SOUTHERN

AFRICAN

DEVELOPMENT

COMMUNITY

NAVIGATIONAL AIDS

SECTIONS

MAY 2012

CHAPTER 8

CHAPTER 8: NAVIGATIONAL AIDS

8.1 INTRODUCTION

8.1.1 General

1 As the complexity of a road network increases the variety of routes leading through junctions and interchanges may create alternative routes by which drivers may reach a destination. Drivers therefore need navigational information to enable an optimum route to be chosen, followed, or adopted when required by local conditions, until their destination is reached. For the majority of drivers and trips, this navigational information is personal knowledge based on experience. Strangers who do not know a route or area should, however, acquire all or most of their navigational information as a result of PRE-TRIP PLAN- NING.

2 Once on the road, drivers should be guided through- out the trip by appropriate messages, which are consistent with their expectations, and which enable them to reach their required destinations, with a minimum of disruption to themselves and to other traffic. Since a tourist has been defined elsewhere as any person undertaking temporary, short term trips to destinations outside the place where they normally live and work, it can be interpreted that the driver referred to in the text is a tourist.

3 This Chapter therefore gives guidelines, designed to help the responsible rural and metropolitan road authorities develop a uniform approach on navigational aids for the road users, as part of the Motorist (Road user) Information System. Municipal road authorities shall consult with other relevant local authorities and with the national and other road authorities to ensure that continuity of destination signage through their areas is achieved.

8.1.2 Assumptions

1 In order to develop this uniform approach a number of assumptions relating to the navigational process have to be made. These assumptions are:

(a) that drivers have a general knowledge of the relative locations of FAMILIAR destinations;

(b) that **maps** and **route numbers** form the **primary information system** on routes on which the majority of trips occur, whether these are work, business, pleasure or directly related to tourism;

(c) that **guidance signs** play an essential **supporting role** to the primary information system;

(d) that direction signs and the destinations displayed on them, and interchange **exit** numbers should be designed on the basis that drivers **do use maps, and plan their trips when these are to areas with which they are not familiar.**

2 Although these assumptions are made in order to place practical limits on the scale of navigational information given to drivers, they shall be applied with circumspection. In some cases one or more of the assumptions may clearly not be appropriate, and extra steps should be taken to ensure that adequate navigational information is available. Such steps may typically result in the use, for instance, of supplementary guidance signs in the form of TOURISM signs to assist foreign visitors, who may lack even basic local knowledge.

8.1.3The Road Network

1 The road network comprises a number of components which can be classified in a hierarchical manner. The principal components are the LINKS or **connecting routes**, and the NODES or **destinations**. In order for drivers to travel along a LINK towards the NODE of their choice they require some form of ORIENTATION at the point of entry to the LINK (often another NODE). Orientation is thus a function or property of a NODE or destination.

2 A systematic approach to providing the necessary navigational information, requires that these components be classified into hierarchies. Each SADC member state has its own road network (see Figure 8.2), and numbered SADC routes have been identified which are superimposed on the individual national networks without affecting these. The SADC numbered route network is shown in Figure 8.1.

8.1.4 Link or Route Classification

1 Regardless of the status of the authority responsible for a particular route, links or routes may be classified as follows :

(a) INTER-STATE routes- numbered major inter-national routes;

(b) PRIMARY or TRUNK routes - numbered major inter-provincial or national links;

(c) SECONDARY or ARTERIAL routes - numbered minor inter-provincial or major inter-regional or intra-regional links;

(d) TERTIARY or REGIONAL routes - numbered minor inter-regional or major intra-regional links;

(e) ACCESS routes - direct access links to local destinations;

(f) METROPOLITAN routes- numbered intra-metropolitan links.

2 INTER-STATE, PRIMARY, SECONDARY and TERTIARY routes are primarily rural routes but they can start in metropolitan or major urban areas and will commonly traverse these types of areas as well. Rural ACCESS routes can be de- fined simply as in paragraph 8.1.4.1(e). In urban areas their route access function is more difficult to define as a wider range of route types is covered. Urban ACCESS routes, as a group, may include collector-distributor roads which may be classified lower than urban Class "B" roads. (i.e. ACCESS routes are not numbered routes.) They may also include direct access roads which have a similar function to their rural counterparts. Since collector-distributor roads, by definition, may serve several local destinations the choice of ORI- ENTATION points, which will commonly be suburb names, will become difficult at this level. Whilst METROPOLITAN routes, as defined in paragraph 8.1.4.1(f), will commonly lie wholly within a metropolitan area, when such areas

abut each other the METROPOLITAN route numbering system may extend across common boundaries.

3 For details of route numbering refer to Section 8.4.

4 Road classification is discussed in Chapter 1, Section 1.2 in a general way, and in Chapter 4, Section 4.5 with regard to urban roads.

8.1.5 Node or Destination Classification

1 Nodes or destinations are selected by way of a methodology described in Section 8.S, and are then classified into the following :

(a) FAMILIAR destinations - those orientation points which are assumed to be known to virtually all drivers, including foreign visitors, in terms of the general direction required to be taken to reach them, and the approximate distance to be covered in order to reach them;

(b) CONTROL destinations – are orientation points which offer drivers *en route* checks or verifications as to their position or progress;

(c) SERVICE destinations- are points on routes where road users would expect to be able to obtain various services such as vehicle service, food and accommodation.

2 Destinations names for use on primary signs are selected from the FAMILIAR and CONTROL levels. SERVICE destinations appear on the confirmation signs together with CONTROL destinations (and/or FAMILIAR destinations in certain cases).

8.1.6 Orientation Point Classification

1 From a study of International and National maps, the locations of major orientational centres of attraction should be identified. In effect the selection is based on the likelihood of a tourist being able to identify with such orientation points. For the purposes of classification the attraction or orientational value of destinations may be described by a number of "Levels". Up to six levels may be considered and the parameters for these levels should be based on various characteristics of candidate towns (see Subsection 8.3.2).Member countries may have appropriate listings of local authorities which can serve as a basis for ORIENTATION POINT classification.

2 The classification of orientation points should be related to the class of LINK on which they occur and to their NODE classification. The relationship between NODES, LINKS and ORIENTATION POINTS is given in Table 8.1.

TABLE 8.1 ORIENTATION POINTS TABLE 8.1

Nodes (Destinations)	Links (Routes)					
	Inter-State	Primary	Secondary	Tertiary	Access	Metropolitan
Familiar		Level 1	Level 2	Level 3	Level 4	Metro Level A
Control		Level 2	Level 3	Level 4	Level 5	Metro Level B
Service		Level 3	Level 4	Level 5	Level 6	Metro Level C
		Level 4	Level 5	Level 6		Metro Level D
		Level 5	Level 6			Metro Level E
		Level 6				

NOTES:

(1) Generally only FAMILIAR and CONTROL Nodes should appear on direction signs. SERVICE nodes should be included on confirmation signs, except in cases where destination signs will logically require the inclusion of these.

(2) Border posts should be listed as a unique Orientation Level. They may be elevated to Level 2 status for direction sign purposes.

(3) This table is used to determine the basic destination classification (see 8.S.3).

