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## URBAN TRANSPORT SAFETY AND SECURITY

Nearly 0.5 million people die and up to 15 million people are injured in urban road accidents in developing countries each year, at a direct economic cost of between 1 and 2 percent of worldwide gross domestic product. A majority of victims are poor pedestrians and bicyclists. Fears for personal safety and security significantly deter the use of nonmotorized transport. This burden of physical harm that is borne by the poor can be reduced by improved road design, traffic management, medical service, and by policy improvement. This solution requires comprehensive action by a well-trained, committed, adequately financed, and organizationally integrated public sector.

### THE SCALE OF THE ISSUE

This chapter distinguishes between the problems of transport *safety*, which are defined as vulnerability to accidental injury (usually involving at least one vehicle as the instrument causing the injury), and the problems of transport *security*, which are defined as vulnerability to intentional criminal or antisocial acts suffered by those engaged in trip making.

Recent conservative estimates suggest that, in 1999, between 750,00 and 880,000 people died as a direct result of road accidents.<sup>1</sup> The World Health Organization (WHO) puts the number even higher—at 1.171 million people.<sup>2</sup> About 85 percent of these deaths occurred in the developing and transitional economies; about one-half were in urban areas. In addition, between 25 and 35 million people were injured in road accidents worldwide, of which up to 75 percent were in urban areas. The economic cost of the accidents in the developing world has been estimated at \$65 billion, which is approximately equal to the total annual aid and lending of the international institutions to these countries. For the developing countries, the economic cost of

accidents is estimated to be between 1 and 2 percent of their gross domestic product (GDP). Road accidents currently rank ninth as a cause of deaths worldwide, and are expected to rise to sixth by the year 2020. Even more significant, because many of the people killed are relatively young, road accidents already rank second in terms of reductions in life expectancy. In Bangladesh, it is reported that nearly 50 percent of hospital beds are occupied by road-accident victims.<sup>3</sup>

The security problem is less well quantified or recognized. It particularly affects pedestrians and cyclists, but also affects people in cars and public transport vehicles. In extreme cases, such as the injuries or deaths of passengers in the South African minibus “wars,” there is some record of the occurrence of events. More usually the acts of personal violence or harassment—particularly sexual harassment in public transport vehicles—do not get recorded. Social surveys in Latin America have demonstrated their prevalence (Gomez 2000).

The significance of poor safety and security is twofold. First, there is the direct injury and

trauma suffered by victims. According to a recent public transport survey carried out in Lima, 10 percent of those interviewed had been involved in a traffic accident on public transport during the previous six months.<sup>4</sup> Second, there is the effect of the perception of vulnerability on the travel patterns of a much wider spectrum of people. The major constraint on the use of non-motorized transport (NMT) is the fear of accident or attack, or of a bicycle's being stolen while it is parked. The diminishing trip rates now being experienced in some of the larger South American cities have been partly attributed to the sense of insecurity experienced by potential passengers. While this affects all social groups, the most vulnerable people appear to be those who have no alternative to an insecure mode of travel, and whose protection takes the form of withdrawal from a socially important activity (for example, evening education of women). When a wage earner in a poor family is badly injured, the whole family economy may collapse, because there is usually neither insurance compensation nor a social security safety net to protect them (box 5.1).

## SAFETY

The World Bank's concern with transport safety is not new. Periodic reviews during the past two decades have shown an increasing proportion of projects with an explicitly stated safety objective and safety components, with nearly one-half of transport projects having safety elements in the latest cohort examined.<sup>5</sup> However, most of these efforts arose as part of the design of infrastructure improvements or traffic management systems, with safety audits becoming a common part of new transport infrastructure projects. Improvement of the accident databases has been included in many projects. The total cost of these activities was estimated as only about 1 percent of total project costs.

Relatively few projects have had transport safety as their primary objective. The Mexico Highway Rehabilitation and Traffic Safety Project included institutional strengthening, research, and training, and a \$14 million expenditure on black-spot improvements. The Buenos Aires Urban Transport Project included an even larger sum to eliminate

### BOX 5.1 ROAD ACCIDENTS AND THE POOR IN SRI LANKA

A study of pedestrian road accidents in Sri Lanka showed that only 5 percent of accidents reported to the police resulted in any form of compensation. Even where compensation was paid, the average amount was 500 rupees (about US\$5).

