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Walking in Indian Cities – A Daily Agony for Millions

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Lack of sufficient or accessible zebra crossings force pedestrians to risk their lives on India's motor-centric roads every day. A scene near Koyembedu in Chennai. File photo: K. Pichumani / The Hindu

In India's hierarchy of roadways, its millions of pedestrians are reduced to helpless trundlers. Despite the reality that they constitute the single largest component of commuters, numbering about 45 million, the country's road networks cater more to the smaller segment of 54-lakh users of cars, jeeps or vans. Consequently, millions of these pedestrians risk their lives every day as they commute along poorly designed roads that expose them to injuries and fatalities, estimated to have cost the nation more than Rs. two lakh crores in 2020.

Making a persuasive case for safe, walkable cities in this article, ***Geetam Tiwari, Professor, Transportation Research and Injury Prevention Centre, Indian Institute of Technology - Delhi****, points out that the major corrective required is to keep the pedestrian in mind when designing roads. This calls for a change from the current motorist-centric networks that have invisibilised the millions of walkers who are in plain sight.*

Tiwari also throws the spotlight on inaccessible facilities for pedestrians such as Foot Over Bridges, haphazard motorisation of urban areas, downsides of grade separators, and the lack of understanding of pedestrian behaviour by policy makers. Effective interventions in planning and implementation, and active monitoring with citizen engagement are non-negotiable if India has to create safe, walkable roads that are consistent with the UN's Sustainable Development Goals relating to mobility. Some immediate measures she suggests include implementing "No Free Left Turns" in urban roads and installing roundabouts at the intersections of small towns, while long-term pedestrian-centric plans are conceptualised and put into action with the active engagement of citizens.

India is a land of walkers. An estimated 45 million walk to work daily, compared with a mere 54 lakhs who used motorised personal transport[1]. However, the infrastructure that is in place for road users is skewed against Non-motorised Transport (NMT), either pushing pedestrians to the margins of the road networks, or even worse, compelling them to jostle for space with motor vehicles, thereby exposing them to injury or death.

More as a norm than as an exception, pedestrians have no option but to walk on the carriageways designed for fast-moving motorised traffic exposing them to a high risk of Road Traffic Crashes (RTCs). Yet, road and traffic regulatory agencies continue to invest in grade-separated, signal-free junctions, and elevated roads that are aimed at solving problems posed by vehicular congestion. These have the combined effect of only further excluding and invisibilising the millions of pedestrians who are in plain sight.

A poorly marked zebra crossing occupied by motorised vehicles makes it inaccessible for pedestrians at a busy intersection in Hyderabad. File photo: G. Ramakrishna

Encouraging children and the elderly to walk as much as possible also provides individual benefits in the form of better health outcomes. The social benefits of such an approach include a reduction in the number of vehicular trips, resulting in a lowering of local and global emissions. For this change to take place, a fundamental flaw in the approach to road design - to cater to smooth flow of motorised traffic - needs to be corrected. In addition, there is a need for a long-term vision of accepting zero deaths of pedestrians in cities. This should be supplemented with a road map for achieving this target in the next decade.

Moreover, current administrative structures in most Indian cities do not respond to long-term goals and conflicting demands. Implementation of a walkable city requires changing the priority at various levels of governance. Although this is a long process that requires continuous efforts and pilot projects to reconfigure the road network, it is an urgent

requirement to ensure that India's pedestrians do not continue to languish at the margins of the country's developmental process.

1. Urban India's invisibilised pedestrians

India's policy planners, traffic engineers, and urban designers are mostly concerned with ensuring smooth flow of motorised traffic in cities by constructing signal-free road junctions and elevated roads. However, data show that 31 per cent of Indian workers in urban areas walk to work[2]. Table 1 shows the proportion of work trips by different travel modes reported in the Census of India, 2011. The proportion of women walking to work is substantially higher than men - 55 per cent vs 28 per cent. Walking trips are higher in rural areas than in urban areas, where walking trips constitute 31 per cent for all workers and 46 per cent for women workers. All public transport trips include walking segments to access and egress from such trips, which mean that at least 50 per cent of urban commutes include a walking component. In addition, school and shopping trips are generally more dependent on walking. If these were to be taken into account, one can safely say that walking constitutes a major mode of mobility in urban India. A 2019-survey in selected cities reflected this, showing that 63 per cent of all trips were walking trips[3], making pedestrians the single largest category of road users (Table 1).

