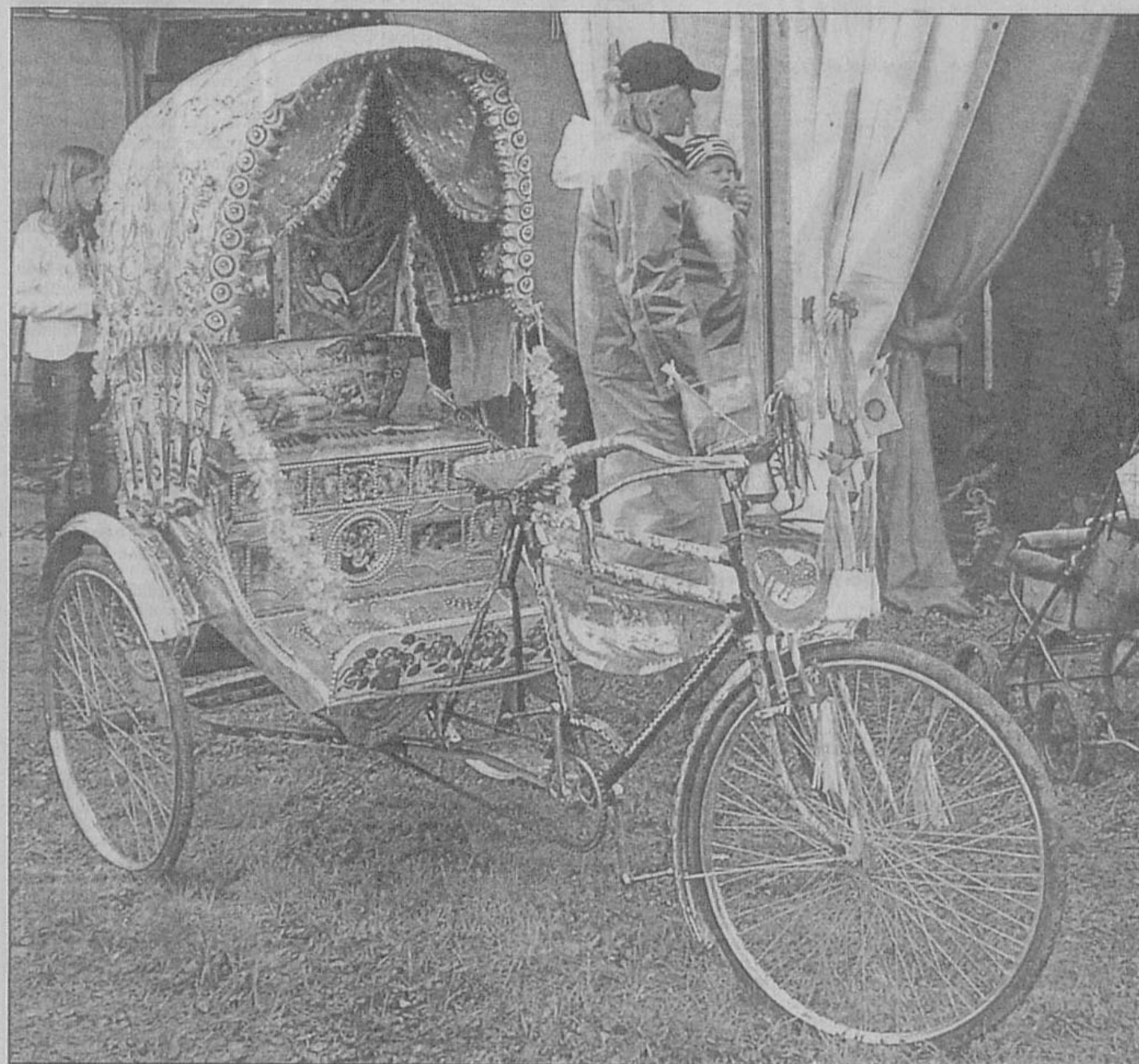


# Rickshaws in the new millennium



**With inadequate arrangements for public transportation and the need of millions for daily commuting, rickshaws provide affordable and clean transport and form an extremely smooth subsystem in the larger web of transportation in small as well as large cities, not counting the hundreds of small towns and thousands of villages. Rickshaws are here to stay.**

SHIREYA GADEPALLI

**R**ICKSHAWS have been an important part of transportation in the whole of Asia and remain so in the Indian sub-continent. With the world fast realising the danger of over-dependence on fossil fuels and the search for sustainable modes of transport, some eyes are turning to pedal-powered vehicles.