A thousand pedestrians and cyclists are killed in the country each year. The maximum compensation payable is only 100,000 rupees (about US\$1,040), compared with the unlimited sum payable for damage to property, which may run to millions of rupees. The victims' loss of earnings is often not covered by motor insurance. Moreover, the legal procedure in making such a claim is too lengthy for the poor to even attempt.

The Motor Traffic Act should clearly stipulate a reasonable and fair compensation for pedestrians and cyclists. There is also need for provision of free (or affordable) legal aid to assist the poor and uneducated in making such claims, and for counseling and rehabilitation in the case of the severely injured.

Source: Kumarage 1998.

at-grade road crossings of the urban and suburban rail network, to speed up rail travel, and to reduce accidents. The most comprehensive effort, however, was the collaborative effort with the PHARE program of the European Union (EU) to improve traffic safety in six countries of Eastern and Central Europe from 1992 to 1994.

The outcomes of these interventions, and others of the same type, have been variable. A review of 25 projects in the early 1990s found them to be equally divided between the categories of successful, partly successful, and unsuccessful interventions.<sup>6</sup> Physical measures were usually implemented, but their effects seldom measured; enforcement efforts were often initially successful, but rarely sustained; and road-user education and legislative reform efforts were most successful when carried out by a well-established coordinating body, such as a national safety council. Above all, few projects were judged to have improved institutional capacity to undertake traffic safety activities beyond the project itself. Of growing concern, also, has been the protection of vulnerable road users, with measures to protect NMT being an important part of recent urban transport projects, in China in particular. The core weaknesses have been the poor level of awareness and commitment of governments and an unwillingness to create a strong enough institutional focus for a concerted, sustained effort.

Despite the horrifying statistical evidence, it remains difficult to persuade governments to give priority to road safety either as a transport problem or as a health problem. For example, a study of road safety in Ethiopia estimated that the annual cost of road accidents was the equivalent of 40 million Ethiopian birr (\$4.8 million) per year. However, a suggestion that 2 percent of a newly established road fund (equivalent to 400,000 birr, or \$47,450) be spent on a comprehensive crash-reduction program each year was rejected by the government.<sup>7</sup> This reflects a certain sense of fatalism and apathy about the problem, nurtured by the belief that, because of the strong human element in accident causation, there can be no well-

established, cost-effective intervention packages for accident prevention, as there are to address other scourges of morbidity and mortality.

To redress that apathy, the magnitude and nature of road accidents must be properly understood. Governments must be convinced that effective action is possible and that institutional arrangements can be put in place so that necessary actions can be effectively implemented. For that reason the Global Road Safety Partnership, established as the result of a World Bank initiative, has concentrated its early efforts on mobilizing the private sector and civil society to assume their responsibilities in road safety, increasing awareness of the nature of the problem, and identifying a limited number of pilot initiatives which can show that something can really be done about it. This section concentrates on the main elements of understanding the phenomenon, policy formulation, infrastructure design, traffic management, medical policies, and institutions.

#### **UNDERSTANDING THE PHENOMENON**

A primary source of policy neglect has been the absence of reliable evidence on the magnitude and nature of the problem of transport safety. Road accident fatalities and serious injuries have long been known to be substantially underreported in official police statistics in developing countries, and should be adjusted up by 10 percent, at the very least.<sup>8</sup> The situation is worse with respect to injury-only accidents.<sup>9</sup> Even within the injury-only accidents recorded in hospital statistics, there is likely to be some bias. For example, females represented only one out of every seven casualties in urban Zimbabwe, probably due to the reduced ability of low-wage earners (often including women) to afford hospital treatment.

The impact of road accidents is concentrated on some classes of vulnerable road users. Pedestrians account for more than twice the proportion of those injured in developing, as compared with industrialized, countries. Drivers and passengers of motorcycles and three-wheel motor vehicles account for fewer than 10 percent

of those injured in developing countries, but up to two-thirds of those injured in some East Asian cities, such as Kuala Lumpur. Public transport passengers, particularly those traveling in the back of a commercial truck or pickup truck, are very vulnerable. In many countries drivers of trucks and buses have particularly bad accident records.