Table 1: Travel mode share for work in India (in per cent)									
Mode	**Total**			**Rural**			**Urban**		
	All	**Male**	**Female**	**All**	**Male**	**Female**	**All**	**Male**	**Female**
On foot	33.1	28.5	55.1	36.2	28.8	67.6	31.3	28.3	46.5
Bicycle	19.2	22.2	4.8	21.9	25.7	5.3	17.6	20.2	4.5
Motorised two wheeler	17.7	19.8	7.8	12.0	13.8	3.9	21.2	23.3	10.5
Motorised four wheeler	3.8	3.8	3.7	2.4	2.4	1.9	4.7	4.6	4.9
Tempo/Auto/Taxi	4.2	4.0	4.8	3.9	4.1	3.1	4.3	3.9	6.0
Bus	16.2	15.5	19.4	18.3	18.8	16.0	14.9	13.5	21.8
Train	4.7	4.9	3.6	3.8	4.3	1.5	5.2	5.2	5.1
Water transport	0.3	0.4	0.1	0.6	0.6	0.1	0.2	0.2	0.1
Any other	0.8	0.9	0.5	1.0	1.2	0.5	0.7	0.8	0.6
Source: Census of India, 2011[4]									

Moreover, a large proportion of people who walk to work are 'captive pedestrians' as they do not have access to any other mode of travel, primarily because of low income. Therefore, despite hostile road conditions because of motorised traffic and the poor quality of pedestrian paths, the proportion of walk trips remains high in all Indian cities. More women walk to work than men. It is possible that women chose work close to home to enable them to look after their own households. Moreover, men have better access to a vehicle at home — a bicycle, a motorcycle or a car. As shown in Table 2, the proportion of walking trips reduces as the distance to commute increases. The proportion of men travelling to work longer than 5 km is higher than women. Indian urban areas have evolved having mixed land-use patterns, enabling short commutes to work. Low income

households whose members rely on walking as their main mode of transportation are located close to their places of work. These are often in the form of informal residential settlements requiring short commutes.

Table 2: Distance travelled for work in India (in per cent)

