

# Non-motorized Transport and Sustainable Development: Evidence from Calcutta

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## Abstract

The important role that non-motorized transport plays in urban sustainability is discussed with particular reference to the developing world and to the links between environmental and poverty issues. The significance of non-motorized transport in terms of reduced pollution, income maintenance for the poor and providing transport for vulnerable groups is stressed and placed within the general context of sustainable development. More specifically, evidence is presented for rickshaws in Calcutta which demonstrates the vital role that non-motorized transport must play if sustainable development objectives are to be met. This evidence indicates that if rickshaws were to disappear from Calcutta's streets there would not only be significant increases in air pollution but also a substantial increase in the numbers of people living in poverty.

## Introduction

It is now generally accepted that the problems faced by cities in the developing world can be tackled effectively only by recognising that they are interconnected, and that policies across a range of issues must be developed and executed in an integrated fashion. The force of the concept of sustainable development is that it is based on just such an integration across environmental, social and economic dimensions. This has been argued strongly by the environmental movement for some time but is also supported by those with a more social or economic interest, and in particular those committed to the reduction of poverty are recognising that environmental issues and poverty must be tackled together. The World Bank has committed itself to the principles of sustainable development (Serageldin and Steer 1994, World Bank 1997) and national governments are now attempting to use these principles as guides in shaping their aid programmes. The UK Government for example is now committed to "support for international development targets and policies which create sustainable livelihoods for poor people, promote human development and conserve the environment" (Department for International Development, 1997, p.6). The reality of action however does not always, or even usually, match the rhetoric of official statements and publications. Development projects often fail to integrate different issues and are also frequently locked into a view of the development process which directly contradicts the principles of sustainable development. Top down, large scale, capital intensive and growth promoting projects heavily dependent on global markets are still being promoted in cities in the developing world, both by international agencies and foreign and home governments, all of whom pay lip service to sustainable development.

These considerations apply to transport particularly strongly. The transport debate globally has changed out of all recognition in recent years. Transport has escaped from the narrow, mechanistic world of highway infrastructure and economic development arguments that dominated discussions in the 1970s and 1980s and is now recognised as a key component of sustainable development and poverty eradication (Replogle 1991, Williams 1998). Transport has significant welfare, environmental and social justice implications just as strong traffic growth has significant negative effects on the economy through congestion and defensive expenditures on health care, road traffic accidents and other diseconomies of

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urban life in crowded cities. In terms of quality of life there is a realisation that crowded, polluted and noisy cities are both unacceptable and avoidable. Evidence is presented here for Calcutta to affirm the importance of sustainability principles in transport development and poverty reduction, and in particular to confirm the vital role that non-motorized transport has in sustainable urban development.

### **Non-motorized transport and sustainable urban development**

Despite the lip service paid to the importance of sustainability for transport systems (see for example World Bank 1996), governments in the developing world are still being encouraged and assisted to pursue transport policies linked to outdated notions of modernisation and car dependency which are rapidly being abandoned in the developed world. Responses to rapidly rising rates of car ownership and consequent congestion have in the main consisted of expensive road building and changes to urban physical structure which are difficult to reverse, damaging to social cohesion, and regressive in their impact. These measures are ultimately futile since they cannot keep pace with the rate of increase of car ownership, and in any case generate more of the congestion they are designed to reduce; Bangkok is perhaps the most extreme example of the futility of major infrastructure expenditure as a solution to congestion, but it is certainly not untypical. These policies also increase pollution in urban environments which are already the most polluted and health damaging in the world. In social and economic terms, their impact is highly regressive since car ownership is restricted to the wealthy whereas the negative consequences of traffic increase and pollution impact most severely on the poor. Furthermore, expenditure on road construction is money which could have been spent in other ways to benefit the community as a whole and the poor in particular, such as improvements to public transport and pollution control measures.