While males between the ages of 16 and 54 account for the majority of injury from accidents in all countries, about 15 percent of those killed in developing countries are children, which is a much higher proportion than that in industrialized countries. Although the police rarely collect income data, recent interviews of pedestrians involved in road accidents in a number of countries show that the poor were disproportionately affected. The damage is even higher where the injured are the main income earners in a household. Studies in Bangladesh and Zimbabwe have shown that 80 percent of those injured have family members who are entirely dependent upon them.

The location of accidents also varies significantly between countries. The majority of urban accidents in industrialized countries occur at intersections, while most urban accidents in developing countries are reported to occur between intersections. Relatively few accidents occur where there are any traffic controls, including traffic police. This is partly because in the absence of effective development control, unrestricted access to main roads increases the risk of a collision. It is also partly attributable to the different mix of vehicle types that are using the roads; this is particularly seen in the juxtaposition of motorized and NMT users, who are more vulnerable between intersections, where speed differences are greatest.

The absence of adequate accident statistics is important, not only because it diverts attention from the seriousness of the problem but also because it hinders the search for, and selection of, appropriate remedies. Identifying the most vulnerable locations, types of accident, and types of person involved is the basis for road-safety policy

design. Introduction of an effective system of accident recording and analysis is thus a very high priority for international assistance. Because accident analysis would be useful to a range of agencies (including the police, the judiciary, insurance companies, car manufacturers, and traffic management agencies), the case can be made for the analysis to be done as independently as possible, perhaps by a road research institute. Alternatively, it should be a function of the traffic management agency. Computer programs developed for analysis in Denmark, the United Kingdom, and elsewhere are already in use in many countries. But that analysis is only as good as the attention to recording of accident detail in the police records. A critical part of the development of an accident analysis capability is to persuade police chiefs to collect, process, and transfer to the responsible agency the data needed for traffic safety analysis—rather than only those needed for legal purposes—and to train their staff accordingly.

## **POLICY FORMULATION**

In most industrialized countries, increases in road accidents have been associated with the increase in car ownership and usage. A large proportion of deaths and injuries occur to vehicle occupants. Many countries, but most notably Australia, Japan, and the United Kingdom, have developed comprehensive programs to reduce the incidence and severity of road accidents; these programs are based on a combination of engineering, enforcement, and education. Urban traffic safety is also a current priority of the EU.<sup>10</sup> Measures include improvements in infrastructure design (which are often informed by black-spot analysis), vehicle characteristics (particularly compulsory installation and use of safety belts [seatbelts]), and driving behavior (such as blanket speed limits in urban areas and campaigns to discourage “drinking and driving”). High-level goals (such as Sweden’s Vision Zero goal of no deaths from road crashes) are typically adopted and advertised at the national level, but are made operational at local levels by municipal and other highway authorities. These programs have been supported by a high

level of agreement and coordination between different authorities under different ministries and with different budgets.

Similar comprehensive road-safety programs can be successful in developing countries. For example, in the early 1990s the Asian Development Bank assisted the government of Fiji to develop a broad national road-safety action plan that reduced road deaths by 20 percent. However, because of the differences in traffic composition and consequently in the characteristics of accidents and of the most vulnerable groups, different policy instruments are likely to be of high priority in developing countries.

### **INFRASTRUCTURE DESIGN**

There is no doubt that good design of road infrastructure can help substantially. Improvements in road surface and horizontal and vertical alignment at black spots has proved very effective in a number of cases.<sup>11</sup> Clear definitions of, and implementation of, a road hierarchy can help to match the use and operating speed of roads to their immediate environment. Much is already well known about measures to protect the pedestrians and cyclists, who are the most vulnerable road users. Proper provision of footways, controlled signals for at-grade pedestrian crossings, grade-separated crossings, pedestrian-only areas, and segregated bicycle lanes and tracks are all effective and, in comparison with most infrastructure, relatively inexpensive.<sup>12</sup> For example, on the basis of pilot projects in East Africa, undertaken as part of the Sub-Saharan Africa Transport Program, it was argued that serious urban pedestrian and bicycle traffic crashes can be reduced significantly by a suitable program of road (and intersection) redesign and traffic calming.<sup>13</sup>

