Agenda 21 as a Tool for Implementing an Improved Traffic Environment and Safety for Developing Countries - A Case Study of Faisalabad, Pakistan

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Abstract

Transportation is one of the main growing crises in developing countries. This is the product of multiple forces including the rapid pace of urbanisation and a mismatch between supply of transportation infrastructure, services and technologies and the mobility needs of the majority of people whose incomes are very low. Transportation development policies and investments in most developing countries are focussed on encouraging motorization and are indifferent and hostile to low-cost, informal, non-motorized transportation modes despite the vital role they play in mobility for lower-income groups. The main focus of this study is Asian developing countries. Pakistan is selected as an example and the largest city in Pakistan, Faisalabad is selected for a detailed analysis. Transportation scenario and problems in the city such as congestion index, loss of working hours, average speed, expenses and commuter dissatisfaction are closely observed using the Agenda 21 framework. Sustainable transportation and environmental problems for the city are also studied and recommendations made to improve them. It is finally inferred that there is an urgent need for comprehensive transportation planning, managing Kachi Abadies, curbing private vehicle use and effectively facilitating the public transportation in the city of Faisalabad

Keywords: Sustainable Transportation; Agenda 21; Traffic Safety; Environmental Problems; Developing Countries; Pakistan; Sustainability Indicators
Introduction
Transport problems such as traffic jams, dangerous roads, pollution, absence of parks, walkways and public spaces and spiralling use of cars and motorcycles is a frequent occurrence in Pakistan, as in other South Asian countries. Urban transport is one of the most important sectors having a direct bearing on sustainable development because of the high growth of the transport sector’s energy consumption and greenhouse gas emissions.

Sustainable transport guiding principles have been developed from Agenda 21. These principles can be subdivided into economic viability, accessibility for all, ecological sustainability, social equity, health and safety, integrated planning, education and public participation, individual and community responsibility. The purpose of these principles is to establish approaches that are holistic, long term and community oriented. In this study we will try to find out the balance among current major transport systems - motorized and non-motorized, whether they fulfill the requirements of Agenda 21 guiding principals.

Due to the considerable interest in transport sustainability and its wider role in sustainable development there are now many definitions of sustainable transport. Black [1] developed a definition that is closely aligned to the most widely used definition of sustainable development by the Brundtland Commission [2]. He defines sustainable transport as “satisfying current transport and mobility needs without compromising the ability of future generations to meet these needs”. Although succinct, this definition is not, perhaps, entirely practically useful. More expansive is the ECMT [3] view that sustainable transport is part of a wider urban sustainability issue involving general quality of life issues as well as use of finite resources. It states that it involves “assuring that the growing numbers of urban and suburban dwellers in all socio-economic classes have access to the services and activities integral to their daily lives, while minimising the negative environmental, equity, economic and health impacts of travel”.

In order to measure the sustainability of a transport system in terms of these three elements, a set of sustainability indicators is required. The World Bank [4] suggested the following: modal split for the journey to work, energy efficiency by mode of transport, journey to work length, journey to work trip time, transport deaths, transport emissions, road expenditure, percentage of money spent on the journey to work and transit cost recovery. The OECD [5] in turn used a very similar set comprising: transport intensity, vehicle ownership, fuel consumption, infrastructure density, air pollution, safety risks, pricing and taxation and subsidies. Many of the indicators of transport sustainability relate either explicitly or implicitly to the proportion of motorised trips made by public transport and most policies to
improve transport sustainability involve seeking to reduce the number of journeys made by car in favour of public transport [5,6].

Traditional, non-motorised and low-cost transportation modes - such as bicycles, carts, trishaws, and donkey carts - generally are ignored or dismissed without study as backward and inefficient. Little data are collected about these modes, reinforcing the impression among many transportation professionals that these modes are of little consequence. The most basic mode, walking, is similarly neglected as an area for serious inquiry and planning in most transportation planning efforts. However, the majority of all trips made in Faisalabad are made by foot. In developing countries, most people rely on non-motorised transportation, occasionally or regularly supplemented by public transportation, often provided by the informal sector of the economy. Very wide variations in the level of walking, bicycling, and other informal transport sector activity can be observed between urban and rural regions.