The irony is that despite their many problems, developing world cities have many characteristics which reinforce sustainability, but which are being ignored or destroyed in the name of a misguided view of progress. In the particular context of transport, modal split is heavily weighted toward walking and non-motorized vehicles. These are the most sustainable transport modes being non-polluting, cheap and labour intensive. They are also the modes most vulnerable to large scale road building programmes. There is now a growing recognition that these traditional means of transport can play a vital part in maintaining sustainable cities (Replogle 1992, 1993; United Nations 1987), a recognition that is being translated into reality in parts of the developed world but is being ignored in most of the developing world. Walking and cycling are healthy, non-polluting and available to everyone including the poor. Moreover, non-motorized transport for hire such as rickshaws and pedicabs generates huge amounts of non-skilled employment and is vital in maintaining the incomes of some of the most vulnerable urban dwellers. Gallagher (1992) in his classic study of rickshaws in Bangladesh has estimated that they contribute 34% of the value added from the transport sector to GDP and support 5 million people (4.5% of the population of Bangladesh). The rickshaw is one of the most important sectors of the Bangladeshi economy and provides a means of subsistence for groups of people for whom there is quite literally no current alternative. Rickshaws are also vital in maintaining mobility in urban areas where streets are narrow and unsuitable for motorized vehicles; rickshaws make up 85% of all vehicular traffic in Old Dhaka (Saito 1993).

Non-motorized transport makes a substantial contribution to reducing air pollution simply by providing a widespread and attractive alternative to heavily polluting motorized transport. Hook (1998) applied this logic to his study of cycle taxis in Agra (India). Using Chilean-specific emissions data he concluded that if all rickshaw trips were reallocated to highly polluting two stroke IC engines (e.g. the autorickshaw) then the annual totals of pollutants in Agra would increase by 11 tonnes of lead, 4,000 tonnes of particulates, 20,000 tonnes of carbon monoxide and 150 tonnes of NO<sub>x</sub>.

There is now widespread acceptance that there are important links between transport systems and poverty, and that non-motorized transport offers significant benefits for low income groups, the sick, the elderly, women and children. This is particularly important in the developing world where so many people live in poverty. Non-motorized transport is cheaper, non-polluting and more flexible. It provides employment to the unskilled and is labour intensive in terms of operation and the manufacture and maintenance of vehicles. Energy intensive and "efficient" (in the narrow monetary sense) motorized transport is too expensive for the poor and is capital intensive. A shift from non-motorized to motorized transport will reduce the mobility of the poor and destroy jobs. The pollution caused by motorized vehicles will impact most heavily on the poor and the sick but they will benefit least from their use. Increased use of motorized transport will make walking and cycling, the modes of transport most used by the poor, more hazardous. The construction of new roads to cater for increased motorized traffic will fragment the built environment and disrupt communities.

Despite the significant and obvious advantages that non-motorized transport has for sustainability objectives, it is increasingly under threat in the developing world and in some cities concerted efforts have been made to eradicate it. This is usually justified by arguments that slow moving non-motorized vehicles obstruct faster cars, buses and lorries thereby causing congestion, and also that they project the wrong image for cities wishing to attract foreign investment. The Indonesian version of the cycle rickshaw, the *becak*, was banned in Jakarta in 1988. In June 1998 activists managed to persuade the Governor of Jakarta to lift the ban in the light of the Asian economic crisis and the need to find low cost transportation problems, and within a short time some 2,000 *becaks* had entered the city from other parts of Indonesia. The Governor's subsequent reversal of his decision led to widespread public dissatisfaction. Governments may also be driven by the desire to boost domestic car manufacture even though the employment gained will probably be more than offset by the employment lost from any decline in non-motorized transport and despite the pollution increase and foreign expenditure required for oil importation. Hook and Replogle (1996) have described recent developments in China, a country still at present dependent upon non-motorized transport but which is devoting substantial resources to supporting motorized modes and which wishes to expand both car ownership and domestic car production. China has borrowed over \$1.4 billion in the past 10 years from the World Bank for road capacity expansion and projections of the Beijing Traffic Bureau show the current modal share for bicycles falling from 50% to 17% by the year 2040. Bicycles have been banned from some of the most congested roads in Beijing in the hope of easing congestion whilst at the same time increasing car ownership and use is being encouraged. The involvement of the World Bank with such developments sits uneasily with commitments to sustainability.