That type of experience needs to be generalized and disseminated. Considerable effort has already been put into the preparation of design manuals for safe road infrastructure. In 1991 the British Overseas Development Agency (now the Department for International Development)

funded the preparation of a manual entitled "Towards Safer Roads in Developing Countries," which has been widely disseminated, both in the English and Spanish versions. The Asian Development Bank has funded road-safety guidelines for the Asia and Pacific region, and country-specific road-safety engineering manuals have been developed in a number of countries, including Bangladesh, Indonesia, Kenya, and Malaysia. The Inter-American Development Bank has undertaken similar work in Latin America.<sup>14</sup> Incorporation of a safety audit of road (and traffic management system) designs by an independent consultant is likely to be a cost-effective way of avoiding the need for black-spot improvement programs later.

Safety is a necessity rather than a luxury, but conventional methods of cost-benefit analysis may make it look like a luxury unless the benefits of improved safety are appropriately valued. There is, of course, an understandable reluctance to attribute a money value to the saving of life or to the reduction of pain and grief. Certainly international comparisons of the value of life are invidious. For allocations of committed funds in explicitly safety-oriented projects, the issue can be evaded by use of cost-effectiveness analysis to compare alternative project designs. But where it is a matter of safety-related design components of investments, for which the bulk of impacts are time- or vehicle operating-cost savings, the omission of safety valuation will make safe design appear as an uneconomic luxury. It is therefore suggested that all governments insist that safety benefits be attributed a value that appears reasonable in terms of local conditions. More-detailed advice on how they might approach evaluation is available.<sup>15</sup>

Road-safety plans and action programs have been prepared in many countries, usually by external consultants piggybacked onto other projects. While these programs have been very broad, they were often led by road-safety professionals, with only limited support from the local enforcement and legal authorities.

## TRAFFIC MANAGEMENT

Where there is no independent traffic-safety analysis unit, the safety functions of a “traffic management agency” generally commence with retrieval of accident data from the traffic police. There is often no systematic, periodic transfer of data from traffic police to the traffic management agency, with data retrieved on an ad hoc basis to resolve particular accident problems. A methodical approach requires that the traffic management agency obtain data on a regular basis and that procedures be established within the traffic management agency to allow the accident data to be analyzed to determine problematic sites, periods, groups, trends, and so on. Various proprietary accident-analysis software programs are available, but any simple database software package can be used.

Although a traffic management agency may have a separate road-safety group with the responsibility to analyze accident data, promote safety programs, and review schemes, safety should be regarded as an integral part of any traffic management scheme design and should be an important evaluation criterion governing the acceptance of any scheme or measure. In some countries, such as the United Kingdom, all but the simplest of schemes are subject to an “Independent Safety Audit.” This involves scrutiny by traffic management designers who were not involved in the original scheme planning and design. In some developing cities, it is acknowledged that there may be few experienced traffic management staff and there may be a lack of resources for hiring consultants. Nevertheless, the savings in social costs from the introduction of “safe” schemes should more than offset costs; the independent safety audit is worth consideration as part of the normal design process.

It is generally accepted that in industrialized countries, the three most common causes of fatalities and injuries are (a) excess driving speed, (b) driving under the influence of alcohol, and (c) inadequate protection of vulnerable persons in

accidents. At the national level there should be enforced systematic policies for dealing with each, while at the local level those policies should be rigorously enforced.

Speed limits and controls are powerful instruments to reduce the severity of accidents. On local roads in European cities, a wide range of physical traffic-calming measures for speed control has been used effectively. Typical measures include:

- Pedestrian refuges that narrow the effective road width
- The control of vehicle overtaking (passing) and prevention of vehicles from reaching high speeds
- Road humps, to reduce vehicle speed
- Road narrowing, to prevent heavy vehicles from using a road or to restrict movement of vehicles to one direction at a time
- Chicanes, to force vehicles to follow a tortuous route and thus reduce speed
- Raised intersections, comprising a plateau or flat-topped road hump built across an entire intersection
- Plantings, to change the perceived width of a road in order to encourage vehicles to reduce speed.