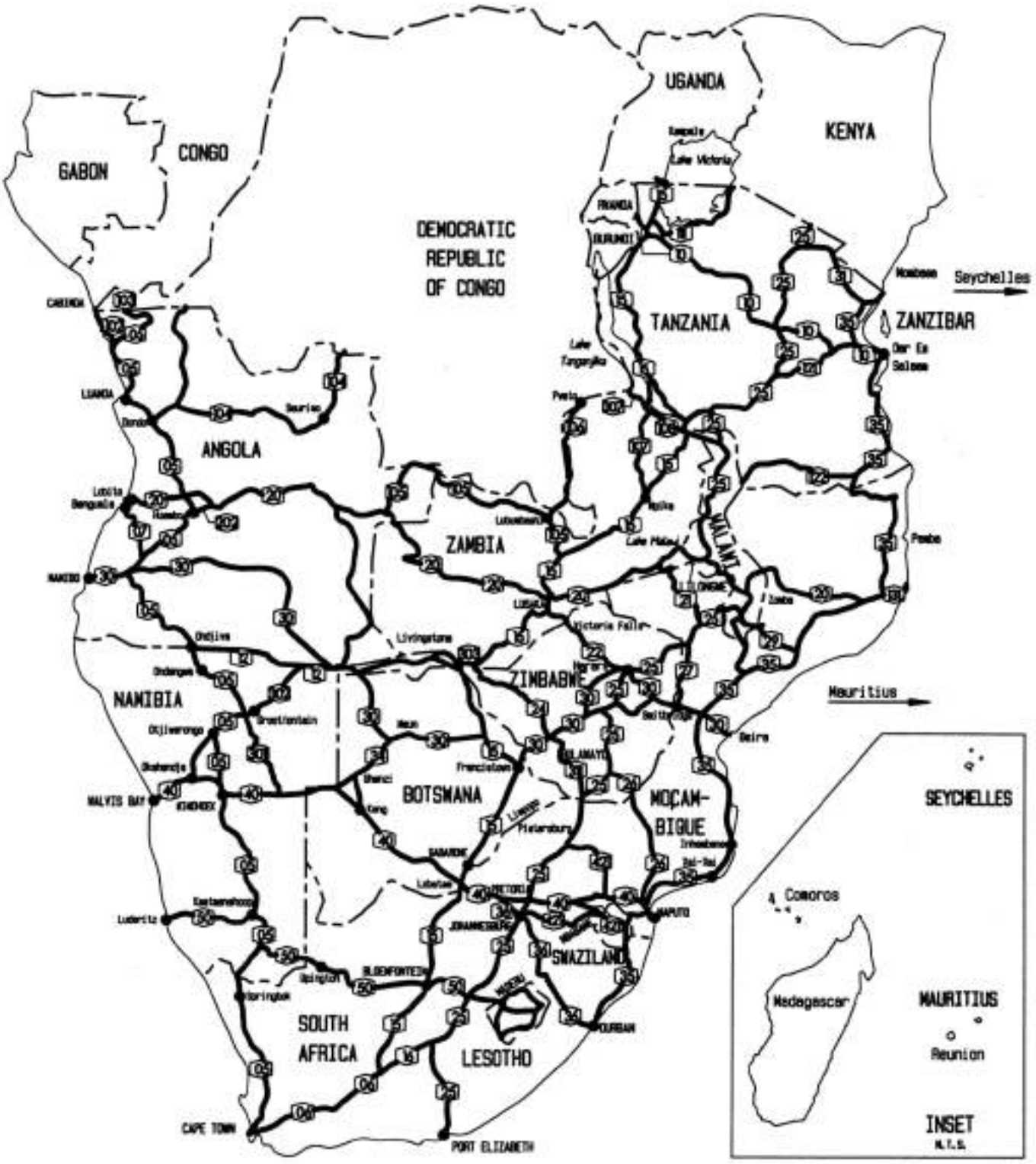


Fig 8.1 **Map Showing Numbered SADC Routes (Superimposed on Member State Primary Routes)**

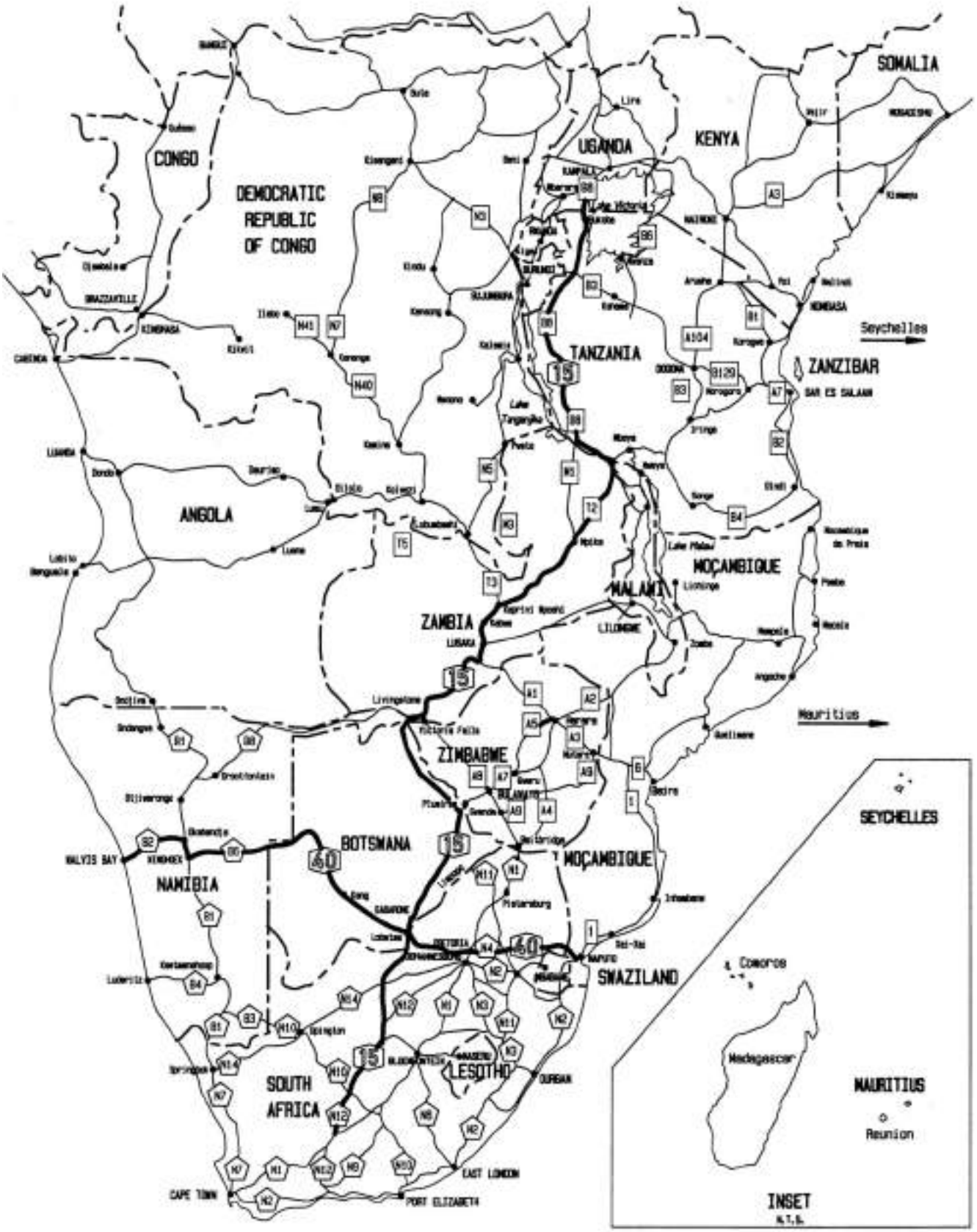


Fig 8.2 **Map Showing Selected Primary Routes, and two Superimposed SADC (Inter-State) Routes (With Some Level 1 and Level 2 Destinations)**

8.2 TYPES OF NAVIGATIONAL AID

8.2.1 General

1 In order for strangers to find their way safely to a previously unvisited destination they have to have adequate access to a range of navigational aids. Such aids to navigation need to be available in an "off-the-road" form for PRE-TRIP PLANNING, and in an "on-the-road" form for IN-TRIP USE. Unvisited trip destinations may range from those visited after crossing several countries (with unknown towns and cities, which need to be successfully navigated through, along the way), to destinations in an unfamiliar part of a major metropolitan area, from that in which the driver lives and works (e.g. Johannesburg).

2 Aids to driver navigation may take several forms. In undertaking a trip, and particularly one into unfamiliar territory, a number, or all, of these may be utilised.

3 The following forms of navigational aid should be provided to road users in accordance with the provisions of subsequent Subsections:

(a) ROAD MAPS (including roadside maps and tourist publicity material);
(b) ROAD REPORTS;
(c) ROUTE NUMBERS;
(d) GUIDANCE SIGNS (including tourism signs), CONFIRMATION SIGNS, TOWN NAMES & STREET NAMES;
(e) PROPERTY NUMBERS, PRIVATE AND COMMERCIAL NAME SIGNS.

8.2.2 Road Maps

1 ROAD MAPS are representations of LINKS or routes, connecting NODES or destinations, according to a hierarchical scale. A driver should use road maps to do pre-trip planning and also to monitor progress and position *en route.* **It Is therefore essential that navigational Information on road maps shall correlate with navigational information given on roads, and *VICE VERSA.***

2 It is the function of map producers to print and distribute road maps to the public although authorities may provide this service themselves. **The supply of current map information to map producers is the responsibility of the road authorities.**

3 The information supplied to map producers should comply with the following requirements:

(a) the base used for the map shall be the National Geo-reference System and this shall be indicated on the map;
(b) the scale of the map shall suit the density of lines and shall be shown on the map;
(c) the map should clearly indicate as much of the following as is practical:
  (i) freeway, toll, dual carriageway, surfaced single carriage way and un-surfaced roads;
  (ii) **all route numbers allocated to routes;**
  (iii) interchange exit numbers allocated to interchanges on freeways and other classes of road, together with street names in urban areas;
  (iv) all orientation points displayed as destinations on signs along the roads;
  (v) tourist attractions indicated on TOURISM signs along the roads;
  (vi) new roads under construction, or roads of which the construction in the near future has been confirmed;
  (vii) all street names in urban areas (subject to map scale);
(d) the map should be supplemented by "Route Schedules" stating the terminal points of routes with route numbers and all other orientation points along these routes (this should include Tourist Routes when appropriate);
(e) subsequent changes and additions to the map and schedules should be indicated in a different colour or by some other coding system.

