficient for revenue, parking and public transport ridership.

Table 2: Data Sources, Variables and Use in the Study

Data category	Key variables	Possible source	Use in analysis
Traffic volume	Vehicle entries, vehicle class, entry point, hour	Traffic police, transport department, camera counts	Baseline congestion, demand response, DiD outcome
Travel speed	Average speed, travel time, corridor delay	GPS based mobility data, traffic apps, transport surveys	Congestion impact and reliability assessment
Public transport	Bus ridership, metro ridership, feeder trips, service frequency	Bus undertakings, metro corporations	Mode shift and mobility dividend analysis
Air quality	PM2.5, PM10, NO2, CO near the zone	Pollution control boards, monitoring stations	Environmental co-benefit assessment

Parking	Occupancy, illegal parking, parking fee collection	Municipal corporation, parking contractors	Parking spillover and complementary pricing
Revenue	Gross collections, exemptions, violations, operating cost	Congestion pricing authority	Net revenue and fiscal feasibility
Equity	Income group, occupation, mode choice, trip purpose	Census, transport surveys, primary commuter survey	Incidence analysis and safeguard design
Enforcement	Violations, unpaid charges, disputed penalties	Enforcement agency	Compliance, administrative quality and trust

The ex-ante component estimates expected traffic and revenue under alternative assumptions. Let (Q_0) denote baseline charged vehicle entries in the pilot zone, (C) the proposed congestion charge per entry, (r) the compliance rate and (OC) the operating cost. Gross revenue (GR) and net revenue (NR) can be expressed as:

$$GR = C \times Q_1 \times r$$

$$NR = GR - OC$$

Where (Q_1) represents post charge vehicle entries. Since a congestion charge is expected to reduce vehicle entries, (Q_1) should not be assumed equal to (Q_0). A simple demand response expression can be written as:

$$Q_1 = Q_0 \left[1 + \varepsilon \left(\frac{GTC_1 - GTC_0}{GTC_0}\right)\right]$$

Where (GTC_0) is baseline generalized travel cost, (GTC_1) is post charge generalized travel cost and (ε) is the price elasticity of vehicle entry demand. Generalized travel cost includes time cost, fuel cost, parking cost and direct user charge. This expression is useful because it prevents the common error of treating congestion pricing as a pure revenue instrument. If the policy works, some discretionary trips should decline, shift route, shift time, shift mode or be combined.

The ex-ante simulation should be presented through scenarios rather than unsupported point estimates. A practical pilot can use three behavioural cases: low response, medium response and high response. These scenarios may be populated only with actual city data when available.

Table 3: Ex-Ante Simulation Logic for an Indian Pilot

Scenario	**Demand response assumption**	**Traffic implication**	**Revenue implication**	**Policy interpretation**
Low response	Vehicle users are weakly responsive to the charge	Small reduction in entries	Higher revenue, but limited congestion relief	Charge may be too low or alternatives may be weak
Medium response	Some trips shift by time, route or mode	Moderate traffic reduction	Balanced revenue and congestion benefit	Preferred initial policy zone
High response	Large share of discretionary trips shift or reduce	Strong congestion reduction	Revenue may be lower than expected	Strong demand management, but business effects must be checked

The ex-post component evaluates the actual impact of the pilot. The main empirical strategy is a difference indifferences design. The treated units are roads, entry points or areas inside the congestion pricing zone. The control units are comparable roads or areas not subject to the charge. The basic specification is:

$$Y_{it} = \alpha_i + \lambda_t + \beta(Treated_i \times Post_t) + \gamma X_{it} + \varepsilon_{it}$$

Where (Y_{it}) represents an outcome such as vehicle entries, average speed, bus ridership, parking occupancy or pollution in area (i) at time (t). (α_i) captures time invariant area characteristics. (λ_t) captures common time shocks such as weekdays, holidays, seasons or fuel price movements. ($Treated_i$) equals one for the congestion pricing zone and zero for control areas. ($Post_t$) equals one after implementation. The coefficient (β) estimates the average treatment effect of the congestion charge, conditional on the control variables (X_{it}). The control vector can consist of rainfall, holidays, road closures, public transport strikes, fuel price changes, school vacations and major events.

