3.6 DEVELOPMENT OF SAFETY MEASURES

In many developing countries, no safety measures are provided at all during maintenance works. The Maintenance Engineer must understand that the safety of his workers and of the road user during maintenance operations is his responsibility. He must train his staff in methods of signing and traffic control and make them understand the need for safe working.

Initially it will probably not be possible to provide all the safety equipment recommended here. However, simple signs can be easy and cheap to make and it is possible to improvise cones and barriers. Turfs of grass cut from the roadside can be used instead of cones and effective road markers can be made from old oil drums painted with black and white bands and filled with sand, stones or water. If signs cannot be provided, a maintenance vehicle should be parked on the road between the on-coming traffic and the maintenance workers with its lights switched on.

When traffic volumes are very low, the Engineers may allow his workers to relax these standards. In particular it may not be necessary to use 'stop/go' signs. However, by relaxing standards, road users and maintenance workers must not be placed in a hazardous position.

4. MAINTENANCE OF ROAD FURNITURE

4.1 TRAFFIC SIGNS

Traffic signs are the principal means of conveying information about the road to drivers and, as the road network becomes more extensive, the number of traffic signs increases. As traffic flows increase, an increasing effort on their maintenance is needed.

The sizes, colours and layouts of signs have, in most developing countries, been standardised in accordance with international protocol and incorporated in Departmental standards. It is important that all signs should comply with these standards.

Signs which are clean and in good repair can be easily seen and understood and inspire confidence, that their message is accurate and reliable. Damaged or missing signs should, for the same reasons, be replaced promptly. Signs which are no longer needed (e.g. because of road improvements) should be removed, as should temporary signs upon completion of the maintenance works to which they are related. The provision and care of signs is very cheap and cost effective.

Signs should be inspected and cleaned at least twice a year. If there are enough signs, it may be worth setting up a small team which tours the District, covering all roads in rotation, which carries out this work as well as repainting posts and replacing damaged signs. The cleaning and inspection team will need to be provided with equipment such as that listed in Section 4.4.

Major repairs, particularly to sign faces, are better carried out in a central workshop which is equipped to do this work under good conditions and supervision. (This is particularly important in relation to signs which have legal force.)

It is worthwhile keeping records of traffic signs; they should be included in an inventory and transferred to a signs register (which may be a card-index) in which inspections, repairs and replacements are recorded. It is useful if their location is recorded on a strip-map.

4.2 RAILS AND POSTS

Guard rails and parapet rails are provided to protect road users guard rails to prevent vehicles from running over high embankments and parapet rails on bridges to safeguard pedestrians. They should be repaired promptly if damaged, and kept clean and repainted regularly so as to maintain their visibility and prevent corrosion.

Kilometre posts provide both drivers and the maintenance organisation with the basic reference for the position of any point on the road. Kilometre posts
should be kept clean and repainted regularly, and vegetation should be cleared so that they can easily be read from a moving vehicle.

Similar requirements apply to bridge and culvert marker posts. It is recommended that each bridge and culvert is provided with a marker post (or posts), serially numbered within the kilometre in which it is located, thus: 79/3 is the third culvert or bridge in km 79. These numbers should be used as references in the culvert and bridge registers.

Delineator posts are usually provided only on bends. They should be kept clean and repainted regularly, preferably with reflective paint if reflectors are not fitted. Vegetation should be cleared so that they can be easily seen.

4.3 WHITE LINES AND REFLECTIVE STUDS

White lines are being used increasingly on principal two-lane roads in developing countries for centre line, lane and edge markings, and for 'stop' or 'give way' lines. They are particularly useful as an aid to night driving. A note on their maintenance is therefore appropriate.

White lines may be of paint or hot-applied plastic. Both materials may be reflectorised with small glass beads (ballotini). Emulsion paint gives a good performance on surface dressed roads with a good surface texture but, on pre-mix roads or roads with less texture depth paint has a short life (perhaps only a few months under heavy traffic) and will require renewing regularly. Hot-applied plastic has a much longer life and should require much less maintenance effort. Its application requires the use of specialised equipment and properly trained operators. Paint, on the other hand, can be applied manually, although this will be a very slow procedure and the use of a portable paint sprayer is preferable. Whichever method is used, road markings should always be applied using templates or a straight edge. Such equipment will usually be provided through the central equipment organisation.

Reflective road studs may be used in conjunction with white lines. They should be replaced promptly if they are lost or damaged and protected by masking when surface dressing is being carried out. They should be installed by men who have been suitably trained. Particular attention should be paid to safety measures when men are working in the middle of busy roads (see Section 3.4).

4.4 MAINTENANCE GANGS

The composition of a typical road furniture gang is given below. Such a gang would be responsible for field repairs to traffic signs, guard rails, parapet rails, marker and delineator posts. They should also be responsible for cleaning signs. The Maintenance Engineer may find that local circumstances mean that a different composition with different tools and equipment are needed.

**Personnel**
1. Overseer/Gang leader
2. Driver
3. Labourers

**Vehicles and equipment**
1. Truck or van, equipped for carrying signs without damage
2. Assorted signs
3. Assorted tools, including spanners, etc
4. Pick-axe
5. Spade or shovel
6. Saw
7. Hand rammer
8. Dry mixed concrete
9. Small ladder
10. Water
11. Detergent
12. Paints
13. Brushes
14. Solvent for brush cleaning
15. Safety equipment as recommended in Section 3.

A typical gang for road marking might consist of the following. These would be responsible for painting white lines and replacing reflective studs.

**Personnel**
1. Overseer/Gang leader
2. Driver
3. Painters or labourers

**Vehicles and equipment**
1. Small truck
2. Stencils
3. 30 metre tape
4. String
5. Paints
6. Brushes
7. Solvents for brush cleaning
8. Safety equipment as recommended in Section 3.2.

If thermoplastic paint is being used, it must be applied using a specially equipped truck and skilled operators in place of the painters or labourers. The truck should be painted yellow or orange and be equipped with flashing yellow warning lights.