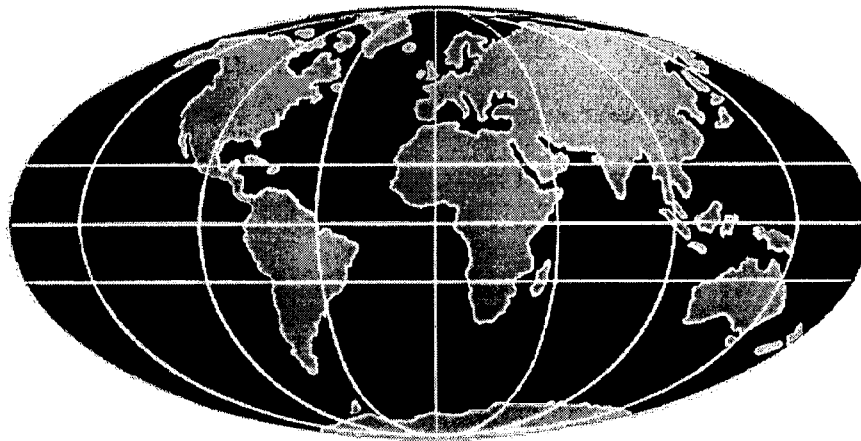


TITLE: A guide to the establishment and
maintenance of vehicle roadworthiness
inspections in developing countries

by: T Pearce



PA3385/98 PEARCE, T. A guide to the establishment and maintenance of vehicle roadworthiness inspections in developing countries. *World Conference on Transport Research, Antwerp, July 1998*

A Guide to The Establishment and Maintenance of Vehicle Roadworthiness Inspections in Developing Countries

by

Tim Pearce, Overseas Centre, Transport Research Laboratory

1 INTRODUCTION

Most countries have a requirement for vehicles to be maintained in a safe, roadworthy condition before use on their roads. Many have established an organisation to inspect some or all vehicles at regular intervals but only a small number of countries ensure that the inspections are carried out in a fair, honest and effective manner.

This paper is designed to be of assistance to those countries of the Developing World who wish to improve their existing system of roadworthiness testing and to those who wish to introduce such a system. The paper examines the general requirements for legislation and for the organisation of the test and the procedures and requirements for carrying out a roadworthiness inspection. The actual items and the standards to which they should be tested will vary from country to country. They will depend on road and vehicle conditions, the resources available for inspection equipment and the maintenance and repair facilities available to enable owners to meet the inspection requirements.

2 LEGISLATION REQUIREMENTS

There are, broadly, three sets of regulations, with amendments, which cover the use of vehicles on the roads in the United Kingdom [UK]. These are issued as Statutory Instruments [SI]:

SI No. 1078 Road Vehicles [Construction and Use] Regulations 1986

SI No. 1796 The Road Vehicles Lighting Regulations 1989 and

SI No. 1694 The Motor Vehicles [Test] Regulations 1981

There are other Acts and SIs in the UK but, for the purpose of this guide, the three SIs above are the most relevant to the roadworthiness of vehicles. All these regulations are made under the powers of the UK Road Traffic Act 1972 or 1988 and are subject to amendment as necessary. In turn, the regulations may be subject to amendment by a variety of European Community [EC] Directives. The relevant Directive is 96/96/EC entitled "on the approximation of laws of the Member States relating to roadworthiness tests for motor vehicles and their trailers."

This section considers the need for each of the legislative tools and will also consider the relevance of the EC Directives to a wider sphere of use than originally envisaged by those composing them.

2.1 Construction and Use and Lighting Regulations

The Construction and Use Regulations [C & U Regs] are designed to control the method and scope of vehicle construction in the UK insofar as they affect the way vehicles are built or adapted for their intended use. There are also conditions relating to the use to which a vehicle may be put including weights and dimensions, the use of trailers, control of noise and avoidance of danger.

Lighting Regulations specify the type and number of lights, reflectors and reflective markings to be fitted to road vehicles, the reasons they are required and the occasions they must be used.

2.2 Roadworthiness test legislation

This legislation covers the definition of vehicle classes required to have roadworthiness certificates, exemptions from requirements, authorised examiners, general administration of the vehicle examination procedure, appeals, fees, records and monitoring of premises. Separate annexes cover the items to be inspected, the manner and conditions for carrying out examinations and the equipment to be used.

