Taking bicycles seriously: three replicable urban bicycle development projects

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Taking Bicycles Seriously:

Three Replicable Urban Bicycle Development Projects

By

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CONTENTS

List of Tables..............................................................................................i

Chapter One
A Paradigm Shift in Transport Development.........................................1

Chapter Two
Stimulating Technological Advances in Bicycle Technology: The Indian Cycle Rickshaw Improvement Project...............................23

Chapter Three
Facilitating Access to Load-Carrying Bicycles: The Workbike Pilot Project...............................................................................60

Chapter Four
Building Bicycle Culture: The Afribike Project........................................79

Chapter Five
Conclusion: Lessons Learned.................................................................90

Bibliography..............................................................................................93
LIST OF TABLES

Projected Transport Sector CO2 emissions..............................7

Average Weekly Collections.................................................66
Introduction

The purpose of this paper is to present to the reader examples of replicable sustainable transportation projects in urban environments.

This paper's impetus arose from the author's involvement with the Institute for Transportation and Development Policy (ITDP), the non-profit environmental organization for which the author first volunteered, and now currently serves as Projects Director.

ITDP was established in 1985 by groups fighting for more environmentally sustainable transportation policies here in the U.S. While trying to halt the disturbing growth of vehicle miles traveled and suburban sprawl here in the U.S., they also saw the growing global environmental and economic danger of a China or an India motorized to the same degree as the U.S. They also saw that U.S.-led institutions like the World Bank were exporting the U.S. model of auto-dependency to these countries.

ITDP's current project activities focus on implementing demonstration projects which demonstrate how non-motorized vehicles can be promoted in a commercially viable manner in a way which better addresses basic mobility needs than standard transport infrastructure development projects.
In the last two decades, a paradigm shift has occurred in how development agencies approach transport. In an attempt to mitigate against the environmental, social and economic ills caused by growing motor vehicle fleets, institutions like the World Bank, the Asian Development Bank, the United Nations Development Programme are now moving beyond their exclusive focus on auto-infrastructure projects and beginning to implement innovative non-motorized transportation projects that aim to reduce poverty, create employment, empower women, and protect the environment.

Heretofore, these new initiatives have targeted rural areas, as poverty is perceived as primarily a rural phenomenon. Consequently, the question of how interventions can effect sustainable transport in *urban* areas—where the majority of the world's poor will reside by the early years of the 21st century—has been less explored.

Bicycle projects are viable options for governments and development institutions assigned the task of developing environmentally, socially and economically sustainable urban transportation systems that address urban poverty. Three examples of replicable urban bicycle projects are presented:

"The Indian Cycle Rickshaw Improvement Project", an effort to stimulate technological advances in bicycle technology and increase the status and income of rickshaw pullers in Agra, India.
"The Workbike Pilot Project", a micro-credit public-private partnership that facilitates access to load-carrying bicycles among a population of recyclable paper collectors in Midrand, South Africa.

"Afribike" a multifunctional community bicycle facility in Newtown, Johannesburg, South Africa that is promoting cycling through youth programs, training, advocacy and innovative schemes that facilitate access to human-powered vehicles.
CHAPTER ONE
A Paradigm Shift in Transport Development

The growing use of private motor vehicles, automobile manufacturing, oil exploration, extraction and processing of vehicle fuel are all responsible for growing environmental problems. The worldwide transport sector is the fastest growing source of global greenhouse gas emissions. Emissions in the transport sector have been increasing 2.4% per year since 1973, unlike many other sectors where emissions are stabilizing. (see fig. 1) Estimates of likely greenhouse gas emissions increases between now and the year 2025 vary between 40% and 100%, with rapid motorization in developing countries and continued growth in vehicle use in developed countries the major causes. (International Energy Agency, 1993)

In developing countries the public health ramifications of growing motorization are even more alarming. Many major cities like Mexico City, Bangkok, and Jakarta, are still operating vehicles burning leaded gasoline, causing learning disabilities in children. Nitrous oxides, carbon monoxide, ground level ozone, and particulates are also implicated in numerous upper respiratory illnesses which are reaching crisis proportions in the cities of developing countries. Road safety may be an even more serious public health problem, claiming an estimated one million lives per year, mostly of pedestrians.
and other vulnerable road users. These motor vehicle related health problems are overwhelmingly borne by the poor.

A Sea Change In Transport Development

"Transportation development" traditionally meant simply building roads to facilitate vehicular travel. Perceived as a field solely for technical experts, planners, engineers and economists, transportation was something outside the ken of laypersons. The highly technical focus of "transportation experts", blindly making way for private automobiles caused many environmental and social problems that were not even considered at the outset of projects. Projects tended to ignore the basic mobility needs of the poor, and in worst cases led to the razing of vibrant urban neighborhoods, and the displacement of thousands of people. Traffic congestion, air pollution, and road safety problems kept getting worse.

Then, about twenty years ago, a paradigm shift in transportation development began. Instead of building roads solely to anticipate vehicular travel, researchers began looking at how people meet their basic mobility needs at the household level. They began to recast transport as an ‘access’ issue, realizing that avoiding the need to travel at all was sometimes better than focusing exclusively on improving mobility. They saw that most of the poor were bereft of vehicles, and therefore didn’t reap benefits from road projects. They found that the poor walk most of the time, sometimes carrying heavy
loads on their heads, sometimes en route to public transit or other forms of collective private transport or 'paratransit'.

In some countries people realized that many trips are made by bicycle, and if mobility was to be improved, then it would behoove them to consult people about what kinds of improvements would actually improve their access to markets, schools, jobs and amenities. Merely building roads was not enough; access to vehicles and bicycle infrastructure was needed.

In the late 1970's the first demonstration projects reflecting this new thinking began to surface. The United Nations Development Programme (UNDP), a leader in such projects, began disseminating non-motorized vehicles in rural areas. The International Labor Organization (ILO) sponsored an international workshop on 'appropriate transport technology and the poor' in New Delhi in 1979. In the early 1980s the United Nations Centre for Human Settlements (UNCHS) also began to explore how people-centered strategies to improve access and basic mobility could be applied to urban areas. The World Bank and the European Investment Bank (EIB) also began supporting projects serving the needs of rural populations using non-motorized modes in the late 1980's. Since then, these and other development institutions have evolved considerable institutional experience in how rural transport projects can best reduce poverty and create employment while simultaneously protecting the environment.
Most of the aforementioned innovative transportation projects, however, were implemented in *rural* areas, as poverty was viewed as primarily a rural phenomenon. Since then, however, poverty has become an increasingly *urban* phenomenon.

A New Paradigm at the Development Agencies

For the past two decades, transport projects around the world have been financed by the Multilateral Development Banks (MDB's), who collectively have provided billions of dollars in loans and grants. In the late seventies and early eighties, the MDB's framed their transport sector activity as providing "technical assistance" to governments' interests in implementing large-scale transportation projects. Then in the mid eighties, the MDB's began responding to the increasing evidence that the transport development to date was often the cause of increasing air pollution, congestion, road deaths and toxic emissions. Accordingly, many MDB's drafted new mandates to ensure that their transport sector projects proceed with the goals of environmental sustainability and poverty alleviation.

The United Nation's Development Program's New Development Paradigm, which is representative of the new directives at many MDB's, is indicative of this new holistic focus:
"The ultimate goal of development is not growth per se, but the expansion of people's opportunities to live long, healthy, and decent lives. Economic growth may contribute to this objective, but is not an end in itself." (UNDP, 1997).

Similarly, the official statements of the World Bank have changed considerably to reflect the new thinking in transport: According to the 1993 World Bank Annual Report,

In the course of its 50 years of the existence, the World Bank's overall development goal has evolved from a simple emphasis on national income growth with trickle down effects to a more complex challenge that includes three main objectives to support economic development in developing nations: Poverty reduction, economic adjustment and growth, and environmental protection and improvement (WB, 1993:57)

And according to former World Bank President Lewis Preston,

"Poverty reduction must be the benchmark against which [the Bank's] performance as a development institution is judged" (WB, 1993c:11).

In order to make manifest this new environmentally and socially aware approach to urban transportation development, new examples of transport projects are needed. If roads and auto infrastructure were the response to the old transportation paradigm, what sorts of transportation interventions are appropriate to respond to these new directives?
Relevant Transportation and Development Issues

Urbanization, Unemployment and the Informal Sector: The Case of South Africa

By all accounts, urbanization in the developing world will continue, and is expected to accelerate: By the year 2005, more than half of the World’s population will reside in urban centers (3.3 Billion) two-thirds by 2025. In accordance with developing world trends, the urban population of South Africa will comprise 70% of the country’s total by the year 2000, and 75% by 2020. (White Paper on Urban Development, 1996.) The greater Johannesburg area, or Pretoria-Witwaterstrand-Vereeniging metropolitan region (PWV) will bear the brunt of this growth; by the year 2010 the PWV will contain 16.5 million people, rivaling the size of Sao Paulo today (Urban Foundation 1990).

South Africa’s cities are currently growing at the unprecedented rate of 3.1 percent per year. (CSS, Dev. Bank of South Africa an the CERN for Development and Enterprise) Significantly higher than the 1 percent growth in developed cities, South Africa’s current rate of urbanization approaches the 3.5 percent population growth of cities in the developing world. Accordingly, South Africa’s cities are increasingly characteristic of developing urban areas, and are experiencing the attendant economic, environmental and social ills. (UN Population Division, World Urbanization Prospects: The 1994 Revision (UN, NY 1995)
A major driving force of urbanization in South Africa, as in other parts of the developing world, is the promise of employment opportunities. According to a World Bank study, 80 percent of future developing countries' economic growth will happen in urban areas, and urban areas in South Africa already account for 80 percent of its GDP. (Bartone et al. 1994) But despite their economic activity, the world's developing urban areas have proven inadequate in absorbing the influx of job-seekers, and as a result the ranks of the urban poor continue to grow.

Indeed, 30% of South African urbanites are officially unemployed. (Central Statistical Service of South Africa, 1996) And it's getting worse. In 1995, the formal economy lost 50,000 jobs. The government's growth, employment and redistribution strategy (GEAR) projected the economy would generate 126,000 jobs in 1996, and 252,000 for 1997. According to the Central Statistical Service, the reality of job creation in the formal sector has fallen short: 71,000 non-agricultural formal sector jobs were lost in 1996. Since 1990, the economy has lost 238,000 formal sector jobs, mostly in mining (199,400) In South Africa today, the number of urban unemployed is high, increasing, and disproportionately concentrated among blacks.

*As a percentage of the economically active population
The Rise of the Informal Sector

As a result of growing unemployment, many urban poor are eking out livings in the burgeoning "informal economy":

"The dramatic reduction in the capacity of the formal sector to create new income opportunities for work-seekers (from 73.6 per cent between 1965-1970 to a meager 12.5 per cent for 1985-1990) has directed attention to the income and job-creation potential of the informal economy...the process of informalization witnessed visible new growth across a range of street or pavement-centred activities (hawking, street barbers, taxi operations, herbalists, prostitution, begging). [and] an expansion in an array of home-based enterprises (shebens, spaza stores, hairdressers, backyard workshops)... (Rogerson, 1995)

"Informal sector" or "micro-enterprise" activity is generally characterized by its small scale, low capital investment and ease of entry. Additionally, such activities operate outside of the regulations and lack official recognition and documentation. According to a 1990 study, 2,778,028 people were employed in the sector, 68 percent part-time and 32 percent full time. (CSS 1990) This data, however, is suspect, for the activity in many newer informal settlements went unrecorded in the study. Moreover, the percentage of male participants in the informal sector, according to this particular study, was found to be greater than that of females—while most of the micro-surveys show that women's participation in the sector approaches two-thirds of the total (World Bank, 1993a)
These discrepancies are representative of the body of data concerning the informal sector: "one of the major challenges in dealing with the problem of the informal sector has been the paucity of data" (Sethuraman, 1992, p.18) Accordingly, Thomas (1993) and others have offered a number of "guesstimates" that draw from a variety of sources. These estimates put the total number of informal workers at 4.3 million, or 28 percent of the total labor force. (Thomas, 1993, p. 14)

There is a strong consensus, however, that most informal sector activities offer scant more than "survivalist" incomes. Rogerson (1996) notes:

"The mass of informal enterprises in South Africa's largest cities, towns and rural areas fall within the category of survivalist enterprises. Typical examples are urban cultivators, child-minders, street barbers or garbage scavengers... All empirical work evidence indicates that these ventures operate at bare survival level."

Heretofore, transport developers have been slow to respond to this growing trend; there is a dearth of proven transport projects that address urban poverty, despite changing policies at the world's leading development agencies.