In the following pages we will discuss sustainable transport issue in detail, in the context of developing countries. A case study of Faisalabad - third largest city of Pakistan - has been chosen and in this study we will try to find out the balance among current major transport systems - motorized and non-motorized, whether they fulfill the requirements of Agenda 21 guiding principals

**Population Growth and Transport Demand**

Population growth rates of 3-5% are common in cities of developing countries [7]. Population growth leads to increasing travel demand and population pressure, which in turn leads to spatial expansion of urban areas and increased journey lengths. Parallel growth in city economies and in household and personal income leads to increased travel demand, increased car ownership and increased car use. World Urban Population, 1950-2000 with Projections to 2020 (in billions) between 1950 and 2000 the global urban population has more than tripled to reach 2.86 billion. While urbanization has considerably slowed down in developed countries, the developing world is where cities are growing the most. It accounted for 68% of the urban population in 2000. By 2020, 77% of the global urban population (3.26 billion) is expected to be in developed countries. This process will be accompanied with significant surges in urban mobility demands. On the other hand, mobility demands in urban areas can be more efficiently satisfied with collective transportation than mobility demands in rural areas [7]. All the new millionaire cities and 12 of the world’s 15 largest cities are in developing countries. If
cities of 8 million are considered, 28 existed in 2000, with 22 of them in developing countries. In 1950, only the largest city in the world (New York) had more than 10 million people and by 2015 12 cities will have a population of more than 15 million inhabitants. Tokyo, the largest, had 26.4 million inhabitants in 2000 while Bombay is expected to have a similar population by 2015 [7].

**Transportation Impacts and Sustainability**

Transportation facilities and activities have significant sustainability impacts as listed in Table 1. As a result, strategies that increase transportation system efficiency and reduce negative impacts from transportation are among the most effective ways to make progress towards a sustainability objective.

<table>
<thead>
<tr>
<th>Economic</th>
<th>Social</th>
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<tr>
<td>♦ Traffic congestion</td>
<td>♦ Air pollution</td>
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<td>♦ Mobility barriers</td>
<td>♦ Climate change</td>
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<td>♦ Crash damages</td>
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<td>♦ Transportation facility costs</td>
<td>♦ Water pollution</td>
<td>♦ Water pollution</td>
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<td>♦ Consumer transportation costs</td>
<td>♦ Hydrologic impacts</td>
<td>♦ Hydrologic impacts</td>
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<td>♦ Depletion of non-renewable resources</td>
<td>♦ Noise pollution</td>
<td>♦ Noise pollution</td>
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Table 1: Transports Economic, Social and Environmental Impacts [8]

Because transportation activities have so many impacts related to sustainability, it is important to identify strategies that help achieve multiple objectives, and avoid those that solve one transportation problem but exacerbate others. For example, a policy or program that reduces traffic congestion but increases air pollution emissions or crashes cannot be considered a sustainable solution. Similarly, a strategy that reduces energy consumption and air pollution emission, but increases traffic congestion, crashes and consumer costs is not necessarily a sustainable strategy. The most sustainable strategies are those that simultaneously help reduce traffic congestion, pollution, crashes and consumer costs while increasing mobility options for non-drivers, and encouraging more efficient land use patterns,
or at least avoiding to contradict these objectives. Conventional planning tends to assume that transport progress is linear, consisting of newer, faster modes that displace older, slower modes as illustrated below. This *series model* assumes that the older modes are unimportant, and so, for example, there is no harm if increasing automobile traffic causes congestion delay to public transit or creates a barrier to pedestrian travel. From this perspective, giving public transit or walking priority over automobile travel, will not be considered desirable. The gradual ‘improvement’ in transportation means can be shown by the following series model:

Walk → Bicycle → Train → Bus → Automobile → Improved Automobiles

However, sustainable transport reflects a *parallel model*, which assumes that each mode can be useful, and strives to create balanced transport systems that use each mode for what it does best. Transport progress therefore involves improving all useful modes and not just the newest mode, as illustrated below. For example, in many cities the most beneficial transportation strategies may involve improving walking and cycling, support for public transport use and restricting automobile traffic in congested urban areas. It does not assume that faster, motorised modes should have priority over slower modes, or that increased travel speed is necessarily more important than qualitative factors such as comfort, safety and equity.

**Effects of Improper Land Use Planning**

a) Urban sprawl
It can be defined as an unplanned and unconstrained growth of urban development, which results in an inefficient and incomplete use of land and resources. It is one of the major causes contributing to broader environmental problems through the interactive mechanism of urbanisation and motorization. Urban sprawl involves developments of low residential densities over a large land space.

b) Automobile Dependency
Dispersed land use patterns require a high level of mobility for a given level of access. This mobility is easily achieved from self-owned automobiles. Automobile dependency consists of high levels of per capita automobile travel, automobile oriented land use, and reduced transport alternatives [9]. It causes poor pedestrian and cycling conditions, limited transit service and under-pricing of automobile travel (such as abundant free parking, unparsed roads and low fuel taxes). In countries with large land areas and widely distributed populations, transit services prove to be enviable, resulting in growth in auto-ownership. For example,
Australian cities were relatively compact in the past, and walking was the dominant mode of personal transport. But there has been a steady progression from a compact “walking city” to a sprawling, car-dependent city at low residential densities by world standards. Residential density and travel characteristics in the suburbs of both Australian and North American urban areas have led to auto dependency in these countries [10]. Americans use their automobiles more than citizens of other developed countries, more likely due to lack of co-ordination between land-use and transportation policies in the United States [11].