4 Sign mounted roadside maps of local areas may be provided. These are used with benefit in major tourist areas and in industrial areas, where the percentage of drivers not familiar with the area may be well above average. These maps should be provided with an adequately signed pull-off area or layby, to give drivers time to take in the required information without obstructing other traffic. Typical examples of industrial area roadside maps and tourist area roadside maps are given in Chapter 5 and Section 4.10 respectively.

5 Local road authorities should submit information pertaining to route numbers and schedules to the controlling road authority for approval. The co-ordination and control of route numbering should be maintained by a Route Numbering Sub - Committee of the relevant Road Traffic Sign Technical Committee.

6 Tourist publicity material should, where practical, include mini- route maps to indicate the location of tourist attractions. The principles appropriate to road maps apply equally here.

8.2.3 Road Reports

1 Road reports give up-to-date information on road and traffic conditions and warn about delays and hazardous conditions. A driver should therefore use road reports to make final adjustments to his pre-trip planning, and road reports received *en route* may give an opportunity to avoid congested or hazardous road sections.

2 Although this information is made known through the press, radio, television and the Internet as a general service to the public, **it is the duty of the road authorities to collect and supply this information**. Road reports for release to the media should be co-ordinated and issued by the National Road Authority through approved bodies.

3 Each authority responsible for a numbered route should, on request, submit accurate current road condition information for such roads to the head office of the National Road Authority. This road report shall comply with the following requirements:

(a) where available a suitable road map complying with the requirements given in Subsection 8.2.2 should

be marked with the sections referred to in the report;

(b) conditions on all sections of Inter-State and Primary routes shall be described; Secondary, Tertiary and lesser routes reports need only be submitted for problem sections;

(c) the ROUTE NUMBER, with a description of terminal orientation points and total length of the route, shall be indicated;

(d) road types, namely - freeway, toll, dual carriage way, four lane undivided, three lane single carriage way (including climbing lanes), single carriage way shall be indicated;

(e) anticipated traffic conditions involving abnormal vehicles, high percentages of heavy vehicles, farm tractors, capacity constraints;

(f) special features such as:

(i) toll plazas;

(ii) rest and service areas;

(iii) 24-hour fuel facilities;

(iv) SOS services;

(v) arrestor beds;

(vi) points of scenic interest;

(g) sections of route which are not operating at their normal level of service for whatever reason, together with a description of the orientation points at the extreme ends and the length of section shall be given;

(h) hazardous conditions on sections such as :

(i) road-works, including detailed information on half-width construction, surfaced or gravel deviations, road closures, detours, presence of construction workers and vehicles, maintenance activities such as resealing, patching, line marking and work on shoulders;

(ii) poor pavement conditions such as pot-holes, uneven surface, slippery when wet, loose stones and falling rocks;

(iii) geometric conditions on alternative routes including sharp curves, steep grades, concealed junctions and/or entrances, surfaced or unsurfaced shoulders;

(iv) floods or wash-aways;

(v) areas prone to climatic conditions such as mist, snow, rain, or smoke;

(vi) high frequency accident locations;

(vii) any other hazardous conditions on the road.

4 When giving this information the road authority should relate it to orientation points along the route in question. In addition, when this is relevant, the distance for which the condition occurs should be given and the time period for which it is expected to exist. Recommended alternative routes should also be detailed, in relation to orientation points which link into the route which is the subject of the report.

8.2.4 Route Numbers

1 As a road grows in importance the necessity to identify it as a specific route reaches the stage when the responsible road authority may decide to allocate a route number to it.

2 The allocation of a route number to a route creates an obligation on the relevant authority to place signs indicating the number of the route, and to notify map producers as soon as possible of the number and the extent of the route, in accordance with the requirements of paragraph 8.2.2.3.

3 Route numbering criteria are dealt with in detail in Section 8.4.

8.2.5 Guidance Signs, Confirmation Signs, Town and Street Names

1 Guidance signs give *en route* navigational information to guide drivers during trips, so that they may reach their destinations in safety and with the minimum of disruption. These signs shall comply with the requirements of design, placement, operation, maintenance and uniformity as set out in this Manual. Note should be taken that guidance signs are solely for the purpose of providing navigational information, and are not an advertising medium.

2 The decision to use a particular legend on a sign should be made on the basis of an engineering study, with the objective of guiding drivers along the optimum route to a destination.

3 The primary guidance signing system may be supplemented by tourism signs where appropriate as set out in Chapter 4, or Volume 2, Chapter 4: Tourism Signing.

8.2.6 Property Numbers, Private and Commercial Name Signs

1 All properties in urban areas must be clearly identified by a number allocated and controlled by the local authority. These should be clearly displayed, and read- able by the driver, from a vehicle in motion. Letter size should conform to that appropriate to the travel speed on the road, but should not be less than 100 mm. The presence of a consistent property numbering system is important in locating the final destination. (See South African Standard Specification SANS 972: Parts 1 and 2 — 2004/2005 : *Signs for Street and Property Identifcation.)*

2 Private and commercial name signs may be used to supplement the property number.

8.3 ROUTE OPTIMISATION

8.3.1 General

1 The choice of an optimum route is dependent on inter-related variables, such as the level of familiarity of orientation information, the purpose of the trip, the time and cost relationships as perceived by the road user, the type of vehicle, and also the avoidance of less attractive or sensitive areas.

8.3.2 Assumptions

1 A system of establishing a hierarchy of Orientation Points or LEVELS (as described in Subsection 8.3.3), and subsequently identifying suitable destination points, was developed for use in South Africa. Much information regarding growth points and regional sub-developments was obtained from various government departments.

2 It is suggested that the various SADC member countries may establish similar systems of their own, should the South African based system prove unsuitable.

3 The selection of orientation points, and their levels of importance, is the foundation of an efficient guidance signing system. It has been found in South Africa that the selection of orientation points can be topical or even controversial. In the process of selecting orientation points on a numbered route, the decision to elevate town A to a higher level of classification than town B has often led to dissatisfaction. **Great care must be taken not to allow subjective arguments to cloud an objective analysis.**

8.3.3 Orientation Points

1 Journeys start at a place, and may proceed through various orientation points, to end at another place which, in itself, is also an orientation point. These orientation points are nodes or destinations in the route network, and are grouped in a hierarchy as set out in Table 8.1.

2 The familiarity of an orientation point to road users is likely to have a significant effect on the route choice, since there is a natural tendency to choose the known in preference to the unknown. Familiar orientation points are therefore more likely to affect the route choice of drivers not familiar with the area.

3 Orientation points must be established for PRIMARY, SECONDARY and TERTIARY routes. These are effectively rural routes, although they may traverse metropolitan areas. The establishment of orientation points within metropolitan areas can be difficult, and is likely to be most effective when carried out on a basis of historical and geographical factors. Orientation information given, on direction signs at systems interchanges on freeways in these areas, generally follow the same rules as those given for interchanges in rural areas.

4 When the route in question is a freeway within an urban or metropolitan area, the information given on the freeway exit signs, at an access interchange, is not generally designed to offer orientation on the freeway. The exit information displayed in urban areas at such interchanges includes the interchange exit number, the town or city name and the intersecting route number and street name(s).

5 In situations in urban areas where space is limited for the location of guidance signs, route numbers, followed by the appropriate cardinal direction, may be the only orientational information which can be given. In such cases it will be necessary to offer drivers confirmation or reassurance, as soon as possible after they make a turn, to indicate that they are heading towards a sufficiently familiar metropolitan orientation point.

6 LEVEL 1 orientation points should be established, on the basis that almost all drivers will have sufficient geographical knowledge of the chosen points, for these points to offer basic orientation, in terms of direction and distance. These points will also be most easily found on road maps, which will assist drivers who have virtually no geographical knowledge of the area.