Growing use of motor vehicles is seen as 'modernization' by most people. Unless this growth is properly managed, however, it can lead to a considerable worsening of global warming, deteriorating public health, economically destructive traffic congestion, increasing roadway deaths, and growing isolation among the poor. While the traffic snarls endemic in more and more countries may appear to be a sign of progress, in fact,
we are paying more and taking longer to commute, our health is getting worse, our communities are becoming less livable, and our poor are becoming more marginalized.

Traffic Congestion

Travel speeds are actually declining in most cities around the world. In developed countries, on average urban rush-hour travel speeds fell from 37 kilometers per hour in 1980 to 30 kilometers per hour in 1990, and travel speeds in developing countries are falling even faster. (OECD, 93) This growing traffic congestion costs the countries of the European Union on average 2% of their GNP (Quinet, 1994, p.53). In heavily congested Bangkok, some $500 million a year is lost in wasted fuel and work time. (Birk & Zegras, 1992)

It is impossible, particularly in Asian countries with high population densities, to deal with congestion by simply building more highway capacity. If all transportation projects planned in Thailand within the next 15 years were built, they would cost $15 billion, would displace hundreds of thousands of low income people, and would speed up the flow of traffic by only 1.6 kilometers per hour. (Tanaboriboon, 1993) Between 1970 and 1990 even wealthy developed countries could only afford to expand road infrastructure by between 4% and 9%, while vehicle kilometers traveled increased by closer to 50%. (OECD, 1993) The cost of providing sufficient road infrastructure to accommodate projected dramatic increases in vehicle traffic in developing countries in
the next ten years is likely to be prohibitive. Travel demand management, more efficient utilization of the existing road system, giving priority to public transit, pedestrians, and bicyclists which consume much less road space per person, have to be significant parts of the solution to this growing problem.

Impacting the Poor

The current, unsustainable form of motorization has a particularly harsh impact on the poor. In developing countries, more than half of the trips made by the poor are made by walking, and the balance are made by taking public transport or some form of non-motorized transport like a bicycle. As roads become more and more congested with private cars and trucks, travel speeds for public transit are adversely affected, and the safety conditions for pedestrians and cyclists tend to deteriorate. More than 500,000 people are killed every year in road traffic accidents, and another 50 million are seriously injured. In developing countries, more than 60% of the victims are pedestrians and other low income, vulnerable road users. Traffic accidents cost most economies between 1.5% to 2% of GNP. In developing countries, every year an estimated $2.8 billion is lost to traffic accidents, and most of these costs are borne by low income people. (Seymour, 1996; Jorgensen, 1995)

Transport emissions are also a source of environmental justice concerns. In many cities, the poor suffer inordinately from urban air pollution. In Mexico City and New
York City, for example, the high density urban neighborhoods suffer from much worse air pollution than upper income neighborhoods, which tend to be lower density and have more green space. In Mexico City, Sao Paulo, Manila, and Kuala Lumpur, road transport is responsible for between 70% and 86% of total airborne pollutants. Airborne lead and carbon monoxide, both of which are over 90% from road transportation, have caused learning disabilities in 7 out of 10 children in Mexico City. Ground level ozone and nitrogen oxide, over 45% of which comes from road transport, are known to exacerbate asthma and other upper respiratory illnesses. In 1989 one seventh of Bangkok residents suffered from chronic bronchitis and other respiratory diseases. (Heierli, 1992; Wijetilleke & Karunaratne, 1995)

Already by the early 1980s, Beijing, Bangkok, Calcutta, New Delhi, Tehran, and a host of other cities were in violation of World Health Organization (WHO) air emissions standards more than 200 days out of the year. Roughly a quarter of the world's population lives in cities which do not meet WHO minimum air quality standards, and the numbers are increasing. (Heierli, 1992)

Global Warming

The transport sector is also a primary source of greenhouse gas emissions. Globally, transport accounts for 22% of total carbon dioxide emissions, some 66% of carbon monoxide, some 47% of nitrogen oxide, and 39% of hydrocarbons. Over 70% of
these emissions come from the road sector. (Wijetilleke & Karunaratne, 1995) Today, over 70% of the motor vehicle-related carbon dioxide emissions come from developed countries. However, by the year 2025, over 50% will be coming from developing countries. This is because between 1988 and the year 2000 motor vehicle fleets in the OECD will increase by 10%, while in developing countries they will increase by 220%. Vehicle usage is increasing at between 3% and 30% a year in developing countries, well above GNP growth rates. (Karmokolias, 1990) As a result, while greenhouse gas emissions in other sectors are stabilizing, carbon dioxide emissions from the transport sector are projected to rise by between 40% and 100% by the year 2025. (International Energy Agency, 1993)

Equity

The explosion of private motor vehicle use has adverse impacts on income distribution and distribution of economic benefits. In developing countries only the richest 1% to 20% of the population have access to a private motor vehicle. Even in relatively high income countries, like Mexico or Brazil, only families in the top income quintile have access to a private car. With motor vehicle ownership so low among the poor, the improvement of roads, which has been the thrust of the support provided by first-world development organizations until now, is only likely to help the poor if the roads are primarily used by public transport vehicles, pedestrians, and non-motorized vehicles.
Private cars occupy a disproportionate share of scarce urban road space both for driving and parking, and consume a disproportionate share of public expenditures. A private car with a single occupant takes up 40 times as much road space as a normal bus, some 8 times as much road space as a bicyclist, double the road space of a pedicab, and 30 times as much space as a pedestrian. (UNCHS, 1984; Wright, 1992) Extremely valuable central city real estate in cities all around the world is being donated virtually free of charge to the richest fifth of the population for road and parking facilities.

Scarcе foreign exchange reserves are often used to meet the mobility needs of a handful of well-to-do travelers. Many countries already spend 30 to 50 percent of their foreign exchange reserves on oil and automobile imports. In 1980, at the height of the oil crisis, Brazil spent US$10.3 billion on imported oil, contributing to Brazil's debt crisis. (Oliveira, 1993; Replogle & Hook, 1993)

Women

Women's basic mobility needs are also rarely addressed by existing transport policies. While men's travel is centered around the commute, women's travel is often focused on meeting household needs like collecting water, fuel, removing solid waste, bringing children to schools and health facilities. Because most transport planning and most transport interventions are geared towards facilitating the mobility of the work-trip, little is done to address the enormous mobility burden that these household tasks places
on women. Women in Africa often have to spend as much as four hours a day meeting these basic mobility needs; time which could be spent educating children or raising additional income. (Overton, 1994)

Economic Growth

The rapid increase in the level of private car consumption is not only a market-driven process. While growing per capita incomes is the main reason for the growth of private motor vehicle use, there is enormous variation in the levels of car use between countries with similar levels of per capita income. Commuting by private motor vehicle is much higher in the cities like Lagos and Dar Es Salaam, where the national economy has grown less that 0.5% a year since 1965, than in Hong Kong, Shanghai, Singapore, and Tokyo, all of which have averaged over 4% annual growth per year since 1965. Countries with public policies which constrain private motor vehicle use also generally have higher savings rates and lower public debt, which are major determinants of economic growth. (Hook, 1995)

Access

Providing safe access to the street network for pedestrians, bicyclists, and pedicabs is also critical if these low cost, non-polluting modes are going to be viable. These modes are not losing in a free market for transportation; rather, they are being
driven off of the streets by government restrictions or due to deteriorating safety conditions. For governments hoping to avoid the many economic, environmental and safety problems related to increasing motorization, protecting these non-polluting, efficient, and affordable modes will be key.

If new transport policies are to be implemented which will protect the environment, reduce poverty, and empower women, the current approaches of development institutions and governments are going to have to be fundamentally re-evaluated, focusing on meeting the basic mobility needs of the majority at the least social cost.

**International Agreements Addressing Transport**

Increasingly, governments are becoming aware of the growing mobility crisis in their cities, and the related environmental and social problems that it is causing. Many of the objectives of a new transportation paradigm are already reflected in existing UN agreements. Three major international agreements deal directly or indirectly with these transport problems; the Framework Convention on Climate Change, Agenda 21, and the Habitat II Global Plan of Action.

The UN Framework Convention on Climate Change
In the Framework Convention on Climate Change (FCCC), ratified at the Earth Summit in Rio, nations agreed to "stabilize atmospheric concentrations of greenhouse gases at levels that will prevent human activities from interfering dangerously with the global climate system." While agreement on specific targets continues to elude the international community, stabilization of greenhouse gas emissions at around 1990 levels may still be agreed upon. Certainly governments are increasingly aware that the problem must be addressed. As 15% of total greenhouse gas emissions come from the transport sector, and a quarter of CO2 emissions, this agreement has forced governments to look closely at the environmental ramifications of transport sector trends. Many governments prepared National Action Plans (NAPs) in which they outline their proposals for compliance with the global pollution reduction goals. As most of the current emissions come from developed countries, most of the focus of the treaty was on reducing greenhouse gas emissions in developed, or 'Annex I' countries.

Recent analysis indicates that most countries are failing to stabilize emissions at anywhere near 1990 levels. The inability to contain rapid growth in motor vehicle fleets is a major factor in the failure of these targets. In the EU, transport's share of CO2 emissions has risen from 17% in 1960 to 31% in 1994. Only England, Germany and some Scandinavian countries managed to stabilize or reduce greenhouse gas levels since 1990; Britain by greatly reducing the use of coal as a fuel source, and Germany by closing factories in Eastern Germany. The U.S. and the rest of Europe failed to meet even these modest targets so far. (Economist, July, 1997)
Meanwhile, CO2 emissions in developing countries are rising sharply. CO2 emissions from motor vehicles in the developing world are growing at 3.5 percent annually, and account for 45 percent of the global growth in vehicle emissions. (Wijetilleke & Karunaratne, 1995) Therefore, the overall goal of the FCCC stabilizing greenhouse gas emissions at levels which avoid significant destabilizing climate change will require that development institutions and governments in developing as well as developed countries begin to address the environmental problems of unsustainable growth in motor vehicle use.

Heretofore, these agreements have not led to a significant redirection in how development agencies develop transport in the real world. The examples offered in this paper intend to inform the project work of development agencies, NGO's, governments and others by providing them with feasible examples of concrete projects that achieve the new goals of environmental, social and economically sustainable transport.
CHAPTER TWO

Stimulating Technological Advances in Bicycle Technology: The Indian Cycle Rickshaw Improvement Project

Introduction

ITDP's Taj Mahal Cycle Taxi Improvement Project was conceived based on a request from the Municipality of Agra, the Indian Government, and the U.S. Environmental Protection Agency, all of whom developed a strategy to save some of the world's most famous monuments. The Taj Mahal and other monuments are being ruined with orange, black, and brown staining from suspended particulate matter (SPM) and Hydrocarbon (HC) emissions. The major sources of these emissions are motorized vehicles and, to a lesser extent, gasoline powered portable generators.

It was suggested that it was possible to mitigate against the ill effects of these pollutants by restricting motor vehicle access to the Taj, because the pollution is localized. Accordingly, a Supreme Court order mandated that motorized vehicles be restricted to the 4 square kilometers surrounding the Taj in 1994. In addition, the Taj is surrounded on three sides by a neighborhood of narrow winding streets known as the Taj Ganj-- rendering taxi and bus access difficult even before the mandate was put into effect. These auspicious circumstances made for a 'captive market' for cycle rickshaws, and an ideal place to initiate their advancement.
As most of the travelers to the Taj are tourists, many of them would like to reach the monument using a traditional mode of travel to give them the flavor of traveling in India. Many tourists already use the horse drawn cart and even camel to make the short trip from the parking lot to the Taj, in trips arranged by various tourist agencies, and many people already travel from the nearby tourist hotels to the Taj by cycle rickshaw.

Tourism is one of the most important sources of income and employment in Agra, and a visit to the Taj Mahal is a major draw for tourists to come to India, bringing critical foreign exchange. Tourist visits to the Taj, however, are quite modest given the fame of the monument. Furthermore, a large number of visitors to the Taj Mahal visit the monument as a day trip from Delhi, and do not visit the four other world-class tourist sites in the city. The environmental and social problems in Agra described below are a large part of why more tourists don't stay longer in Agra, creating more jobs and local revenue.

The Associated Chambers of Commerce in Agra, the Agra Tourist Promotion Board, and the Municipality, have therefore taken a serious role in working to improve the environmental and social conditions to make the city a more hospitable place for tourists and residents alike. The ITDP saw in this very particular set of circumstances an opportunity to address two critical environmental and social problems in India which it had long been working towards some solution: the low status and wages of rickshaw pullers and the increasing air pollution from motorized vehicles.
The goals of the Cycle Rickshaw Improvement Project, as stated by Walter Hook, Executive Director ITDP:

   a) to improve the lives of the residents of Agra by reducing their current and future exposure to toxic air emissions from motor vehicle exhaust,

   b) to prevent further damage to the Taj Mahal, the Agra Fort, Akbar's Tomb at Sikandra, Krishna's birth site, the Itmad-Ud Daula and other historical monuments in Agra by reducing their exposure to air emissions from motor vehicle exhaust,

   c) to generate jobs and income in the tourist industry by providing pleasurable and convenient access to the Taj Mahal, other tourist sites, local craft SHOPS and artisan markets, in an environmentally safe manner,

   d) to improve the quality of life and level of income for cycle rickshaw wallahs by transferring and developing a technology of increased efficiency and ergo-dynamic design,

   e) to improve the long term economic viability and enhance the capacity to export of cycle rickshaw manufacturing by improving the end-product design.

   f) to maintain the long term viability of this energy efficient, non-polluting, employment-generating mode of transport by improving its public image and prestige, increasing the number of people with a vested interest in its continuation and improvement, and by demonstrating that modernization need not imply motorization.