On main roads, speed limits must be enforced by the traffic police by various means—direct measurement by radar guns, static or mobile camera enforcement, following vehicles, and so on. Traffic calming can also reduce traffic speeds, especially if carefully related to the hierarchy of roads. On main roads, effective devices include positive signs and road markings emphasizing speed limits, rumble devices, bar markings, road texture and color on the approaches to critical locations (intersections, pedestrian crossings, and so on), and adjustment of intersection traffic-signal timings to control and maintain a desired safe speed of traffic progression. However, some of the more extreme physical traffic-calming measures used on local roads might add to accident hazards if introduced on main roads.

The strict enforcement of stringent national standards on drinking and driving is the basis for reducing the second serious cause of accidents. The right to perform random tests assists enforcement, but may be a platform for corruption in some countries. Holding employers of professional drivers, as well as the drivers themselves, responsible is also a powerful inducement to effective control, especially in public transport companies. Above all, it is important that it is the outcome (reduction of drunken driving) and not any particular procedure (for example, daily medical inspection of drivers as routinely required in many countries of the former Soviet Union) that is subject to control.

In industrialized countries, efforts to protect persons in accidents have concentrated on seat belt and airbag installation and use. In some middle-income developing countries, the emphasis has been on the use of crash helmets by bicyclists and motorcyclists. In many poorer countries, however, the real issue is the protection of pedestrians from motorized vehicles; the provision of adequate sidewalks, barriers, and road-crossing facilities is most important. While the provision of pedestrian bridges or tunnels may offer the greatest potential protection, it may not be the most effective measure, especially where the crossings involve arduous detours or are designed as a potential operating ground for thieves.

### **MEDICAL POLICIES**

There is considerable evidence that the lack of adequate medical facilities contributes to the high level of fatalities in developing-country cities.<sup>16</sup> Many lives could be saved if medical attention were provided within the hour immediately following an accident (the “golden hour”). This requires the improvement of emergency service response time, which can often be improved at modest cost by the following:

- Strategic positioning of emergency service centers (perhaps first aid stations at fuel stations)

- Provision of an emergency telephone number
- Establishment of a control center
- Use of ITS (Intelligent Transport Systems) applications for efficient service control
- Setting up an emergency medical services committee
- Provision of first aid training
- Creation of a mechanism, possibly funded by insurance companies, to cover costs of minor expenses in bringing injured persons to the hospital
- Upgrading hospital emergency rooms and departments.

### **INSTITUTIONS**

In many countries too many different agencies and institutions have some responsibility for road safety for it to be viewed as the primary responsibility—and hence institutional priority—for any of them. Moreover, some of those institutions, notably the police departments, often have such a bad image in developing countries that both citizens and international institutions may be loathe to support them.<sup>17</sup> It is therefore important that emphasis should be placed on the development of an institutional focus for transport (particularly road) safety. Emphasis thus needs to be given to developing an institutional responsibility for coordination of safety efforts at a very high level, while at the same time enhancing the commitment of the interested line agencies (police, traffic management, health, and education), at both the national and local levels. Direct responsibility of the national road-safety agency to the prime minister’s office is a device used to focus attention on, and obtain satisfactory commitment to, road safety in countries such as India and Vietnam. Parallel institutional arrangements at the municipal level, with direct responsibility to the head of the city government, have been successful in prosecuting urban road-safety campaigns (box 5.2).

Funding arrangements for road safety need particular attention. Most cities finance safety measures out of limited departmental construction

## BOX 5.2 SAVING LIVES IN BRASÍLIA

As a planned new city, Brasília has an extensive road network, which in 1995 sustained an average traffic speed of 40 kilometers an hour (km/h), twice the national urban average, but which also experienced 11 deaths per 1,000 vehicles. On the recommendations of a joint working group of the secretariats of public safety and transport, in July 1995 the governor established by decree a traffic safety program, entitled "Peace within Traffic." The aims of the program included:

- Control of excess speeding
- Control of driving under the influence of alcohol
- Tighter traffic rules enforcement
- Improved medical assistance to accident victims
- Improved road infrastructure safety features
- Vehicle safety inspection and control
- Pedestrian, cyclist, and public transport priority.