The regulations do not cover the standard to which components should be inspected or particular failure modes - they are enabling regulations and will refer back to the relevant sections of the C & U Regs and the Lighting Regulations. Individual component or system standards are specified in the testers' manuals and in specific EC Directives such as 94/23/EC which specifies minimum braking standards or 92/55/EEC which specifies maximum limits for exhaust emissions. It should be noted that member states of the EC, such as the UK, are at liberty to impose stricter standards than those specified in these Directives.

2.3 Relevance to countries improving or introducing roadworthiness testing

Many countries already have legislation that is intended to govern the routine roadworthiness tests required of [or part of] their fleet. In ex-colonial countries this is based on legislation drawn up by previous colonial administrations and either not updated or revised by a piecemeal process.

Less developed countries are unlikely to draw up their own C & U regulations to meet their own particular needs or requirements.

The location of testing centres is important and it may well be better in both safety and administrative terms initially to locate testing in the capital or the major cities. Supervision and skilled labour will be easier to administer, traffic levels are normally significantly higher and enforcement is easier to undertake. Once a vehicle testing scheme is operating satisfactorily in the capital it can be expanded to the regions.

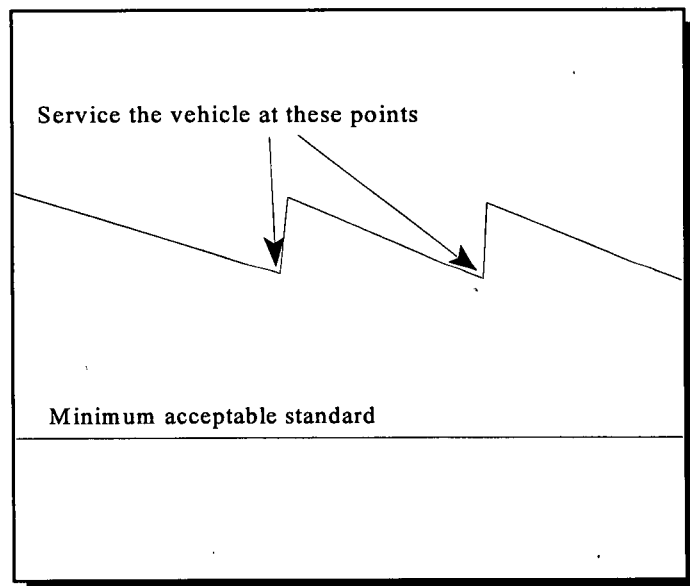
3 TEST PROCEDURES AND REQUIREMENTS

3.1 Minimum Acceptable Standard

This approach considers the condition of the vehicle on the day of inspection only and examines the performance of the various sub-systems as they can be evaluated without dismantling but purely by operating or inspecting. For example the performance of the brakes is examined using a roller brake tester. From this test a number of different parameters can be evaluated. The overall brake efficiency is the prime measurement the balance from left to right and front to rear, distortion in or binding of the brake drum or disc, and any lag in the braking system that prevents all the vehicle brakes from being applied at the same time can be evaluated.

The author firmly believes the annual fitness test should ensure, on at least one day a year, that vehicles are at a minimum acceptable standard. The phrase "Minimum Acceptable Standard" has a very clear meaning and is one that should be appreciated by all vehicle operators. It means these are the lowest standards that vehicles should be allowed to fall into; vehicles that are maintained to "Minimum acceptable standards" will be unsafe and in an unroadworthy condition for most of their time in use. It follows that vehicles should be maintained to a higher standard to allow for any deterioration between servicing to ensure that they do not reach a condition in which they are unsafe to use. Responsible owners and operators will ensure that their vehicles are maintained at a level significantly above the minimum. Figure 1, below, illustrates this relationship graphically.

Figure 1 Comparison of ideal standards of maintenance and examination



3.2 Written procedures for vehicle inspection with failure modes

Procedures for inspecting vehicles must be clearly and unambiguously published. They should be available for members of the public who wish to prepare their own vehicles for the test, for garages involved in the repair and maintenance of such vehicles and for the examiners themselves to ensure that they carry out the tests in the correct manner.