"Reincarnating the Indian Cycle Rickshaw"

The following recounts recent developments in ITDP’s Cycle Rickshaw Improvement Project, based on the trip report of ITDP Projects Director Paul White, who was in India from May 4- June 11. An extensive presentation of the project design follows this article.

“IT Will Never Work”
BBC reporter Paul Shuttlesworth wanted to shoot ITDP’s Indian Cycle Rickshaw Improvement Project. I told him to call back in October, when our prototypes would be better developed. Yes, we were a little behind schedule. “Well,” Mr. Shuttlesworth replied, “I really need some information now, because we’re leaving for Delhi tomorrow.” Later, we learned that he wanted the material for his science show called “It Will Never Work.” Great.

When I arrived in Delhi on May 4, ITDP consultant Karl Miller had been in country for two months, sweltering in 115 degree heat, developing three prototypes. Contrary to our hopes, they weren’t ready. Karl, who’d developed an award-winning human-powered quadracycle in China, had run into some problems.

We’d decided to do the design work in-country so we could cooperate with Mr. C.P. Bhatnagar, an Indian engineer with ties to the local bike industry with new rickshaw designs of his own. Our project partners, the Asian Institute for Transport Development, (AITD), agreed to co-operate with ITDP on the project, as AITD’s Dr. Anand, the Director of the National Gandhi Museum, had just published a book on cycle rickshaws in India, and supported their development as consistent with Gandhian development theory. They were going to bring in Mr. Bhatnagar to work on the project, and we would work out of his shop until a new shop could be set up.
Unfortunately, Mr. Bhatnagar and AITD ran into some sort of contractual dispute, and Mr. Bhatnagar was no longer willing to work on the project. Mr. Miller had to spend his first weeks working with AITD's Mr. Mehta finding and setting up a shop. Karl then had to do the design work more or less by himself, although Mr. R.P. Gupta of Shivati Cycles, an associate of Mr. Bhatnagar's, provided some key help. Karl then lost some time developing a vehicle which Dr. Anand pointed out was too wide to comply with Indian traffic laws, which set the maximum width of rickshaws at 45 inches.

Then the bombs went off. My first thought was: thermonuclear war, oh, no, there goes the cycle rickshaw project! The political fallout from India's nuclear tests-- U.S. sanctions-- threatened our USAID project funding for months, and cast a specter of doom over Karl's final week. I was beginning to think the BBC was right.

It Probably Won't Work: The First Prototypes Are Developed

Working night and day to prepare the prototypes for their formal unveiling to the Delhi Advisory Board on May 15, I helped as Karl partially completed two innovative prototypes, and closed in on a third.

Indian rickshaws in their present incarnation have a lot going for them. They are inexpensive, aesthetically pleasing, strong, and easy to repair. Their antiquated design, however, has contributed to current anti-rickshaw sentiment, as they are also heavy,
difficult to pedal, precarious and uncomfortable for both puller and passenger. Improvements in cycle rickshaw technology have been inhibited because their low and moderate income operators and customers are understandably risk-averse. We knew if we were to overcome these barriers, we would need to bring the manufacturers, and potential customers and operators directly into the design process. So we asked Karl to develop three prototypes. By the day of the demonstration, this is what we had:

“Delhi Model” Designed for cost parity with existing cycle rickshaws used in Delhi, this model was completed. Karl modified a work-bike carriage and attached it to a standard Neelham cycle rickshaw kit. This innovation reduced the carriage weight by 20 kilos, made the seat wider and more comfortable, lowered the gear ratio, and gave it a better canopy and less air drag, at a cost competitive with the existing vehicle.

“Taj Taxi” Designed to meet the requirements of lucrative tourist markets in Agra, home of the Taj Mahal, and other tourist cities, as well as for export, this model was done except for the canopy. Karl managed to get the weight down by 25 kilos, lowered the center of gravity and shortened the vehicle, making it more stable, gave it a new differential that he and Mr. Gupta of Shivati developed, five speeds, and mountain-bike handlebars, while still using the standard Neelham kit. In order to make some of these innovations, however, the passengers had to sit facing backwards.
"New Age" This model was intended to demonstrate the technological capabilities of human powered passenger transport, using modern materials, with an integral frame, maximizing stability, travel comfort, speed, and safety. The day of the demonstration this vehicle was still propped up on bricks, as the drive train had still not been worked out.

On the day of the demonstration, Dr. Anand and Mr. Mehta of AITD, students and teachers from the Indian Institute of Technology, and other NGOs came to scrutinize and test the prototypes. Dr. Anand liked the Delhi model, which was lighter, more comfortable, while still affordable, but wanted better armrests and a retractable canopy. The students and Mr. Mehta were intrigued by the "New Age," but it wasn't ready for a test drive. Most observers felt the Taj Taxi was much easier to pedal, more comfortable, more stable, and handled better, but all felt that the rear-facing passenger seat found on this vehicle was inappropriate, particularly for tourists approaching the Taj Mahal.

The rear-facing design presented another problem. When Dr. Y.P. Anand, former director of Indian National Railways and current director of the National Gandhi Museum sat on the passenger seat, the front of the vehicle popped up, jostling him a bit. Karl, red-faced, explained that the short wheel base of the vehicle, while making it extremely maneuverable, made it prone to pop-up unless the puller was already seated as a counterweight. He pointed out that this could be remedied by placing the axle farther to the rear of the vehicle’s frame.
Other advisory board members didn’t fail to point out other flaws. The chain pops off when switching gears. The designers showed poor taste in seat and canopy color selection; they should have used more chrome and less pea green. There should be more passenger amenities, such as soft-drink holders, armrest padding, and space for parcels. Clearly, the prototypes needed more work.

After the presentation, a beleaguered Mr. Miller, his wife and his three-year old son returned to the cool of their native Calgary, Canada, and I returned to the air-conditioned apartment of the family I was staying with, to take stock of my notes, video recordings and photographs of Miller’s work, and finally to a fitful sleep. At 3:00 a.m. I awoke in a puddle of sweat— the air conditioning had cut off again.

It was clear we needed an Indian engineer on the design team. The next day I set out for the Indian Institute of Technology (IIT), as usual, on my bicycle, trying to follow in the footsteps of India’s most famous proponent of human-powered transport, Gandhi, who’s life was his message. (I’d brought my bike over for basic transportation, and to do a little touring on the side. Sweating in 115 degree heat, and with particulate levels between ten and a hundred times higher than in the U.S., I looked like a coal miner after every ride.) A mile down the road, a grinding noise told me something was horribly wrong with my bicycle: seat crooked, rims out of true, front fork bent. Hmm.
Walking back to my residence, I considered suspects. Ramu, a local "house boy", was smitten by my Cannondale tourer from the minute I pulled it from the KLM travel box. (Bicycles available in India are largely limited to standard English-racer style bikes.) "May I ride it, Mr. White?" he had asked me repeatedly. "But it's too big for you, Ramu," I told him. When I got back to the house, Ramu was sitting on the step, his knees covered with abrasions. "I'm sorry about crashing your bicycle, Mr. White," he said. What could go wrong next? That night, Pakistan set off their bombs...

Maybe it Will Work

Mr. Mehta loaded my bicycle into the back of his car and drove me to Jhandewalan Cycle Market, a Nirvana for cycle enthusiasts, where in ten minutes the mechanic had my front fork on a hydraulic press and bent back into shape. Twenty minutes later, my bicycle was back together and finely tuned. My confidence was making a comeback.

Meanwhile, bearing the Advisory Board's comments in mind, ITDP's Vice President and chief design expert Matteo Martignoni began the next phase of prototype development at his state-of-the-art Petaluma, California studio. He also started developing a new vehicle designed for carrying school children, another popular use of rickshaws in India. Assisting his work are Stephen Delaire, the manufacturer of Rotator Recumbent Bicycles, Glen Ray, a current Vice-President of the International Human
Powered Vehicle Association who had worked on the Space Shuttle, and George Bliss, founder of Pedicabs of New York (PONY), and its non-profit affiliate, the Center for Appropriate Transport.

I set out for Agra with Mr. Mehta to get opinions on our prototypes from our Agra-based Advisory Board, to set-up our Agra workshop, and to show the photos to the people who would know best whether the vehicles would work or not: the cycle rickshaw wallahs that make the trip to the Taj on a daily basis.

Mr. Mehta and I secured a 10,000 sq. ft. workspace, appropriately, on Mahatma Gandhi Road. We outfitted the shop with workbenches, tools and supplies. Workers were busy whitewashing the walls and installing light fixtures. At the front of the building, the previous tenants had left a huge sign where they had painted their logo. It was time to hang a shingle and give this project a home. We commissioned a local artisan, who in no time had beautifully painted over the old sign with the following:

ITDP   CYCLE RICKshaw IMPROVEMENT PROJECT   AITD

That completed, I ventured out on my bicycle to gather comments on our prototypes from the denizens of Agra's rickshaw culture. I had met Mohammed Khan, a puller operating near the Taj Mahal, and invited him and several of his fellow wallahs to visit our new shop, thinking it would be a great photo opportunity with them in front of our new sign.
When we returned to the workshop, however, the sign was gone. I asked the landlord what happened. “Just as your painter was finishing, they showed up with a blow torch, cut it down and carted it off. I guess they did want it, after all.” We called the painter back, and he painted a new sign.

I then met with Rajiv Narain, the General Manager of the Taj View Hotel and Chairman of the Agra Tourist Promotion Board. He agreed to Chair our Agra Advisory Board, along with several other tourist industry executives, manufacturers, assemblers, government officials, and rickshaw wallahs. Mr. Narain had numerous useful comments about the prototypes. He pointed out that the main advantage of the cycle rickshaw over the Bajaj (motor rickshaw) is that it affords an expansive, open air feeling, so the canopy needs to be completely retractable. He suggested we include such features as on-board maps, rate sheets, drink holders, and other items which would help the cycle rickshaw function as a top-flight touring vehicle.

Reactions from the Wallahs

I first spotted Mohammed Khan as he and his 100-pound single-speed cycle rickshaw were cranking two stout German tourists and their luggage uphill in blistering heat. I gave chase immediately. As I sidled up to Mohammed on my Cannondale, I noticed that he was very thin, and his sandals were worn through so that the balls of his
bare feet touched his pedals. I tried to ask him some questions in my broken Hindi. Despite breathing air as poisonous as smoking 40 cigarettes a day, he said to me, in perfect English, "I will talk to you, but let me finish first."

Of historic Agra, Jawaharlal Nehru, India’s first prime minister, said, “every stone, nay every grain of sand here, would have a story to tell if those were gifted with a tongue.” Mohammed, who had plied Agra’s streets for over twenty years, was conversant in several languages. He more than compensated for Agra’s silent sands.

I pulled the photos of our prototypes from my messenger bag and asked his opinion. He squinted at them skeptically at first, then, as his countenance changed, Mohammed started talking. He was interested in the differential that Karl had developed from a modified auto-rickshaw differential; liked the gearing, which as he pointed out was similar to the cluster on my cycle; was pessimistic about the backwards-facing passenger seat on the Taj Taxi prototype. “It will never work, not for tourists.” “And,” he added, “these rickshaws you have are not pretty.” Then he launched into a lecture about Mughal art and architecture, elements of which, absent on our prototypes, are part of the beauty of the current rickshaws.

Then Mohammed shared his bundle of photos and letters from satisfied customers from around the world, all wrapped-up in his “good luck” bandana. Indeed, a ride in Mohammed’s rickshaw, “though occasionally bone-jarring, (is) an informative
and memorable experience," hand-scribbled one devotee. "You were a veritable encyclopedia of Taj lore" said another. We continued chatting about gearing, wheel base lengths, carriage materials, differentials, and what makes tourists tip. In closing, he emphasized the ever-important issue of affordability: such innovative rickshaws are worthless unless they are obtainable for the thousands of Agra rickshaw "wallahs", he said. This project, if it does nothing for Mohammed, will be a failure.