But at a time when the west is looking for such sustainable solutions, most Asian governments are ignoring them, and still worse trying to discard them. Rather than improving the cycle rickshaws, they are attempting to eliminate them in a false hope of creating a more "developed" way of living.

Rickshaws have been banned in many cities in India and Asia, most famously in Jakarta when Suharto ordered all the becak to be dumped in the bay back in 1980s. This continues today in cities like Delhi and Dhaka, where despite their massive modal share, the government bans cycle rickshaws from more and more streets. This pushes modal share into high-polluting 2-stroke motorised rickshaws.

The vast majority of transport sector projects supported by environmental funding agencies and local governments have been targeted to electric, hydrogen, CNG/LPG, natural gas, and other alternative fuel vehicles. While the nature of the programs has been to subsidise technological innovation and commercialisation of alternative fuel vehicles, minimal environmental funding in the past had gone to modernising human powered vehicles.

The reasoning follows from logical framework analysis: 1) Identify the Problem: cars, trucks,

smaller and weaker corporations which are generally not as able to influence government policy and are rarely aware that international funding guidelines actually encourage projects promoting non-motorised transport.

As a result, the funders and donors rarely receives proposals targeting the human powered vehicle industry. As most sources of international funding require government approval, most governments are also likely to prioritise projects which cost a lot of money, simply to maximise the total size of their grant and low interest loan funds. This creates a sort of adverse selection process, where large expensive projects like metros are favoured over more cost effective solutions like non-motorised transport improvements and busways.

Bicycles could be manufactured in most countries. Work tricycles, cycle rickshaws, animal carts, handcarts, and other human powered vehicles are almost entirely produced by local manufacturers in developing countries. In fact, were people able to bicycle safely, they might not need to spend billions of rupees on imported motor vehicles and fuels.

### Rickshaws in the subcontinent

Cycle rickshaws first came into existence in the subcontinent in the early 1940s. They were a great technological improvement over the large, inefficient, wooden-wheeled hand-pulled rickshaw that can be still seen in the city of joy, Calcutta. Cycle rickshaws also gave a little dignity to the profession by making the service provider a driver rather than a puller

**Banning the vehicles would directly reduce the earning capacity of the poor.**

motorcycles and buses make a lot of pollution. 2) Solution: reduce their pollution through changes in the vehicle technology. In many countries, millions of rupees in grants are being given to the automotive industry in subsidies to develop cleaner technologies precisely because they are the cause of a major environmental problem. Part of the reason simply has to do with the power of the motor vehicle industry to shape the debate and influence both national and international funding. There are currently several requests from Indian motor vehicle manufacturers to the global environmental facility to develop cleaner motor vehicles.

Meanwhile, the bicycle and the human powered vehicle industry, which currently generates no pollution, is composed of much

(though the word puller is still widely used which seemingly is a term borrowed from the era of hand pulled rickshaws).

Traditional cycle rickshaws in the subcontinent can be seen in almost every nook and corner of the region. And when one looks at them closely there is great variety in them. Some are narrow, some are wide and a few have a top while at many places the top has been done away with. Ornamentation and decoration varies from region to region. But within this wide variety there is a common thread that makes most of them less efficient and comfortable and often, less safe vehicles than desired. This is one of the prime reasons for the gradually diminishing clientele of the cycle rickshaws. Yet, they are ubiquitous. Most small cities' and towns' transportation systems

depend heavily on them.

### Traditional rickshaw design

We could look at what the principal problems are with the traditional rickshaws. One needs to look at how the traditional cycle rickshaws are constructed to understand this issue. Cycle rickshaws can be divided into three main components: the front bicycle frame, the lower angle iron chassis and the wooden passenger seat structure. This main structure is usually bolted together. On this basic structure are mounted the rest of the parts like wheels, handlebars, fork, etc.

The rickshaw industry can also be divided into three sectors. The first is the mass production industry that produces the relatively complex parts that need precision-components like wheels, fork, handlebars, the chain drive, and last, but not the least, the front bicycle frame. All these parts are primarily bicycle components that have been strengthened for the rickshaw. The strengthening on a part by part basis has resulted in a significant increase in weight. The vehicles are sold on the principle of the heavier the better! They are not rickshaw specific parts but are rather bicycle components modified for the rickshaw industry.