Several secretariats were involved in implementing this high-level activity, which was supported by an energetic press campaign, as well as by intensive efforts to involve civil society. Between 1995 and 1997 the number of deaths per 1,000 vehicles fell from 11 to 6.6, and the emphasis and benefit has been subsequently maintained.

Source: Affonso, Rezende, and Vitor 1998.

and management budgets. In Vietnam some dedicated road-safety funding is obtained at a local level from traffic fines. Of the new generation of road funds that have been developed in recent years in Africa and elsewhere, only those funds in Ethiopia are known to specify safety measures, along with road-maintenance activities, as the responsibility of the fund.<sup>18</sup>

Other sources of funding are clearly required. One source of increasing interest in a number of industrialized countries is through contributions from insurance company premiums. However, since a large proportion of road vehicles are operated without insurance in many developing countries, this is only likely to offer a viable source of funds in the wealthier and better-governed countries. In a very few cases private sector support has been mobilized. In Delhi, Indian vehicle manufacturers Maruti Udyog Ltd. have sponsored interceptor patrol vehicles. These patrol vehicles have played a prominent role in traffic law

enforcement and resulted in a considerable increase in revenue from fines—however, it is not possible for the police to reinvest the revenue for road-safety activities. This sponsorship came about following the brokering of a partnership between a nongovernmental organization, the traffic police, the Delhi state government, and Maruti Udyog (Aeron-Thomas and others 2002).

## SECURITY

Personal security while engaged in transport activity is an increasing problem throughout the world. In a sense, this is not a transport problem but a symptom of a much wider social malaise. But the inescapable need to undertake travel to pursue essential activities of life—such as work, education, health care, and so on—may force people into situations where they are most vulnerable to attack, with only a limited ability to adjust activities to avoid or ease their vulnerability (box 5.3).

### BOX 5.3 CRIME, VIOLENCE, AND DIMINISHING MOBILITY

In a number of major cities in Latin America, such as São Paulo, the number of trips undertaken per day have been declining in recent years, and it has been suggested that this is at least partly a consequence of declining security, particularly in the evening hours when trip rates have declined most. This interpretation is supported by evidence from a survey of poor households in Ecuador. In a six-month period in 1992, one in five women in Cisne Dos was robbed on a bus, and one in two women had witnessed such an attack. There was a drop in the use of public transport at night, and an increase in the relatively safer small trucks operated by the informal sector. For those who could not afford the alternative, travel was curtailed. The lack of safe transport during off-peak hours has caused girls, generally from the poorest families, to drop out of night schools.

Sources: Henry 2000; and Moser 1996.

Threats to security of person and property may be classified into four main types.

- a. Theft by stealth, which is largely a function of crowding on public transport vehicles, but which may also involve the unattended parking of bicycles and other vehicles.
- b. Theft by force, which can occur in crowded places but is more likely to occur in situations where the victim is relatively isolated. Theft by force includes vandalism and violent physical attack.
- c. Sexual harassment, which with different degrees of violence can occur in either crowded or isolated situations.
- d. Political and social violence, which may have some transport significance (such as the attacks on South African commuters traveling by rail, bus, or minibus) or for which the transport vehicle may simply be an opportune location.

In each case, while the origin of the problem may not lie primarily in transport conditions, questions arise about the planning and management of transport facilities and services.

*Theft by stealth* is the most common manifestation of this problem, and is the most difficult to act

against, but usually, fortunately, is the least traumatic of the phenomena. Passengers in vehicles can be frequently reminded of the need for caution, and of the best ways to secure themselves against theft. Automatic prosecution and exemplary sentencing of those caught can also be a deterrent. Provision for secure parking of bicycles has been an important element of policies that support bicycle ownership, in some countries. Electronic surveillance may be effective in stations but less so (and more expensive) on crowded vehicles.

*Theft by force*, because it is more likely to occur in less-crowded locations, is more susceptible to electronic surveillance, which, however, is only likely to be effective if accompanied by adequate arrest-and-arraignment arrangements. The existence of a specialist transport policing force has helped in rail and metro systems in industrialized countries, but is less likely to be affordable for the fragmented bus sector.