On to Ludhiana: The Bicycle Shangri-La of India

In Ludhiana, the Shangri-La of bicycle manufacturing in India, project fortunes continued to improve. Neelam, the main Indian manufacturer of cycle rickshaw "kits" (the front end of the rickshaw which rickshaw assemblers throughout India use to construct complete rickshaws after adding their own unique carriages) agreed to partner with us to produce our new rickshaw frames when the time comes to manufacture a trial fleet. Research and design executives at Hero Cycles-- the largest bicycle manufacturer in the world, producing 3 million bicycles per year-- offered their assistance in putting our new designs on CAD-CAM (a computer design program), and pledged to back our project with other forms of technical support.

Next Steps
On September 1, 1998, Mr. Martignoni will return to ITDP's rickshaw design and manufacturing facilities in Delhi and Agra. At this time, Mr. Martignoni will be working with Mr. Prabhu, a graduate student in mechanical engineering from the Indian Institute of Technology-Delhi who has extensive experience working on cycle rickshaw design and prototype development. Together with Sunil Kumar of Hari Om Cycle Mart, they will finish the prototype development.

Then, by late October, ITDP will convene the members of both Project Advisory Boards and present to them the fully finalized prototypes. In the following weeks, the design team will incorporate their final suggestions into the completed prototypes, thus ending Phase I of the project. Then we’ll contract out a local manufacturer to build a trial fleet of ten to twenty vehicles of the Taj Taxi, the Delhi Model, and the school children model. The Delhi Model fleet will be tested in Delhi by our project partners, AITD. At the same time, we will negotiate with several tourist service providers in Agra, hold a competitive bidding process, and then identify a trial operator who will operate and maintain the trial fleet for a period of several months.

ITDP's improved cycle rickshaws should be able to attract a significant share of tourist trips and school trips, allowing the participating rickshaw pullers to increase their income. Increased income should make possible the introduction of an improved but more expensive vehicle, a necessary condition if this project is to work.
Epilogue

As my stint in India drew to a close, I set out on a four-day bicycle tour from Ludhiana to Dharamsala, the home of ‘Tibet in Exile’ located in the foothills of the Himalayas. Other cyclists would often ride with me as I passed Hindu temples and families of monkeys, with the snow-covered peaks of the Himalayas visible in the distance. But the heat was intense, and the road often no more than broken bits of concrete and mud. I camped, stayed in hostels, or with village families who put me up. Nervous about the strength of my front fork because of Ramu’s accident, I loaded my gear entirely onto my back rack. On the third day the rack gave out, and makeshift roadside repairs with electric wire proved unsuccessful. I was stranded, and couldn’t understand why nobody would pick up a sweaty, dust-covered cyclist. After awhile, however, I was finally able to flag a bus. As soon as I climbed up on the roof with my bike, the bus took off. I held on for dear life as the driver swerved around road workers, pedestrians, cows, trucks, and cyclists laden with firewood.

When I finally reached Dharamsala, the Tibetans were dancing on the rooftops. A hero’s welcome, well deserved? No, it turned out to be the Dalai Lama’s birthday. I spent the days conferring with the re-incarnation of the 7th Markham Dakpa Rinpoche. We had a vision. Lamas on bikes? Why not!
Project Impetus, Design and Implementation

Environmental Pollution

As an environmental organization, ITDP is concerned about the environmental ramifications of the trend in India of rapid increases in motor vehicle use. As incomes rise, individuals switch from using the non-polluting, energy-saving bicycles and non-motorized cycle rickshaw to highly-polluting two-stroke engine motorcycles and three-wheeled Bajaj taxi, resulting in a dramatic increase in transport sector air emissions. As well as damage to the monuments, residents of Indian cities face severe public health risks as a result of being exposed to levels of lead, NOx, CO, SPM, and HC from motor vehicle emissions well above World Health Organization standards. The major threat to public health from motor vehicle emissions in Indian cities is airborne lead, which has been proven to hurt early childhood cognitive development. Incidences of bronchitis, lung cancer, pneumonia, and other upper respiratory illnesses in Agra are also elevated. Finally, motor vehicle emissions are also a major source of CO2 emissions, which are a major cause of global warming. While currently India is not a major contributor to greenhouse gas emissions, if the country motorizes rapidly using available technology, their contribution to global warming will grow sharply.

The cycle rickshaw and wallah (cycle rickshaw driver) contribute minimally to pollution. In Agra the average rickshaw wallah travels around 24,500 km per year. If
these trips were changed into trips by highly polluting two stroke IC engine, the annual emission impact would be roughly an additional 11 metric tons of lead in Agra's atmosphere, 4000 tons of particulates, 20,000 metric tons of CO, and 150 tons of NOx. (Based on estimates of 2 stroke motorcycle engines in Chile, from Turner, Weaver, and Reale, 1993). Such increases, particularly of particulates, CO, and lead, would lead to thousands of additional deaths from respiratory and cardiac disease each year.

ITDP was therefore looking for ways of encouraging the use of human powered taxis, cycling, and walking in population centers where the air quality benefits are the most important, and where distances are short enough to make this mode economically and commercially viable. In order to do so, however, many criticisms of cycle rickshaws, both legitimate and unfair, would need to be overcome.

Equity

While a city of some of the world's most magnificent monuments, Agra is also a city of severe poverty, underemployment, and low productivity employment. The cycle rickshaw is an important source of employment for many of India's lower income people. In Agra the cycle rickshaws provide employment for roughly 10% of the adult population, and a critical source of low-cost basic mobility for India's lower and middle classes. Even wealthier Indians tend to rely on the cycle rickshaw for bringing their
children to school, paying a monthly fee for the service. At the same time, there is a stigma attached to being a wallah, as it is seen as a lower class job.

There are officially 10,000 licensed cycle rickshaws in Agra employing 30,000 wallahs; three wallahs will use a single cycle rickshaw in shifts. While no official count exists of unregistered cycle rickshaws, estimates from Agra residents indicate that there are at least another 10,000 to 20,000 unregistered cycle rickshaws employing another 30,000 to 60,000 wallahs. Thus, the total number of jobs created by the provision of cycle rickshaw service in Agra ranges from 30,000 to 90,000

Some 30% to 40% of wallahs own and operate their own vehicles, and 60% to 70% rent them from an owner of a cycle rickshaw fleet. Average earnings are $1.30 per day, of which $0.30 goes to the owner of the cycle rickshaw. This puts cycle rickshaw drivers at the World Bank's global poverty line (income of $1.00 per day or less). It also makes the industry a sizable one for the region. Total annual revenue to the region from direct income of the wallahs thus ranges between $14.345 million and $42.7 million.

Agra is also an important regional manufacturer of cycle rickshaws, and is known for producing a high-quality cycle rickshaw. Agra produces between 30,000 and 50,000 cycle rickshaws per year, the majority of which are exported throughout the region within a roughly 80 km. radius of the city. The average cycle rickshaw manufacturing firm employs 20 or more people, and there are 5 major cycle rickshaw manufacturers in Agra,
producing roughly 10 to 20 vehicles per day. Thus, more than 100 people are employed in the manufacture of cycle rickshaws in Agra, and at least as many in service and maintenance activities. These manufacturers also rely on subcontractors to construct the seats and other specialty components, constituting probably another 100 jobs. The cycle rickshaw kit which is assembled by a local manufacturer is made in the Punjabi city of Ludhiana, known as the 'bicycle capital of India', which produces bicycles for export all over the developing world, and components for cycle rickshaws all over India. A rough estimate of total employment generated by the manufacture and service side of the cycle rickshaw industry in Agra thus ranges between 500 and 1000 jobs. These are slightly better paying jobs than those of the wallahs.

The cost of the average cycle rickshaw ranges between 4500 and 7000 rupees, or between $100 and $250. Cycle rickshaw manufacturing brings a value added to Agra of roughly $3 - $5 million, much of it in export revenues (i.e. exported to the surrounding region). The total size of the cycle rickshaw industry in Agra is thus in the range of $20 to $50 million per year, and total employment ranging between 30,500 and 91,000 per year.

Despite the environmental benefits of the cycle rickshaw, and the economic importance of the industry particularly to low income families, public attitudes towards the cycle rickshaw in India are negative, and their use is being phased out in many Indian cities and elsewhere in Asia. Negative attitudes about the cycle rickshaw are based on
views that their use is exploitative to the driver, the vehicles are not safe, the drivers are not trustworthy, they exacerbate roadway congestion, and are in general viewed as backward. While no immediate threat exists to cycle rickshaw operations in Agra, the cycle rickshaw was banned from operating in New Delhi less than a decade ago, although they still operate in Old Delhi, and they face a major battle for their existence in Calcutta this year. Similar trends to restrict the use of cycle rickshaws can be observed in Indonesia, Vietnam, and China.

By contrast, cycle rickshaws have been introduced for the first time in history in over 40 cities in the U.S., as well as in the capitals of many major Western and Central European cities, and recently in Manila as well. Their emergence in Europe and the U.S. is the result of a confluence of factors: growing concern about environmental pollution, the growing popularity of urban planning measures to traffic calm and pedestrianize the street environment in downtown commercial or tourist areas, the growing importance of tourism as an industry, and finally the enormous gains in human powered vehicle technologies which, by dramatic reductions in vehicle weight and specialized gearing, have increased dramatically the ease with which the vehicles are operated and their safety and stability in traffic conditions.

ITDP realized that unless the legitimate criticisms of the cycle rickshaw could be addressed, the positive environmental and social benefits of the industry would be lost. Much of the stigma against the vehicle was based on its perception of being 'backward.'
In fact, the current vehicles in operation are 'backward,' in the sense that the technology being used was developed more than fifty years ago based on indigenous modifications of a British-designed bicycle, and only very limited modifications have occurred since then. We therefore set up a project designed not only to develop a superior vehicle, but to induce a process of ongoing, commercially-induced technological change in the Indian private sector bicycle and cycle-rickshaw industries. Only by demonstrating the technical possibilities of human powered technology, and by introducing technologically superior vehicles to a concrete test market, could we begin to change the image of the cycle rickshaw, reduce the exploitation of the driver, and give the mode a chance to compete with motorized alternatives for certain segments of the transport market.

Lack of innovation is not restricted to the non-motorized vehicle industry, but typifies much vehicle technology in India. The common 'Ambassador' taxi, based on the 'Simca,' dates from the 1960s. The three-wheeled motorized Bajaj taxi only recently introduced the first innovation in decades, overcoming considerable resistance.

Technological innovation in the bicycle industry in developing countries, as in other industries, has generally been prompted by an attempt to capture more lucrative export markets, with production developments only gradually being passed on to domestic production where profit margins are not high enough to justify the technological innovation. Most technical innovation in China and India has resulted from technical collaboration with foreigners through joint-ventures. Bicycles produced in Shenzhen (a
special economic zone) by Chinese-Taiwanese, Chinese-Hong Kong, and Chinese-American joint ventures, are now producing the most competitive low-end product available. For example, the China Bicycle Company, (CBC) a joint venture with Hong Kong Bicycles and Schwinn Bicycle Company, is now producing one of the most competitively priced bicycles in the world. These firms have focused on producing a higher quality bicycle, costing around $100, rather than producing the lowest price/lowest quality bicycle. A large share of their market is for exports, but the higher quality vehicles are also entering the domestic market.

In India, the vast majority of bicycles tend to be made using technologies and designs many decades old, with low cost materials and components that are widely available in India. They tend to use low-carbon steel tubing, dipped in molten brass, or 'furnace brazed.' The frame is sand-blasted then chrome plated or painted in an electrostatic painting chamber; a reasonable method but of irregular quality. Most of the vehicles are sold 'completely-knocked-down' (CKD), and assembled locally, to save money on shipping, although some exports are sold 'semi-knocked down' (SKD). Similarly, the cycle rickshaw currently manufactured in Agra is a combination of a 'kit' which is mass-produced in Ludhiana and sent completely knocked down to Agra, where the chassis and carriage are manufactured by hand in small shops.

While there is little technological innovation going on at most of the big bicycle and cycle-rickshaw manufacturers, Hero Cycles is the most advanced Indian
manufacturer in terms of technological innovation, has a fairly sophisticated research and development department, and has been slowly modernizing their bicycle, both by upgrading their equipment and by setting up new components manufacturers. Hero, in joint venture with Honda Motors of Japan, now has a new bicycle factory with the most modern welding, assembling, and painting machinery in the world, imported from Europe, Japan, and Taiwan, although most of this technical innovation has gone to the development of a moped rather than to a superior bicycle. There has also appeared in recent years on the outskirts of Delhi a cluster of smaller, more innovation-minded bike manufacturers producing specialty mountain bikes and even recumbants. These smaller manufacturers are able to produce small batch, higher cost specialty orders with high risk designs that the larger manufacturers are unwilling to produce.

