

HEALTH OF PROFESSIONAL DRIVERS

A Report for

Transport & General Workers Union

by

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INTRODUCTION

Considerable progress has been made in recent years in improving health and safety at work. For many people work does not take place in a fixed location but involves a large number of tasks associated with the control of a vehicle and exposed to all the hazards of a heavily trafficked environment. For those who drive lorries and buses there has been a deterioration over the last 20 years in work conditions. This deterioration is largely the result of traffic congestion and its associated air and noise pollution but also with the pressures of maintaining a demanding schedule in circumstances that make that task almost impossible. A lorry or bus driver is at the sharp end of the failure of our transport system. Buses find it almost impossible to maintain schedules and the pressure on lorry drivers to meet demanding schedules is intense. The driver in both circumstances has to absorb the failures of the transport system in the form of increased stress levels, conflict with customers and the intensification of a wide range of work pressures in a hostile environment. These circumstances damage the health of drivers in a way that is unacceptable. The objectives of this report are to review the evidence on the work related health problems of drivers and to make recommendations for a significant improvement in the working environment of this neglected group of professionals.

THE TRAFFIC ENVIRONMENT

The environment in which drivers spend the majority of their time is polluted, noisy and dangerous. It is an environment over which they have no control whatsoever and is an environment that wrecks their schedules, disrupts their home life, makes social activities and regular breaks very hard to plan and supplies constant hassle. To make matters worse drivers frequently bear the brunt of criticism for problems that crop up whilst driving.

Drivers are exposed to significant amounts of health damaging air pollutants in their work. Diesel fuels have carcinogenic properties and exhaust emissions from the total vehicle fleet contain pollutants such as carbon monoxide, nitrogen oxides and sulphur dioxide all of which can damage the respiratory system and are associated with asthma, bronchitis and a range of other health problems including headaches, sore eyes and ear problems. Levels of pollution are higher in the cab than at the kerbside giving workers a level of exposure to air pollutants that would not be tolerated in the workplace.

Drivers are exposed to constant noise and vibration from their own vehicles and their working environment is dominated by noise from all vehicles. Noise damages hearing and damages health and can frequently exceed levels set for occupational noise.

The road environment in urban areas and on motorways is a dangerous environment. In urban areas it is far more dangerous for pedestrians and cyclists than it is for lorry and bus drivers but the risk of accident and injury for professional drivers is a work related hazard that should be reduced to levels that are no greater than accident and injury levels in a workplace at a fixed location. In 1993 635 HGV drivers and passengers were killed or severely injured and 3333 persons injured in total (all severities). The equivalent figures for LGV (<3.5 tonnes) drivers and passengers were 1082 killed or severely injured and 7417 injuries of all kinds.

Lorry drivers and bus drivers contribute to the level of danger experienced by the more vulnerable road users especially pedestrians and cyclists. They do this primarily through the exceedance of speed limits and as a direct result of time pressures and work intensification that in their turn add to the stresses and strains of the job. Some indicative information from the 1994 edition of Transport Statistics Great Britain is summarised in Table 1.

	buses and coaches	rigid and articulated lorries with 4 axles	rigid and articulated lorries with 5 axles
Motorways	21	32	36
Dual Carriageways	29	70	76
A Roads	14	56	64

Source: Table 4.12, Transport Statistics Great Britain, 1994. HMSO September 1994

The high rates of non-compliance add to the stress and danger experienced by drivers and add to the dangers experienced by vulnerable road users. They also add to operating costs through higher levels of fuel consumption. Work practices that are designed to eliminate speeding will dramatically improve the working conditions of drivers. Put simply drivers need more time to do the work that is expected of them and more time for breaks.

DOES DRIVING MAKE THE DRIVER ILL?

The answer to this question for both bus and lorry drivers is an unequivocal "yes". The weight of accumulated epidemiological evidence and occupational health surveys could not be clearer. Bus and lorry drivers are more likely to experience a range of respiratory, gastrointestinal, musculoskeletal disorders than a population matched for age and social class that does not drive professionally. Drivers can also expect a higher incidence of cancers particularly lung and bowel than a matched population.