c) Increase in external costs

Although automobiles are expensive to own, they are not very expensive to drive. Use of automobile has internal and external costs [9]. Internal costs (costs borne by the vehicle owner) include price paid for the vehicle, maintenance, taxes and fuel costs. External costs (costs borne by the society) in the form of environmental impacts (air pollution, noise), congestion (delay caused to others), and accident costs (suffering and grief) are believed to be more than the internal costs. Thus the social cost (summation of internal cost and external cost) is always high. An inappropriate land use planning can lead to automobile-oriented city, poorly suited for walking, cycling and transit. The growth and development of such city is unsustainable and depicts a lack of co-ordination amongst stakeholders. For instance, in Bangkok, large tracts of land remain undeveloped between and behind the main roads. This development is the result of improper planning with inefficient use of land. Since much potentially valuable land is either not used or used only for small-scale farming, this type of development is highly uneconomical for transportation as it simultaneously causes obstruction of the main roads and produces deplorable living conditions for the people who live and work along the roads [12].

Implementation of Land Use Planning and Control

As discussed earlier, most of the population growth is occurring in the metropolitan cities and suburbs. This rate and pattern of growth which is totally or substantially unplanned is expected to continue. Such unplanned growth will move jobs farther from homes, increasing commuting distances and thereby longer travel times. Land use planning techniques are thus required for co-ordination between travel and transport facilities. Smart Growth, a concept associated with ‘growth management’ is used as an anti urban-sprawling technique. It aims at establishing land use strategies to increase population and housing densities and make transit more feasible [13]. It also intends to create resource efficient and liveable communities. One of the best examples of efficiency and sustainability gains that come from coordinated transportation and land use planning is that of Stockholm, Sweden. The last half century of
strategic regional planning has given rise to a regional settlement and commutation pattern that has substantially lowered car dependency in middle-income suburbs. Stockholm planners have created jobs-housing balance along rail-served axial corridors. This in turn has produced directional flow balances. During peak hours, 55 per cent of commuters are typically travelling in one direction on trains and 45 per cent are heading in the other direction. Such balanced directional splits stand in marked contrast to the United States where, because of lack of coordination in infrastructure and development, trains and buses are often filled in the morning inbound but back-haul three-quarters empty [14]. Countries like France, Denmark and Sweden have held sprawl in check by heavily taxing electricity and petroleum consumption at a rate three to four times higher than in United States [14]. Increasingly, policy makers around the world are promoting measures like fuel taxing, road pricing and tolls, which will discourage the use of private vehicles. New suburban developments in The Netherlands and Germany are designed to provide safe and convenient pedestrian and bicycling access. Residential developments almost always include other uses such as cultural centres, shopping and service establishments that can easily be reached by foot or bike. New residential areas are located adjacent to town centres, connected by a fine mesh of local streets. The proximity to town makes trips shorter, while the finer grain of the road network allows pedestrians and bicyclists to choose quieter, less heavily travelled streets over busier, more dangerous roads [15].

**Importance of Non-Motorised Transportation**

Walking and cycling are sustainable means of transport. All journeys, whether short or long involve walking. A pedestrian friendly city is more humane. In many ways, walking and cycling are ideal ways to get around cities. These non-motorised travel modes cause virtually no noise or air pollution. The only energy they require is provided directly by the traveller. Moreover, they are quite economical, costing much less than auto or public transit, both in direct user costs and public infrastructure costs [15]. Conventional transportation evaluation practices usually seem to prioritise automobile-oriented planning to non-motorised transportation (NMT). This is because the benefits of NMT are difficult to quantify. Walking and cycling are inexpensive and hence tend to be ignored. It may be difficult to determine the number of non-motorised trips in an area because they are often under-recorded in travel surveys and traffic counts. Some travel surveys exclude non-motorised trips altogether and when included, walking and cycling trips are often undercounted because they include many short, non-work and recreational trips, and trips by children, all of which tend to be overlooked. Automatic traffic counters do not record non-motorised travel and manual counts usually focus on arterial streets, ignoring side streets and paths that may be popular walking
and cycling routes. Most trips involve non-motorised links that are often ignored in traffic counts. Trips classified as “auto” or “transit” are usually “walk-auto-walk,” or “walk-transit-walk” trips, yet the walking component is often not counted, even if it takes place on a roadway [16]. One study finds that the actual number of non-motorised trips is six times greater than what conventional surveys indicate. This suggests that 20 to 30 per cent of all trips are non-motorised, yet a much smaller portion of transport funds are spent on facilities and safety programs for non-motorised modes [17].

Researches and studies have proved the importance of non-motorised transportation and its planning. Significance of walking and cycling has been realised, and improvements towards it are being done or proposed for the future. Some countries have undertaken a wide range of measures to improve safety including better facilities for walking and bicycling, urban design sensitive to the needs of non-motorists, traffic calming of residential neighbourhoods, restrictions on motor vehicle use in cities, rigorous traffic education of both motorists and non-motorists, and strict enforcement of traffic regulations protecting pedestrians and bicyclists [15].