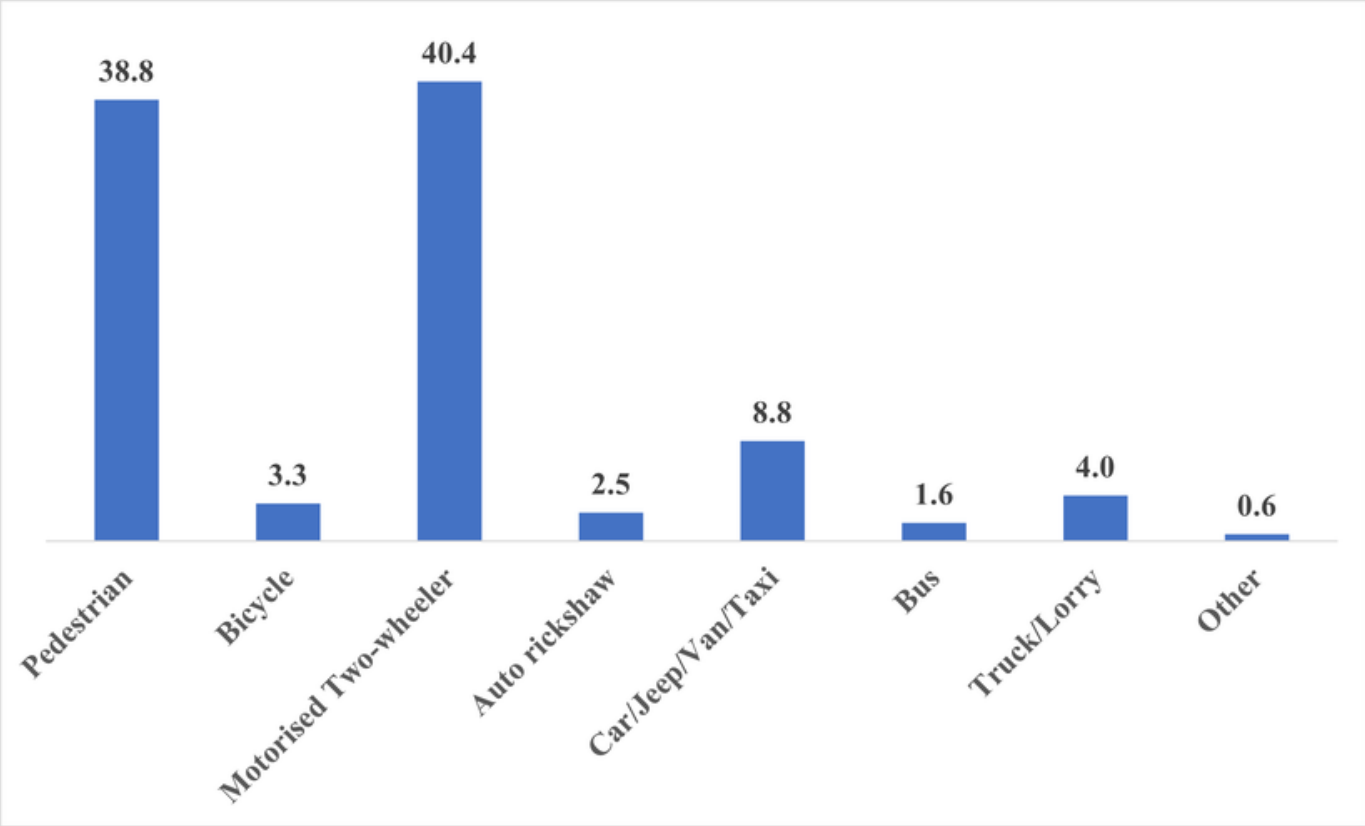
Trip Length	Total			Rural			Urban		
	All	Male	Female	All	Male	Female	All	Male	Female
No travel	30.6	26.4	45.2	38.8	33.2	54.8	24.5	21.8	35.8
Less than 1 km	16.6	16.1	18.2	14.4	13.3	17.6	18.3	18.1	18.9
2-5 km	23.2	24.7	18.1	18.0	19.3	14.2	27.1	28.3	22.0
6-10 km	13.9	15.0	10.1	12.5	14.1	7.8	15.0	15.6	12.4
11-20 km	6.8	7.6	4.0	6.6	8.0	2.5	6.9	7.2	5.4
21-30 km	3.8	4.4	1.9	3.8	4.6	1.3	3.8	4.1	2.5
31-50 km	2.5	3.2	1.3	2.6	3.5	0.9	2.4	3.0	1.8
> 50 km	2.7	3.1	1.1	3.5	4.3	1.0	2.1	2.3	1.2

Source: Census of India, 2011[5]

2. Cost of walking in Indian cities

Pedestrians bear a high cost of walking in terms of road traffic fatalities and injuries, and exposure to high levels of pollution. The Ministry of Roads and Highways (MoRTH) and the National Crime Record Bureau (NCRB) report the number of road traffic fatalities at the national, State, and city levels[6]. Reports from the last three years show the proportion of pedestrian fatalities in road traffic crashes to be 13, 15, and 17 per cent, respectively (MoRTH 2017, 2018, 2019)[7].

Figure 1: Proportion of Road Traffic Crashes (RTCs) Fatalities by Mode of Travel [in per cent]



Source: MoRTH, 2020.

However, studies by independent researchers using police reports (the same sources as used by MoRTH) from different cities and highway locations show at least 30 per cent pedestrian fatalities (Mani and Tagat 2013[8], Delhi Traffic Police 2014[9], Tiwari, Mohan, and Gupta 2000[10], Tiwari 2015)[11]. In another survey of Victim Type in RTCs in 20 cities completed in 2018 (MoRTH, 2020)[12], the pedestrian component in RTCs was reported to be 38.8 per cent (Figure 1). It is clear that pedestrian deaths in the national reports have not been reported correctly. In Delhi and Mumbai, the proportion of pedestrian fatalities is more than 50 per cent of all road traffic deaths. The cost of pedestrian fatalities and injuries is estimated to be Rs. 2,38,728 crore (MoRTH, 2020).