Professional drivers have a lifestyle that is not conducive to good health. In addition to their exposure to noise and air pollution the job does not provide the same opportunities for social contact as many other jobs, and shift work, unsocial hours etc can disrupt both home life and social activity. Home life and social contacts provide a powerful source of support for those experiencing stress and an absence of this support compounds an already difficult problem. Drivers are more likely to have a diet that is not conducive to health than those groups of workers who can return home for an evening meal on a regular basis and take regular meal breaks in a staff canteen. A diet high in fats and carbohydrates and low in fresh fruit, salads and fibre will add to the level of poor health. The incidence of smoking and drinking can also create health problems and most surveys of the health of drivers that form the basis of this review have gone to considerable lengths to "control" for this aspect of lifestyle. If we are to be accurate in an assessment of the health risks of professional driving it is important to filter out other factors such as smoking and diet. It is of little help to conclude that drivers are ill because they smoke a lot when a "driving effect" can be identified even when smoking is taken into account in the statistical analysis.

Drivers are exposed to a number of health problems as a direct result of the posture adopted in driving. Sitting in the driving position exerts considerable forces on the spine and can cause a number of problems with the musculoskeletal system in particular backaches, neck problems, pulled muscles, and general stiffness. The driving posture also causes problems for the digestive system.

The evidence on health effects of driving has been collected together under four headings:

- 1 cancers
- 2 gastro intestinal and musculoskeletal disorders
- 3 fatigue
- 4 noise and health

1. Cancers

There is a long standing concern for the effects of exposure to diesel exhaust and the risks of lung and bladder cancer. This concern is wider than bus and lorry drivers and covers air quality in bus garages, warehouses etc where inadequate ventilation can lead to significant concentrations of pollutants. If drivers spend time in the cab, in filling stations, on motorway service areas and truck stops, on the road and in polluted depots their accumulated exposure would give rise to serious concerns. Total exposure to all sources of cancer causing chemicals is very important indeed and goes unrecorded.

A large study of cancers and exhaust and combustion products was undertaken in Montreal in the 1980s(1). Interviews were carried out for 3726 cancer patients, 20 sites of cancer were examined and information obtained for exposure to about 300 substances. Detailed job histories were collected and a number of associations detected. Gasoline exhaust was associated with rectal cancer and diesel exhaust with colon cancer. An increased lung cancer risk was associated with both diesel and gasoline exhausts. The study identified the occupational group "motor transport operating" as the dominant group exposed to diesel and gasoline emissions.

Studies going back to the 1950s have arrived at similar conclusions. A review of this field by the American Health Foundation(2) confirms the existence of a high death rate from lung cancer in transportation workers from a variety of sources including "exhaust from diesel and gasoline engines,

petroleum lubricants and dust from asphalt roads". Truck drivers, auto repair workers and transportation workers exhibited high standard mortality ratios (SMRs) from lung cancer. Associations between exposure to diesel exhaust emissions and elevated rates of cancer incidence have been identified for railroad workers and for those working with heavy construction equipment. Evidence is also presented in this review of the relationship between smoking and exposure to exhaust emissions. A two fold increase in risk of cancer was observed in the group exposed to diesel exhaust emissions even when smoking was controlled. Elevated rates of bladder cancer are also reported for gas station workers, fuel oil dealers, garage owner, auto mechanic, taxi driver, truck driver, bus driver and deliveryman. These risks persisted after allowing for smoking. The cancer rates amongst lorry and bus drivers were higher than control groups having taken into account the effects of smoking. A study in Detroit reported an increased risk of lower urinary tract cancer in truck drivers and once again the raised risks persisted after allowance was made for smoking.

A study of 2,465 male urban bus drivers in three major cities in Denmark(3) reported "significantly elevated" SMRs for bladder and skin cancers. Interestingly this study identified the air intake for bus defroster systems as a problem. These are located at the front of the bus 1.0-1.5m above the street "where the concentration of air pollutants is the highest". The study implicates carcinogens in the driver's cab as the source of the problem particularly polycyclic aromatic hydrocarbons (PAHs). Concurrence with other Danish studies (lorry drivers and taxi drivers) is also reported. Elevated rates of cancer were reported even when smoking was controlled for.

A study of professional drivers in London(4) found fewer deaths from all causes than expected. Lorry drivers showed excess deaths from stomach cancer and lung cancer and taxi drivers experienced raised mortality rates from bladder cancer, leukaemia and other lymphatic cancers (though these raised incidences did not reach statistical significance). Bus, coach and lorry drivers mortality patterns were similar but the all driver data was strongly influenced by lorry drivers who contributed to over 75% of the deaths in the study.