**Pedestrianisation – Facilitation for walking and bicycling**

Over the last few decades, European countries have implemented a range of policies to make walking and cycling safer. Copenhagen, Denmark has recognised the social value of Pedestrian Street [18]. There were heated discussions when Copenhagen started the Pedestrianization. However, it became a great success almost immediately. Pedestrianization continued over a period of 30 years and the downtown parking policy aimed to remove 2-3 per cent of the parking spaces every year. With the improvement of the public transport system and the enlargement of the bicycle network, more and more space has been taken away from the traffic and given to people. Pedestrianised zones are currently found in Munich in Germany, Boston in Massachusetts and Denver and Boulder in Colorado. Pedestrianized commercial areas generate up to 25 per cent more revenues than spaces developed to encourage automobile use. This financial success is attributable to easy access by foot and public transportation [19].

In The Netherlands and Germany, new suburban commercial developments have sidewalks and bicycle paths to serve non-motorists. Parking lots almost never surround buildings, as in the United States; instead, they are built next to or behind buildings, thus permitting easy access to pedestrians and bicyclists. When an obstacle such as a highway, railroad, or river must be traversed, Dutch and German cities usually provide safe and attractive pedestrian and
bicyclist crossings. German and Dutch cities have invested heavily to expand and improve facilities specifically for bicycling; many of these investments have focused on increased safety. The most obvious symbol of this investment is the already massive and ever expanding network of bike lanes and bike paths, which provide completely separate rights of way for cyclists. Unlike the fragmented cycling facilities, the bike paths and lanes in The Netherlands and Germany form a truly integrated, co-ordinated network covering both rural and urban areas. Dutch and German bikeway systems serve practical destinations for everyday travel, and not just recreational attractions. In The Netherlands, the network of bike paths and lanes more than doubled in length in less than 20 years: from 9,282 km in 1978 to 18,948 km in 1996. The German bikeway network almost tripled in length: from 12,911 km in 1976 to 31,236 km [15].

**Case Study Faisalabad**

The current transport situation in Pakistan shows several transportation problems which are getting worse with economic development. Moreover, urban transport is one of the most important sectors having a direct impact on sustainable development due to high energy consumption and greenhouse gas emissions. This is especially important in Pakistan where the motor vehicle fleet is growing at two to three times the rate of population [20]. In Faisalabad, designed transport strategies and programs have resulted in high growth of urban road traffic, increasing air and noise pollution, and traffic crashes.

Faisalabad is Pakistan’s third largest city with a population of around two million and covers an area of 168 sq. kms. Faisalabad is suffering from several serious problems related to high population growth and rapid urbanisation. The most pressing problems include urban transport, solid waste management, sewerage and drainage, water supply, pollution, population explosion, high infant and maternal mortality, health, and education. Problems of traffic congestion, multi-speed traffic and a lack of parking places have also resulted from rapid and unplanned growth. The population explosion is a serious cause for concern and the alarming 2.6% growth rate cannot be supported by the city infrastructure [20]. This has caused the formation of countless slums where living conditions are often deplorable.

**Concept of Sustainable Transport and Current Situation of Faisalabad**

Sustainable transport guiding principles have been developed to streamline the research. These principles can be subdivided into the following categories: economic viability,
accessibility for all, ecological sustainability, social equity, health and safety, integrated planning, land and resource use, education and public participation, individual and community responsibility. The purpose of these principles is to establish approaches that are holistic, long term and community oriented. With the help of these guiding principles, short lists of indicators have been designed to provide a basis for monitoring progress in Faisalabad towards or away from sustainable transportation and to provide a better understanding of the dynamics of Faisalabad’s transportation systems in relation to sustainability. Ongoing projects have been reviewed in order to analyse government and private sector efforts towards improving the sustainability of the transport sector. These projects include the Fuel Efficiency in Road Transport Sector project, the National Environmental Action Plan, the Environmental Awareness Program, the Facilitating Women’s Mobility Project and the Faisalabad Urban Transport Project. Some efforts are also being made to reduce the use of pressure horns and to improve the ambient air quality.

Housing Problems

According to a survey conducted by the Faisalabad Development Authority (FDA), the city is facing an acute shortage of housing [21] is spreading in different direction without any proper planning. There are three types of communities:

a) Colonies: planned developments which apparently accounted for 60 per cent of the total population
b) Katchi abadies: houses developed in an unplanned manner on land occupied illegally by squatters; and
c) Slums, which are developed on private land without the municipal authority’s approval.

According to an estimate, around 30 percent of the total population of Faisalabad reside in Katchi Abadies, and in slums. The problems of managing solid waste, sewage disposal, traffic congestion etc. are more severe in these areas than in the other relatively developed areas in the city. Consequently, the population of these areas is exposed to serious environmental hazards. In brief, the level of environmental pollution in the city is increasing day by day due to the increasing number of smoke-emitting vehicles, evaporation of chemicals and release of untreated waste by textile processing units. The socioeconomic and physical condition of these Katchi abadies is very poor. Structures are mostly very small, dilapidated/deteriorated and have no sanitation.