3.3 Equipment requirements

Although equipment is essential for many of the tests used in the UK it is not totally indispensable and it may often be feasible to replace it with low cost alternatives or by simplified test procedures. Although precision and accuracy may suffer, similar tests may be carried out with such equipment. Table 1 gives an indication of equipment requirements for different levels of roadworthiness testing.

Table 1 Equipment requirements

Level of testing	Equipment
Basic No previous effective testing <20 veh/1000 inhabitants GDP per capita <\$500 Widespread evasion of testing	Low cost equipment: Headlamp pattern marked on wall Black smoke visual inspection Brake test on road using decelerometer
Medium Testing carried out but has been restricted due to domestic situation or lack of resources <100 veh/1000 inhabitants GDP per capita >\$500 Evasion common	Mixture of equipment Optical headlamp meter Black smoke meter Tyre tread depth gauge [low cost] Roller brake tester for heavy vehicles Road test using decelerometer for light vehicles Steering free play meter
High Routine testing to consistent international standards >100 veh/1000 inhabitants GDP per capita >\$3000	High quality, standardised equipment Optical headlamp meter Black smoke meter CO/HC meter Tyre tread depth gauge Roller brake tester for all vehicles Steering free play and suspension checking equipment
State of the art High motorisation with need for control of vehicle numbers High income GDP per capita >\$10,000	Computer controlled equipment giving the minimum of operator subjectivity and the maximum throughput. Possible full control by one organisation High security documentation and control paramount

It should be noted that computers are now relatively inexpensive so that even the most basic organisation should actively consider their introduction for all aspects of administration.

Equipment is often designed by a manufacturer for a particular market. When sold in a new market, the problem arises of lack of know-how, both in equipment operation and maintenance. The provision of equipment without maintenance contracts is frequent even if the inspectors have been given instruction in operation of the equipment. In several countries roller brake testers have been observed in an unserviceable condition because of a lack of maintenance and parts. In other countries this may be compounded by the donation of

equipment without any training or maintenance backup at all.

The preparation of clear, written procedures, possibly in the local language but most definitely in the official language, is essential. These procedures should include elementary fault finding, routine calibration, cleaning and basic maintenance. Where the results from testing a system are dependent on the design of that system then amplification notes must be provided. More complex maintenance should be contracted to the local agent for the equipment or to a reputable local company with skills in the maintenance of electromechanical equipment.

3.4 Fee levels for different vehicle classes

Vehicle roadworthiness testing is a road safety measure and the general public should be encouraged to view it as such. The institution or company performing the tests should be able to recover its costs and, if a private company, to make a realistic but limited profit.

3.5 Qualified/trained staff

The minimum qualifications for technical staff should be that of vehicle mechanic but this should not be seen as a licence to permit a mechanic to act as a vehicle inspector without further training. In the UK a five day course is required to train mechanics in the techniques of inspecting heavy vehicles although the training course for both HGVs and PSVs includes a considerable amount of duplication. A full course including the necessary administration requirements of the test would therefore take, for all vehicles, about twelve days for a test regime of medium to high standards with slightly less time required for a more abbreviated test regime. It is suggested that the syllabi for different classes of vehicles should be common although the standards to which inspectors will test vehicles will vary depending on the vehicle.

3.6 Security

Inspection staff should not be permitted to hold or handle cash during the process of inspection and certification. The ideal requirement is to have a cash room with access for payment only through a grill or window. Payment of the required fee would result in the vehicle owner being given a token that would:

- give him a guaranteed inspection and
- give him a place in the queue of vehicles or
- an assigned time and date if a booking scheme was in existence.

The token could take the form of a flag or magnetic placard to be placed on the vehicle acting as a clear identification. No staff other than the cashier's staff would then be permitted access to the cash room and consequently all money could be properly accounted for.

Setting up a through flow production line in which technical staff are only responsible for part of the examination is one way of restricting the potential for corrupt practices. It is obviously

much more difficult to influence three or four inspectors than one. Naturally where the workload of a test station is low this may be difficult to organise. In larger test stations with a high throughput of vehicles this is an essential part of controlling the potential for corruption. When this method is linked to a random allotment of staff to tasks it is very difficult for planned corruption to take place. It may be possible to move inspectors around the country at intervals but this may prove difficult. Nevertheless it may be necessary to prohibit inspectors from working in their home town or region.