The possible reason for the discrepancy between the official data and those derived from independent studies has been explained by Bhalla et al (2017)[13] and Tiwari et al (2022)[14]:

miscoding pedestrians and motorised two-wheeler and bicycle victims at the time of preparing detailed tables. In a nationally representative mortality survey of 1.1 million homes, Hsiao, M. et al (2013)[15] found that pedestrians constituted 37 per cent of the total RTC fatalities. A more recent estimate by the Global Burden of Disease study, 2017 (Dandona, et al. 2020)[16] reports that pedestrians accounted for 76,729 (35.1 per cent) of all deaths due to road injuries.

Although pedestrians do not contribute to air pollution, they are exposed to high levels of pollution in cities. This is especially true for public transport commuters while walking to bus stops or metro stations located along arterial roads. In Delhi, among various travel modes, walking, cycling, and use of public transport result in the highest dose of particulate pollution, estimated for a unit of distance, or time, whereas traveling in an air-conditioned car leads to the least amount of dose (Goel et al, 2015)[17]. This study found that on an average, unenclosed travel modes in Delhi experience 10-40 per cent higher PM (particulate matter) concentration than an ambient location.

Exposure to high levels of pollution, risk of traffic injuries and poor quality of infrastructure are deterrents to the use of public transport by middle- and high-income travellers who have a choice of using personal motorised vehicle. While globally, walking and cycling is being promoted for people of all ages, walking is not a preferred option for many in Indian cities due to poor walkability.

Thick smoke emanating from a car engulfs the surrounding areas including pedestrians in Vijayawada. File photo: V Raju / The Hindu

The benefits of increased walking include not only reductions in traffic congestion, air pollution and emissions, but also improvements in public and private health. (Doyle et al., 2006[18], Durand et al., 2011)[19]. Woodcock et al studied different mobility scenarios in London and Delhi to assess the public health benefits and impact on carbon dioxide emission. The active transport scenario, which included improving infrastructure of walking, bicycling and public transport systems, not only reported substantial change in CO_2 emissions but also reduction in other adverse health outcomes. The largest health gains were from reductions in ischemic heart disease (11–25 per cent of total ischemic heart disease burden), cerebrovascular disease (11–25 per cent of total cerebrovascular disease burden), and diabetes (6–17 per cent of total diabetes disease burden); the reduction in road traffic injuries was 27 per cent. (Woodcock et al 2009)[20]

3. What are the policies?

Historically, Indian cities evolved as walking cities. From the 1960s onwards, major cities initiated the exercise of preparing Master Plans in India (Khan 2011[21], Wood 1958[22]). The Master Plans were mostly influenced by the American vision of cities and some version of the Garden City movements. The Master Plan-making exercise focussed on allocation of land for different uses, gridiron street structures, and straight streets. The discussion on traffic problems continued to focus on traffic congestion and had no mention of conflicts and problems faced by pedestrians or bicyclists. Between the 1970s and the 1980s, the focus shifted to preparing Comprehensive Traffic and Transport Studies (CTTS) commissioned by city administrations to find solutions to traffic congestion at specific roads and junctions in their cities.

At international meetings organised by the PIRAC (a World Road Association founded in 1909 which enjoys a consultative status at the UN's Economic and Social Council) in 1971, 1973, 1975, 1983, and 1985, Indian representatives spoke of a major thrust on the pedestrianisation of its cities (Subbaraju 1971[23], Kale 1975[24], R.T. Atre and Srinivasan 1987[25]). Complete Bicycle Master Plans for Delhi, Chennai, and Pune were also presented at these meetings. Disappointingly, nearly 40 years later, no Indian city has any meaningful semblance of a network of pedestrian or bicycle friendly infrastructure. It is clear that the official presentations to the international community were only statements of policy intent, not implementation.

A cyclist navigates through traffic at a junction in Bengaluru on May 14, 2022. Photo: Murali Kumar K / The Hindu

In the new millennium, specific polices have been recommended for urban mobility. In 2006, the first National Urban Transport Policy (NUTP) was adopted by the Government of India[26]. Designing cities "for people, not for vehicles" made its debut in official thinking. The policy asked for a revision of several standards in order to achieve this vision. From 2014 onwards, the Smart Cities Mission led to the formation of Special Purpose Vehicles and appointment of CEOs for efficient implementation. Many cities have been designated "Smart Cities". The programme began with 100 cities, with completion dates for the projects set between 2019 and 2023. As of 2019, the effective cumulative completion rate of all projects was 11 per cent. As of March this year, 3,577 projects had been completed out of a total of 6,939 tendered projects, utilising Rs. 60,073 crore out of a total tendered cost of Rs. 1,91,294 crore.[27]

There are examples from Chennai (Thyagaraya Nagar Plaza), Bengaluru (Church Street), Delhi (Chandni Chowk) where small road stretches have become pedestrianised at least in certain time of the day. However, no city has a road map for achieving a complete city-wide network for pedestrian friendly streets.