**Economic characteristics**

According to a recent survey covering household monthly income distributions in Faisalabad, it is evident that about one third of households fall into low-income groups (i.e. below Rs.3000 per month). Another one third of the population belongs to the lower the middle-income group, while nearly 12 per cent belong to the upper middle-income group. Slightly more than 8 per cent earn a high income. The citywide average monthly household income is approximately Rs.5500 [22].

**Social structure**

The largest age group in the population of the city is children under 10 years (33.6 per cent). More than 26 per cent fall in the age group of 11 to 18 years. The working age group (18 to 60 years of age) is about 33 per cent. The remaining 6.8 per cent of the population is that of elderly people. More than 54 per cent of the population is illiterate; the level of education in males is higher than in females. Only 26 per cent of the total population is actively working. The majority are businessmen and the self-employed, followed by labourers and government/private sector employees. This indicates that, due to the industrial base, most job opportunities are in the industrial and commercial sectors. The total population living in the slums and katchi abadies is around 35 per cent [22].

**Traffic Congestion**

The city was originally laid out as a square, with eight bazaars radiating from the Central Clock Tower to act as a focal point for inbound traffic. These radiating roads merge with the fringes of an outer road encircling the perimeter of the city. A road also encompasses the eight bazaars. Commercial activities were carried on at each bazaar while other activities such as residential, religious and educational activities etc. were conducted between these bazaars. The urban sprawl caused by the influx of people after independence necessitated a piecemeal development, resulting in the choking of the central business district. Increased commercial activities began to invade the residential areas, resulting in heavy traffic congestion on streets meant to serve residential development. The central business district is now overcrowded with buildings, and parking spaces are very limited. Long queues of bicycles are now a common scene at all bazaars. The uncontrolled physical growth of the city, the lack of a ring road linking the different spokes radiating from the centre, and the spread of industrial activities into residential zones, have destroyed any capacity for a smooth and safe flow of traffic. Moreover, the surrounding settlements are now being served by inadequate and irregular patterns of roads.
There is a great variety of vehicles in common use on Faisalabad streets. These include motorized or man-powered rickshaws, bicycles, motorcycles, cars, large trucks, small vans, and buses. In addition, there are carts drawn by donkeys, horses, camels or oxen. Recent traffic counts show the total number of motorized vehicles in Faisalabad to be around 104,000. Non-motorized vehicles such as donkey/camel carts, hand carts, tri-vans, etc. are counted to be 8,000. Daily travel patterns show that the public transportation system carries about 40 percent of the daily traffic [23]. Approximately 33 percent of people in Faisalabad use bicycles as their means of daily transportation, while 15 percent travel on foot and 12 percent use private automobiles. The number of accidents in Faisalabad has remained small, but is now on the increase. It increased from 70 in 1970 to 130 in 1998 [23]. There is currently no monitoring of air quality in Faisalabad. Personal assessments of the author reveal that vehicle exhaust pollution, containing particulate matter, nitrous oxides and lead is high.

**Heterogeneous Mix of Traffic**

With a mixed land use pattern, Faisalabad traffic consists of motorized and non motorized vehicles. Roads carry pedestrians, bicycles, scooters, auto-rickshaws, taxis, cars, buses, bullock carts and trucks thus there is no distinction of roads for vehicles and pedestrians. Cattle from the sheds are often let loose by their owners, which find their way to roads. This holds up the traffic jams even more. Pedestrians walking on roads further reduce the vehicular speeds. In order to stop at bus stops at regular intervals, buses suddenly change their lanes making it inconvenient and unsafe for pedestrians and cyclists on the road, who walk on the leftmost sides. During such peak hours, buses and cycles are seen moving with roughly the same speed. Low income groups in Faisalabad prefer to walk or use bicycles. As a result there is a very high pedestrian activity at any place and time. Vehicle-pedestrian conflicts are more hindering near bus station. This place gets crowded with pedestrians, vendors, customers and vehicles.