### **Transport and the Environment in Calcutta**

Calcutta encapsulates the essence of the 'mega-city' transport problem in developing countries. It is a city of 14 million residents living at high density (over 10,000 persons per square kilometre on average, and over 23,000 per square kilometre in central Calcutta) suffering severe infrastructure problems. Housing, water supply and sanitation are substandard with over 3 million people living in slums or on the pavements. Calcutta has a motor vehicle population of over 600,000 with low but rapidly rising levels of car ownership (at least 20% per annum) which operates under conditions most likely to maximise air pollution. The fuel used is poor quality, predominantly leaded and often adulterated. Vehicles are poorly maintained (most emitting black smoke) and there is widespread and official 'approval' of breaches of vehicle pollution laws (including readily obtainable certificates of pollution law compliance without checks). Traffic congestion is severe and there are no traffic management systems such as bus lanes.

Air quality is as bad as anywhere in the world. Suspended Particulate Matter (SPM) pollution (mainly from diesel engines and from auto-rickshaws) frequently exceeds 1000 ug/cubic metre when the WHO standard which should not be exceeded is 70 ug/cubic metre (Chakraborti 1997, Samanta et al 1998). In the UK a limit value of 50ug/cubic metre (24 hour running mean) is recommended as the level that should not be exceeded. Traffic remains the largest single source of health damaging air pollution and the source which is growing in significance over time. Noise is also a problem and levels on any of the main roads and intersections render human speech unintelligible. Road traffic accidents are increasingly threatening the lives of its residents. Congestion levels are not as bad as Bangkok but journeys to and from the centre (BBD Bag) or in and around Barrabazaar, New Market, Howrah and Sealdah stations will incur substantial delay and create an urban environment for residents, pedestrians and rickshaw drivers/occupants that is as miserable as any in the world.

Urban transport planning and urban governance have failed in the most dramatic ways in Calcutta. The failures are compounded by the import of transport strategies from the developed world that are inappropriate in Europe or Japan and are even more so in Calcutta. Calcutta is to receive six new flyovers from Japanese overseas aid in a plan that is so fundamentally flawed and weakly substantiated that it would not pass any test of appropriateness, efficacy or environmental assessment in Japan. US consultants are recommending a new mass transit system that will cost several billion dollars when a highly effective, low cost tram system already exists and simply needs 1% of the funds recommended for the new system in order to catch up on the backlog of maintenance and on urgent replacement of track, electrical systems and overhead power lines. The pattern of transport development in Calcutta vividly illustrates the major international faultlines between rhetoric and reality and between the public espousal of sustainable development objectives and the daily negation of those objectives in plans on the ground.

## **Rickshaws in Calcutta**

One of the many faultlines in transport and sustainable development policy concerns the significance of non-motorised transport generally and in Calcutta the significance of rickshaws specifically. The hand-pulled and cycle rickshaws of Calcutta are non-polluting, they provide desperately needed employment for citizens on the knife edge of existence and they support many hundreds of thousands of dependents both in Calcutta and in home areas of those migrant workers who fill the jobs of rickshaw pullers (and to a lesser extent rickshaw pedallers). Rickshaws provide cheap, reliable and consumer friendly transport options in a city where the buses are irredeemably dirty, crowded and dangerous and the car and taxi unaffordable for the majority of the residents. They are particularly useful for women, the elderly, the frail and the disabled. The rickshaw wallahs will take customers at any hour of the day or night, will work during the worst of the monsoons and through the most waterlogged streets and will take children to and from school in a city where personal care and reliability are highly valued. Every rickshaw journey is a journey that is not being made by another form of transport that will almost certainly be more polluting, especially the three-wheeled auto-rickshaw. Every rickshaw journey provides employment opportunities that are otherwise simply non-existent.

This is an impressive catalogue of characteristics and yet the rickshaw is frequently targeted as the cause of congestion and therefore also of pollution. This view is shared by the Commissioner of Police in Calcutta (personal interview, August 1998) and has prompted periodic attempts to ban rickshaws at least from the jurisdiction of the Calcutta Metropolitan Corporation (the central part of Greater Calcutta). The negative attitude toward rickshaws common within the Government of West Bengal and the Calcutta Metropolitan Corporation is also associated with a perception of the rickshaw as backward and not in tune with a vision of Calcutta as a city which is modernising and prospering (Sen 1998). The environmental and employment consequences of banning rickshaws have not been considered.