7 LEVEL 2 orientation points should also be established. This can be done on the basis that nearly all drivers resident in the province concerned, will have sufficient geographical knowledge for the chosen points for them to offer orientation, in terms of direction and distance. Towns identified as main centres for sub-regional development could form the basis of this classification.

8 LEVEL 3 orientation points should be established in a similar way, based on the likelihood that nearly all drivers resident in a region, will have sufficient geographical knowledge for the points to offer adequate orientation in terms of direction and distance.

9 LEVEL 4 orientation points are higher level local authorities, which have not been included in levels 1, 2 and 3 above. Classification as a LEVEL 4 orientation point may change from time to time.

10 LEVEL 5 orientation points are medium level local authorities. Classification as a LEVEL 5 orientation point may change from time to time.

11 LEVEL6 orientation points are lower level local authorities and other places. Classification as a LEVEL 6 orientation point may change from time to time.

12 LEVEL 4, 5 and 6 orientation points have been established to distinguish between destinations at the lower levels. Many of the towns/township communities chosen may be regarded as parts/suburbs of the destinations appearing in the higher levels, and must be indicated at appropriate levels in the road network.

8.3.4 Trip Purpose

1 The purposes which influence the choice of an optimum route are:

(a) business trips;
(b) commercial (including industrial) trips;
(c) trips to work and home;
(d) tourism/leisure trips.

2 In the particular case of tourists' needs for route selection, the basic direction signing system shall be adequate, to enable drivers not familiar with the area to reach the general area of their intended destination. This is always provided tourists have reasonable ac- cess to suitable up-to-date maps. **Special efforts should particularly be made to ensure that such**

maps are available to foreign visitors. When discussing signing aspects with tourist facility operators, road authority representatives are recommended to encourage such operators to include basic route identification information, relevant to numbered routes in particular, in their letterhead, booking forms or brochures.

3 It may be necessary in the general area of the more frequently visited tourist regions, and of the more obscure and inaccessible ones, to provide tourism signs which are supplementary to the basic DIRECTION signs system. Details of these signs are given in Section 4.10 and warrants for their use are covered in Volume 2, Chapter 4:Tourism Signing.

8.3.5 Time and Cost Relationships

1 The time and cost relationships which influence the choice of an optimum route are:

(a) minimum time;
(b) minimum distance;
(c) minimum cost.

8.3.6 Vehicle Type

1 The vehicle types which influence choice of the optimum route can be classified into :

(a) freight carrying vehicles;
(b) passenger vehicles;
(c) multi-passenger carrying vehicles.

8.3.7 Less Attractive or Sensitive Areas

1 Based on the knowledge that tourists will be strongly influenced by route signing, it is desirable to avoid less attractive or sensitive areas. Adaptation of route information to indicate a route other than the most obvious or direct, may be considered .Such areas include:

(a) central business districts;
(b) residential areas;
(c) poor standard roads;
(d) security risk areas.

2 The signing of alternative or "preferred" routes may be accomplished within the normal parameters of direction sign policy. In certain circumstances it is likely, however, that additional signs may be necessary to supplement the basic direction sign system. This need should be restricted as far as possible by road authorities.

8.3.8 Route Identification and Signing

1 Route identification, by the allocation of route numbers and signing, may be used to optimise route selection, to the benefit of network capacity. The optimum route may be selected, by determining the values attached to the various factors for occasional and first time motorists, not familiar with the area, and then by selecting the best alternative after com- paring the potential cost savings.

2 This procedure is strongly recommended for determining the optimum routes in metropolitan areas. In rural areas, however, where alternative routes are not commonly available, the selection of the optimum rural route can be simplified by considering the relative importance of destinations and assuming that passenger carrying vehicles will generally prefer the quickest route, and freight carrying vehicles will generally prefer the shortest route.

3 Decisions on route numbering, the selection of destinations to be displayed on guidance signs, and the use of trail blazer signs, are, over a period of time, generally part of an iterative process, based on the various optimum routes which form a network hierarchy be- tween the various orientation points these routes serve. As such, in order to maintain a measure of optimisation in a system, changes may be necessary, with time and alterations in traffic patterns. It is, however, recommended that route numbers, once allocated, should not be changed unless as part of a major system upgrade, and such changes must be carried out with the necessary publicity.

8.4 ROUTE NUMBERING

8.4.1 General

1 When a road network becomes complex, the task of navigating within the network, or through the network, also becomes complex. This complexity is particularly a problem for visitors to a region or area, because they are not familiar with place names at the same hierarchical level as local drivers. Factors which result in such a situation are:

(a) when pairs or sets of NODES or destinations, are served by more than one LINK;
(b) when only one LINK is available and this serves several destinations or NODES;
(c) when complex manoeuvres are required, in order to return to a major route serving as an exit route from the region or area.

When one or more of these factors exists, signing by destination name or street name alone is no longer adequate. This problem can be overcome by allocating a specific ROUTE NUMBER to the optimum route between ORIENTATION POINTS.

2 Although such routes could be allocated a name, this is generally considered an impractical navigational technique. Such a practice would require larger signs, which would often be difficult to fit into the available roadside space. Readability of guidance signs could be compromised, and a confusing situation could develop due to the need to display destination names and route names. In metropolitan areas such routes coincide with named streets. These street names may change several times along the length of a route, and to allocate a route name in such circumstances could confuse rather than assist drivers. Conversely the use of a route number can effectively combine the various sections of contiguous, but differently named streets, into a cohesive route for drivers.

3 Historically a number of routes may have been named. These may be retained provided the signing of these names is not incorporated into the navigational signing system. The signing of such routes is covered in Chapter 4.

4 In a similar manner, other *en route* features such as bridges, passes, tunnels, toll plazas, rest and service areas and tourist routes may be named and signed with benefit to the navigational process. However, such signs shall be considered as of secondary, or supplementary, value to the navigational guidance signing of routes and destinations.

5 Interchange (EXIT) or junction numbers may provide an effective supplementary navigational aid to route numbers.

8.4.2 Metropolitan Route Numbering Criteria

1 The metropolitan planning authority should co-ordinate the numbering of metropolitan routes, in consultation with the provincial road authority, and the various local authorities in the area. When the numbering system has been agreed, and the guidance signs in the area effectively indicate the relevant route numbers, it is recommended that the metropolitan planning authority issue a route numbering map for the area. In practice this may be accomplished in co-operation with automobile associations, or map producers and should be supported by a publicity campaign.

2 An ideal situation would be one in which all trip purposes could be accommodated on a route to give minimum time, distance and cost. This is, however, not always possible, and the following criteria should be considered when deciding whether a route should be numbered, or which route should be numbered:

(a) orientation point characteristics, such as :
  (i) category, namely - city, town, suburb, industrial area or recreational area;
  (ii) grade of local authority (see relevant Government publication);
  (iii) high intensity attractors, namely - sports stadia, universities, regional shopping centres, hospitals or tourist areas;
(b) road type and quality;
(c) trip characteristics, such as :
  (i) numbers of vehicles attracted;
  (ii) quick trip preference (work and business);
  (iii) short trip preference (commercial and industrial);
  (iv) leisure trips;
(d) all numbered routes should start and end at orientation points, and as far as possible at another numbered route, and be of reasonable length;
(e) a numbered route should avoid changing direction at junctions as far as possible, and should not double back and cross itself, or cross another numbered route (except parallel minor routes), more than once;
(f) a numbered route should be continuous throughout a metropolitan area, as well as through contiguous metropolitan areas. with the same number and symbol (care shall be exercised when numbering a route which is "circular");
(g) all routes which are wholly contained in a metropolitan area, even if they are roads administered by a provincial authority, should preferably be given a metropolitan route number, and all rural routes passing through or terminating in a metropolitan area should retain their non-metropolitan route numbers.

3 The effectiveness of the route numbering system, in a metropolitan area, should be assessed at intervals of from five to ten years, subject to the rate of development in the area. When changes are made, maps shall be updated as quickly as possible and interim publicity should be initiated to make drivers aware of changes.