A 2021- study[28] in three small Indian cities concluded:

> **"A dedicated space for pedestrians, bicycles, and public transport is acceptable as long as car traffic is not adversely affected. Sustainable mobility targets involve the development of a common mobility vision on behalf of all citizens. The current institutional structure and political discourse do not have space for this dialogue".**

Litman summarises the current planning practices as follows:

> **"City planners and engineers continue to practice the conventional traffic-oriented approach which aimed at maximising network capacity, traffic volumes and travel speed. This is in conflict with the SDG targets and the alternative transport planning approach which focuses on people and maximizing accessibility"[29].**

Wefering et al point that sustainable planning gives high priority to the alternative modes of transport i.e. walking, cycling, and the use of public transport. Transport planning which was introduced as a modal-focused domain of traffic engineers has now evolved into a multidisciplinary, holistic, and long term approach[30]. However, this is completely missing at the ground level amongst practitioners. Localising SDGs remains a challenge and requires long-term sustained efforts.

A broken footpath on the bridge on the mini bypass road in Thripunithura across the Thattappallikkattupuzha in Kerala, posing grave danger to pedestrians in June 2022. Photo: R.K. Nithin/The Hindu

Pedestrians on Indian urban roads are often exposed to high risks. This is because their basic needs are not recognised as a part of the urban transport infrastructure improvement projects. Rather, an ever increasing number of cars and motorised two-wheelers encourage the construction of large numbers of flyovers/grade separators to facilitate signal-free movement for motorised vehicles, exposing pedestrians to greater risk. A significant number of pedestrians are willing to take risks in both before and after situations.

The absence of signals makes pedestrians act independently, resulting in rash and erratic risk-taking behaviour. The variability in the speeds of all categories of vehicles has increased after the construction of grade separators, while the waiting time of pedestrians at the starting point of a crossing has also increased. The correlation between waiting

times and gaps acceptable by pedestrians shows that after a certain time of waiting, pedestrians become impatient and seek out even small gaps in the vehicular flow to cross the road.

Khatoon et al studied pedestrian risk taking behaviour in Delhi after the construction of a grade separator and the removal of the traffic signal to provide an uninterrupted flow for motorised traffic. A signal-cycle provides green time for pedestrians to cross the road without exposing them to risk. But after the construction of a grade separator, all pedestrians who were crossing the road at the grade separator face the risk because of the continuous flow of traffic. The removal of the traffic signal also resulted in increased variability in speeds of all categories of vehicles. At the starting point of the crossing, the pedestrians' waiting time increased after the construction of grade separator. It was also found that higher pedestrian delays result in a higher number of unsafe crossings. (Khatoon, M., Tiwari, G. and Chatterjee, N., 2013)[31].

The motorised-traffic-centric road network exposes cyclists and pedestrians to grave danger. A view of one such road in Salem, Tamil Nadu. File photo: Lakshmi Narayanan E / The Hindu

Pedestrians give higher priority to convenience and saving time rather than to road safety (Rankavat and Tiwari, 2016[32]; Hussein and Sayed, 2015[33]), a behavioural trait that should be considered by policymakers, planners, and engineers while planning to promote urban traffic and transport infrastructure. A large number of Foot Over Bridges (FOBs) and subways continue to be created to ensure safe pedestrian crossings, despite research studies repeatedly showing that FOBs and subways are neither comfortable nor convenient for most pedestrians (MacKenzie et al., 2008)[34]. The usage of such facilities remains low, and often the area near FOBs and flyovers become accident black spots because pedestrians crossing the road at such locations are exposed to high speed motorised traffic (Khatoon, M., Tiwari, G. and Chatterjee, N., 2013)[35].