Security of documents, especially pass certificates is essential. The ideal form of certificate will vary depending on level of sophistication involved but, at the very minimum, it is recommended that computer generated certificates should be used. Theft of these would be difficult as they physically would not exist until they were authorised and the use of special papers to make alteration or erasure impossible is quite practical at a modest cost.

3.7 Pass rates and other measures of performance

Public acceptance and accountability of a more stringent test regime may be easier to achieve if not only the benefits but also the fairness of the new system can be demonstrated and proven. In addition, precise monitoring of pass [or fail] rates for vehicles, inspectors and components and of productivity will give the management a clear measure of the overall performance of the inspection system and of changes in demand.

The time required for an individual test will obviously depend on the number of items required for testing and the complexity of the inspection itself. The mean time for an inspection should be set as the result of careful trialing and will be different for different classes of vehicles. It is important the vehicle inspectors are not overloaded in terms of their work as the result will either be one of skimmed inspections or of unacceptably long waiting times for vehicle owners.

There may well be times when the system fails to deliver an acceptable standard of performance. If, for example, a vehicle is incorrectly failed then the owner should have some right of redress. This should take the form of an agreed appeals procedure that would be triggered when the aggrieved party completes an appeal form at the time of the inspection. This is especially valuable when testing is carried out by an independent, private organisation. The appeals procedure should then be handled by the regulating body which will normally be the department responsible for administering the test procedure. It is also important that the appeal is made at the time of inspection and that the regulating body responds within a very short time.

3.8 Who should carry out inspections?

Most countries use a state organisation to perform the inspections but the inspection system can be publicly or privately owned or a combination of both. However testing is performed, the organisation responsible should be subject to regulation by a government department. In the UK, testing of large commercial vehicles and buses is carried out by the state while light

vehicle testing is carried out privately. The Vehicle Inspectorate [VI], which carries out the heavy vehicle testing, is also responsible for regulation of all testing in the UK.

3.8.1 Private ownership and operation

Full private ownership reduces the capital costs to the state to a minimum but necessitates strong and independent supervision of testing standards, facilities and training of testing station staff. This system has been adopted by Singapore where contractors, all qualified to ISO 9002, have been licensed. In the UK, testing of light vehicles is similarly carried out by this system.

3.8.2 Public ownership/Private operation

Public ownership of the facility, but operated by a private enterprise, is one of three systems operated in Hong Kong. The right to carry out the business is frequently offered for contract. This has the advantage of lowering the immediate capital cost to small operators interested in tendering and, if the government maintains a presence in the testing station for booking and other functions, it is possible to closely monitor standards. Although it increases the government's capital investment it does however ensure that it can keep close control over property and land rights.

3.8.3 Public ownership and operation

Public ownership and operation of the facility is the system used in the UK for much of the testing of HGVs and PSVs. It ties up considerable government capital but can offer an unbiased and relatively corruption free service whose running costs may be completely funded from test fees. This system is the most common around the world but, unless properly funded, organised and monitored, the possibility of corruption may be high.

3.8.4 Private ownership/Public operation

Private ownership of the facility with testing carried out by public sector inspectors is a system being encouraged in the UK by the Vehicle Inspectorate [VI]. The private operator installs equipment in his premises to the specification of the VI. Tests are booked through the parent VI Test Station by operators who wish to have their vehicles tested in the facility. A vehicle inspector visits the premises to a regular programme and carries out the tests. This has the advantage of providing a more immediate service to the customer, reducing travelling and down time and decreasing capital investment by the state. The disadvantages may be lack of control over facilities and equipment standards and increased staff costs to the Inspectorate.

3.8.5 Independence from the Police

It is important that the police are not directly involved in the testing or inspection of vehicles for two reasons. The first is that, in most countries, they will have very little technical knowledge and, secondly, that there may well be a conflict of interest between the police who have just carried out an inspection and the police who then stop a vehicle 100 m up the road.

The police certainly have a part to play in the enforcement of construction and use regulations via the medium of random roadside checks. However, the organisation of these should be that the police stop the vehicles, inspect documents and charge the driver, if necessary, while authorised vehicle inspectors carry out a technical inspection of the vehicle. Vehicle weight

checking can also be incorporated in such inspections and such a combined task force can form a very useful enforcement tool for long or short periods.