8.4.3 Rural Route Numbering Criteria

1 As mentioned in Subsection 8.3.7, a simplified procedure may be utilised to determine an optimum rural route between orientation points, as a candidate for route numbering. In most member states several Primary routes are numbered and it is not envisaged that major changes to them will take place. The following criteria should be applied, to decide if a route will qualify for a route number, and in what other category such a route should be classified :

(a) the population level of the relevant orientation points as given in Table 8.2:

TABLE 8.2	POPULATION	TABLE 8.2
Population of Orientation Point	Level	
> 100 000	1	
50 000 - 100 000	2	
10 000 - 50 000	3	
5 000 - 10 000	4	
500 - 5 000	5	
<500	6	

(b) the rural route hierarchy level as given in Table 8.3:

TABLE 8.3	ROUTE HIERARCHY	TABLE 8.3
Class of route	Level	
Primary	1	
Secondary	2	
Tertiary	3	

(c) the numbering of a route, and the category in which it should be numbered, are summarised in Table 8.4:

TABLE 8.4	ROUTE CATEGORY AND NUMBERING CRITERIA		TABLE 8.4
	Level from Tables 8.2 and 8.3		
Relevant Factor	Secondary Routes	Tertiary Routes	Tertiary Parallel Routes
Route terminal orientation point population level	1 – 4(1)	1 - 5 (1)	1 - 5 (1)
Population level difference between route terminal points	< 2(2)	< 3 (2)	<3 (2)
Route hierarchy level of joining route at terminal points	< 2	<3	<3

NOTES:

(1) These tables (8.2-8.4) indicate, for example, that a Secondary numbered route terminal orientation point, should have a population of 5000 or more.

(2) Similarly, the population level difference, for example, for a Secondary numbered route should not be greater than two levels as given in Table 8.2. If one route terminal has a population of 100 000 the other should not have less than 10 000.

(3) This Table indicates the levels required before a route should be allocated a number, and into which route category it should be allocated.

(d) in order to qualify as a particular category of route the following criteria as given in Table 8.5 should also be complied with:

TABLE 8.5 SUPPLEMENTARY CRITERIA TABLE 8.5

Relevant Factor	Secondary Routes	Tertiary Routes	Tertiary Parallel Routes
Distance between route terminal orientation points	> 100 km	>20km	>10km
Road surface	80% of route surfaced	All weather	Fully surfaced

(e) When considering routes to coastal destinations, at least three of the following criteria should be satisfied:
- population of the control town must be equal to a grading higher than 5, (see Table 8.2);
- route to join with another numbered route;
- route should have a length not less than 20 kilometres;
- have an all-weather surface; or
- serve two or more communities.

2 Once a route has been allocated a number, the route in question should be checked, in relation to the relevant part of the overall route network, for compliance with the following:

(a) the allocation of more than one number to one section of road, should be avoided as far as possible, but if it is unavoidable that numbered routes overlap, **all numbers shall be displayed;**

(b) all roads to which abnormal vehicles will be directed shall be allocated route numbers (if the route or section of route does not otherwise qualify according to the criteria laid down, it should be numbered as a Regional route);

(c) all numbered routes should start and finish at the appropriate level of orientation point, and as far as possible at another numbered route;

(d) a numbered route should avoid changing direction at road junctions, as far as possible, and it should not double back or cross itself or cross another numbered route (except parallel Regional routes), more than once;

(e) a number should not be allocated to a route in an urban area, which is not identified as a major route.

8.4.4 Traffic Assignments by Computer

1 In extremely complex situations, either metropolitan or rural, routes which may qualify for numbering, may be identified, by studying traffic volumes assigned to the network, by computer.

2 Such assignments normally require large quantities of data to be effective. However, such data may exist as a result of other transportation studies, in which case the use of the assignment process may be justified and indeed effective.

3 It is anticipated that in time the assessment of the importance of a route or LINK, and of a destination or NODE, will be computerised at primary, secondary and tertiary levels.

8.4.5 Route Number Display

1 Full details of the display of route numbers on guidance signs are given in Chapter 4.The points covered by the following paragraphs are of particular relevance to the navigational aids policy.

2 Once a route has been allocated a number, all ROUTE MARKER, DIRECTION and FREEWAY DIRECTION signs, shall display the route number appropriate to any directions and/or destinations given on the signs. The route identification letter, route number, and when applicable the cardinal direction, shall be displayed in yellow retroreflective material without any form of surrounding symbol, **EXCEPT** that on ROUTE MARKER signs the background symbol appropriate to the category of route shall be used. In the case of ROUTE MARKER CONFIRMATION signs the signs shall have the shape of the relevant symbol (see Chapter 4, Section 4.7).

3 When the sign indicates a route or direction which is not on the intersecting route, but is reached VIA the intersecting route i.e. "indirectly", the route number shall be displayed within brackets of yellow retroreflective material. This form of display applies to all TRAIL-BLAZER signs (see Section 4.7).

4 In metropolitan areas a unique background symbol may be adopted for each specific metropolitan area, for use on METROPOLITAN ROUTE MARKER signs. The symbol shall meet with the approval of all local authorities in the area, and shall also be submitted to the relevant Authority for approval (see Volume 4, Chapter 4, Section 4.3).

5 If a route is a toll route, the route number shall be displayed followed by the TOLL ROUTE symbol GDS9. When alternative routes to toll routes are signed, supplementary signs displaying the number of the toll route and the ALTERNATIVE ROUTE symbol GDS-10, should be erected as required to identify the alternative route. This alternative route may already have another route number, which should be displayed on the guidance signs provided according to normal principles.

8.5 SELECTION OF DESTINATIONS

8.5.1 General

1 The message on guidance signs should enable drivers to make the correct decision regarding their next driving action, on the journey towards their final destination. In simple terms, this action is likely to be one of the following:

(a) to continue on the route on which they are travelling;

(b) to turn onto an intersecting route (either numbered or non-numbered);

(c) to stop for rest or service.

2 The minimum navigational information which drivers not familiar with the area require, to ensure a correct and safe driving action at a decision point, varies according to the road geometry of the situation. The first decision required, when a change in direction is possible, can be made on the basis of as little information as the straight-on route number and the route number of the crossing route. Approaching a high speed freeway exit this information, supplemented by the interchange exit number, can be sufficient to make the decision to exit the route on which the driver is travelling, **or not to exit**. At the off-ramp junction with the cross road, however, as with all other at-grade junctions, the minimum information shall be increased to include the route number of the cross route plus at least one orientating destination for each direction in which the driver may tum. This minimum information may be supplemented, when necessary, by other guidance signs such as TOURISM signs. Such treatment will become more appropriate at junctions with un- numbered roads at the lower levels of the road hierarchy.

3 The destination part of the message should orientate drivers. **It is therefore essential that the destinations displayed to drivers, when they make a change of direction, are familiar to them.** In metropolitan areas space may preclude the provision of DIRECTION signs. ROUTE MARKER signs will then represent the minimum level of guidance signing, and the orientation offered by these signs is the cardinal direction in which the sign is pointing.

4 The orientation message, displayed should correlate with what are familiar orientation points for drivers, whether this is as a result of knowledge gained from pre-trip planning, or general knowledge. **The objective of destination selection is therefore to display familiar orientation points, needed by drivers,** to follow the optimum route to reach their final destinations.

5 The selection of the destination to be displayed on any direction or confirmation sign may often seem to be a simple task. However, the increasing complexity of a modern road network, demands that a systematic and consistent approach be adopted by road authorities, whenever a destination is selected for permanent display on guidance signs.

6 The interchange exit number, place name, cross road route number (where allocated), and/or street name, in urban areas, will confirm to drivers what point in their journey they have reached.

8.5.2 Metropolitan Destination Selection

1 Since metropolitan areas invariably have a complex road network, and a wide range of available destinations for use on guidance signs, the selection of effective destinations is likely to be a difficult task. In metropolitan areas, there may be locations where an excessive number of destinations for guidance signs, would exceed the "bits of information" that the road-user can satisfactorily assimilate. In such locations it is recommended that the higher order (LEVEL 1 or METRO-LEVEL A) orientation points be used on freeways, to reduce the number of destinations to an acceptable minimum. However, when destinations are required, a traffic assignment model of the metropolitan area can be adapted to analyse the needs for destination signing. This analysis should incorporate such route network characteristics as the type and standard of the link, distances between destinations, a destination hierarchy based on category of place (e.g. city, town, suburb, industrial or recreational area) and the grade of local authority, and population size. The analysis should be sensitive to trip purpose and traffic com- position, and be adaptable to take less attractive or sensitive areas into consideration. The objectives of the analysis are to compare alternative destination selections, and to establish routes which offer adequate orientational guidance to drivers not familiar with the area. In doing so the analysis should also optimise the time, distance, and cost components for all road users.