The basic bolted-on unit is overly flexible and often misaligned. This makes the vehicle inefficient because of misalignment and excessive flex that the rider has to overcome by putting in extra effort while pedaling. The front end is a typical black roadster bicycle frame that is large for an average subcontinentals. It comes from the British and no one ever changed the geometry to suit

average subcontinentals! The rear passenger seat is made out of thick planks of wood which are nailed together. This construction makes a heavy yet weak frame that is not very durable either. The passenger is perched up high on a spring, coir (coconut husk) and cotton filled seat that is small, hard and slopes forward... in short, extremely uncomfortable and dangerous. The absence of a suspension system is enough to give a bad headache to anyone! It is also very unsafe because the small seat is a separate unit that sits on top of the wooden frame, slopes forward and comes out very easily. Often, on too strong an application of brakes, it catapults the passenger out onto the road. The seat is close to three feet above ground and the step in height is over a foot and a half making it very inconvenient

especially for the elderly to climb in.

The seat has to be repaired every few months and the complete wooden structure has to be replaced every two to three years. The poor construction creates stresses in the rest of the vehicle drastically reducing its efficiency. The single high gearing ratio in the transmission often forces the driver to get off his seat and pull the rickshaw. The traditional rickshaw weighs (at 80kgs) four times as much as an average bicycle, yet has a similar gearing ratio. The absence of a multi-speed gear system makes the human being riding the rickshaw act as a gearbox producing varying torque depending on the loading and road conditions. This tires him very fast and has an adverse effect on his health.

Though the improvement from the hand-pulled rickshaw to a cycle rickshaw was a radical change, the traditional cycle rickshaw has remained almost the same for over half a century since its inception in India. It is not that



ICRIP designed cycle rickshaw.

work on technical improvement of cycle rickshaws hadn't occurred in India. But unfortunately it had been too little and too far apart. The work had rarely been tested in real life conditions and in no case had been followed up to its logical conclusion of commercial implementation. Rather, it had ended up as project reports in files at various places.

### India Cycle Rickshaw Improvement Project

Beginning in 1999, path-breaking work was done by designers working for the India Cycle Rickshaw Improvement Project (ICRIP). This project started out of a concern for the damage caused to the world heritage monument, Taj Mahal, by the motor vehicular pollution in the city of Agra. It was undertaken by the Institute for Transportation and Development Policy (ITDP), New York in association with some Indian organisations, under grants provided by the United States Agency for International Development, New Delhi and some other funding groups. The principal idea was to develop a modern cycle rickshaw that could demonstrate the possibility of growth of this traditional mode of transportation in India to counter the growing menace of motor vehicular pollution. After extensive research and

real life testing of prototypes over a period of three years by the project design team, ICRIP created a modernized Indian cycle rickshaw. The design process was not limited to the closed environs of the research center but involved the participation of all people involved with the rickshaws whether it be the rickshaw drivers and passengers or the manufacturers and assemblers, and others like the ones from the tourist industry.

### Modern cycle rickshaws: New design

These new rickshaws are truly revolutionary in terms of safety and comfort both for the rickshaw drivers as well as the passengers. With the reduction of the weight of the vehicle by more than 30% (at 55kgs compared to 80kgs) by means of an integral tubular frame that has excellent structural qualities, and the provision of a multi gear system specifically designed for rickshaws, the rickshaw driver is at a tremendous advantage. He gets less stressed and can ply more in a day without harming his health. The center of gravity has been lowered by about a third greatly improving the stability of the vehicle.

Independent surveys done on the rickshaw drivers plying these modern rickshaws have shown that they can ply them longer and average earnings have gone up by close to 50%. Increase in earnings can also be attributed to the very comfortable passenger seat that is woven with nylon strap on the tubular frame. It provides comfortable and safe seating with adequate suspension, hence giving a bump-free ride.

With a low step-in height, space for luggage and other passenger-friendly features like a permanent top which provides year round protection from sun and rain, the users are ready to pay more for the added comfort and more so for the safety. Issues such as ergonomics and road safety, low maintenance and longevity of the vehicle are among other issues that were of prime consideration in the design development. An interesting feature of this new design is that the same vehicle can be used for passenger transport as well as cargo hauling therefore giving the driver more avenues of income.

Other than the passenger rickshaw, the project also developed the design of a school bus rickshaw specifically meant to provide a comfortable and safe ride to and back from the school to young students who need such daily service. These vehicles seat up to 8 children of the age group of 4-12 years and have space for their school bags. A step for easy ingress-exit and a safety door are some of the other important features of this vehicle.

### Project implementation

Participation by the commercial

**Rickshaw-pulling is less stressful than other manual labour.**

ernized rickshaw actually sells for 5,200 Indian rupees (quoted price in early 2005). This is almost at par with the price of the traditional rickshaw but with the advantage of a much longer life (expected to be thrice as durable) and low maintenance and repair costs.