Thus, technological innovation is generally a market driven process aimed at producing a more expensive, higher quality vehicle for higher income groups, and the new technology gradually becomes more affordable to lower income groups. The lack of technological innovation in the cycle rickshaw industry was linked to the perception that there is no market for an up-scale, superior vehicle, as it was assumed that higher income taxi drivers and passengers would switch to motorized vehicles. The typical passenger doesn't care how difficult it is for the wallah to pedal, so long as the price is low, and the wallah is generally very poor and wants to buy the cheapest vehicle available that will require the least maintenance.
Previous attempts by NGOs to attempt to induce technological innovation in the cycle rickshaw industry in India and elsewhere have met with only limited success in terms of the commercial dissemination of newly developed technologies. Nonetheless, this institutional experience of both failures and modest success provided valuable insight into how NGO can facilitate the process of technological innovation, and how they can fail as well.

The best documented attempts to upgrade the rickshaw and the cycle rickshaw come from Bangladesh. Conditions in Bangladesh differ slightly from Indian conditions. The bicycle, cycle-rickshaw, and components industries, as well as industrial producers of alternative metals such as higher grade aluminum, are far better developed in India than in Bangladesh. Nonetheless, the Bangladesh experience offers valuable insights.

The first attempt to improve the Bangladesh cycle rickshaw started as a cooperative venture between the Bangladesh University of Engineering and Technology and the Intermediate Technology Development Group of the U.K. in the late 1970s. Together, they designed a lighter passenger seat, and introduced gears. In the mid-1980s, Inter-Pares, a Canadian NGO working with engineer Fred Willkie, designed an entirely new cycle rickshaw which was manufactured at two factories in Comilla and Manikganj.

In both cases, improved vehicle designs were developed, but were never incorporated into commercial production. The reasons for the failure to gain commercial acceptance
were many. According to our analysis, the two most typical causes of project failure were the failure to work closely with industry and the failure to identify a clear target market for a superior cycle rickshaw that will inevitably cost more in the initial years of production. In most previous projects, all of the work was done by universities and NGO's in isolation from the industry, and then only once the vehicle was designed did they try to convince the industry to adopt it. They tried to introduce the vehicles in a geographically dispersed manner, which meant that the handful that were seen were regarded as oddities and there were no centralized facilities for their maintenance. (Gallagher, 1992)

Finally, in the Bangladesh project, the project sponsors decided that the new rickshaws would be sold only to rickshaw puller cooperatives rather than large businesses owned by a single family firm. Their aim was that the benefits should go directly to the pullers, rather than the owners, and also to encourage cooperatives. Furthermore, they manufactured the trial fleet themselves, rather than hiring a current manufacturer of the vehicles, so the current manufacturers viewed the new technology as a threat. In this way, many of the strongest firms in the industry had a vested interest in the failure of the new technology, as it was a threat to their business. (Gallagher, 1992)

Several other attempts to introduce commercially viable intermediate transport technologies in India, by IT Transport and the Intermediate Technology Development Group in England, under contract for the International Labor Organization, have been

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more successful. IT Transport successfully introduced a bicycle trailer in the Indian states of Andhra and Uttar Pradesh (located in Agra Region). After an initial design was developed by IT Transport engineers, four local manufacturing facilities of bicycle trailers began production on a commercial basis, and have produced some 400 trailers as of last reporting. Purchasers of the trailers were said to double their income, (Zille, 1989) helping them generate sufficient revenues to repay the cost of the trailer.

World Bank-sponsored projects to develop commercially viable bicycle trailers and small farm vehicles in Ghana also had considerable success. IT Transport in the U.K. developed two bicycle trailers and five small farm vehicle prototypes over a period of several months in cooperation with the Technology Consultancy Center (TCC) in Kumasi. At the same time, a market survey was conducted to identify possible users. Then, several local manufacturing facilities were hired to manufacture 600 bicycle trailers and 500 small farm vehicles (modified wheelbarrows). These vehicles relied on imported wheels, and logistical problems of receiving the wheels and distributing the final product slowed the project down. These first vehicles were then distributed to project beneficiaries at minimal cost for testing the impacts on their basic mobility, and to refine vehicle design. In the second phase, IT Transport and TCC trained technicians from two local private sector manufacturers, Fatawu Bicycles, and Goodman & Sons, Inc. who were interested in commercial production. Training took approximately two weeks. Fatawu modified the design and developed three prototypes of their own, and another local entrepreneur in Sunyani developed a hand cart. The cost of the vehicles, at
$120 (for the bicycle) plus $150 for the trailer was unaffordable to many project beneficiaries. In order to induce the commercial manufacturers to produce these vehicles on a commercial basis, they required the cooperation of the Ministry of Local Government, which in cooperation with the Social Security Bank, set up a revolving loan fund at below-market interest rates, making the vehicle affordable in a hire-to-purchase arrangement over a three year period. (Heierli, 1993; Pankaj, T., 1991) The small farm vehicles were adopted by many small scale entrepreneurs without need for credit and is now in wide commercial production and use throughout Ghana. (Amegbletor, 1993)

ITDP's Mobility Haiti project developed innovative designs for human powered ambulatory vehicles which are now used to bring patients from local clinics in Deschapelles to the Hospital Albert Schweitzer based in Haiti's Artibonite Valley. Prototype development took several months, and access to components was a continuing problem. The initial purchaser of these vehicles was the Hospital, and other health facilities in the region also expressed considerable interest, but the Hospital never decided to purchase a trial fleet. As such, the vehicles were successful from the point of view of meeting basic human needs and finding a market niche, but while the product displayed commercial viability, the project partners were not able to take the prototype to commercial production.
The above projects and programs provided critical experience in both the
development and viable commercial dissemination of appropriate transport technologies,
and outlines some key dangers that the Agra project has tried to carefully avoid.

The Market for a Superior Cycle Rickshaw, or a 'Cycle Taxi'

The particular circumstances in Agra, with the large tourist industry, a famous
monument, and thus a private sector and a public sector dedicated to a cleaner
environment, created the market and political conditions ideal for the introduction of a
superior technology.

ITDP identified three possible markets for a superior cycle rickshaw or cycle
rickshaws for use in the Agra area which have the potential of attracting private sector
investor interest. First, the tourists represent a significant potential market for a superior
vehicle. The 4 square kilometer ban on motorized vehicles around the Taj Mahal means
that travel agencies running large tour groups in Agra tend to bring tourists to a bus
parking lot still a few kilometers from the entrance to the Taj Mahal. Cycle rickshaws
are already providing this service through agreements with the large tourist agencies, as
are camel and horse drawn vehicles. Tourists feel somewhat uncomfortable on the
current cycle rickshaws as they are not very stable, are often poorly maintained, and the
wallahs have to get off the cycle rickshaw and pull the passengers up a modest hill, an
experience which many tourists find embarrassing. Discussions with these travel
agencies expressed their interest in a superior cycle rickshaw service that would be of lower cost than the horse and camel-drawn vehicles, and several tourist agencies expressed a willingness to explore the possibility of investing in a trial fleet if the prototypes were acceptable.

A tourist can visit four of the five major tourist sites in Agra entirely on cycle rickshaw. Reaching the Taj Mahal from the major tourist hotels is a short trip by cycle rickshaw through the winding streets of the Taj Ganj, a quaint traditional Indian neighborhood of considerable tourist appeal in itself, which is closed to most motorized vehicle traffic. Reaching the three other major sites by cycle rickshaw is less than a half hour ride between destinations. A current cycle rickshaw can be hired for a full day to reach all of these sites for 100 Rupees (roughly $3.00). The trip from the train station to the hotels could also be made by cycle rickshaw, though the journey is somewhat longer. Unfortunately, only more adventurous tourists are likely to be willing to make this trip. Casual interviews with tourists indicated their reluctance to travel by cycle rickshaw, despite the pleasure of this mode of travel, because of difficulties in communicating with the driver, fear that the driver is going to charge them an unfair price, discomfort about exploiting the driver, and fear that the driver will take them to a destination they did not intend and place them in a compromising position.

Based on interviews and discussions with the Tourist Promotion Board in Agra, tourists would be willing to pay considerably more than the $3.00 to hire a cycle

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rickshaw for a day if the cycle rickshaw were more comfortable, more stable, and safer, if the driver was able to pedal up the modest hills surrounding the Taj rather than having to walk, if the service was associated with a travel agency or a hotel, if the rates were made clear at some set rate, and if the destinations were made clear ahead of time. Currently, due to the low esteem in which cycle rickshaws are held, the cycle rickshaw operators are not allowed to ride up to the hotel's front door, unlike motorized vehicles. A superior vehicle, however, might be allowed to pick up passengers from directly from the concierge.

The Tourist Promotion Board estimates that 1/3 of the 1000 visitors to the Taj per day would be willing to travel to the Taj by cycle rickshaw under these conditions, and would be willing to pay $3.00 just for the trip to the Taj and back to the hotels. If the wallah made three trips per day, they could afford to pay $3.00 a day for the rental of the vehicle (ten times the current rental rate), and the wallah would earn $6.00 per day, (six times the average). The estimated number of vehicles to meet this demand would be roughly 100. As the profits on this vehicle owner would be roughly ten times that of a standard vehicle, the cost of the vehicle could be as much as ten times the cost of the existing vehicle and still be profitable. This would allow for a vehicle cost of between $600 and $1000 dollars.

Secondly, the growing use of cycle rickshaws in the cities of the U.S. and Western Europe has also created the possibility of exporting the vehicles. The most
popular cycle rickshaws currently in operation in the U.S. cost $3000 to $4000 per vehicle FOB US Ports. Cycle rickshaws manufactured in India, if they could come close to matching the quality of these vehicles, could readily enjoy an export market. There are already cycle rickshaws being manufactured in Madras for export to Oxford, England, with designs developed with a company in Oxford. Most cycle rickshaw manufacturers have exported a few cycle rickshaws to Europe, but European cycle rickshaw operators prefer more expensive Western vehicles because the Indian vehicles are too heavy, to unstable, and lack gearing.

A third possible market for a superior cycle rickshaw is for the school children of middle and upper income families. Currently most families send their children to school in cycle rickshaws heavily crowded with children. Concerns about their safety might induce some families to switch to a superior vehicle even if more expensive if they felt their children would be safer.

Implementation

ITDP knew that we could not implement the project alone. Many individuals in India had been working for years on possible improvements on the cycle rickshaw, knew the capabilities of the Indian cycle industry, the availability of various specialty components, and the problems encountered in these projects. In order to combine this experience with ITDP's international experience in the field, we negotiated a
memorandum of understanding with the Asian Institute for Transport Development (AITD) in New Delhi. AITD was not as interested in developing a higher-end cycle rickshaw for the tourist market, and was more interested in disseminating a superior, lower cost vehicle in the Delhi area. They put together an advisory team of Indian experts familiar with many similar projects in the past, and hired a human powered vehicle designer and a project manager to locate and set up a design facility in Delhi near the new small and innovative bicycle industry on the outskirts of Delhi and cooperate in the design of the new prototypes.

In March of 1998, ITDP's human powered vehicle engineer arrived in New Delhi. In cooperation with AITD staff, a workshop was set up on the outskirts of Delhi and prototype development commenced. Staff had collected a host of information on past cycle rickshaw improvement projects from India and around the world ahead of time. In agreement with our project partners AITD, it was decided to develop three prototypes. The first would be a modest improvement of the existing cycle rickshaw operating in Delhi within very tight cost parameters. The new vehicle should cost no more than 25% more than the cost of the existing vehicle, or no more than $150. The second prototype would be a luxury version of the cycle rickshaw operating in Agra, sticking more or less to the traditional design, but creating an integral frame, a lighter weight vehicle, with superior components. This vehicle would retain the classic hand crafted features of the traditional vehicle but be targeted to a higher end tourist market. The cost of this vehicle would be kept to no more than $400. The third vehicle would be an essentially
experimental vehicle which would be the best cycle rickshaw that can be made from the perspective of speed, stability, and style, but using all Indian components, without concern for the cost. The purpose of this third vehicle was to demonstrate the technical possibilities of human powered vehicle technology, which can be made to travel up to the speed of a normal motor vehicle. We would then develop variations on each of these three basic types.

In order to avoid developing a vehicle in isolation of commercial interest, ITDP and AITD decided to set up two advisory boards, one in Agra and one in Delhi. The first prototype and its variations, which we called among ourselves the 'Volkswagen', is targeted to the Delhi low-end market, and AITD has taken responsibility to set up an advisory board of existing cycle rickshaw manufacturers, owners, and experts, who would comment on the prototype, discuss whether and under what conditions they would consider investing the development of a trial fleet, and provide recommendations for further design modifications.

The second prototype, which we called among ourselves the 'Rolls Royce,' which is targeted to the Agra tourist market, ITDP set up an advisory board in Agra of potential investors, potential manufacturers of the new designs (the owners of tourist agencies and hotels, all members of the Tourist Promotion Board), local government officials, and the cycle rickshaw wallah's union.
The project is currently developing these prototypes, and their projected completion date is May of 1998. In May, all of the prototypes will be presented to the advisory boards in Agra and Delhi, and a further round of design revisions will be made. Once the further revisions are made, Phase I of the project will be complete.