Calcutta is the last city anywhere to have hand-pulled rickshaws and these operate only in the central part of Greater Calcutta within the jurisdiction of the Calcutta Metropolitan Corporation where cycle rickshaws are largely absent. The latter are found throughout the remainder of Greater Calcutta (see Figure 1). The total number of rickshaws operating in Calcutta is not known. Although there is a licensing system, the vast majority of rickshaws are unlicensed. Halder and Basu (1982) estimated the number of hand-pulled rickshaws in Calcutta to be between 24,000 and 70,000 but it is not clear upon what basis this estimate was made. A more comprehensive study made by Thomas (1981) estimated that there were approximately 35,000 hand-pulled rickshaws and 45,000 cycle rickshaws; there have been no other surveys since but there is no reason to believe that the number has changed significantly. Given the large number of rickshaws in the city, the consequences of banning them are likely to be significant.

In August/September 1998 a sample survey of rickshaw pullers/pedallers was undertaken at 13 locations in Calcutta Metropolitan Corporation area and surrounding municipalities within Greater Calcutta (Figure 1). Data were collected with respect to distances travelled, passengers carried and fares collected. Data were also gathered on the demographic, economic and housing circumstances of the pullers and pedallers. The data from the questionnaires were combined with secondary data to estimate the total contribution rickshaws make to Calcutta's transport and economic system and also to estimate the environmental impact of replacing the rickshaws with motorised transport.

## **Environmental Consequences of Banning Rickshaws**

If rickshaws were to be banned from Calcutta, many of the journeys formerly made by rickshaw would transfer to motorized and therefore polluting vehicles. The likely impact on air pollution if this were to occur has been estimated using travel data collected from the rickshaw survey and secondary data regarding vehicular emissions in India derived from the International Institute for Energy Conservation (IIEC, 1992; see Table 1).

**Table 1 Estimated vehicular emissions in Varanasi, 1991**

All data in grams of pollutant per kilometre travelled

## Gasoline

	CO	HC	Nox	%CO	%HC	%NOx
2 wheelers		32	21.7	0.2	49.73	84.77
3 wheelers (P)		78	9.4	2	31.46	9.53
Taxis/cars		78	9.4	2	4.02	1.22
3 wheelers (F)		78	9.4	0.2	8.12	2.46
Cars/jeeps		78	9.4	2	5.57	2.32
					98.9	100.3
						100

## Diesel

Trucks	14.9	4.2	21.7	63.93	63.41	64.91
LCVs (goods)	2.2	0.3	1.5	0.91	1.16	0.43
Buses	14.9	4.2	21.7	29.75	29.51	30.2
Mini buses	2.2	0.8	1.5	1.42	1.82	0.68
Taxi/cars	2.2	0.3	1.5	0.01	0.01	0.01
3 wheelers (P)	2.2	0.3	1.5	0.17	0.22	0.08
Cars/jeeps	2.2	0.8	1.5	0.3	0.36	0.14
Tractors	14.9	4.2	21.7	0.21	0.21	0.21
3 wheelers (F)	2.2	0.3	1.5	0.03	0.04	0.02
				96.73	96.74	96.68

Source: IIEC (1992) Appendix B2

These data do not include suspended particulate matter (SPM) which is a major constituent of vehicle exhaust emissions in Indian cities.

None of these data are exact and hence ranges of estimates are given rather than exact predictions. The modal split of transport to which people might transfer from rickshaws is also not known and hence optimistic and pessimistic scenarios have been used as to the degree to which the transfer is to less or more polluting modes.

Both cycle and hand-pulled rickshaws can carry only two adults, although the majority of trips are for one person. Given the physically demanding nature of rickshaw-pulling/ driving, the number of trips made per day is limited even when custom is plentiful. Some locations are more favourable than others for attracting custom and thus may generate more trips. On the basis of the questionnaire responses, the number of trips made per day per rickshaw driver/puller is 10 to 20 with an average of 15. In many cases the rickshaws are shared by two pullers/drivers on a shift basis which increases the number of trips per day. As for distance travelled, again the physically demanding nature of rickshaw pulling/driving imposes maximum limits and most journeys are short and less than 3 km. The hand-pulled rickshaws make shorter journeys on average, both because it is physically more demanding and because they operate in central areas only. The survey data gave estimates for the average distance travelled per trip of one kilometre for the hand-pulled rickshaws and 1.5 kilometres for the cycle rickshaws. Using Thomas's estimates of rickshaw numbers, these data give estimates for the total number of passenger kilometres per day in Greater Calcutta as a minimum of 1.847 million (10 trips per rickshaw per day) and a maximum of 3.695 million (20 trips per rickshaw per day) with an average value of 2.771 million.