Local assemblers retain final assembly work. These assemblers also act as retailers and financiers who provide various loan schemes. The principal change to the manufacturing process is the loss of the intermediate sector that earlier produced the angle iron chassis, other metal components and the wooden frame. This sector is replaced by one that manufactures the integral frame.

The issue of recycling too has been addressed. The old rickshaws don't go to the dump yard but are completely recycled in the process. Since the new design retains most of the basic components that go on the traditional vehicles, components like wheels, fork, and chain from the old vehicles that are in good condition are refitted on the new vehicles. And the front bicycle frames of the old rickshaws are used to make second hand roadsters.

The idea was not to make a complex high-tech product that is inaccessible to most, but instead to proliferate a design of a simple and efficient cycle rickshaw whose genesis is in appropriate technology. The rickshaw industry remains a part of the small-scale sector with local enterprise creating a sustainable system that provides employment in many ways.

In addition to the areas where rickshaws are commonly used, ICRIP attempted with fair success to bring these rickshaws into new territories, areas where they had never been used. The radical changes and a new aesthetic that fits into many new environments spread open the arena. Cycle rickshaws are no longer seen as those old, rickety, unsafe three wheeled machines that degrade human dignity. These new machines are not only friendly to the environment but to the rickshaw drivers and passengers too.

With improved earnings, the rickshaw drivers enjoy a new economic status never heard of before. The passengers too, many of whom would have never wanted to be associated with a cycle rickshaw are enticed by these new rickshaws due to their comfort, safety and a brand new image. This is amply demonstrated by the fact that many five star hotels in the city of Agra now not only allow these new cycle rickshaws on their premises but also promote them amongst their visi-

### Does the project promote exploitation, or reduce it?

The impact that the project was having on project participants was documented. Interviews with the owners of the new vehicles showed the impact that the purchase of the new vehicle had on their income. Perhaps in part because of the novelty of the new vehicles, but also because the new vehicles are more comfortable, owners found that their incomes increased on average by over 50%.

The average income of a cycle rickshaw driver in the Taj Ganj area of Agra is Rs.110 per day, which is under \$3.00 per day. The income for cycle rickshaw drivers in Agra as a whole ranges from Rs.60-90 per day (\$1.25 - \$1.85), or near the internationally-recognized poverty line (\$1) as measured by the World Bank. As such, the beneficiaries of this project can all be considered "poor."

The other jobs available to this generally unskilled, often recent migrant population tend to be in day labour jobs at small workshops and factories and day labour construction. These jobs tend to pay around Rs.50 per day. The interviews indicated that there were benefits of operating a cycle rickshaw relative to these other options. The pay is moderately better.

Secondly, the working conditions, in the daylight and getting reasonably ergonomic exercise, are healthier than the alternatives of working in unsafe, dark factories where they are exposed to significant occupational health and safety hazards.

Furthermore, many of the drivers said they liked the freedom associated with being a cycle rickshaw driver, as they did not have to be under the direct supervision of a boss and could go and come wherever they liked, and rest whenever they liked, unlike day labourers. Nonetheless, they felt there is something of a social stigma attached to operating a cycle rickshaw.

According to Dr. Amartya Sen, recent winner of the Nobel Prize in economics, interventions aimed at alleviating poverty can only succeed if they directly increase the capacity of the poor to earn income.

Analysis based on an independent interview with cycle rickshaw drivers using these new vehicles shows that their income has increased by more than 50% (Rs.150 to Rs. 200 per day). As the cost of renting the new vehicles is roughly the same, at around Rs.15-25 per day, the introduction of this superior technology directly increased the income of the poor by more than

of effort well below the average workload for other types of employment available to this low-income population. The new vehicles are of a weight and similar to the cycle rickshaws currently operating in 40 cities in the United States and Europe, including New York, San Francisco, Denver, Boulder, Savannah, Miami, Amsterdam, Prague, and Krakow. The cycle rickshaw operators in India are paid far less, but otherwise are no more exploited than their counterparts in the West.

Health studies done in Bangladesh on a standard cycle rickshaw indicate that the level of stress on the cycle rickshaw driver operating with two passengers in level conditions (without wind) is somewhat less than the average level of stress from most other forms of manual labor. This includes carrying materials for construction and agricultural work, the two most common alternative forms of employment. In these normal conditions, and assuming that the drivers are consuming sufficient calories, the level of exercise is healthy. But because the traditional vehicles are of poor ergonomic design, the drivers tend to experience problems of hips, lower back, and shoulders.