Vandalism, which is a form of property theft, and unruly behavior toward passengers are common in poorly managed public transport operations in both developed and developing countries. Management changes or institutional reform can rapidly reduce vandalism. For example, graffiti almost disappeared from the New York subway once public transport management took deter-

mined action. In Buenos Aires, service on the government-run suburban railways had become very irregular and unreliable in the 1980s and early 1990s, and windows were broken, seats slashed, and passengers harassed by roving bands of vandals. When railway services were privatized in 1994, the first action of the new concessionaires was to introduce controllers (supported by government security guards) on each train—in part to control fare evasion and in part to establish a safer environment. Within four years the number of passengers had doubled, to a large degree because of the improved safety associated with train travel.

Perhaps even more than the public transport passenger, the pedestrian is increasingly likely to suffer violent attack. This may occur after dark as part of a robbery or, in the case of women, sexual assault. It can occur in business or residential districts, but is most common in low-income settlements controlled by gangs in the absence of a viable police presence. Again, the poor suffer most, because they are vulnerable to physical attack when walking from bus stops to home. Travel by taxi is expensive—and often not even an option when drivers refuse to drive into dangerous neighborhoods. For example, in Caracas (República Bolivariana de Venezuela) it was reported that people missing the last safe opportunity to return home in the evening are obliged to stay overnight at their places of work. In some countries, such as Ghana and South Africa, theft by violence from cars or of cars when stationary or slow moving has been a problem, against which drivers tend to protect themselves by the equally dangerous procedure of ignoring traffic signals, particularly after dark. Civilian neighborhood patrols, common in some industrialized countries, may also play a role in improving safety from violent physical attack in the developing world. Police bicycle patrols, which have become popular in the United States, have also shown promise in Venezuela.

**Sexual harassment** can be reduced by the provision of women-only vehicles in situations where

the density of movement makes this feasible without loss of service availability. Examples of this include buses in Bangladesh, India, and Sri Lanka; and coaches on some trains in the Mexico metros. In Karachi, Pakistan, women-only compartments in buses are physically separated from the larger conductor-controlled compartment of the vehicle. Given increasing personal awareness of the problem, a commercial response is beginning to emerge in some Latin American minibuses and taxi markets that specifically protect vulnerable travelers. This response might be stimulated at very little cost by government encouragement and some externally supported experiments. Harassment by male transport staff unwilling to make allowance for the difficulties of women in entering or leaving moving vehicles might be addressed by use of mixed-gender crews on public transport vehicles.<sup>19</sup> Female police officers have become effective, and have a reputation for being tough and incorruptible, in the enforcement of traffic rules in La Paz, Bolivia, and Lima. Women also might have a wider role in responding to issues of sexual harassment.

**Political and social violence** often finds a focus in burning buses or destroying traffic signals, even where there is no transport-related stimulus. There are also some transport-specific origins of violence. Bus and rail passengers in South Africa were allegedly targeted in order to coerce them to ride the black-operated minibuses. Minibus passengers were also frequently caught up in murderous struggles between competing operators. These types of insecurity are particularly susceptible to actions designed to regularize and give legally defensible property rights to operators of franchised services. Economically motivated policy reform in urban transport operations may thus have a very significant security payoff. The benefit accrued depends on the regulations being enforceable, and on being actually enforced, by legitimate authorities, and not by mafias. For example, in Medellín, Colombia, gangs controlling a low-income area extorted protection money from bus operators serving the area; funds were recovered from the fares of the poor passengers.

Some general points may be made in conclusion. Increasing criminality in many developing cities is a symptom of a much wider social malaise. While it affects the transport behavior of everybody, it is primarily the poor who suffer when essential trips for work or education are curtailed. Lack of security also frustrates environmentally motivated attempts to reduce the need for car travel when children can no longer safely walk or take the bus to school, and many people are obliged to go by car or taxi when even a short walk may have become too dangerous. To some degree, security in public transport might be improved by establishing minimum regulations on service quality. There are some technical fixes to improve personal security for pedestrians, such as better street lighting and use of video or CCTV (closed circuit television) monitoring of public spaces,<sup>20</sup> but ultimately this is a function of much broader and more complex issues, such as social cohesiveness and the tradeoff between police power and human rights concerns.