If rickshaws ceased to exist this amount of travel would switch to other modes. The 'optimistic' scenario assumes that some rickshaw travel (10%) will not be translated into motorised transport. The 'pessimistic' scenario assumes all former rickshaw travel becomes motorised transport (see Table 2). Table

3 gives the estimates of the increase in air pollution that would be caused by the transference of rickshaw journeys onto other modes of transport on the basis of 15 trips per rickshaw per day and using IIEC emissions data. These estimates indicate a huge additional pollution burden on Calcutta. Up to date data on total air pollution in Calcutta were not available but data were found for 1985 (Ghosh 1997). These data give pollution per day from all sources of 47.3 tonnes NO<sub>x</sub>, 177 tonnes CO and 59 tonnes HC. The increase in air pollution that would follow the banning of rickshaws is thus immensely significant. Given Calcutta's already serious pollution problem (certainly in the worst five cities of the world) every possible policy measure and safeguard needs to be put in place to protect rickshaw travel and prevent this extra pollution falling on a population already suffering unacceptable burdens.

**Table 2. Possible modal shifts from rickshaws**

Scenario 1 Optimistic	
10%	of journeys cease to be made or are made on foot or by bicycle
10%	of journeys switch to bus
10%	of journeys switch to car/taxi
70%	of journeys switch to auto rickshaw
Scenario 2 Pessimistic	
5%	of journeys switch to bus
5%	of journeys switch to car/taxi
90%	of journeys switch to auto-rickshaw

**Table 3. Increase in Air Pollution for Calcutta if rickshaws are banned**

		Daily	Annual
Optimistic	CO	177.1	64,641
	HC	21.9	7993
	NO <sub>x</sub>	10.3	3760
Pessimistic	CO	207.3	75,664
	HC	25.3	9235
	NO <sub>x</sub>	8.0	2920

All data in tonnes; assumes 2.77 million kilometres of travel per day

The IIEC data unfortunately does not include Suspended Particulate Matter

### **The Rickshaw and Poverty in Calcutta**

Rickshaw pulling/driving is unskilled and demands no educational attainment. The organisation of the industry, whereby there are owners of rickshaws requiring pullers/drivers, provides employment for those disadvantaged in the labour market. This applies particularly to the hand-pulled rickshaws, since some of the cycle rickshaws have owner-drivers. Almost all of the rickshaw pullers are Biharis who have left their families at home and spend ten months of the year in Calcutta; many of the other pullers are Bengalis from rural areas who have also left their families at home. The cycle rickshaw drivers tend to be Calcutta-born Bengalis and live with their families.

The survey revealed low earnings which varied little from pullers to drivers and from place to place. The average was Rs 60 to 70 per day net of rickshaw rent. These incomes place the rickshaw pullers and drivers at almost the bottom of the scale for Calcutta as a whole. They are better placed than rag-pickers and beggars but are amongst the poorest groups in the city. For the purpose of international comparison of poverty levels, the World Bank uses reference lines set at \$1 and \$2 income per day in 1985 Purchasing

Power Parity (PPP) terms (where PPPs measure the relative purchasing power of currencies across countries). At the August 1998 dollar-rupee exchange rate these poverty reference levels are Rs 44 and Rs 88 indicating that rickshaw pullers/drivers in Calcutta are at or below internationally recognised poverty levels. The incomes of the pullers/drivers have to support not only themselves but also their dependents. Those who live apart from their families send Rs 500 to Rs 1,000 or so home every month, representing between 30% to 50% of their total income; the rest is spent on subsistence for food and (when paid) rent for accommodation.