2 The different types of interchanges on freeways in metropolitan areas also play a major role in the selection of destination names to be displayed on direction signs. At systems interchanges, that is freeway-to-free- way interchanges, usually only long distance orientation, or LEVEL 1 information is provided as primary information, because of generally limited available space. However, in many cases LEVEL A metropolitan orientation information has to be added, in order to provide a cohesive information system. At access interchanges, that is interchanges providing access to the local street system, or the area in the immediate vicinity of the freeway or interchange, local orientation information is provided. In the case of access inter- changes in urban or metropolitan areas, it is, for various reasons (including ease of identification and the correlation of information given on maps and signs), considered highly appropriate to only display the name of the crossing street, together with the route number where applicable, and not selected names from sometimes a great number of suburb names. The names of major traffic generators, such as large industrial areas and destinations outwards from the city centre should, how- ever, be added to direction signs at such interchanges, provided that sufficient space is available.

3 In order to formulate a worthwhile set of policies for a metropolitan signing system a Study Team, Working Group, or Steering Committee, under the aegis of the metropolitan planning authority should be established to assume technical responsibility for all aspects of the study, including detailed methodology, procedures to be adopted, and liaison with interest groups such as the Automobile Association, Publicity Associations, Tourism Board, organised local commerce, etc.

4 To assist in the formulation of acceptable policies for input into the direction sign system design, the various local authorities should be consulted in addition to the core city authority and the national and provincial road authorities, to determine the existing situation regarding signing in their areas. The factors which affect the selection of destinations and routes, which are specific to the metropolitan area under study, can thus be established.

5 It is recommended that in formulating a systematic area policy, a minimum level of guidance signing be accepted, and that guidelines be established which indicate when a higher level of signing is appropriate. The guidelines should be based on the principles of continuity, consistency and uniformity as detailed in Chapter 4.

8.5.3 Rural Destination Selection

1 The selection of rural route destinations is dependent on a variety of factors. These vary from driver expectations, distances between points, classification of road, to geographical considerations. To attempt to provide a generic procedure for all the SADC countries is considered to be impractical. Each country has its own characteristics and qualities; for example the area of Tanzania is 945 090 km^2, whereas the area of Mauritius is 2 040 km^2. Clearly the Route Numbering policy and Destination Selection procedures for these two states will be quite different. It is therefore recommended that the procedures set out below be used as a guide. An example of destination analysis procedure is contained in Section 8.6: National Variants.

2 The factors which influence the selection of destination names to be displayed on direction signs are:

(a) class of route;
(b) distance between destinations;
(c) classification of intersecting routes (if and when they occur).

3 The following procedures are recommended:

(a) using Tables 8.6,8.7 and 8.8,together with the list of Orientation Points as classified according to the principles listed under Subsection 8.1.6 (including

TABLE 8.6 FAMILIAR DESTINATIONS: BASIC ORIENTATION LEVELS TABLE 8.6

Class of route	Destination to be displayed
Primary route	(a) On Class A1 or A2 roads: LEVEL 1 Orientation Point (b) On Class B roads: LEVEL 2 Orientation Point
Secondary route	LEVEL 2 orientation point
Tertiary route	LEVEL 3 orientation point

TABLE8.7 CONTROL DESTINATIONS: BASIC ORIENTATION LEVELS TABLE 8.7

Class of Route	Destination to be displayed
Primary route	(a) On Class A1 or A2 roads: LEVEL 2 Orientation Point. (b) On Class B roads: LEVEL 3 Orientation Point.
Secondary route	LEVEL 3 Orientation Point.
Tertiary route	LEVEL 4 Orientation Point.

TABLE 8.8 SERVICE DESTINATIONS: BASIC ORIENTATION LEVELS TABLE 8.8

Class of route	Destination to be displayed {l)	
Primary route:	(a) Class A1 or A2 roads:	LEVEL 3 Orientation Point.
	(b) Class B roads:	LEVEL 4 Orientation Point.
Secondary route	LEVEL 4 Orientation Point.	
Tertiary route	LEVEL 5 Orientation Point.	

Table 8.1) make a list, in order along the route, of all the destinations;

(b) for each orientation point also:

(i) the Orientation LEVEL;

(ii) the distance to the nearest km, between successive points;

(iii) the Route Number (i.e. classification) of any intersecting route

Only listed Orientation Points are to be used.

4 In terms of the distance criteria, as set out in Tables 8.9, 8.10 and 8.11, these BASIC ORIENTATION LEVELS may be up-graded to the next higher level, should the km distance between successive destinations exceed those recommended.

5 A further criterion, i.e. the classification of the intersecting route, may also be applied to up-grade the BASIC ORIENTATION LEVEL. Where an intersecting route passes through an Orientation Point, the BASIC ORIENTATION LEVEL may be up-graded. In this respect, the following criteria are recommended

(a) where the intersecting route is of an **equal or higher** road classification, then the BASIC ORIENTATION LEVEL may be up-graded;

(b) where both distance and intersecting route criteria apply, the BASIC ORIENTATION LEVEL of orientation may be up-graded by **TWO** levels;

(c) on a primary route, even if both up-grading criteria are applicable, the BASIC ORIENTATION LEVEL only be up-graded **ONE** level.

6 Upon completion of this procedure a list of Orientation Points on the Route, together with a final classification of up-graded FAMILIAR, CONTROL and SERVICE destinations will be available. This final classification

TABLE 8.9 UPGRADED TO FAMILIAR DESTINATION TABLE8.9

Class of route	Maximum distance between consecutive destinations and/or Intersecting Route of the same Class (or Higher)	Destination to be displayed
Primary route	150 km 100 km	(a) On Class A1 or A2 roads: LEVEL 2 Orientation Point(1) (b) On Class Broads: LEVEL 2 Orientation Point
Secondary route	100 km	LEVEL 3 Orientation Point (2)
Tertiary route	50 km	LEVEL 4 Orientation Point(2)

TABLE8.10 UPGRADED TO CONTROL DESTINATION TABLE 8.10

Class of Route	Maximum distance between consecutive destinations and/or Intersecting Route of the same Class (or Higher)	Destination to be displayed
Primary route	150 km 100 km	(a) On Class A1 or A2 roads: LEVEL 3 Orientation Point(1) (b) On Class Broads: LEVEL 3 Orientation Point
Secondary route	100 km	LEVEL 4 Orientation Point(2)
Tertiary route	50km	LEVEL 5 Orientation Point(2)

TABLE 8.11 UPGRADED TO SERVICE DESTINATION TABLE 8.11

Class of route	Maximum distance between consecutive destinations and/or Intersecting Route of the same Class (or Higher)	Destination to be displayed
Primary route:	150 km 100 km	(a) Class A1 or A2 roads: LEVEL 4 Orientation Point(1) (b) Class Broads: LEVEL 5 orientation point
Secondary route	100 km	LEVEL 5 Orientation Point(2)
Tertiary route	50 km	LEVEL 6 Orientation Point(2)

NOTES:

(1) For Primary Routes it is recommended that an Orientation Level should only be up-graded by **ONE** Classification Level even if both distance and intersecting route criteria are applicable.

(2) For Secondary and Tertiary routes, an Orientation Level **may** be up-graded by **TWO** levels if both distance and intersecting route criteria apply.

will determine what destination names appear on the direction signs (an example of this procedure, as applied to a South African route, may be found in Section 8.6).

7 At this stage, the destinations to be displayed on DIRECTION signs at junctions/interchanges can be determined. Depending on individual member policies, these should be "FAMILIAR", but never less than "CONTROL".

8 Destinations that are finally classified as SERVICE destinations should only be displayed on CONFIRMATION signs, or at a final turn towards such a SERVICE destination, if it is not located directly on the route.

9 Where primary routes intersect, as well as where two routes follow a common section, two destinations will have to be displayed; these could be either FAMILIAR or CONTROL depending on policy and circumstances.

10 In areas approaching metropolitan areas, the route network may become increasingly complex, to such an extent that it is difficult to provide meaningful continuity of a destination name to a driver not familiar with the area. In such a case, the road authority may decide not to upgrade the basic destination classification to be displayed on DIRECTION signs, or may decide to display only orientation points that had been upgraded to "FAMILIAR" destinations.

11 Particular care should be taken to ensure that the terminal orientation point of a route, or the point where two coinciding routes split, is adequately signed. The road authority may decide to display such a point as a "CONTROL" or "SERVICE" destination even if it would not otherwise be warranted.

12 Where primary routes are being developed in such a way that certain orientation points will be by-passed by a considerable distance, it may be necessary to regard such orientation points purely as "SERVICE" destinations.