Safe pedestrian crossings can be easily ensured by controlling the speed of motorised traffic. This can be most effectively achieved by appropriate use of rumble strips and speed calming humps (World Health Organization, 2013)[36]. These are low-cost measures and are found to be very effective in controlling speed. On non-arterial roads, small round-abouts have been found to be very effective in controlling vehicular speed and ensuring safety. However, cities continue to invest in high-cost projects which have very little benefits for pedestrians or public transport users.

4. Why pedestrian safety remains a challenge?

The first ever recorded pedestrian fatality was that of a British woman, Bridget Driscoll, more than 120 years ago[37]. Driscoll was hit on the grounds of Crystal Palace by an experimental vehicle —a horseless car—which could travel at a maximum speed of 8 mph (13 km/h). The investigation included court testimonies by witnesses who were questioned and their observations about the vehicle speed were reported. Florence Ashmore, a domestic servant who had witnessed the crash, said the vehicle had come on "at a tremendous pace, in fact, like a fire engine."[38] There were statements about the

driver's abilities and training. "Witnesses testified that Edsall had been driving for all of three weeks' time and had not even been told which side of the road he should stay on. (Perhaps unsurprising, he also had no license.)" The vehicle hit the lady and the blow knocked Driscoll down, inflicting a fatal head injury. The driver hit the brakes right away. The jury deliberated for six hours and concluded that this was an "accidental" incident and hoped that this would not be repeated.

The framework of the investigation of this first pedestrian crash influenced the process of investigation for many years. Researchers and policy makers focused on "investigating" the role of the driver, skills of the driver, and "awareness or information" given to the road users to induce safe behaviour on the road. Some other observations from this incident included the possibility of fatality even at a low speed, and the consequences of the head hitting a hard surface. However, for the next 60 years, the role of speed, environment around the road user, and road user behaviour after knowing the "correct information", continued to be ignored by most researchers.

The narrow but congested Vypeen-Munambam Road is amongst the most accident-prone stretches in Ernakulam district, Kerala. Pedestrians are especially at risk . Photo: R. K. Nithin/The Hindu

Since 1960s, many researchers in the U.S. and Europe focussed on understanding the epidemiology of crashes involving pedestrians. Scientific evidence was collected to understand the injury location, mechanisms and cognitive and judgmental factors in traffic crash causation. These studies established the methodology of conducting controlled observational studies which are close to real-life situations[39]. The researchers concluded:

> **"The crossing of streets, which in some cases can be a risky endeavour for pedestrians, is clearly controlled by a consciousness of what those risks are. Gap acceptance rates suggest that pedestrians tend to choose safe crossing gaps and that individual gap acceptance levels are strongly mitigated by individual capabilities. For example, older people, who walk slower, will select longer gaps. The width of the crossing point also affects gap acceptance rates, clearly showing awareness on the pedestrian's part of the risks they are taking (or, in most cases, risks that are avoided through rational decisions)."**

The results of these pioneering studies have been very robust. In recent times with more automation, computational power and technology to collect large amount of data, the results regarding pedestrian crossing behaviour, safe gap acceptance and speed have remained constant across different countries.

Generally, pedestrian safety has been studied as an urban problem. Recent studies have reported pedestrians facing high risks near bus stops in urban areas (Hess, Moudon, & Matlick, 2004[40]; Quistberg et al., 2015[41]; Truong & Somenahalli, 2011[42]). Some new emerging patterns of pedestrian crashes which have not been reported in published studies include fatalities of pedestrian on access control expressways in India and those waiting along the shoulder of a high-speed road to board buses.

Overall, pedestrian deaths reduced in the U.S., the EU, and Australia compared with low- and middle-income countries (LMICS). However, travel surveys from Australia, EU and the U.S., also show a decrease in pedestrian trips at the same time. School active transport

generally declined for males and older female children (19 and 20 percentage points per decade, respectively) between 1985 and 2003 and 2013 in Australia.[43] The Swedish national travel survey 2015–2016, shows that for all types of travel (business, work and study-related, service and shopping, leisure and other purposes) walking and cycling trips were only 27 per cent of all trips[44]. Reduction in pedestrian trips is a matter of concern both from lack of active transport resulting in adverse impacts of health[45] and also the effectiveness of strategies that have been implemented for improving pedestrian safety.