During Phase II, ITDP and AITD will hold negotiations with potential investors in the trial fleet. The investors in Agra are likely to be from the tourist industry and in Delhi will be cycle rickshaw fleet owners. Through a process of competitive bidding, ITDP and AITD will sign a contract with the investor to purchase and operate the trial fleet for a period of six months, allowing ITDP and AITD to study the financial, economic, and cultural feasibility of expanding operations. ITDP and AITD will also arrange for the manufacture of the trial fleet through a process of competitive bidding, but there is one cycle rickshaw manufacturer in Agra which is technically more proficient than the others, with whom we have a relationship, and it is likely that we will ask this manufacturer to produce the trial fleet. This will require ITDP training of the local manufacturer on how to manufacture these vehicles, which is likely to take several weeks to a month and oversight of the manufacture of the trial fleet. A similar process will occur in Delhi. Once the trial fleet is completed, it will be turned over to the investor for operation.

After six months of operation, ITDP will perform a financial and technical analysis of the business, and make further design changes based on observed cost
parameters, customer and operator opinions, and other factors. At the same time, AITD will perform a survey to estimate the total market for such vehicles in Agra, Delhi, and perhaps selected other locations.

Based on the conclusions of this evaluation, and the level of investor interest in the project, ITDP will work on developing a 'kit' for mass production, which could considerably reduce the unit cost of the cycle rickshaw. The hope would be to make an integral frame part of the standard kit and thus possible to mass produce. ITDP and AITD will solicit bids from potential investors and provide sufficient guarantees to the private sector to ensure a willingness to participate in order to reach a minimum order required by the large scale mass manufacturers. By working with smaller manufacturers on the outskirts of Delhi, we are hoping that the numbers required to initiate a trial order of re-engineered kits, but the ultimate orders will be placed based on competitive bids.

Conclusion

Several fundamental changes in the global economy have made the reports of the imminent death of the cycle rickshaw premature. First, tourism has grown in its economic importance. Globally, it now accounts for an estimated 7% of world economic output. This change has given municipalities strong incentives to improve the quality of life and the attractiveness of their cities as tourist destinations. Further, it has created market opportunities both for traditional crafts but also for traditional means of transport.
Touring a city does not require high speed, it requires slow speeds and safe, unpolluted travel conditions.

Secondly, rapid motorization has brought with it a host of environmental problems that are causing an increasing public health problems. Restrictions on the use of private motor vehicles in central urban areas to control pollution and congestion are increasingly common around the world and increasingly in Southeast Asia. Exclusive bus lanes have been put in recently in Kuala Lumpur, are being discussed in Manila, and Singapore has long had an area licensing scheme in its downtown. In these conditions, the majority of the congestion is being created by extremely space-intensive private motor vehicles. Average travel speeds in heavily congested Jakarta, Bangkok, and other Asian cities have slowed to levels below those attained by cycle rickshaw due to traffic congestion. Most countries are gradually adopting a fundamentally new approach to traffic planning which focuses on improving the mobility of people rather than of vehicles, facilitating public transit, pedestrian and human-powered vehicle access, and allowing private motor vehicle use only to those willing and able to afford the enormous external pollution and congestion costs generated by this mode of travel.

Several questions about the Taj Cycle Taxi Project remain. First, it is unclear as yet whether this project will successfully lead to the commercial production of a superior cycle rickshaw. Secondly, it is not yet clear that if such commercial production does commence with an elite vehicle, that the technological advances used will find their way
into the manufacture of the cycle rickshaw fleet being used by ordinary people. Third, it is possible that the existence of a superior alternative vehicle will be used by authorities to ban the old vehicles, which would cause a major disruption of the livelihoods of many current cycle rickshaw owners, manufacturers, and operators, significantly increasing their operating costs for a time, if nothing else. Fourth, the interests of all the project partners are not identical. ITDP and AITD would like to see the new technology disseminated and copied by as many manufacturers as possible, while our private sector partners, if the new model is successful, would like to profit from the new product at the expense of their competitors. How this conflict will manifest itself is not yet clear.
CHAPTER THREE

Facilitating Access to Load-Carrying Bicycles:
The Workbike Pilot Project

Introduction

The gross economic inequity that characterized South Africa before its recent political revolution persists, and with urban unemployment approaching 50%, many urban poor are seeking jobs in the growing informal economy. Many development professionals assigned with the task of initiating job-creating programs for the increasing numbers of urban poor cite the successes of recent initiatives targeting the informal sector, and see promise in furthering the facilitation of informal, small-scale economic activities as an effective measure against growing unemployment. The challenge is to identify informal-sector initiatives that are economically, socially and environmentally sustainable.

"Making Bikes Work for South Africa"

Gabriel Notweta reaches into the metal bin that’s welded to the back of his tricycle, grabs the last handful white waste paper, and piles it on the scale. Hands on hips, he squints at the reading and grins. It’s been a good morning: in one trip, he collected 80kg. His haul nets him 39 Rand (US$8.21), ample funds to replace his
threadbare front tire. He inspects his tire carefully, deems it worthy for now, then pedals away for another sortie.

Gabriel, one of the thousands of black South Africans unable to find formal employment, ekes out a living collecting recyclables. Gabriel collects his paper in and around Midrand, perhaps the most rapidly growing community in the Johannesburg-Pretoria conurbation. Paper “hawksers” throughout South Africa collect all kinds of paper and cardboard, but prefer white office paper, “HL1”, because it yields the most money per kilogram. Hawkers collect their paper from myriad sources—offices, homes, dumpsters—and typically transport their loads on their heads or in shopping trolleys borrowed from local supermarkets. Some hawkers, however, have recently discovered a more efficient method.

Gabriel is one of ten participants in the Workbike Pilot Project, the product of an experimental partnership between ITDP and Mondi Recycling, a branch of the largest paper producer in South Africa. The main goal of the project is to explore the viability of using non-motorized load-carrying technologies to fulfill the transportation needs of paper hawksers and other South Africans engaged in small-scale economic activities. The needs are vital: thousands of black South Africans are presently forced to transport their loads on foot—the inefficiency of which ensures that their endeavors will fail to bring their families out of poverty.
Equipped with workbikes, hawkers were able to triple their collecting radius, almost triple their speed, and double their hauling capacity over walking. More importantly, they doubled and in some cases tripled their income. "The bike is better than the trolley" boasts Gabriel, "and people in the street ask me: 'where did you get this bicycle and how did you get this bicycle?'"

Paper hawking and other informal sector enterprises were anathema to pre-revolution policy makers. Now, in the 'new' South Africa, they are encouraged for their employment-generating potential. Indeed, in an effort to breathe life into a sagging economy rife with unemployed, Mandela's government eliminated many apartheid era policies that curtailed the informal sector. Black South Africans are now free to hawk anywhere they want, with virtually no restrictions. Unfortunately, not all vestiges of the apartheid era are so easily redressed: fragmented and sprawling race-dictated urban geography persists, and continues to place an enormous transport burden on black South Africans—98% of whom cannot afford motorized transport.

Gabriel, his wife and their three children live in Ivory Park, an informal settlement of 250,000, located 8km east of the area where Gabriel collects his paper. A spry 39, Gabriel is known for his far-reaching collection trips and is recognized by his peers as a strong cyclist and an accomplished mechanic. His enduring good humor and multi-lingual mediation skills (English, Afrikaans, Sutu, Zulu, Stronka) make him the go-to-guy in work-related disputes. When asked what he thinks about his new workbike,
he responds: “I’m making more Rands, I’m not as tired at the end of the day, and my shoes last longer.” But he would still rather be doing something else. The hours are long, and digging through rubbish is, understandably, not his idea of fulfilling work. Still, he says, he is much better off than before. With his workbike, he now makes about 190 Rand per week ($40.86)—almost three times as much as he used to earn.

Peter Hunter of Mondi Recycling is happy with the project, and is eager to replicate it at other Mondi Paper Buy-In Centres throughout the country. Says Peter: “After we work out the bugs (replacing 8-gauge spokes with heartier 16-gauge) we’ll export the workbike concept to our other centers in Cape Town and Durban.” The Project’s novel finance program will accompany the workbike concept at the new locations. Though the collectors were initially unable to take full ownership of their bicycles, increased earnings and an ITDP subsidy have made the bikes affordable. Some collectors are currently making monthly payments on their bikes, and will soon own them outright. Peter has found that ownership of the workbikes has facilitated a new sense of pride and responsibility. Peter feels good about what the program has done for the collectors, but also has more a more prosaic reason to relish the success of the project: a healthier bottom line. Mondi’s profits are commensurate with the amount of paper the hawkers collect, thus rendering the relationship between Mondi and the collectors mutually beneficial. The project has shown that bikes are good for business.
As South Africa’s sole manufacturer of load-carrying bicycles, Kim Johnson has sold his workbikes to a panoply of buyers: South African Airways uses scores of his stout rigs to ferry items around the tarmac at Johannesburg International Airport; ice cream vendors use them to chase customers at Zoo Lake; uniformed pie sellers pedal meat-filled pastries to white-collar workers “too lazy to leave their offices for lunch.” Fruit sellers, car washers—and paper collectors—all use Johnson’s workbikes.

Johnson talks like a businessman, and is “bullish” on what he calls “mobile vending systems”:

*If you are in a stationary position, you can only get as much business as the people who walk in your front door, or frequent your street corner. But if you’re mobile, you can literally chase the business. [workbikes] bridge the white and black economies...There is a lot of business out there, just waiting to be taken, business that would benefit all of us.*

Johnson continues:

*These people [black enterprisers] have been trading in their backyards for years, and we [whites] weren’t exposed to it. We lived on this side of the railway, and they on the other. But now, we are realizing that there is a helluva lot that these guys are doing that Johnson Cycles could help them with... bikes give them cheap access to white markets*

Insofar as the the Workbike Pilot Project sought to alleviate poverty and increase incomes, it was a success. Here’s the breakdown: The average hawker equipped with a workbike earns US$88 more per month more than a hawker without one. Subtract the monthly maintenance costs, which amount to US$15 per month. That leaves US$73 per month that a biking hawker makes over and above what he used to earn walking. If a
hawker borrows the US$630 required to purchase a bike at 10% annual interest, and makes his monthly payments with the extra income that the workbike affords, he will have paid the bike off in 9 months.

The project also aspired to demonstrate the utility of workbikes to other potential users; the project’s success has already proven contagious: car washers, inspired by the new prosperity of the collectors, have just recently started using workbikes to service customers they used to reach on foot. The average workbike-equipped car-washer washes 6.5 cars per day, and is making, on average, 220 Rand per week ($46.30)—double what they used to earn walking.

Additionally, it is worth noting that the increased income that the workbike equipped-collectors earn is not to the detriment of the other collectors using more primitive means—the workbike collectors have a larger collection radius, and are thus able to occupy a different niche than the walking collectors who concentrate their efforts at a closer proximity to the Buy-In Centre.

At the outset, ITDP and Mondi Recycling agreed that at least four of the participants should be women. Yet no women participated in the Workbike Pilot Project. The fact that South African women bear a disproportionately larger share of poverty’s burden begs the question even more: Why didn’t women participate in the Workbike Pilot Project?
Upon being interviewed, the Mondi employees responsible for selecting the project participants stated their belief that the goal of encouraging women to participate was misguided: “you’ll never see a black woman on a bike,” one stated. This belief is widely held in South Africa, and may be one self-fulfilling prophetic reason why no women were recruited to participate. Another reason for the failure to include women in the project is the fact that most paper collectors are men. If the project targeted roadside kitchen operators, which are almost invariably owned and operated by women, the results may have been different. Nevertheless, at present very few black South African women ride bicycles. Most have never been able to afford one, and as a consequence, many don’t know how to ride. This trend is strengthened and perpetuated by the conventional view that “women shouldn’t ride bikes”, as one male paper collector put it. The ubiquity of this view, coupled with the fact that women have less income to spend on bicycles, puts bicycling out of reach for most South African women.

Maria Sshbambu didn’t ever consider riding a bicycle, but she does now. Her roadside kitchen, which fits into a large plastic cooler which in turn fits into a shopping trolley, is the place for lunch. Her food is popular with the paper collectors, and Gabriel is at the front of the line. On the menu today is “pom” (like thick grits) and spiced mutton. A paperplateful costs seven Rand. (US $1.52). Maria uses a shopping trolley to ferry her business from her squatter camp, located 2km from her roadside site, and as a result spends much of her work day in transit. When asked whether or not she would ride a bike instead of pushing her trolley, she gazes sheepishly at the ground and defers to
Gabriel: “She would like a bicycle.” he says, “now she sees me with my bicycle, and would like one, but she has no Rands (money) to buy one.”