8.6 NATIONAL VARIANTS

8.6.1 General

1 The objective of the SADC Road Traffic Sign System is to achieve the highest possible degree of harmonisation of the system throughout the region. However, due to differences in the road networks of member countries, there will be occasion for a variation of basic principles and policies. This is especially true in the establishing of a Route Numbering and Destination Selection Systems.

2 The principles and policies set out in this Chapter are based on a system evolved in South Africa over a period of more than 20 years. The following Subsections are examples of the application of various Navigational Aids to the South African road network. These examples are merely a guide for other member countries.

8.6.2 Orientation Points

1 Section 8.3 discusses the concept of Orientation Points and a method of establishing a system of grading these points into various LEVELS. **The temptation to include almost every place into the system should be avoided, since an oversupply of Orientation Points can result in a congested and ineffective Destination Analysis.**

2 Tables 8.12 to 8.19 list Orientation Points in South Africa as established in their LEVEL categories. These lists have been updated and revised as a result of the increase in number of provinces in South Africa.

3 Tables 8.20 to 8.23 similarly list destinations of different levels of importance for Namibia. Other member states are encouraged to prepare similar lists which can be added to this chapter when available.

4 It should also be noted that Orientation Points in Metropolitan Areas are defined and identified at METRO LEVEL.

8.6.3 South Africa - Route Number Allocation

1 All route numbers shall comprise a route identification letter together with the specific number allocated to the route. Additional information (toll route symbol, alternative route symbol or cardinal direction letter) may be displayed with the route number. This is detailed in Chapter 4.

2 The following number groups have been allocated to the different route categories. These allocations were made when South Africa consisted of four provinces, hence the varied groupings in the R300 to R499 category, as well as the R500 to R599 category.

(a) National Routes: N1 to N20;
(b) Provincial Routes: R21 to R99;
(c) Regional Parallel Routes: R1xy (where xy is the number of the parallel National Route; e.g. R104 is parallel to the N4);
{d) Regional Routes in the Eastern, Western and Northern Cape: R300 to R499;
(e) Regional Routes in Gauteng, Mpumalanga, North - ern Province and North West : R500 to R599;
(f) Regional Routes in KwaZulu-Natal: R600 to R699;
(g) Regional Routes in the Free State: R700 to R799;
(h) Metropolitan Routes: M followed by any number - but not to conflict with any adjacent National, Provincial or Regional route number;
(i) Tourist Routes: "T" followed by a number (refer to Volume 2, Chapter 4: Tourism Signing).

3 At the time of publishing no routes have been allocated numbers in the R200 to R299, or R800 to R999 groups.

4 In the case of new or upgraded routes crossing provincial borders, the Route Numbering Working Group shall co-ordinate and award new route numbers. In the case of all other route numbers the relevant Provincial road authority or metropolitan planning authority can decide on new numbers within the limits stated. Details of all new routes and their numbers must be submitted to map producers and to the Secretary of the Route Numbering Working Group.

8.6.4 South Africa – Rural Destination Selection- Corridor Procedure

1 The procedures given in the following paragraphs, and as set out in Figure 8.2 illustrate the methodology recommended in Subsection 8.5.3 to determine rural route destinations.

2 The example considers National Route N4 between Pretoria and Maputo. From Pretoria to east of Middelburg the route is a Class A1 road, then it becomes a Class A2 road up to Machadodorp, and a Class B road to Maputo.

3 The basic methodology recommends an up-grading of orientation points by one level if they are situated on a Class B or lesser route; i.e. a Level 3 SERVICE Orientation Point would be deemed to become a CONTROL Orientation Point. However, if this application results in a preponderance of FAMILIAR orientation points in the final analysis, it is recommended that the result be reviewed. It is recommended that on Primary routes a Basic SERVICE destination may not be up-graded to a FAMILIAR destination.

4 With the aid of a road map, write down all the place names, in order, along the N4 route, starting from Pretoria, to Maputo. These names must only be names from the list of established ORIENTATION POINTS, as listed in Tables 8.12 to 8.14 (Figure 8.3-Column 1).

5 Next to these names write down the BASIC ORIENTATION LEVEL, as set out in Tables 8.6 to 8.8 (Figure 8.3 -Column 2).

6 Using a route number map, write down all the NUMBERED ROUTES joining the N4 at (or near) these orientation points (Figure 8.3 • Column 3).

7 In the next column write down the POINT TO POINT KM DISTANCE between these orientation points (Figure 8.3 - Column 4).

8 Now write down the BASIC ORIENTATION LEVEL CLASSIFICATION in Column 5, based on Table 8.1, as well as taking into consideration the road classification (Figure 8.3 - Column 5).

9 The process of possible up-grading now takes place. Assess, according to the distance criteria, if the Orientation Level must be upgraded (Yes/No) (Figure 8.3- Column 6).
(Continued on page 8.6.8)

TABLE 8.12 **LEVEL 1 (FAMILIAR) ORIENTATION POINTS- RSA** **TABLE 8.12**

Eastern Cape	Free State	Gauteng	Kwazulu/ Natal	Mpumalanga	Northern Cape	Limpopo	North West	Western Cape
King Williams Town	Bloemfontein	Johannesburg	Durban	Nelspruit	Kimberley	Pietersburg	Mafikeng	CapeTown
East London		Pretoria	Pietermaritzburg					
Port Elizabeth								

TABLE 8.13 **LEVEL 2 (CONTROL) ORIENTATION POINTS- RSA** **TABLE 8.13**

Eastern Cape	Free State	Gauteng	Kwazulu/ Natal	Mpumalanga	Northern Cape	Limpopo	North West	Western Cape
Aliwal North	Bethlehem	Alberton	Amanzimtoti	Bethai	De Aar	Louis Trichardt	Klerksdorp	Beaufort-West
Cradock	Bothaville	Benoni	Ballito	Ermelo	Kuruman	Phalaborwa	Lichtenburg	Bellville
Graaff-Reinet	Botshabelo	Boksburg	Dundee	Middelburg	Prieska	Potgietersrus	Potchefstroom	Caledon
Grahamstown	Ficksburg	Brakpan	Empangeni	Secunda	Springbok	Thohoyandou	Rustenburg	George
Middelburg	Harrismith	Carletonville	Eshowe	Standerton			Vryburg	Malmesbury
Queenstown	Kroonstad	Centurion	Estcourt	Witbank				MosselBay
Uitenhage	Mangaung	Germiston	Graytown					Oudtshoom
Umtata	Maokeng	Heidelberg	Hawick					Saldanha
	Odendaalsrus	Kempton Park	Isipingo					Vredenburg
	Parys	Krugersdorp	Kokstad					Vredendal
	Phuthaditjhaba	Nigel	Ladysmith					Worcester
	Sasolburg	Randburg	New Germany					
	Thabong	Randfontein	Newcastle					
	Virginia	Roodepoort	Ningizimu					
	Welkom	Sandton	Pinetown					
		Soweto	Port Edward					
		Springs	Port Shepstone					
		Vanderbijlpark	Queensburgh					
		Vereeniging	Richards Bay					
			Stanger					
			Tongaat					
			Umhlanga					
			Verulam					
			Vryheid					
			Westville					

TABLE 8.14 **LEVEL 3 (SERVICE) ORIENTATION POINTS- RSA** **TABLE 8.14**

Eastern Cape	Free State	Gauteng	Kwazulu/ Natal	Mpumalanga	Northern Cape	Limpopo	North West	Western Cape
Burgersdorp	Bainsvlei	Akasia	Glencoe	Balfour	Colesburg	Ellisras	Brits	Bredasdorp
Butterworth	Frankfort	Bedfordview	Hluhluwe	Barberton	Douglas	Giyani	Christiana	Ceres
Fort Beaufort	Heilbron	Bekkersdal	Kingsburgh	Carolina	Keimoes	Messina	Fochville	Clanwilliam
Humansdorp	Henneman	Bronkhorstspruit	Kloof	Delmas	Postmasburg	Naboomspruit	Hartbeespoort	Grabouw
Port Alfred	Ladybrand	Davey1on	Marburg	Evander	Upington	Namakgale	Jan Kempdorp	Hermanus
Stutterheim	Reitz	Edenvale	Margate	Groblersdal	Warrenton	Nylstroom	Orkney	Knysna
Uitenhage	Senekal	Evaton	Mkuze	Kinross		Seshego	Schweizer-Reneke	Moorreesburg
	Thaba Nchu	Kagiso	Mooi River	Leandra		Thabazimbi	Stilfontein	Paarl
		Kwa-Thema	Nongoma	Lydenburg		Tzaneen	Ventersdorp	Piketberg
		Meyerton	Scottburgh	Marble Hall		Warmbaths	Zeerust	Plettenberg Bay
		Midrand	Ulundi	Piet Relief				Riversdale
		Modderfontein	Utrecht	Volksrust				Robertson
		Sebokeng	Uvongo	White River				Somerset-West
		Tembisa	Winkelspruit					Stellenbosch
		Vosloorus						Strand
		Westonaria						Swellendam
								Velddrif
								Wellington