Pedestrian behaviour on the road is guided by perceived risks, comfort, and convenience. The Perception of Risk remains low from life experience. Comfort and convenience are more important for pedestrians as compared to risk. Several studies conducted since the 1950s to understand pedestrian crossing behaviour find high levels of non-compliance of traffic regulation by pedestrians (red light violation). This indicates that traffic control policies do not adequately account for pedestrian behaviour and their travel needs, even if they risk a financial penalty.

Students struggling to cross a road due to the absence of pedestrian crossing at Kalavasal in Madurai. File photo: Ashok R / The Hindu

However, most pedestrians recognise their own capabilities in safely crossing streets, as indicated by age and gender differences in gap acceptance, most adopt non-complying behaviour only when gaps are sufficient and street widths are narrower (or there is a median refuge)[46]. The capability of individuals also affects their risk-taking behaviour: Harrell[47] found that older people and women tend to be more cautious in crossing streets. Group dynamics can also affect risk-taking decisions, although there is little research in this area. Harrell found that when more pedestrians are present, levels of caution while crossing streets is less. This could be due to a perception that a large group is more visible to motorists and thus that risk is reduced; this could also explain the slower speeds when a group is walking and crossing a street, although this could also be specific to trip purpose and many other factors.

5. Opportunities for improving pedestrian safety and urban walkability

The Government of India is a signatory to the UN's 17 SDGs and is committed to achieving them. At the level of the Union government, the NITI Aayog (The National Institution for Transforming India) has been assigned the role of overseeing the implementation of SDGs in the country. The NITI Aayog works closely with the Ministry of Statistics and Programme Implementation (MoSPI), which is accountable for the development of the baseline data on the National Indicator Framework, all Union Ministries, States and Union Territories, international development organisations such as the UN system, think tanks, and civil society organisations in driving the adoption, implementation, and monitoring of the SDG agenda[48]. The NITI Aayog has been supporting the States/UTs in putting in place monitoring mechanisms at their and district levels. Most States/UTs have mapped their government's schemes, programmes, and policies with the SDG targets thereby assigning the responsibility of targets to their respective departments.

At least three of the 17 SDGs declared by the UN in 2016 can be met by improving walkability in Indian cities. Target 3.6 requires halving the number of global deaths and injuries from road traffic accidents by the year 2030; Target 3.9 requires a substantial

reduction in the number of deaths and illnesses from hazardous chemicals and air pollution and contamination; Target 11.2. requires providing access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport with special attention to the needs of those in vulnerable situations — women, children, persons with disabilities, and older persons.

A pedestrian crossing installed recently by the Tambaram Police Commissionerate, Chennai. Photo: By Special Arrangement

Target 3.6 can be met by making urban areas accessible and safe, especially for pedestrians. In addition, by providing accessibility to public transport, India would also meet SDG 3.9 because a higher mode share of public transport would mean reduced dependence on private motorised modes resulting in fuel savings and decline in the levels

of air pollution. So far the efforts to localise SDGs have been at a State level; however, there has been no effort at a city level to localise SDG targets. Although policies are set at the State level, the implementation of many targets have to be at the city level. This is especially true for SDG target 11 and associated targets discussed in the next section.

The WHO kicked off the Decade of Action for Road Safety 2021-2030 in October 2021, with the ambitious target of preventing at least 50 per cent of road traffic deaths and injuries by 2030. India can meet this target by focussing on pedestrian safety and improving the walkability of cities. Many countries have adopted the safe systems approach based on The Vision Zero policy propagated by Sweden in the late 1990s aims to ensure that none should be killed or injured due to traffic accidents and, therefore, the transport system should be designed in a way that fatal or serious injuries do not occur. This means that safety is more important than other issues in the road transport system (except for health-related environmental issues). Mobility, therefore, should flow from safety and cannot be obtained at the expense of safety.

Current traffic safety science suggests that if road users do not take their share of the responsibility, for example, due to a lack of knowledge or competence, or if personal injuries occur for other reasons that lead to risk, the system designers (road designers) must take further measures to prevent people from being killed or seriously injured. This is consistent with the Vision Zero theory, which suggests that humans have limitations in perception, diligence, and other driving-related performance that are predictable and inevitable. These natural limitations constitute the primary reason for increased responsibility by system designers.