In 1989 the International Agency for Research on Cancer (IARC) in Lyon, France classified diesel engine exhaust as a "probable human carcinogen". This view is shared by the UK Department of Health Committee on Carcinogens and the US National Institute of Occupational Safety and Health. In 1990 the US Environmental Protection Agency classified the compound as a probable human carcinogen.

More recent research has identified a statistically significant association between particulates and excess mortality in the general population(5). Particulates are an important constituent of diesel exhaust emissions and are associated with deaths from lung cancer and cardiopulmonary disease. An estimate for Britain(6) puts excess mortality from this cause at approximately 10,000. Whilst these studies and estimates are based on air quality data and careful collection of mortality data in the general population they have already identified a major area of health concern not hitherto recognised. The implications of particulates for the health of lorry and bus drivers has not yet been evaluated particularly the links with cardiopulmonary disease.

The existence of a literature going back over 40 years and demonstrating that bus and lorry drivers are exposed to proven cancer causing agents is a public health issue of some importance. The likelihood that there are additional deaths arising particularly from particulates and associated with heart disease merits close scrutiny. The need for intervention in this area of work to reduce exposure to cancer causing chemicals is long overdue.

2 Gastrointestinal disorders and musculoskeletal disorders

A wide ranging review of city bus drivers(7) has identified occupational stress as a primary causal factor in a number of diseases. These include gastrointestinal diseases, heart disease and musculoskeletal disorders. The review quotes information on absenteeism and early retirement in support of its findings. Absenteeism for bus drivers is double the rate for other public sector employees and more than half of the bus drivers will retire prematurely, typically from stress related illness or musculoskeletal dysfunction. A study of peptic ulcers among urban bus drivers in Denmark(8) showed a prevalence of abdominal pain alleviated by food intake of 12% among bus drivers and 6% among the general population. The incidence of hospital discharge with duodenal ulcer among young bus drivers was twice the incidence among Danish men as a whole. 33% of Copenhagen bus drivers over the age of 50 had left their jobs for health reasons and peptic ulcers were an important factor in the profile of health reasons. The causes of these health

problems were described as "psychosocial" and relate to stress, shift work and very difficult time schedules.

A study of low back trouble among urban bus drivers in Denmark(9) demonstrated that 57% of the 2045 bus drivers studied suffered from this health problem. The sitting position and exposure to vibration were identified as the most likely causal factors associated with this high proportion of back trouble. The differences between bus drivers and a control group were statistically significant. In a US study focusing on reasons for early retirement(7) musculoskeletal problems accounted for 35% of the cases and psychiatric problems 35% of the cases. Only 12% of the drivers worked to the official retirement age.

Musculoskeletal disorders have been observed in lorry drivers particularly those involved in the distribution of goods. A Swedish investigation(10) of 460 professional drivers showed that the prevalence of musculoskeletal complaints was highest for lower back, shoulders and knees. Drivers engaged in local deliveries had the highest prevalence of complaints. They showed a higher relative frequency of complaints in hands, lower back, hips and knees in comparison to the whole group studies. More than half the drivers interviewed in this study expressed the view that their job involved physical strain and mental stress.

A Dutch study of 439 lorry drivers(11) found an association between work demands and musculoskeletal complaints and work demands and psychosomatic complaints. The study is interesting because of the way it relates the musculoskeletal complaints to psychological aspects of the work environment. The study suggests a link between what the authors call "decision latitude" and a number of commonly occurring muscular and related complaints. The complaints include pain or stiffness in the neck and upper limbs, pain or stiffness in the back and perceived difficulty with standing, sitting, walking and stair climbing. In more simple language the study is suggesting that where drivers have very little control over their working environment and have to take what it throws at them they respond with physical illnesses of the kind described.

It is very important in understanding the demanding working environment of drivers that there will be a complex interaction between the physical aspects of that environment (eg posture, ventilation, noise) and the psychological stresses that will work to initiate or amplify physical ailments. One study has referred to the incidence of psychological disturbance in urban bus drivers(7). In this study 13% of the sample of drivers scored "in the range equivalent to hospitalised psychiatric patients" and that this was the result of the amount of hassle involved in the job of driving a bus. The existence of highly stressed and ill bus drivers has been noted in another study(12). Stressful factors identified for bus drivers include time pressures, traffic noise, congestion, equipment vibration, air pollution, lack of control over working conditions and social isolation of the drivers from co-workers. It is not surprising therefore that many bus drivers seek early retirement and many more suffer hypertension and a predisposition to cardiovascular diseases(7).