Joyce Mzelase, 44, and Ulysses Mzelase, 35, know first-hand the obstacles that keep black South African women from riding bikes. However, according to Joyce, a lot of it is in their heads. “[they] think it’s too difficult,” she says. They have been riding avidly for almost two years, always ride together, and are both saving a lot of money that they used to spend on combies (mini-bus taxis). They ride identical mountain bikes, wear identical University of Michigan baseball hats, and sport matching lycra riding shorts. Together, they overcome the deterrents: they helped each other save the money to buy their bikes, look out for each other in traffic, and through mutual encouragement give each other the mettle necessary to endure the disapproving yells and “funny looks” that men often throw their way.

For the majority of people that reside in and around Johannesburg, South Africa, bicycling is not an easy alternative to embrace. Social censure, lack of capital, poor facilities and sprawling urban geography are formidable barriers for any would-be cyclist to overcome. The Workbike Pilot Project demonstrates that the small investment required to surmount these obstacles pays.
Project impetus, Design and Implementation

Needs that were addressed

Johannesburg's urban environment is not conducive to the development of vibrant small-scale informal enterprises-- its sprawling, fragmented and race-driven urban geography precludes cheap and efficient access to resources and customers. The minority white population, unlike the majority black population, has the affluence to purchase private motor transport, which for many trips is the only way to bridge the vast distances between destinations. The majority of blacks, however, are unable to afford motorcars, and make their daily rounds on foot— wasting potentially productive time ferrying heavy loads over great distances. The hours of lost productivity spent in transit ensure that small-scale enterprises will continue to operate below their potential, and continue to provide only a survivalist income. Non-motorized vehicles (NMV's), which are prevalent in many successful formal and informal economies in Asia, could be an effective way for South Africans to meet their transport needs— providing efficient, sustainable, inexpensive transportation. Today, however, there exist formidable barriers to their use: lack of capital; lack of bicycle infrastructure and facilities; and anti-bicycle attitudes.

Project Purpose
It was the intent of the 1996-97 Workbike Pilot Project to remove these barriers, and explore the potential for NMV's in meeting the transportation needs of those engaged in small-scale micro-economic activities.

**Implementation**

In and around the Johannesburg metro area, self-employed paper recyclers gather recyclable paper waste from offices, shopping malls and private homes, then bring their loads to paper recycling “Buy-In” centres for payment. Most of Johannesburg’s estimated 1,000 recyclers transport their loads in shopping carts, large canvas bags, or on their heads. In order to facilitate a productive, efficient, and environmentally sustainable method of collection, ITDP and Mondi Recycling, South Africa’s largest paper recycling company with “Buy-In” centres located throughout South Africa, implemented the Workbike Pilot Project.

Each of the ten recyclers chosen by Mondi to participate in the Workbike Pilot Project received one load-carrying tricycle, manufactured by the Johannesburg-based Johnson Cycle Works. In November 1996, 10 collectors began using workbikes to gather more paper in less time from offices, homes and industrial sites throughout Midrand, a burgeoning suburb 20km north of Johannesburg.
Subsidization

In order to make the workbikes, which cost US$630, more affordable to the collectors, it was agreed that the cost of the bikes should be subsidized. The collectors, at the outset, were reluctant to invest in an unproven technology—despite an ITDP/Mondi Recycling subsidy of $315, or half the cost of the bike. Accordingly, it was decided that Mondi and ITDP would purchase the bikes outright. Later, after the workbikes had proven their worth, the plan was to implement a finance program through which the collectors would eventually come to own the bikes. In July of 1997, such a program was implemented. The program received mixed-reviews from the collectors. Only 5 collectors agreed to the terms; the other five opted not to participate, citing the fear that their bikes would be stolen. Given the high crime rate in Johannesburg, such fears are not unfounded. At present, the collectors that agreed to the terms will have paid their bikes off by July of 1998, and none of their bikes have been stolen. Regardless of whether or not the bikes are owned outright, leased, or used free of charge with the permission of Mondi Recycling, the collectors using workbikes have seen a marked improvement in their economic fortunes. As such fortunes are increasingly apparent, ownership will only become more attractive for the collectors—especially if arrangements for adequate personal workbike security are implemented.
Workbikes and Women

As per the Memorandum of Agreement between Mondi Recycling and ITDP, at least four of the workbike recipients were to be women. That did not happen; no women participated in the project. Upon being interviewed, the Mondi employees responsible for selecting the project participants stated their belief that the goal of encouraging women to participate was misguided: "you'll never see a black woman on a bike," one stated. This belief is widely held in South Africa, and may be one reason why no women were recruited to participate. Another reason for the failure to include women in the project is the fact that most paper collectors are men. If the project targeted roadside kitchen operators, which are almost invariably owned and operated by women, the results may have been different. Nevertheless, at present very few black South African women ride bicycles. Most have never been able to afford one, and as a consequence, many don’t know how to ride. This trend is strengthened and perpetuated by the conventional view that "women shouldn’t ride bikes", as one male paper collector put it. The ubiquity of this view, coupled with the fact that women have less income to spend on bicycles, puts bicycling out of reach for most South African women.
Project Benefits

Economic Empowerment

The prime objective of the Workbike Pilot Project was to increase the incomes of paper collectors. As the enclosed graph (fig. 1) indicates, the weekly collection averages (in kilograms) were found to be significantly higher than their weekly collection averages before receiving workbikes. On average, paper collectors using workbikes collected 2.4 times as much paper per week as they did using previous methods (headloading, shopping trolleys, canvas bags). This increase was due to:

1) the increased hauling capacity of the workbikes, which allowed more paper to be collected per trip. It is not uncommon for a workbike-equipped collector to bring in 100 kilograms of paper in one trip. By comparison, collectors using prior means are able to ferry, on average about 50-60 kilograms per load

2) the speed of the workbikes, which allowed more trips per day. Typically, a collector on foot is only able to make 1.5 trips in an eight hour working day. Workbike collectors were making 3.2 trips in the same eight hour day.

3) the range of the workbikes (also related to their superior speed over walking) which allowed a wider collection radius—the workbike collectors were able to visit
collection sites that were previously inaccessible. Some workbike collectors ventured as far as 7 km from the Buy-In Centre.

The increased payloads, attributable to the aforementioned workbike capacity, speed, and collection radius, led to a commensurate increase in income. (see fig. 1) This comparative advantage allowed the workbike collectors to visit sites containing most valuable paper, since the most lucrative collection sites, containing the most valuable paper, are often 1) inaccessible on foot, and 2) ephemeral—collectors that get to the sites quickly are able to collect the paper before it goes to the landfill. Accordingly, workbike incomes were about 2.8 times greater than those collectors employing prior means. (if all paper was equally valuable, the increase in income would be closer to 2.4, or equal to the increase in weekly payload indicated in fig. 1)

Though the ability of a workbike-equipped collector to significantly increase income is clearly apparent, it is more important to determine whether or not such an increase is sufficient to warrant an investment in a bike. The average collector equipped with a workbike was found to earn US$88 more per month more than a collector without one. Subtract the monthly maintenance costs, which amount to US$15 per month, and that leaves US $73 per month that a biking collector makes over and above what he/she used to earn walking. If a hawker borrows the US$630 required to purchase a bike at 10% annual interest, and makes monthly payments with
the extra income that the workbike affords (US $73 per month), he/she will have paid the bike off in 9 months. And that is without a subsidy. Clearly, these figures support the assertion that workbike technology, at least in the paper collection business, is a worthwhile investment.

Demonstrative Effect

The success of the Pilot was sufficient for Mondi Recycling to replicate it at other locations in South Africa. In November 1997, Mondi ordered a fleet of workbikes for use at its “Buy-In” centre in Durban, and is drafting plans to do the same at a similar facility in Cape Town.

Since its inception, the Workbike Pilot Project has enjoyed a high-profile in the Johannesburg area. This was due to several factors, including outreach and dissemination efforts conducted by Mondi Recycling; their press releases resulted in a favorable article in a local paper. Kim Johnson, of Johnson Cycle Works, the manufacturer of the workbikes, was interviewed on a local television station, titled “About Your Business”. In the piece, which aired in March 1997, Johnson cited the success of the Workbike Pilot Project as proof that non-motorized technology is a valuable tool towards achieving myriad development objectives.
Perhaps more effective in demonstrating the Pilot's success, however, was the ubiquity of the workbike collectors throughout Midrand. There is a wealth of anecdotal evidence to support the conclusion that the Pilot was successful in raising public awareness to the potential of workbikes; seldom did ITDP staff encounter business people that were not aware of the workbike paper collectors. Most had either seen them pedaling around town, heard of them by word-of-mouth, or were exposed to them through the media. Many Black South Africans interviewed in the greater Johannesburg area were not only familiar with the project, but inspired as well. Many voiced their desire to acquire a similar bicycle, if they only had the money.

There is one documented example of the project having a direct demonstrative effect: car washers. Akin to the collectors, there are many informal entrepreneurs in Johannesburg that earn survivalist incomes washing cars. Most travel on foot, carrying sponges, soap, and hoses to perform their duties. Inspired by the Pilot's success, Arend Oliver, a white South African cyclist/entrepreneur, decided to purchase a fleet of nine front-loading workbikes for use in his new car-washing business. Though the nine blacks that work for him do not own their cycles (nor does he at present plan to implement such a measure) the cycling car washers have seen their incomes double since they started working for Mr. Oliver-- they are able to wash twice as many cars as before, when they were on foot.

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Outreach

In order to augment the already successful demonstrative capacity of the Pilot, efforts are currently underway to disseminate the results of the Pilot to additional organizations and companies that would similarly benefit from workbikes. Coca-Cola South Africa was one target of this outreach; they have since expressed interest in the Pilot and are exploring the possibility of using workbikes to distribute their product.

We are also disseminating the results to various NGO’s and development organizations whose aims of economic empowerment, job creation and sustainable development could be furthered by adopting workbike-assisted programs and projects. The United Nations Centre for Human Settlements contacted us about the Pilot; they are currently drafting a proposal to implement a similar workbike-assisted job creation program, based on the Pilot. The proposed program will serve recyclable collectors and garbage collectors in Lucknow, India.

Through our recent outreach to organizations like Counterpart International, The Development Bank of South Africa, Southern Africa Information Access Inc., Africare and others, we hope to raise the development community’s awareness of the potential of non-motorized transportation.
Conclusion

The Workbike Pilot Project proved that bike projects are capable of meeting myriad development objectives in urban areas. As such, the pilot generated wide interest in the potential of non-motorized load-carrying technologies, and sparked discussion among development professionals, who were now asking the question: "How does the pilot, which served only a handful of traders, translate into a larger development milieu?"

The next chapter attempts to answer that question.
CHAPTER FOUR

Building Bicycle Culture:
The Afribike Project

Introduction

Afribike, an innovative project originally conceived by Karen Overton, Jon Orcutt and John Griffin, proposed to facilitate the use of all manner of non-motorized vehicles among South Africa's low-income majority through establishing a multi-functional bicycle oriented "Afribike" center in Johannesburg. To test the viability of such a plan, they launched the Workbike Pilot Project in 1996. The project proved that "hawking" (read: small-scale income-generating activities) -- most of which are typically carried out on foot -- could be made enormously more productive through the use of workbikes. Though geographically informal enterprises are equally prevalent in urban and rural areas, it is widely held that the prospects for growth of micro-enterprise are greater in urban areas, given their greater potential access to markets.

Afribike aspires to explore this potential. Figures indicate that the dominant activity in the South African micro-enterprise economy is hawking. More importantly, the pilot found that the increases in personal productivity were more than sufficient to justify the costs of acquiring and operating such vehicles. It is also noteworthy that the recent growth in informal activity is occurring primarily through the replication of
informal businesses. In other words, if the example set forth in Afribike is successful, it is likely that it will spread throughout South Africa's informal sector.

Thanks to grants from the International Foundation ($20,000), The Marcia Brady Tucker Foundation (10,000), The Hunt Foundation ($5,000), in-kind donations from the United States bicycle industry and the support of ITDP members, the fully-funded Afribike is now underway at The Afrika Cultural Centre (ACC) in Newton, Johannesburg. The ACC's executive director, Benjy Francis, outlined his organization's purpose in the project proposal:

_The Afrika Cultural Centre (ACC) was launched in 1980. It works to promote and produce, to research and develop cultural, artistic, educational and vocational programs for the encouragement and advancement of community development. Its programme of activity is grounded in the will to link, shape and build resources, develop community skills, perception and understanding on a primary, secondary and tertiary level. The Afrika Cultural Centre is dedicated to forging a bicycle culture in Johannesburg._

May 16, 1998 heralded the beginning of Afribike implementation when a group of volunteers from ITDP and NYC Recycle-A-Bicycle (RAB) loaded and shipped a 40' container of used bicycles, trailers and tools to the ACC. Since the arrival of the container, ACC staff and students have labored to improve the shop facility, and recently started refurbishing the bicycles-- painting bicycles in a distinctly African fashion. Implementation of Afribike will continue through the fall, culminating in December/January when several ITDP & ACC staff, volunteers and affiliates will complete an intensive six-week effort to inventory two 40' containers of bicycles and
parts, equip the shop, train the staff and participants, and work with local staff to get the shop on track for self-sufficiency.