If the conditions are windy, the roads are bad, the weight being hauled rise above 130 kg, or there are steep hills, or the drivers are not eating sufficiently, the level of strain on the human body can become as bad as other forms of manual labor.

The reduction of weight and introduction of gearing system in the new vehicles reduces the strain on the human body by 17%-30%. They also have reduced friction with superior bearings, tires, and gear-axle alignment. In total, this is roughly a one third reduction in the level of effort (and hence the caloric consumption). These improvements more than compensate for the modest uphill climbs making the strain consistently less than that from other forms of labor available to this population.

### A bright future

Less than two years since their commercial introduction, there were more than 8,000 of these modern vehicles on the road. The new design has been embraced by the rickshaw industry in more than 10 cities and towns and the numbers are growing every day. In towns like Vrindavan, the modern rickshaws have completely replaced the old ones. Most important of all, the local industry is continuously evolving the design to suit the local conditions and socio-cultural requirements. The project, in essence, has set in place a process of evolution that will help the design to change with time and not remain stagnant as it had for close to half a century. As of early 2006, there are more than 200,000 modern rickshaws plying in various Indian cities.

The modernization of cycle rickshaw technology in India has already proven to be a more cost effective way of reducing CO2 and TSP emissions than projects promoting electric and other alternative fuel vehicles. With the successful commercialization of this technology, the emissions reduction impacts per rupee of investment would be extremely low indeed. It is of course conceivable that the entire cycle rickshaw fleet in India might begin a process of sustained technological innovation throughout India. The beneficiaries of these projects are also among the lowest income populations in the world, which contrasts markedly with the beneficiaries of alternative fuel vehicle promotion projects, where the beneficiaries in the long run are likely to be multinational corporations.

Nonetheless, it is possible to quantify the emissions reduction benefits of this type of project, and it is possible to convince open-minded funding agencies that modernizing human powered vehicle technologies is a more cost effective method of reducing greenhouse gas and other emissions than alternative fuel vehicle promotion projects.

As such projects do not directly benefit any multi-national corporations, however, it is difficult for them to find political support among development institutions all too often influenced by corporate lobbyists. For this reason, it is critical that such projects find political support among the increasingly vocal environmental and bicycle advocacy community.

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50%. Income increased because they were able to attract more passengers each day, and because each passenger was willing to pay more, primarily due to the superior comfort.

Were cycle rickshaws in the area banned all together, this population of poor people would be forced to seek employment in the other employment available to them, the wages for which tend to be lower than for cycle rickshaw operation. As such, banning the vehicles would directly reduce the earning capacity of the poor.

There is little chance that this population would ever be able to afford to rent and operate an auto-rickshaw, the rental costs of which is roughly Rs.75-80 per day. The total income for those slightly higher income individuals who rent auto rickshaws on a daily basis is only marginally higher, and because the rental costs and vehicle operating costs are higher, the financial risks are also greater. Adding a non-polluting electric motor (though there is pollution at the site of power generation not to speak of the problems associated with the deep storage batteries) to the cycle rickshaws would only further increase the daily rental cost beyond the reach of the current cycle rickshaw drivers.

Secondly, the improved technology reduces the workload faced by the operator by one third, to a level

**The new vehicles increase income by 50%.**

sector was an essential aspect of this project, and played an important role in its success on a large scale. The design process kept in mind the rickshaw industry and how this new design could be incorporated with ease into the existing system. The main changes in the design were the light yet strong mild steel integral frame and the option of a multi gear system, plus the comfortable passenger seating which enticed more and more passengers to choose these new rickshaws as their preferred mode of transport.

This modern rickshaw still retains most sectors of the traditional rickshaw industry and adds to it a new sector - frame manufacturing. Precision components like wheels and handlebars are still made by the centralized mass production bicycle industry. The front bicycle frame becomes redundant. The new integral frame provides good alignment to the vehicle with a reduction in the complexity of assembly, hence reducing the costs and increasing the production rates. The mod-

ers. A growing number of tourists now use these modern vehicles to visit sites of tourist interest.

The pride that the new vehicles give to their operators should also not be under-estimated. Many cycle rickshaw operators are aware that their profession is of low social status. However, the new vehicles have restored a sense of pride to the non-motorized operator profession.

Many have already modified their vehicles with stereo systems, luggage compartments, and other amenities. In fact, one auto rickshaw operator sold his vehicle to buy one of our new vehicles (lower overheads, greater income), and one auto rickshaw manufacturer has entered into the business of manufacturing these new vehicles in Lucknow. The auto-rickshaw industry knows that it is under considerable political threat due to the environmental emissions that the vehicles generate.