3.9 Vehicles to be tested

There is no automatic choice of category for the testing of vehicles. The EC sets minimum requirements, Table 2 below, but this may be [and in the UK is] altered to suit an individual country's requirements.

Table 2. EC minimum requirements

<i>Categories of vehicle</i>	<i>Frequency of tests</i>
1 Motor vehicles used for the carriage of passengers and with more than eight seats, excluding the driver's seat	One year after the date on which the vehicle was first used and thereafter annually
2 Motor vehicles used for the carriage of goods and having a maximum permissible weight exceeding 3500 kg	One year after the date on which the vehicle was first used and thereafter annually
3 Trailers and semi-trailers with a maximum permissible weight exceeding 3500 kg	One year after the date on which the vehicle was first used and thereafter annually
4 Taxis, ambulances	One year after the date on which the vehicle was first used and thereafter annually
5 Motor vehicles with at least four wheels, normally used for the road carriage of goods and with a maximum permissible weight not exceeding 3500 kg, excluding agricultural tractors and machinery	Four years after the date on which the vehicle was first used and thereafter every two years
6 Motor vehicles used for the road carriage of passengers and with not more than eight seats, excluding the driver's seat	Four years after the date on which the vehicle was first used and thereafter every two years

Source: Annex 1 of EC directive 96/96/EC

The requirement for different classes of vehicles to be tested relies on two main points. One is the resources available in the country to perform the tests and the second is the potential for causing death and destruction when a fault causes or contributes to an accident. By these two factors it can be seen that trucks and buses [including all vehicles used for public transport] are given the highest priority.

Not only are the physical numbers of trucks and buses in most countries of a manageable size but when an accident occurs involving one of these vehicles it is not unusual for the death toll to enter double figures. The cost effectiveness of tackling these vehicles initially can therefore easily be established for a given country. Conversely, the testing of motorcycles is most likely to be of the lowest priority as accidents involving them may cause injury to the rider but rarely to other people and the large numbers of motorcycles in many countries would result in a disproportionate demand on available resources.

In conclusion, concentration on trucks and buses first, and then gradually expanding the system as resources and experience grows, is the best way of implementing an effective

vehicle roadworthiness inspection system. Absolute vehicle numbers are kept to a manageable number while the vehicles with the potential for causing the most damage are targeted first.

4 CONCLUSIONS

- 4.1 Developing Countries that wish to improve their existing system of roadworthiness testing, or who wish to introduce such a system need to ensure that a clear, unambiguous legal framework is constructed. The legislation should be framed to control how vehicles are constructed and used and as to enable the regular, in-service inspection of vehicles. The enabling legislation will be modified by specific regulations which will define standards required for testing, procedures for testing and reasons for rejection of different categories of vehicles and sub-systems.
- 4.2 Test procedures and requirements should cover all aspects of testing and should include equipment operation and testing methodology. Clear written procedures are essential and their availability to the public is necessary to enable full acceptance of the vehicle inspection scheme.
- 4.3 Current EC Directives and Vehicle Inspectorate manuals, suitably modified, may well form an excellent basis for the introduction and establishment of roadworthiness testing in a country that is introducing such a system for the first time.
- 4.4 Training of staff to inspect vehicles, fee levels for testing and security of cash and accountable documents are all aspects that need to be considered to ensure an efficient organisation and public confidence in the scheme.
- 4.5 The incorporation of the private sector with the public sector in vehicle inspections needs to be carefully evaluated as does the choice of vehicle required for testing although the latter is likely, initially, to be restricted to heavy commercial vehicle [trucks and buses] testing.

ACKNOWLEDGEMENTS

This work was carried out in the Overseas Centre of Transport Research Laboratory under funding by the UK Department for International Development [formerly the ODA]
©Transport Research Laboratory, 1997

REFERENCES

- SI No. 1078 Road Vehicles [Construction and Use] Regulations [1986]. HMSO, London
SI No. 1796 The Road Vehicles Lighting Regulations [1989]. HMSO, London
SI No. 1694 The Motor Vehicles [Test] Regulations [1981]. HMSO, London

Cars and Light Commercial Vehicle Testing. The Stationery Office, London [1996]

Motor Cycle Testing. The Stationery Office, London [1991]

Heavy Goods Vehicle Inspection Manual. The Stationery Office, London [1996]

Public Service Vehicle Inspection Manual. The Stationery Office, London [1996]