**Environmental pollution**

Fuel quality and vehicle emissions are closely linked, and they in turn affect the level of air pollution. In developing a strategy for urban air quality management, it is important first to understand which pollutants are affecting public health the most in a given city. Faisalabad lacks legislative authority to enforce emission standards, and there is as yet no monitoring of air quality in the city, nor is there a local facility for the chemical analysis of effluent samples taken from the industrial plants. The Economic Survey of Pakistan 2004 pinpoints vehicle and
industrial emissions as the main air pollutant. The annual report from the Economic Survey, Pakistan stated that the average compounded growth of vehicles is about 12 percent and the total vehicles on road has increased from 0.8 to 5 million over the past two decades[24]. It explained that motorcycles and rickshaws, due to their two-stroke engines, are the most inefficient in burning fuel and contribute most to emissions. Rickshaws have more than doubled in number, while motorcycles and scooters have increased seven-fold over the past 20 years. A study carried out by the Ministry of Environment says about 16.28 million people (40 percent of the total urban population) of Pakistan are at a health risk due to air pollution because the province does not comply with World Health Organization (WHO) ambient air quality standards [25]. The Environment Protection Department (EPD) is trying to soften the blow by the provision of loans to owners of two-stroke vehicles to replace their engines with natural gas burning units after the ban. It says the ban will help cut pollution in big cities such as Lahore, Faisalabad, Rawalpindi and Multan. Such a ban exists in the federal capital, Islamabad, and has gone some way to improving air quality there.

6.2 Streets and Vendors

In general roads are narrow and insufficient to the growing demand of pedestrians and vehicular traffic. Traffic jams are common in this area, lasting for extended durations of time. Streets have a heterogeneous mix of traffic comprising of motorized and non motorized vehicles, pedestrians, cattle and hawkers. Roads are poorly maintained, and excavation works for water and telephone lines often deteriorate them further. Roads get worse even more during monsoon. Medians are narrow and fenced and alternate arrangements for crossing are not provided. As a result pedestrians haphazardly cross the roads and walk at places that are unsafe to walk

Bicycles, pedestrians and bus traffic attract street vendors. Often the side roads and pedestrian paths are occupied by people selling food, drinks and other articles, which are demanded by these road users. Vendors often locate themselves at places, which are natural markets for them. If any, then sidewalks are occupied by hawkers. Jay walking is frequent and common due to inability to walk comfortably and safely along the sides, thus causing confusion to the drivers. Pedestrian crossings are not provided or maintained at critical places. Widening of roads as suggested and implemented by various authorities, further increases the pavement for growing traffic and discourages the concept of having sidewalks for pedestrians. Either the sidewalks are narrowed or they are completely removed.
Pedestrians and slow moving traffic

Walking and non-motorised vehicles are the principal modes of transport for most of the urban poor in Faisalabad. For a large number of people even subsidised public transport (buses) and low cost bicycles are beyond their means, so that a significant proportion of the population falls into the category of ‘pedestrians’. Pedestrians and public transport users together form the largest group of road users. Yet their need for a safe and convenient infrastructure continues to be ignored. This has two major impacts on city traffic and travel patterns. Pedestrian and public transport trips as a percentage of total journeys have declined over the years which are unsustainable pattern, though they are not expected to disappear in the near future. Pedestrians are present on the roads despite hostile infrastructure designs and motor vehicles are forced to share the road space with them; this creates suboptimal conditions for all road users. In pursuit of development, cities continue to invest in infrastructure which makes the environment for the pedestrian even more hostile than at present.

A reversal of this trend is possible. It is possible to create pedestrian, bicycle and public transport friendly urban roads without increasing the right of way of existing arterial roads in Faisalabad. The guiding principle of such a design is re-assigning priorities to various road users and by meeting the needs of pedestrians, cyclists and public transport commuters in that order. The two most important factors walking 51% and Bicycle 16% [22] point out the rapid increase in poor residents in the city. The introduction of private buses, which are more expensive than public buses and may be beyond the means of many people, results in declining shares of bus trips and an increase in bicycle trips. The decline in walking trips, despite the increase in low income households, is noticeable. Since access to public transport requires a walking trip to the bus stop, all public transport users are also pedestrians. Despite large increases in private car and scooter ownership, 66% of all trips are by foot and bicycle [22]. Therefore, public transport pedestrians together with other pedestrians form the largest group of road users. Yet road design and traffic management policies cater to the convenience of car users, often to the detriment of pedestrians, public transport users and other road users.

The existing road design does not cater for the needs of pedestrians, cyclists, or other slow moving traffic. Service roads if present are not well maintained. Footpaths are either not present or poorly maintained. Furthermore, there are no specific facilities. Approaches to bus shelters, bus priority lanes, continuous pedestrian paths, and lanes for slow vehicles like bicycles and rickshaws have not been included in the road network designs. Consequently, all road users have to share the carriageway. This often leads to unsafe conditions for pedestrians.
and slow moving vehicles and congested conditions for motor vehicles. The extensive road network has not been developed to serve the mixed traffic presently using the roads. State authorities and ‘experts’ continue to plan infrastructure which ensures fast movement of car traffic at the expense of pedestrians and non-motorised vehicles. The basic needs of pedestrians are not recognised as a key part of the urban transport infrastructure. This has two major impacts on city traffic and travel patterns.