3. Fatigue

Fatigue is a manifestation of stress and a symptom of a number of physical health problems. It certainly indicates the existence of a problem and in the case of bus and lorry drivers is a very serious matter indeed with implications for their own safety and that of others. The discussion of fatigue is inextricably bound up with discussions about driving hours, rest hours, road traffic accidents and safety.

Fatigue is a consequence of too much work in too little time, with too many hassles and too little scope to intervene and correct the situation. The driver is the victim of a number of circumstances, the majority of which are outside his or her control and this itself adds to the problem. One study(7) has referred to the incessant pressure on bus drivers to stay on time. Approximately one third of drivers reported they frequently had no time for any scheduled rest breaks except for a meal respite. The same study has referred to an association between drowsiness and low-frequency noise levels and observed that tiredness gets more severe as the driver grows older. Bus drivers find it very difficult to relax at home after a shift and this contributes to fatigue.

A Japanese study(13) has reported greater levels of fatigue in staff operating one person buses compared with two person buses. Greater mental fatigue and stress was found in the one person bus and more cases of near accident were observed in the one person bus.

Fatigue in lorry drivers has been associated with an increase in the likelihood of becoming involved in

a road traffic accident(14). The accident rate in the second half of a driving trip is approximately twice as high as in the first half. Numerous other factors influence the accident rate but fatigue is sufficiently important to warrant close attention. Not surprisingly extremely long working days and short sleeping periods results in a serious state of fatigue(14). A relatively high risk of becoming involved in a road traffic accident prevails when drivers are on the road during "abnormal working hours" and/or when a substantial work load (> 11 hours) has been demonstrated.

A study carried out in the Netherlands for the International Transport Workers Federation(15) has identified the root cause of the problem: professional drivers do too much work to the detriment of their health and to the detriment of the road safety environment. This study concludes:

Most research on the relationship between working and driving hours and rest periods on the one hand and accidents on the other has concentrated on truck drivers. Harris et al (1972) and Mackie and Miller (1978) investigated this relationship for bus drivers too, but compared to the truck drivers the bus drivers' samples were small. No specific conclusions about bus drivers will be drawn.

Truck drivers do not comply fully with the regulations that are supposed to govern their working activities. They work very long days resulting in weeks of more than 60 hours. Averages of 62.5 hours were found in France by Hamelin (1981) and 75 hours for European drivers of several nationalities by Van Ouwerkerk et al (1986). A truck driver spends about 60% of this time driving.

Long distance truck drivers who are away from home for several days work irregularly because their work-rest cycle deviates from the normal cycle of 24 hours and the number of working hours differs from day to day. As a consequence of this irregularity a working day may start at any time of the day.

Driving between 24:00 and 8:00 is hazardous for the professional driver; the possibility of being involved in an accident is twice as high as between 8:00 and 24:00. Driving between 3:00 and 6:00 is even worse, with the possibility of being involved in an accident due to falling asleep at the wheel being 71 times higher than during the period 18:00 to 21:00.

Research on the involvement of trucks in road accidents has not produced consistent results. The only firm statement about the relationship between driving time and road accidents has been made by Mackie and Miller (1978). They found that a driver was more likely to be involved in an accident after 5 hours of driving than after less than 5 hours. Working time appears to be a better predictor for road accident occurrence. Hamelin (1981) found that the accident risk was 2.5 times higher when a driver worked over 13 hours than when he worked less than 10 hours.

Indications were found that about 7% of road accidents involving a truck are the result of the driver falling asleep at the wheel because of fatigue. There is also a suggestion that short rest periods, say less than 6.5 hours, are related to falling asleep while driving. A substantial proportion of drivers take rest periods shorter than this.

No hard evidence was found concerning the relationship between long working and driving hours and health problems of professional road transport drivers. However, several studies indicated that chronic pain in the neck, shoulders and back as well as hernia were serious health problems for the driver. Almost half of the drivers in two studies, OIBF (1985) and Van Ouwerkerk et al (1986), reported suffering from some health problem. Many drivers complained about noise, vibrations and heat at work, but no firm relationship between long exposure to these factors and health could be found in the literature.