Afribike proceeds with two other partner organizations:

**Xtracycle International** aims to empower people across the globe by equipping them with an effective and affordable mode of transportation. The Xtracycle is a bolt-on frame assembly which attaches to virtually any bicycle at three points. Bicycles retrofitted with an Xtracycle have an extended wheelbase while retaining the speed, maneuverability, and superb handling of a bicycle. The frame is composed of standard parts using tube-bending and welding and is perfectly suited to the needs of the informal sector: hauling food, water, wood, recyclables, and passengers. Though based in the United States it is our mission to meet the broader demands of developing nations. Xtracycle International will draw from prior experience in Nicaragua, Cuba, and Senegal, to now team up with ITDP in promoting non-motorized vehicles in South Africa. Our goal is to encourage innovation by empowering local fabricators to design cargo-carrying tools that will meet specific local needs.

**Re~Cycle** is a UK charity, aiming to relive poverty in developing countries by providing cheap, sustainable transport. In the UK, servicable bicycles are rusting in garages and being thrown away, due to the labour cost of refurbishment. In some less developed countries, the investment to fix them is soon repaid, and substantial gains can be made in saved time, helping people to escape the poverty trap. Cost effective, as the majority of money has already been invested in manufacturing the bicycles. A sustainable, self-help project, as the recipients are taught how to fix and maintain the bicycles.

Background: The Post-Apartheid rise of the Informal Sector

The informal economy, long anathema to apartheid-era policy makers, is now widely recognized as legitimate target of development efforts. Indeed, Habitat II, the
United Nations Conference on Human Settlements, estimates that informal jobs comprise 75 percent of urban employment in many sub-Saharan African countries, and further legitimize its worth to the formal economy:

...in smoothing the transition from the apartheid-to post-apartheid city, planners, policy-makers and development agencies must take cognizance of the importance and circumstances of the informal sector (Rogerson 1988a)

Until recently, informal jobs have been viewed as disconnected from the “real” economy of a city, yet evidence suggests that informal jobs are well integrated and contribute directly to the urban economy as a whole. Informal enterprises, however, still only provide barley a subsistence wage for their practitioners. Clearly, what is needed is a mechanism that expands the income-generating capacity of informal activities so that they afford more than a subsistence existence. In short, What is needed to transform “survivalist” enterprises into viable businesses?

Hindson (1987) and Azarenda (1989) see an informal sector with the potential of redressing urban unemployment, and a recent document published by the Development Bank of South Africa, titled “Rethinking South Africa’s Informal Economy” states:

*The informal sector and micro-enterprises are the focus of so many resources, debates, experiments and expectations-- all in the name of promoting development. Since the beginning of the apartheid reform period, state policy has evolved towards tolerance of the informal sector, even selectively assisting the long-suppressed activities of hawkers, backyard artisans and other enterprisers. (emphasis added)*
Project Design and Implementation

Project Description

The overarching goal of Afribike is to establish a high-profile, multi-functional and self-sustaining utility bicycle resource and support center serving informal businesspersons operating in or near downtown Johannesburg. Afribike will initially serve the cohesive ACC-affiliated community, which consists of adult artisans and craftspersons, self-employed small business persons, and teens. It is the goal of Afribike to achieve full financial independence within 18 months of implementation through the sales of refurbished bicycles, fabricated workbikes, repair services and accessories; leasing of workbikes; sales of bicycle art.

Afribike has five main components:

Bicycle Education and Vocational Training

Given that the Afrika Cultural Centre's main focus is children, Afribike, from the outset, was to include a provision for youth bicycle education, based on the successful NYC Recycle-A-Bicycle (RAB) which is outlined in "Tools for Life" by Karen Overton. As such, Afribike's RAB program will include an Earn-A-Bike component based on Ms.
Overton's successful program, through which ACC teens will earn their own bicycles through working in the Afribike shop. Plenty of youth bicycles (BMX, etc.) are on-site to meet the requirements of this program. It is the goal of Afribike to cycle 100 teens through the Earn-a-Bike program in 1999.

Additionally, Afribike will educate adults. Ongoing classes in maintenance, repair, riding and safety will be held at Afribike, the frequency of which will be determined by demand. In addition to bicycle maintenance and repair, information about bicycle-oriented income-generating activities will be made available.

**Workbike Fabrication (AfriWorks)**

AfriWorks is the name given to the workbike fabrication component of the shop where Xtracycles and other load-carrying vehicles will be manufactured. These items will be inducted into the Afribike Fleet and sold to local aspiring utility cyclists throughout South Africa. Xtracycle International has agreed to donate their services in this regard.

**Bicycle Recycling**

Afribike will refurbish used bicycles and sell them to aspiring cyclists in the Johannesburg conurbation. Some bikes will be equipped with racks and other additions to meet the load-carrying requirements of local micro-enterprisers, others will be suitable
for commuting. Additionally, many used bicycles will also be converted into Xtracycles, which can carry loads in excess of 300 pounds. Total used bicycles acquired to date: 675. (275 from ITDP shipment, 400 from imminent Re-Cycle shipment) Future sources of bicycles: US (ITDP sponsored shipment July '99), UK (Re-cycle shipment October '99), sources within South Africa.

Containers of bicycles are loaded with the help of student participants of New York City's Recycle-A-Bicycle program, and proceeds according to the following:

Workbike Leasing and Sales

Afribike will operate a modest workbike leasing program so that local micro-enterprisers access to affordable, load-carrying and income-generating transportation on a daily, weekly or monthly basis, and provide them mechanical and technical support. The leasing scheme appears to reduce more obstacles to entry than other micro-credit or lease-to-own schemes, and will be easier to implement.¹

The Afribike Lease Fleet

25 Heavy-Duty Xtracycles
15 Afribike Messenger bikes
35 Bikes with Burley Trailers (converted to cargo-hauling)
4 Afribike Cycle Rickshaws

2 Johnson WorkCycles

1This scheme, we believe, will help build a supportive environment and maintain Afribike's capital. Leasing lowers the obstacles to entry (namely price), keeps the difficult maintenance, parts procurement, and safe storage centralized. Alleviates the problems with banking (microbanking works best in rural environments and we aren't bankers), is the lowest risk for the operator, and gives the microentrepreneur more choice (Xtracycle for this job; Worktrike for that one). Basically the same reasons why the vast majority of motorized cargo haulers here in NYC lease their trucks. Later, when people become more established, ownership becomes more attractive and prudent. Then Afribike will "recycle" its fleet into the community by selling older models as it acquires newer ones.

2of the 275 used bicycles that were shipped, approx. 130 will be suitable for use as utility cycles, 70 will be reconditioned and sold, 35 will be cannibalized for parts, and about 40 are children's/BMX bikes that will go to the RAB participants through the Earn-A-Bike program. The contents of the container from Re-Cycle will be divided similarly.

Workbike and Bicycle Sales

Because Afribike has many more used bicycles than it needs to maintain a fleet of workbikes for lease, its staff will refurbish many of the bikes for subsequent sale to local artisans, hawkers and traders. This component of Afribike, coupled with the related sales of bicycle parts and accessories will contribute significantly to the economic sustainability of Afribike.
Bicycle Art, Activities and Culture

Afribike BikeArt

As the ACC is primarily an art and culture focused organization, it makes sense to make the most of these talents. The US market for African wire bicycles and other bike art is very strong, and ITDP and Re-cycle have made inroads with retailers in the US and UK who are willing to sell the products. The potential here for cash flow for the ACC is tremendous. ITDP's ties with the UN and UNICEF respectively may yield opportunities for further outlets for Afribike BikeArt. The cards which accompany the BikeArt reads:

"AFRIBIKES"
"Gifts of Freedom"

Apartheid has ended; we can now ride our bikes anywhere. And we do. We made your Afribike from recycled materials for you and your beloveds. We are spirited artisans and more. Can you see what your Afribike embodies? Free movement and expression and the freedom to pursue sustainable livelihoods.

AFRIBIKE is a community of young artisans in Johannesburg, South Africa that are advancing their unique brand of bicycle/art culture in their community and abroad. The profit from this purchase goes directly back to the artisans who made it, and sustains AFRIBIKE's core programs: bicycle recycling, training, and workbike fabrication.

Afribikes are Handmade bicycle sculptures crafted from recycled electrical wire. Each one is unique, sporting a variety of colors, accessories and features. Though the size varies slightly, all Afribikes are about as large as a pair of hefty glasses.
Afribike is a community of young black South African bike artisans operating their own multifunctional bicycle recycling, employment, education and repair facility in downtown Johannesburg. Founded after the dismantling of apartheid, Afribike advances bicycle culture and economic self-determination—both of which were brutally discouraged for decades.

Afribikes generate the income necessary to provide tools, educational materials and livelihoods for working members of the Afribike community; and enables periodic shipments of used bicycles, parts and tools to Afribike from "cycle and recycle" donation centers in London and New York.

Afribikes are distributed by the Institute for Transportation and Development Policy (ITDP), a New York-based non-profit environmental organization that has promoted environmentally sustainable and socially equitable transportation policies and projects since 1985.

Annual Youth Bicycle Day

The mayor of Johannesburg has agreed to co-sponsor a "Youth Bicycle Day" and "Afribike Parade", which would ostensibly double as Afribike's debut party. The Executive Director of the Afrika Cultural Centre, Benjy Francis, has also suggested a longer and more eco-tourism oriented annual Afribike Bike Tour, which would attract recreational cyclists from a variety of locations. The parade's purpose is to raise the project profile in the eyes of the community, and to demonstrate that the number of bicyclists on Johannesburg streets is growing.

Conclusion

Whether or not the Afribike project will be a success remains to be determined. Its ambitious scale of the project, however, has already garnered the attention of South
African policy makers who are currently exploring the role that bicycles can play in the "New" South Africa, particularly with respect to job creation.
The three projects presented in the preceding chapters show how transport projects may be implemented to achieve the strategic goals of reducing poverty, generating employment, sustaining the environment, and empowering women. Though the projects presented here are all 'works in progress', implementation has progressed sufficiently to yield guidelines for those that would attempt to replicate them.

First, transport interventions must adopt a more holistic, integrated approach to project design if they are to best meet basic access and mobility goals at the least cost, with the least environmental stress, in a way which maximizes the benefits enjoyed by low income people and women. In practice this amounts to identifying all of the components of the given transport crisis to be addressed at the outset, then designing the project accordingly. This may seem obvious, but in the past, just the opposite occurred: a transport mode was chosen first (i.e. private motorized transport), then the project was designed around the chosen mode. Following are two suggestions to facilitate this more holistic approach:

1) Agencies could implement programs to provide technical assistance and funding to pedestrian and bicycling promotion organizations, to help users of
sustainable modes better articulate their concerns to development agencies and government planners.

2) Agencies could work with indigenous groups to complete feasibility studies for improving those transport modes used directly by the poor; namely, pedestrian, non-motorized, and public transit facilities. Such studies could assist in the design of infrastructure to enhance the safety and efficiency of travel pedestrians, bicyclists, and other human powered vehicle operators.

Second, transport projects should, at their outset, start with asking the right questions, in sufficient detail. Identifying a bicycle procurement project as the most effective way to meet a population's mobility needs is not enough. There are many other variables to consider (type of bicycle, availability of spare parts and skilled mechanics), variables that could be understood by asking the right questions of the target population and surveying the local situation.

Third, the project design should contain provisions ensuring project plasticity. As was the case with all of the projects presented, the final projects were arrived at only through a process of significant modification of the original project design. This plasticity is necessary not only to address the dynamism of the various project components and unforeseen site-specific contingencies, but also to respond to the populations changing capacities. For example, a type of work bicycles chosen at the
outset for their reliability for a group of novice riders may become sub-optimal after their incomes have increased and their mechanical and operational skills have progressed.

Fourth, project partners must be chosen very carefully. As has been the case with every ITDP project, the strength of in-country project partners has been a main determinant of project success. Project partners should be judged more on their track record than the appropriateness of their mission to the project at hand. In short, it is better to team with an established NGO with experienced and proven staff whose mission may not rest exclusively with transport than with an inexperienced one that is dedicated solely to transportation.

Finally, because the resources available to development agencies to promote sustainable transportation are limited, bicycle projects should always be designed and implemented as not an end in themselves but as a tool to leverage and marshal larger market, government and societal forces. In practical terms this means that projects should strive for financial self-sustainability (thus enhancing their replicability) and should also include a marketing component to disseminate the results.
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