The expected interpretation of (β) depends on the outcome variable. If (Y_{it}) is vehicle volume, a negative and statistically meaningful () would indicate traffic reduction in the priced zone relative to comparison areas. If (Y_{it}) is average speed, a positive (β) would indicate improved travel conditions. If (Y_{it}) is bus ridership, a positive (β) may indicate mode shift. If (Y_{it}) is pollution concentration, a negative (β) may indicate an environmental improvement, subject to meteorological controls and monitoring station location.

The identifying assumption is that without congestion charging, the treated and control areas would have been on parallel trends. This assumption cannot be just stated, it needs to be analyzed. An event study model can test pre-policy trends and trace dynamic effects:

$$Y_{it} = \alpha_i + \lambda_t + \sum_{k \neq -1} \beta_k \, (Treated_i \times EventTime_k) + \gamma X_{it} + \varepsilon_{it}$$

Where $(EventTime_k)$ represents periods before and after implementation. The missing category is the time just before the charge. When the estimated pre-treatment coefficients are near to zero and are not systematically divergent, the difference indifferences design is more plausible. Post-treatment coefficients can indicate whether the effect is short term, long term or short term.
The spatial analysis can be reinforced by a boundary regression discontinuity approach. Roads just inside the charged boundary can be compared with roads just outside the boundary:

$$Y_{rt} = \alpha + \delta Inside_r + f(Distance_r) + \lambda_t + \varepsilon_{rt}$$

Where (Y_{rt}) is the outcome on road segment (r) at time (t), $(Inside_r)$ equals one for road segments inside the priced zone, and $(Distance_r)$ measures distance from the cordon boundary. The coefficient (δ) captures the local discontinuity associated with being inside the charging zone. This design can be applied to identify whether the policy will improve the situation within the zone but aggravate the situation on boundary roads.
The design should incorporate equity analysis and not be added afterwards. A congestion charge can be effective in traffic but socially ineffective when it imposes on commuters with no alternatives. The incidence of equity can be expressed as:

$$NMB_g = TTS_g + SI_g - CP_g - AL_g$$

Where (NMB_g) is the net mobility benefit for group (g), (TTS_g) denotes travel time savings, (SI_g) denotes service improvement, (CP_g) denotes charges paid and (AL_g) denotes access loss. The group (g) may represent income class, occupation, mode category, gender, disability status or commuter type. It offers a clear framework of gauging the policy as progressive, neutral or regressive after pilot data have been gathered.

IV. Pilot Design and Revenue Recycling

The pilot of a congestion pricing in India ought to be restricted, visible and reversible during the early stages. The administrative complexity and political vulnerability of a citywide system would be high. The first pilot must be in a well-defined high congestion area with quantifiable entry points, observable peak period traffic, availability of public transport and manageable enforcement needs. Potential sites are central business districts, high density commercial areas, airport approach corridors, major bridge approaches, market areas or heritage cores with high private vehicle pressure.

The initial design principle is simplicity. A cordon based or parking linked charge is better at pilot stage since users can know where, when and why charge is charged. The fee should be charged only at first at identified peak times. A basic peak period structure enables the city to experiment with the responsiveness of travel behaviour to price signals without the all-day burden. Exemptions should be made to emergency vehicles, public buses, bicycles, pedestrians and other important civic services. Time window pricing can be more effective in managing delivery vehicles than blanket exemption. The people living in the zone can be given concessions to a certain extent, yet the traffic impact can be undermined by unlimited exemptions.

The second design principle is moderate pricing. An aggressive charge should not be started by a pilot. The first charge must be high enough to produce a behavioural signal but not so high that it produces instantaneous opposition of the population or access blockage. The charge can later be revised using observed values of $(\frac{Q_1}{Q_0})$, net revenue, boundary congestion and public transport load. A practical adjustment rule may be expressed as:

$$C_{t+1} = C_t + \theta(V_t - V^*)$$

Where (C_{t+1}) is the revised charge, (C_t) is the current charge, (V_t) is observed vehicle volume, (V^*) is the target vehicle volume and (θ) is an adjustment parameter. This equation denotes the adaptive pricing logic. Real revision must be done with care by publicizing and institutionalizing.
The third design principle is the digital reliability. Urban road pricing can be supported with the help of India experience with electronic tolling, UPI payments, vehicle registration databases and camera based enforcement. Nevertheless, congestion charging cannot be considered as a technological exercise. The system should comprise data minimization, privacy protection, explicit guidelines on the issuance of penalties, a grievance redressal process that is easily accessible and independent auditing of the accuracy of the enforcement. Even in cases where the policy goal is legitimate, technology failure, erroneous punishments and black box data practices can diminish trust among the people.