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The author of the report of the International Transport Workers Federation has carried out an original empirical study of international truck drivers(16) showing the prevalence of fatigue and the links with road traffic accidents and safety problems. The study involved interviews with 650 truck drivers and has made available important insights into fatigue and accidents. Table 2 summarise the results of the survey in terms of falling asleep whilst driving a truck and Table 3 summaries the information on whether or not an accident resulted from falling asleep.

Categories	Almost fallen asleep		Actually fallen asleep	
	f	%	f	%
many times	88	14	16	4
sometimes	301	46	92	24
never	261	40	281	72
Total	650	100	389	100

Reference 16

	f	%	% of the total group
yes	47	44	7
no	59	56	9
Total	106(*)	100	16

(*) the answer of 2 drivers of the 108 is unknown

Reference 16

A result which shows that 28% of truck drivers have actually fallen asleep at the wheel and 60% have almost fallen asleep reveals a serious cause for concern and intervention. It is in the interests of both driver and the general public to take make sure this does not happen. The message is made particularly clear in the statistic in Table 3 showing that 44% of those drivers who did fall asleep actually had an accident.

4. Noise and health

Noise is a cause of poor health. It can damage hearing and is associated with a number of psychological problems that can contribute to stress. As noise is usually experienced at the same time as vibration there is a combined assault on the lorry and bus driver from both sources. Noise contributes to disorders of the cardiovascular, nervous and digestive system and reduces worker productivity(17). Noise has an adverse effect on the nervous system leading to stress and increased blood pressure. This is particularly worrying for bus and lorry drivers who already experience elevated stress levels from the traffic environment and time pressures of the work.

One study in India(18) has identified noise levels in bus cabs of 89-106dB(A) and observed that 89% of the bus drivers had abnormal audiograms ie they had impaired hearing. A control group not exposed to noise levels in this range showed 19% with abnormal audiograms. 65 dB(A) is normally taken as an acceptable level(17) so levels above 80dB(A) give serious cause for concern. A loss of hearing is typically the result of continuous exposure to high noise levels of 85 dB(A) and above for a number of years

The Noise at Work Regulations (1989) require personal hearing protection to be provided where noise levels reach 85 dB(A) or more. Personal hearing protectors must not only be maintained and used correctly but must also be worn for the entire period of exposure to the noise to be effective. Failure to wear the

protection for only 15% of the time renders it virtually useless(19).

Noise protection is not an easy matter for drivers. Drivers need to be in aural contact with the outside world and need to be protected from the health damaging consequences of noise. Resolving this dilemma through cab design and more fundamental solutions for the general traffic environment will be a high priority.

THE COMBINED EFFECT OF WORK PRESSURES AND ENVIRONMENTAL ASSAULTS ON THE HEALTH OF DRIVERS

A driver is not exposed to serious assaults on his or her health. In any one working period a driver will experience all the stress and strains of getting the job done to a very tight schedule. This will be accompanied by exposure to air and noise pollution with proven health damaging consequences in situations where shifts and sleep patterns have produced fatigue. Drivers cannot intervene to reduce these negative impacts and this lack of control together with daily hassles produces a powerful cocktail of impacts that make the job of a driver very difficult indeed.

It is acknowledged in the epidemiological literature that multiple assaults on health can have a bigger effect on total health than the sum of all the individual effects might suggest. Put simply a driver who is tired and stressed will be more susceptible to infections and a driver with back trouble and hearing problems will be more stressed. The combination of factors works to amplify the effects of those factors causing poor health.

Drivers are not uniquely exposed to occupational hazards that are far worse than any other group of workers. They are, however, very exposed indeed to those sources of poor health that we know are growing in importance. Noise, air pollution, congestion and hassle in an environment where there is not enough time to do the job well are exactly those factors where the trend is in the direction of making the pressures worse. Drivers are very susceptible to health related problems and this situation will deteriorate over the next few years. It is this deterioration that is as important as the observation of current levels of poor health.

CONCLUSIONS AND RECOMMENDATIONS

The health of drivers is an important issue in public health, occupational health, transport policy and employment conditions. There has not been a concerted assault on those factors that cause poor health and this is an area of neglect that needs urgent attention.