The three important principles of Safe Systems Approach (SSA), derived from Vision Zero, provide the necessary guidance for ensuring pedestrian safety and meeting the mobility related SDG targets. The SSA has three key principles (H. Y. Chen & L. Meuleners, 2011[50]; Transport Research Centre, 2008[51]):

- **Principle 1** - Recognition of human frailty
- **Principle 2** - Acceptance of human error
- **Principle 3** - Creation of a forgiving environment and appropriate crash energy management

Understanding of pedestrian behaviour and acceptance of SSA principles together can lead to ensuring pedestrian safety and creating walkable, inclusive safe cities. Improving walkability and safety of pedestrians, therefore, is the key to meeting the UN's SDG related to mobility.

6. How can India have walkable cities?

A large proportion of people walk in Indian cities; however, cities are not walkable. Making cities walkable requires a strong policy framework guiding investments and implementation of planning and design guidelines.

For this to be effectively translated to reality, interventions are required at various levels.

i. Policy framework

As urban transport is a State subject, the NUTP has to be adopted at a State or city level or an urban transport policy framework has to be developed and mandated by the State or city level government. Chennai, Pune and Coimbatore have attempted this. However, the policy framework and the revised standards are not mandated by any law. Therefore, the impact of the NMT policy has not been achieved as desired. A mandatory State-level policy guiding all the cities in the State in preparing a road map for achieving pedestrian friendly (sustainable urban transport compliance) seems necessary. The small pilot projects of pedestrian friendly streets that are currently underway cannot be scaled up in the absence of a State Urban Transport Policy adopted by the State Legislature.

ii. Planning and design guidelines

In the last decade, many street design guidelines have become available to guide city-engineers. The Indian Roads Congress has revised the Urban Street Design Guidelines. Global best practices have been introduced by NGOs working in a few cities in India. However, city-engineers and planners often need city-specific guidelines. Preparation and implementation of city-specific guidelines require a combination of civil engineering and design skills of architects. Public works department and municipalities should induct designers and planners to work closely with civil engineers to make pedestrian-friendly streets. Compliance with current street design guidelines should be made mandatory by law. Traffic enforcement agencies also have to be guided to ensure pedestrian safety and compliance to pedestrian requirements over motorised traffic.

A No Free Left marking in Chennai. File photo: M. Karunakaran

Some immediate interventions

Specific interventions can be implemented with immediate effect such as restricting free left turns at signalised intersections and speed compliance of motorised vehicles on arterial roads by better enforcement through red light camera and police monitoring. The installation of speed tables at all intersections on non-arterial roads to enforce the 30km/h speed limit is also an immediately possible intervention. In intersections of small towns, well designed small round-abouts can be constructed to ensure speed compliance and smooth flow of traffic. Similarly, rural road junctions can have a combination of rumble strips and speed humps.

iii. Monitoring progress

City administration has to create a monitoring mechanism to evaluate the progress of implementing walkability guidelines. This can be on the lines of SDG monitoring mechanisms by the NITI Aayog. At the city level, administrative units should be set up whose responsibility is to evaluate various indicators of walkability and monitor the progress of pedestrian compliant infrastructure implementation.

There are many challenges and barriers to create walkable cities. Current administrative structures in most Indian cities do not respond to long-term goals and conflicting demands. The SDGs are not a priority for many city governments. Cities need encouragement and national support to adopt and implement the SDGs. Fresh thought has to be given to how the SDGs can be used to influence day-to-day decisions. The SDGs can also be a part of the outcome-based budget of municipalities in order to make them a priority.

More than anything else, citizens' engagement is a primary requirement and has been discussed in many policy documents. However, it is difficult to measure the outcome of such engagement in the short term. Citizens who are adversely affected by many infrastructure decisions (high speed roads through the city, poor facilities for pedestrians) do not have institutional mechanisms to express their demands. A "predict and provide" paradigm (i.e.) forecast increase in vehicles and increase capacity for motorised traffic movement, seems to dominate the approach of decision makers and city planners, rather than well-designed scientific approaches that are backed by empirical evidence.

Implementing programmes that elevate India's anarchic urban clusters to walkable cities requires a comprehensive re-look at the priorities given to this important role of the state at various levels of governance. Needless to emphasise, this is a long process and will require continuous efforts and demonstration projects. It is also an unavoidable investment in the future for a nation that aspires to join the comity of the developed world.

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