The fourth design principle is revenue ring fencing. The revenue of congestion pricing should not be lost in the general municipal budget. The charge can be fiscally legitimate based on the observation of a direct mobility benefit by the citizens. Net revenue should be earmarked for public transport, walking, cycling, and road safety, parking management, air quality monitoring and last mile connectivity in the same mobility region. The fiscal identity of the system can be stated as:

$$NR = B + F + W + CYC + PM + AQ + E$$

Where (NR) is net congestion charge revenue, (B) is bus improvement expenditure, (F) is feeder service expenditure, (W) is walking infrastructure, (CYC) is cycling infrastructure, (PM) is parking management, (AQ) is air quality monitoring and (E) is equity support. The equation is not a statistical finding. It is a rule of governance that mandates all the rupees of net revenue to be allocated to a specified mobility purpose.

Table 4: Proposed Pilot Design Matrix

Design element	Recommended approach	Analytical reason
Pilot geography	Limited congestion zone, corridor or commercial core	Reduces administrative complexity and improves measurability
Charging period	Peak hour application in first phase	Targets congestion when external cost is highest
Charge structure	Simple cordon or parking linked model	Easier public communication and enforcement
Exemptions	Emergency vehicles, buses, essential civic services	Protects public interest and service continuity
Delivery vehicles	Off-peak incentives and loading windows	Avoids unnecessary harm to business activity
Digital system	Camera, vehicle database and digital payment integration	Reduces leakage and improves compliance
Revenue use	Ring fenced mobility fund	Builds legitimacy and links pricing with public benefit
Evaluation	Independent pre-post and control area analysis	Prevents unsupported success claims

The political economy of congestion charging revolves around the idea of a mobility dividend. A mobility dividend means that revenue collected from congested road use is returned to citizens through improved mobility services. This may include more frequent buses, safer bus stops, metro feeder routes, and footpath repairs, pedestrian crossings, cycling lanes, smart parking, school zone safety, air quality monitoring and targeted support for low-income commuters.

Table 5: Revenue Recycling Priorities

Revenue use	Direct benefit	Equity relevance
Bus service improvement	Higher frequency and faster movement	Benefits lower and middle-income commuters
Metro feeder services	Better first mile and last mile connectivity	Improves access for non-car users
Footpaths and crossings	Safer walking conditions	Supports pedestrians, workers and elderly users
Cycling infrastructure	Low cost mobility alternative	Useful for short distance commuters
Parking management	Less cruising and illegal parking	Reduces street conflict
Air quality monitoring	Evidence on environmental outcomes	Improves public accountability
Freight time window management	Better delivery scheduling	Protects market activity
Low-income mobility support	Reduced burden on vulnerable commuters	Strengthens social acceptability

The policy should therefore be communicated not as “pay to enter the city”, but as “pay when imposing peak period congestion costs, and use the revenue to improve mobility for all”. Such framing is significant in Indian cities where people might not trust user charges easily unless they see benefits and can identify with them locally.

V. Expected Results, Interpretation and Policy Discussion

Since this is a methodological policy paper, it does not report empirical findings. Rather, it outlines the manner in which results are to be derived and interpreted once a pilot has been implemented. The anticipated results ought to be measured on five dimensions namely: traffic, speed of travel, public transport, environment and fiscal performance.

For traffic volume, the main indicator is the percentage change in charged entries:

$$\%\Delta Q = \frac{Q_1 - Q_0}{Q_0} \times 100$$

Where (Q_0) is baseline entries and (Q_1) is post charge entries. A negative value indicates reduced vehicle entries. However, the interpretation must consider whether the reduction reflects desirable mode shift or undesirable displacement to nearby roads. Therefore, priced zone traffic should be examined along with boundary road traffic.
For speed, the main indicator is change in average corridor speed:

$$\%\Delta S = \frac{S_1 - S_0}{S_0} \times 100$$

Where (S_0) and (S_1) denote pre-charge and post-charge average speeds. The speed increase can be a sign of congestion alleviation, yet the reliability can also be analyzed using the peak period travel time variation. Even a policy that modestly increases average speed but significantly increases reliability can result in commuter benefits.
In the case of public transport, bus and metro ridership ought to be measured prior to and after the implementation. In case bus ridership goes up and bus speeds go up, the policy can be facilitating mode shift. Should the number of people using public transport increase and the level of crowding becomes more severe and the quality of service deteriorates, the city will have to redirect the revenue faster into service frequency and feeder capacity.
Local pollutant concentrations must be viewed with caution in terms of environmental outcomes. The weather, regional pollution, construction, fuel mix and non-traffic sources influence air quality. Thus, simple before after comparison should not be used to assess the results of pollution. They should be examined with control locations and meteorological variables wherever possible.
For fiscal performance, the main measure is not gross revenue but net usable revenue:

$$NRR = \frac{NR}{GR} \times 100$$

Where (NRR) is the net revenue ratio, (NR) is net revenue after operating costs and (GR) is gross revenue. A high gross collection, but high operating cost, congestion pricing system can be of little fiscal value. Equally, a revenue generating system that fails to alleviate congestion can be administratively effective but economically feeble.

The most important interpretation principle is that congestion charging cannot be considered as a revenue maximization tool. In case the charge is successful, there should be a decrease in vehicle entries. Thus, reduced traffic and average revenue can be better than high revenue with no alleviation of congestion. An effective pilot must demonstrate a mix of decreased peak period vehicle volume, enhanced speeds or reliability, controllable boundary effects, stable or enhanced public transport performance, transparent revenue use and acceptable equity results.

The Indian applicability of congestion charging is in it's out of the box nature in the urban finance. The majority of infrastructure finance discourse starts with borrowing, grants, public private partnerships, municipal bonds or budgetary transfers. The origin of congestion charging has a different question: why is precious road space during the peak period not priced when overuse of that space can be quantified to cost other users? This changes the debate on finance to scarcity management rather than mobilization of debt.

The fairness argument should also be framed. Currently, the congestion caused by the use of personal vehicles is usually transferred to the bus passengers, pedestrians and cyclists. Buses are slowed down, walking is unsafe and the space is taken by moving and parked vehicles. An effective congestion charge can ensure that the external cost imposed by the users of the private vehicles is partially paid by them, and the revenue is used to enhance the alternatives that are used by a larger population. In this respect, congestion charging may be more equitable than the current system provided that and only provided that revenue recycling is plausible and that alternatives are reinforced.

The policy is still politically difficult. A congestion charge is apparent, but the price of congestion is usually concealed. Individuals might be opposed to a direct fee despite the fact that they are already paying indirectly by losing time, wasting fuel and not having clean air. The public communication should thus clarify the problem at the base, the logic of pilots, how the revenue is used, the exemption framework and the grievance mechanism. The trial period can be effective as the public acceptance can shift when the users can see the real improvement of the situation in the sphere of traveling.

There are a number of risks to be expected. Diversion of traffic can cause congestion to be transferred to other residential streets. Poor transport infrastructure can leave the commuters without alternatives. Ineffective exemptions can be poorly designed. Mistakes in technology can establish unjust punishments. Privacy may be an issue when collecting data. The revenue can be diverted to other unrelated uses. Before results can be seen, political opposition can result in reversal. These dangers do not nullify congestion charging but demonstrate why it should be implemented as a pilot to be monitored and not as a sudden permanent charge.

Table 6: Risks, Measurement Indicators and Safeguards

Risk	Indicator to monitor	Safeguard
Traffic diversion	Boundary road traffic volume and speed	Boundary monitoring, traffic calming and zone adjustment
Weak public transport	Bus load factor, waiting time, ridership	Improve service before and during rollout
Revenue misuse	Share of net revenue spent on mobility	Ring fenced mobility fund and public dashboard
Burden on vulnerable commuters	Net mobility benefit by income or occupation group	Targeted discounts, improved alternatives and equity audit
Impact on small businesses	Delivery access, market footfall, trader feedback	Off-peak delivery windows and loading zones
Wrong penalties	Number of disputes and penalty reversals	Transparent grievance redressal
Privacy concerns	Type and duration of vehicle data stored	Data minimization and legal safeguards
Weak evidence	Missing baseline or control data	Independent evaluation and open data protocol

The larger implication is that congestion charging is to be handled as a learning system. The pilot is expected to create data, experiment with behavioural response, detect design faults and enable course correction. The initial aim should not be to demonstrate that congestion charging is always right. It should be to determine where, when and under what safeguards it can work in Indian urban conditions.