Measures to protect and improve the health of drivers should be pursued in a way that maximises gains to all sectors of society. Lorries are perceived as noisy and dangerous and are certainly unwelcome in many city centres and residential areas. It is in the interest of lorry drivers as well as members of the public that lorries are made much quieter, much less polluting and much less intrusive. If lorries are managed as part of a wider strategy to handle freight by all modes of transport then congestion problems could be reduced, time pressures eliminated and more jobs created in the multi-modal, transshipment activities that would result. It is important in lorry discussions to have a strategic view of the role and future development of lorry transport as well as a very practical view of how to improve conditions for drivers and members of the public now.

Similar arguments can be made for buses. Public transport in many parts of Europe is receiving investment at a rate many times greater than in Britain. Investments in the Netherlands, Germany, France and Denmark in new buses, new tram systems, bus lanes and traffic management systems that support buses will improve life for the driver and the general public. A driver behind the wheel of a new bus with excellent facilities for the disabled, state of the art communication technology, direct control over signalling at intersections, excellent linkage possibilities with all other modes and ticketing systems that almost eliminate taking fares on the bus will be a much happier and healthier bus driver than the UK version of this situation. When buses have preferential treatment in cities and cars are restrained then the job of a bus driver can refocus on high quality service to the customer in a safe well regulated environment. The advantages for bus drivers and passengers of a move in this direction are enormous.

At the practical level of contemporary bus and lorry driving there are a number of policies that should be implemented on a short time scale whilst the more strategic and longer term arguments about employment, the environment and investment are developed and pressed home. The main areas for

immediate action for both bus and lorry drivers can be summarised as follows:

- 1 Attention to cab design and ventilation to ensure that air quality is the highest attainable standard and noise levels are reduced to below 70 dB(A). Air in the cab should not be fed directly from the street and there should be no possibility of evaporative emissions entering the cab from fuel lines, fuel tanks etc.
- 2 Continuing progress with detailed attention to design matters to ensure that posture is correct and all tasks associated with driving can be accomplished with no strain on eyes, hearing, motor functions, reach etc.
- 3 The introduction of realistic work schedules that fully reflect the realities of traffic congestion, keeping to speed limits, the need for breaks and rest periods. This should be kept under constant review to ensure that drivers do not become the principal victims in absorbing the failures of the transport system and the workers that bear the brunt of cost cutting. If more time is needed to accomplish the tasks that have to be accomplished then the health of drivers and the safety of the public require that this be provided. Drivers should be given longer breaks and wherever possible breaks that facilitate interaction with other drivers.
- 4 The design and implementation of shift patterns and working practices that maximise the time than can be spent at home and/or the time that can be spent with co-workers
- 5 Install state of the art communications technology in all vehicles. Communications are important for work efficiency, for the safety of the driver and for eliminating the feelings of isolation.
- 6 Drivers should become more involved with management decision making about schedules, routes, timings and organisation. They have considerable experience of these matters which are of value to the overall commercial success of the organisation and studies(7) have shown that stress can be reduced and health improved by greater levels of involvement in the management process.
- 7 For lorry drivers change in working practices and drivers pay (by agreement with workers) to reward adherence to speed limits. Schneider in the US pays bonuses to truckers on the basis of observance of the 55mph speed limit. This reduces hassle for the trucker and saves the company money in fuel costs(20).
- 8 For lorry drivers install state of the art scheduling and rostering computer software to maximise use of vehicles, maximise the number of trips involving a return home in the evening or weekend and minimise mileages. A system of this kind would improve the health of drivers, improve the safety of the general public and reduce costs for the organisation.
- 9 For bus drivers pay particular attention to safety and security of the driver and where circumstances are particularly difficult use two person operated buses.
- 10 For bus drivers ensure that bus stations and bus stops are well lit, well located, adequately supervised, easily accessed, fully equipped with state of the art information technology and where possible involve immediate and unimpeded access back into the traffic flow. Bus stops can be located on extensions to the pavement into the street so that when the bus stops all the other traffic stops behind it and cannot pass. When the bus moves off the normal flow of traffic resumes and cars can overtake where it is safe to do so. Buses are far more important than cars in urban areas and giving them physical priority in this way will improve timings, increase passenger satisfaction and reduce the hassle of driving a bus in congested streets.

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