## CONCLUSIONS: A STRATEGY FOR URBAN TRANSPORT SAFETY AND SECURITY

The development of a strategy for urban transport safety should include:

- Development of national road-accident statistics data collection and analysis capability
- Incorporation of safety elements in all transport infrastructure projects by the incorporation of a mandatory safety audit in the design process
- Incorporation of estimation and evaluation safety benefits of improved designs in all infrastructure projects, using values determined by government in collaboration with local safety agencies
- Development and associated training of staff for specific road-safety coordinating agencies or councils, both at the national and the municipal levels

- Specification, clear signing, and enforcement of maximum speed limits for different road categories in urban areas
- National-level specifications, advertising, and enforcement of limits for blood-alcohol levels for vehicle drivers
- Financing of specific safety-related infrastructure investment (such as the financing of infrastructure for NMT, or the railway crossing investments in Buenos Aires) based on the identification of vulnerable groups and locations
- Involvement of police in road safety, such as the collaboration between police and traffic management departments in black-spot analysis in Seoul
- Involvement of medical authorities in joint planning for improved accessibility to medical facilities for victims of accident trauma
- Inclusion of compensation provisions and liabilities in motor traffic and associated insurance legislation
- Creation of high-level committees with responsibility for road safety in all major city administrations
- Development of plans for financing safety activities as part of transport strategy plans in all major municipalities.

With respect to security, serious effort remains necessary both to analyze the nature and significance of insecurity in the urban transport sector, and to devise policy instruments to counter it. That might include:

- Collection and analysis of data on personal security in the transport sector
- Development of an awareness of the problem, together with the commitment of police authorities to arrest, and the courts to appropriately penalize, delinquents
- Development of franchise conditions giving incentives for improved attention to security by public transport operators
- Including street lighting—designed to improve pedestrian security—in street improvement, and particularly in slum-upgrading projects

- Strengthening public participation in projects—particularly those dealing with improvements at the neighborhood level.

## NOTES

1. Jacobs and Aeron-Thomas 2000.
2. WHO 1999.
3. TRL and Silcock 2000.
4. Gomez 2000.
5. Amundsen 1996.
6. Ross 1993.
7. TRL and Silcock 2000.
8. A TRL study in Colombo, Sri Lanka, in 1984 showed that fewer than one-quarter of hospital-reported road traffic accident casualties were recorded in police statistics. The problem remains. In Karachi, 1999 police statistics showed only 56 percent of the fatalities and only 4 percent of the serious injuries attributed to road accidents in hospital statistics. Even hospital records can be a poor source for accident research. In Buenos Aires most deaths are attributed solely to a medical condition (broken skull, for instance) and not to the cause of that condition.
9. The number of urban injuries reported for every fatality in official statistics in 1999 was 160 in Great Britain, 22 in Zimbabwe, but only 3 in Dhaka.
10. The DUMAS (Developing Urban Management and Safety) project involves collaboration of research teams in nine countries to produce a framework for the design and evaluation of urban safety initiatives (European Commission 2000).
11. For example, the Amman Transport and Municipal Development Project, funded by the World Bank, planned improvements at 15 intersections. Crash reductions of 98 percent were achieved between 1984 and 1990 at the first two intersections treated. However, these were the only two implemented, and only 18 percent of the planned expenditure on traffic management was achieved.
12. Cracknell 2000.
13. Koster and de Langen 1998.
14. Gold 1999.
15. TRL 1995.
16. TRL and Silcock 2000.
17. For example, there is widespread concern about the provision of equipment—such as cars, cameras, and other enforcement devices—which might also be used for less legitimate, non-traffic-related purposes.
18. Even in this case, the only safety measure finance so far has been the upgrading of traffic signs in Addis Ababa. Since 91 percent of traffic accidents in Addis Ababa involve pedestrians, the provision of new traffic signs is unlikely to be a significant safety benefit.
19. Gomez 2000.
20. Some cameras used for traffic control have also been used for other purposes, but this raises broader questions of personal privacy and possible misuse of government power.