VI. Conclusion

Indian cities cannot solve congestion only through road widening, flyovers and additional vehicle infrastructure. Congestion is also a demand side problem created by scarce road space being used at very low marginal cost during high demand periods. When each additional vehicle imposes delay and pollution costs on others, the resulting congestion becomes an economic externality as well as a transport problem.

This paper has examined congestion charging as a non-debt urban infrastructure finance instrument for Indian cities. The core proposition is that charging for scarce road space during congested periods can serve two linked purposes. It can discourage avoidable peak period vehicle use, and it can generate dedicated revenue for public transport, walking, cycling, and parking management and air quality improvement. The policy should therefore not be designed as a crude tax on drivers. It should be designed as a mobility dividend mechanism in which road space pricing funds better mobility choices.

The paper's main contribution is methodological. It proposes a two stage research design consisting of ex-ante traffic and revenue simulation followed by ex-post causal evaluation. The main policy message is that congestion charging can only be socially defensible under certain circumstances. Charging should be preceded or accompanied by the strengthening of public transport alternatives. Mobility should be ring fenced to improve revenue. Discounts and exemptions should be well focused. The enforcement in the digital realm should be precise, privacy friendly and backed by redress of grievances. Findings should be assessed by independent evaluation and made public.

In India, congestion charging will not come easy. It requires legal clarity, institutional coordination, digital capability, public communication and trust. Nevertheless, it is among the few urban finance tools that can both control demand, enhance mobility and raise non-debt revenue. When properly managed, transparently assessed and socially safeguarded, congestion charging can be a significant new generation urban finance instrument in Indian cities.

References

[1]. Angrist, J. D., & Pischke, J.S. (2009). Mostly Harmless Econometrics: An Empiricist's Companion. Princeton University Press.
[2]. Arnott, R., de Palma, A., & Lindsey, R. (1993). A structural model of peak period congestion: A traffic bottleneck with elastic demand. American Economic Review, 83(1), 161–179.
[3]. Börjesson, M., Eliasson, J., Hugosson, M. B., & BrundellFreij, K. (2012). The Stockholm congestion charges: Five years on. Effects, acceptability and lessons learnt. Transport Policy, 20, 1–12.
[4]. Cornago, E. (2019). Evaluating the impact of urban road pricing on the use of green transport modes: The case of Milan. OECD Environment Working Papers, No. 143. OECD Publishing.
[5]. Eliasson, J. (2009). A cost benefit analysis of the Stockholm congestion charging system. Transportation Research Part A: Policy and Practice, 43(4), 468–480.
[6]. Government of India. (2006). National Urban Transport Policy. Ministry of Urban Development.
[7]. Government of India. (2014). National Urban Transport Policy, 2014. Ministry of Urban Development.
[8]. Imbens, G. W., & Lemieux, T. (2008). Regression discontinuity designs: A guide to practice. Journal of Econometrics, 142(2), 615–635.
[9]. Leape, J. (2006). The London congestion charge. Journal of Economic Perspectives, 20(4), 157–176.
[10]. Pigou, A. C. (1920). The Economics of Welfare. Macmillan.
[11]. Santos, G., & Bhakar, J. (2006). The impact of the London congestion charging scheme on the generalized cost of car commuters to the City of London from a value of travel time savings perspective. Transport Policy, 13(1), 22–33.
[12]. Small, K. A., & Verhoef, E. T. (2007). The Economics of Urban Transportation. Routledge.

[13]. Transport for London. (2007). Central London Congestion Charging: Impacts Monitoring—Fifth Annual Report. Transport for London.
[14]. Transport for London. (2025). Congestion Charge Consultation Documents and Scheme Information. Transport for London.
[15]. Vickrey, W. S. (1969). Congestion theory and transport investment. American Economic Review, 59(2), 251–260.
[16]. World Bank. (2021). Decarbonizing Cities by Improving Public Transport and Managing Land Use and Traffic. World Bank.
[17]. World Resources Institute India. (2020). Road Pricing to Decongest Mumbai. WRI India / Shakti Sustainable Energy Foundation.