The number of dependents (i.e. immediate and extended family) of the puller/drivers varies and may be up to 8; 4 to 5 is more common. A conservative estimate of 100,000 puller/drivers would give a figure of perhaps 600,000 people directly dependent on their income. To this figure would have to be added the rickshaw owners and their supervisors and those involved in the manufacture and repair of the rickshaws to give a total figure of perhaps 650,000 people who derive income from rickshaws in Greater Calcutta.

The removal of rickshaws from Calcutta would have an immediate and catastrophic effect on the well being of hundreds of thousands of people already struggling on the economic margin. The livelihoods of the puller/drivers would be destroyed with little prospect of them finding alternative employment given their lack of education and skills, even supposing alternative employment on the scale required was available. Their dependents would likewise suffer including the hundreds of thousands in rural Bengal and Bihar where there would be negative effects on the local economies through multiplier effects. Those employed in the manufacture and maintenance of rickshaws would also lose their livelihoods but might be better placed to find alternative employment being more skilled. On the assumption that there are 100,000 puller/drivers in Calcutta earning an average of Rs 70 per day, the total loss of puller/driver income in the city as a whole should rickshaws disappear would be over Rs 2 billion (approximately US\$50 million) per annum. There would also be less direct but no less harmful consequences of the demise of the rickshaw. Motorised traffic would increase making walking and cycling more difficult; since the poor depend upon these modes their mobility and therefore access to services and employment would decrease. The increase in congestion following rising motorised traffic would also have an economic cost. For a variety of reasons, therefore, replacing rickshaws in Calcutta's traffic system makes no economic sense and indeed would be harmful to the economy of the city and the economic well being of many of its citizens.

### **Redefining the Rickshaw**

The rickshaw is currently undervalued and under-utilised as a means of transport. There are currently a large number of journeys made by the highly polluting auto-rickshaw which with the right kind of traffic management and pollution control would transfer to rickshaws. This under-representation of a transport choice has its roots in unsubstantiated biases in traditional transport engineering, the poor status of rickshaw pullers and drivers, the drive to modernity in Indian society which sees the rickshaw as an unwelcome reminder of a pre-modern and colonial society and the insulation of Calcutta decision makers and opinion formers from the rigours of every day travel experiences in this city. In this sense recognising the role and importance of the rickshaw is indicative of a wider political and social process which recognises the rights of women and children as well as the rights of workers in this sector of the economy. This in its turn is as good an example as one could wish of Local Agenda 21 at work. Those that use rickshaws and those that depend on rickshaws for their livelihood have a significant role to play in the debate about the future of rickshaws and the future of sustainable transport in Calcutta. The fact that these interests also coincide with greenhouse gas reduction strategies, gender strategies and urban air pollution reduction strategies emphasises their importance.

This is not to say that there are not problems connected with rickshaws in Calcutta. The work is hard and low paid and the pullers and drivers are poorly organised. The licensing system is abused and a mechanism for harassment and exploitation rather than regulation for welfare or efficiency. Redefining the rickshaw so that it can play a more secure role in Calcutta's transport system involves tackling rickshaw technology, licensing and operating conditions, traffic management and welfare issues. Work is already underway elsewhere in India to produce a more efficient cycle rickshaw design (Hook 1998) which would make rickshaw driving easier for the driver and rickshaw travel more comfortable and secure for the passenger. A more regulated industry with higher status, and the self-organisation of the drivers, could raise their incomes and combined with welfare and health measures make a significant difference to their quality of life.

Rickshaws can be of central importance to the achievement of sustainable development objectives in

Calcutta. Their removal from the streets of Calcutta would increase and deepen levels of poverty in a city already burdened by more than its share of the world's poor, and increase dramatically air and noise pollution in one of the world's most polluted urban environments. Rickshaws stand for far more than one transport choice amongst many. Their importance to the welfare of approximately 650,000 people is matched by their ability to deliver high quality local transport with zero pollution and with a high use value to women, children and to the local economy. This importance is not matched by the way rickshaws are perceived at high political and official levels. Indeed there is a view that rickshaws should be abolished. The importance of rickshaws requires that the threats against them should be removed and that their role in the overall transport system of Calcutta should be maximised. Indeed a commitment to sustainable development and sustainable transport requires as a matter of urgency that rickshaws be given a secure position in Calcutta's transport system and a new role in an integrated transport plan.

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