- Pedestrian and public transport trips as a share of total trips have reduced over the years. In both cases the only people who continue to walk and use public transport, despite the hostile environment, are those who do not have any other option.
- Given the socio-economic context of our cities, pedestrians are present on the roads despite hostile infrastructure designs and motor vehicles are forced to share the road space with them, which creates sub-optimal conditions for all road users. Since pedestrians, bicycles and other non-motorised vehicles use the left side of the road; buses are unable to use the designated bus lanes and are forced to stop in the middle lane, often 4 m - 6 m away from bus stops. The carriageway between the bus and the bus stop is occupied by waiting commuters, parked rickshaws and hawkers.

**Relationship of Income on Bicycle Use**

Income plays a significant role in influencing transportation choices people have. People with low incomes face extremely limited transport choices. Where there is extensive poverty, it is most important to ensure that the modes used by the poor continue to remain available as travel options. Despite rising incomes in many cities across Pakistan many low income people in Pakistani cities cannot afford even subsidized public transport fares and have no choice but to walk or cycle, even for travel distances of 10 to 20 km. For most poor households, walking accounts for the majority of all trips. When incomes are low, the value of time relative to cost for travellers is low as well. Although walking costs nothing, it takes a lot of time for all but short trips. Cycling often offers four or five times greater speed and is cheaper than public transport, once a bicycle is in hand.

Low-income households are forced to spend a higher share of their income on transportation than higher income households. A number of factors contribute to this - the poor often have to live far away from their jobs to find cheap housing, they often hold multiple part time jobs, and, since their income is so small, a single bus fare represents a larger share of earnings than for others. The poor in general make fewer trips than higher income people and engage in little discretionary travel. Irrespective of city size, the poor will continue for the foreseeable future to be dependent on non-motorised transport modes for mobility in Pakistani cities.
However, it is not only the poor who use bicycles. The travel time and convenience offered by the bicycle attracts people of all income levels to bicycles in many cities, particularly where measures have been taken to facilitate cycling. As traffic congestion in Asian cities increases, public transport schedule reliability and average travel speeds both decrease, making bicycles competitive at longer trip lengths due to their flexibility, convenience, and greater reliability.

**Non-Motorised Vehicle Facilities (NMVs)**

In Faisalabad where NMVs predominate, there has been great need to create a separate Non-motorised network because large numbers of NMVs define their own legitimacy to right-of-way. However, as motorization increases, or as traffic congestion worsens, it becomes increasingly important to develop modal separation in high traffic flow corridors. This is particularly vital in mixed traffic cities where NMV use is declining due to competition from growing motorized traffic. Motorized modes are heavier, faster, and often accorded higher social status than NMVs. When street space is scarce, NMVs are vulnerable to displacement from mixed traffic streets unless they are present in sufficient numbers to assert an almost continuous claim to their share of road space. A key function of bicycle or NMV facilities is to protect the legitimacy and safety of NMVs in the transport system where it would otherwise be threatened by motorized traffic.

**Future directions**

A well-functioning road infrastructure must fulfil the requirements of all road users. In the context of the present socio-economic realities in Faisalabad, pedestrians, cyclists and other slow moving vehicles cannot be eliminated from the urban landscape. The needs of pedestrians have been ignored in conventional planning strategies and have been assigned lower importance compared with other vehicles on the road. However, the experience from environments where pedestrians are present makes a very strong case for re-thinking the conventional hierarchy of road users. It is clear that present investment patterns focussed on improving conditions for cars are not giving the desired results. Congestion continues to worsen along with a shift away from walking, bicycles and public transport - the desirable modes for sustainability. A reversal of this trend is possible. It is possible to create pedestrian, bicycle and public transport friendly urban roads without increasing the right of way of existing arterial roads in Faisalabad. The guiding principle of such a design is meeting the needs of pedestrians, cyclists and public transport commuters in that order.
The proposed network must enable direct and safe walking and bicycle travel within a coherent system. The proposed routes must guarantee a coherent network, minimise trip length (directness) and minimise encounters between cyclists and motor vehicles. The success of bicycle/non-motorised vehicle route design depends upon meeting not only the requirements and convenience of bicycles and non-motorised vehicles but pedestrians as well. Otherwise, all road users are obliged to share space with motor vehicles resulting in sub-optimal conditions for all.

**Recommendations**

Hardly any co-ordinated efforts on issues relating to the city’s development are made. Surprisingly, no agency in the city is considering or working on planning of traffic system and public transport. Somehow the function appears to have been relegated to the provincial government. There is a dire need for such an agency or department that would work on people. This agency should not only have enough resources to deal with current needs across the city, but also should be able to plan for the coming years. Considering this gap, a holistic approach to establishing such an agency is recommended, as the provision of public transport is not an isolated function; it is, rather, entwined with other aspects of urban life.

**Parking** is seen to be another critical problem of Faisalabad transportation system. There are no appropriate spaces provided for parking in residential complexes and offices. The situation is even worst in the central city around the clock tower. Thus people are forced to park their vehicles on nearby streets. Parking if provided is generally free or at a reasonable rate, easily affordable by the car owners. This encourages more use of cars and two-wheelers. Special parking zones should be provided for bicycles around Clock Tower bazaars, central bus station and other public places.

**Public transportation** facilities should be enhanced to such an extent that people will prefer these modes more than their cars.

- Fares should be rational
- Bus stop facilities and other public transport infrastructure should be provided
- Public transport facilities are not available in all parts of the city, proper planning is required for equal access of public transport in all areas
- Quality of public transport must be improved.
- Smoking in public places and public transport is prohibited under law but the law / provision is not being enforced
The awareness campaign can be initiated in the schools, colleges and other institutions and matters relating to safety and efficient use of public transport can be discussed.

Pedestrian Convenience

Another important development that Faisalabad requires is improvement in pedestrian facilities. Sustainability demands convenience of people, irrespective of their age and economic background. It is seen that roads are built or widened considering the convenience of vehicle owners, without giving enough thought to the pedestrians. Most trips involve walking and at least 60 per cent requires considerable amount of walk on roads. Accidents mostly involve pedestrians, and hence there is a need to place them in a safer environment. Sidewalks, pedestrian signals and pedestrian crossings should be provided at all places. Special sound systems should be provided at the traffic signals especially for the blind.

Segregated lanes for non-motorized transport and safer pedestrian facilities should be as following:
1) Urban and road design characteristics that ensure the safety of pedestrians and bicyclists;
2) Provision of segregated bicycle lanes on all arterial roads;
3) Wider use of traffic calming techniques, keeping peak vehicle speeds below 50 km/h on arterial roads and 30 km/h on residential streets and shopping areas;
4) Convenient Street crossing facilities for pedestrians.

The key barriers to NMV use include affordability of vehicles, NMV-hostile street environments, vehicle theft, negative social and government attitudes to NMVs, and excessive and inappropriate regulation of NMVs. Overcoming these barriers may require changes in transport investment patterns, infrastructure design standards, street space allocation, credit and financing systems, regulatory policy, public education, and marketing, depending on local circumstances. Such changes should be part of much larger efforts to manage the modal mix of cities to favour greater efficiency of resource utilisation in the transport sector while enhancing accessibility.

The bicycle/non-motorized vehicle plan can be developed for Faisalabad to fulfil the following objectives: (1) Traffic flow of all vehicles using that corridor should improve; (2) Number of accidents involving bicyclists should reduce; (3) Potential bicyclists should be encouraged to use bicycles.
The proposed plans have focused at the three levels of bicycle facilities as follows: (1) Network route planning; (2) Road section planning; (3) Intersection planning.

**Network route planning**: Detailed origin destination analysis of bicycle users shows that there is a need for a continuous network for bicyclists covering the whole of Faisalabad. This is because there are no areas where they are not present. Since a majority of the bicyclists are captive riders who are daily commuters (with no other mode choice owing to economic compulsions) the proposed network must enable direct and safe bicycle-travel within a coherent system. The proposed routes must guarantee minimum trip lengths (directness) and minimize the number of encounters between cyclists and motor-vehicles (safety). The development process can be prioritized to meet the three objectives of the bicycle master plan.

The bicycle network should be developed in the following phases:

**Phase I**: The routes which have heavy bicycle traffic sharing the road space with other traffic should be developed in the first phase because this would result in improving flow of bicycles as well as public transport buses and motorized private modes which are affected by the presence of bicycles on the same carriageway. This will cover 90 km of road length.

**Phase II**: Routes which should be developed in the second phase are the major arterials which carry MV traffic at speeds of 50 km/h but were not included in phase I. In non-peak hours and at night when the visibility is poor, bicyclists are exposed to a high risk of fatal accidents on these roads; therefore a well-designed network will ensure safety of bicyclists on these routes. Phase II includes four radials and two ring roads in the city.

**Phase III**: Remaining roads with at least 30 m right of way (ROW) will be developed as a part of bicycle network level plan in this phase.

**Phase IV**: In the fourth phase bicycle routes are proposed through parks and green belts. This would primarily be additional network capacity for bicyclists

The new cross sections also result in enhanced efficiency of the public transport buses that can be given the curb side lane or central two lanes for buses as per the site demand. Physically segregated lanes also improve safety of the vulnerable road users by reducing the conflicts between motorized and non-motorized modes.
Conclusion

This study has revealed that there is no single solution to achieving sustainable urban transport in Faisalabad, Pakistan. The transportation systems in Pakistani cities are at a crossroads and if they continue on their present path of rapid and uncontrolled motorization, they may face very high long-term economic and environmental costs with diminishing benefits. If they instead follow the models given by Agenda 21 which is followed by many European Countries like Sweden, Germany and the Netherlands, they may be able to stabilise or increase the appropriate use of non-motorized vehicles with large positive long-term economic and environmental consequences. NMVs offer no panacea to growing problems of traffic congestion, air pollution, energy use, global warming, and regional economic development, but they should be seen as a potentially important element in addressing these problems.

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