TABLE 8.15 **LEVEL 4 (SERVICE) ORIENTATION POINTS RSA** **TABLE 8.15**

Eastern Cape	Free State	Gauteng	Kwazulu/ Natal	Mpumalanga	Northern Cape	Limpopo	North West	Western Cape
Aberdeen	Allanridge	Lenasia	Dannhauser	Belfast	Barkly-west	Duiwelskloof	Bloemhof	Ashton
Adelaide	Brandfort	Randvaal	Eston	Brey1en	Britstown	LebowaKgomo	Coligny	Bonnievale
Barkly-East	Bultfontein		Harding	Hectorspruit	Carnarvon		Delareyville	Brackenfell
Despatch	Hoopstad		Mandini	Komatipoort	Danielskuil		Koster	Darling
Elliot	Koffiefontein		Matatiele	KwaMhlanga	Kakamas		Leeudoringstad	De Doorns
Joubertina	Masilo		Munster	Malelane	Noupoort		Thembalethu	Durbanville
Kirkwood	Petsana		Richmond	Sable	Olifantshoek		Wolmaranstad	Franschhoek
Somerset-East	Phiritona		St Lucia	Trichardt	Port Nolloth			Goodwood
Venterstad	Phomolong		Umbogintwini	Waterval-Boven	Victoria West			Gordons Bay
Willowmore	Theunissen		Umtentweni					Grootbrakrivier
	Viljoenskroon		Umzinto North					Hartenbos
	Villiers		Umzinto					Heidelberg
	Vrede							Kleinmond
	Vredefort							Ladismith
	Wepener							Laingsburg
	Wesselsbron							Lambert's Bay
	Winburg							Langebaan
	Zastron							Mbekweni
								Mitchell's Plain
								Montagu
								Muizenburg
								Porterville
								Stilbaai
								Touws River
								Tulbach
								Vanrhynsdorp
								Villiersdorp
								Wolseley

TABLE 8.16 LEVEL 5 (SERVICE) ORIENTATION POINTS- RSA TABLE 8.16

Eastern Cape	Free State	Gauteng	Kwazulu/ Natal	Mpumalanga	Northern Cape	Limpopo	North West	Western Cape
Alexandria	Bethulie	Cullinan	Assagay	Amersfoort	Boichoko	Mahwelereng	Ipelegeng	Albertinia
Barkley-East	Boshoff	Magaliesburg	Bendigo	Amsterdam	Brandvlei	Marken	Makwassie	Barrydale
Bedford	Clarens	Munsieville	Bergville	Badplaas	Calvinia	Settlers	Ottosdal	Betty's Bay
Boesmansrivier-mond	Clocolan	Nancefield	Camperdown	Balmoral	Delportshoop	Tolwe	Reivilo	Bitterfontein
Cathcart	Deneysville	Rayton	Colenso	Clewer	Fraserburg	Tshipise	Sannieshof	Calitzdorp
Dordrecht	Dewetsdorp		Gillits	Graskop	Garies		Swartruggens	Citrusdal
Engcobo	Edenburg		Hambanati	Greylingstad	Griekwastad		Tshing	De Rust
Hankey	Edenville		Hibberdene	Hendrina	Groblershoop			Graafwater
Indwe	Excelsior		Hillcrest	Kaapmuiden	Hopelawn			Greyton
Jansenville	Fauresmith		Hilton	Kriel	Kenhardt			Hopefield
Kei Mouth	Fouriesburg		Ixopo	Machadodorp	Loeriesfontein			Klawer
Keiskammahoek	Hertzogville		Melmoth	Mashishing	Marydale			Lingelethu
Kenton-on-Sea	Hobhouse		Mtubatuba	Montrose	Nonzwakazi			Murraysburg
Kirkwood	Jacobsdal		Mtunzini	Ogies	Paballelo			Napier
Klipplaat	Jagersfontein		Paulpietersburg	Ohrigstad	Petrusville			Onrusrivier
Komga	Kestell		Pennington	Phola	Philipstown			Prince Alfred
Lady Grey	Koppies		Pongola	Pilgrims Rest	Pofadder			Prince Alfred Hamlet
Lusikisiki	Lindley		Ramsgate	Siyabuswa	Richmond			Riviersonderend
Maclear	Marquard		Shelly Beach	Wakkerstroom	Ritchie			St Helena Bay
Molteno	Matwabeng		Sobantu		Strydenberg			Stanford
Mount Frere	Memel		Steadville		Sutherland			
Pearston	Namahadi		Umdloti Beach		Vander Kloof			
Peddie	Paul Roux		Umkomaas		Williston			
Port St Johns	Petrus Steyn		Weenen					
Seymour	Petrusburg		Yellow Wood Park					
Sterkstroom	Philipolis							
Steynsburg	Rammulotsi							
Steytlerville	Reddersburg							
Tarkastad	Rouxville							
Ugie	Smithfield							
	Springfontein							
	Steynsrus							
	Tembalihle							
	Trompsburg							
	Tweeling							
	Tweespruit							
	Ventersburg							
	Warden							

TABLE 8.17 LEVEL 6 (SERVICE) ORIENTATION POINTS - RSA TABLE 8.17

Eastern Cape	Free State	Gauteng	Kwazulu/ Natal	Mpumalanga	Northern Cape	Limpopo	North West	Western Cape
Addo	Arlington	Bapsfontein	Ashburton	Burgersfort	Andriesvale	Alldays	Amalia	Agulhas
Alicedale	Cornelia	Devon	Blythedale	Chrissiesmeer	Campbell	Baltimore	Bray	Atlantis
Ann's Villa	Dealesville	Ennerdale	Bothas Hill	Dullstroom	Hanover	Dendron	Broederstroom	Aurora
Baroe	Kransfontein	Hammanskraal	Canelands	Hazyview	Hotazel	Gravelotte	Derby	Avontuur
Bathurst	Luckoff		Cato Ridge	Karino	Kamieskroon	Haenertsburg	HartbeesfonteinDoringbos	
Cofimvaba	Oranjeville		Cedarville	Morgenzon	Kathu	Hoedspruit	Lykso	Eendekuil
Cookhouse	Rosendal		Creighton	Stoffberg	Kleinsee	Klaserie	Ottoshoop	Eerste Rivier
Flagstaff	Soutpan		Dalton	Van Dyksdrif	Kraankuil	Letsitele	Pie!Plessis	Gansbaai
Hamburg	Van Stadensrus		Darnall		Lime Acres	Mica	Stella	Gouda
Hofmeyer	Verkeerdevlei		Drummond		Loxton	Northam	Taung	Groot Drakenstein
Hogsback	Verkykerskop		Everton		Lutzville	Roedtan	Vergelee	Herbertsdale
Idutywa			Gingindlovu		Mata-Mata	Soekmekaar		Herolds Bay
Jamestown			Hattinghspruit		Matsap	Vivo		Hotagterklip
Kareedouw			Himeville		Middelpos			Hottentotskloof
KeiRoad			Illovo		Mount Rupert			Khayelitsha
Klipfontein			Kranskop		Nieuwoudtville			Klaarstroom
Magusheni			Mariaanhill		Onseepkans			Klipheuwel
Middledrift			Marina Beach		Sakrivier			Koringberg
Mount Ayliff			Mount Michael		Schmidtsdrif			Kraaifontein
Mount Fletcher			Mpolweni		Steinkopf			Leeu-Gamka
Nieu-Bethesda			Saicor		Three Sisters			Matjiesfontein
Patensie			Southbroom		Twee Rivieren			McGregor
Paterson			Talana		Van Wyksvlei			Nuwerus
Qumbu			Umhlali		Vosburg			Port Beaufort
Riebeeck-East			Underberg		Windsorton Road			Prince Albert
Sada			Wartburg					Prince Albert Road
Spitskopvlei			Widenham					Rawsonville
St Francis Bay			Winterton					Riebeeck-Castle
Sterkspruit			Zinkwazi					Riebeeck-West
Whittlesea								Sedgefield
Wolwefontein								Stormsvlei
								Strandfontein
								Struisbaai
								Suurbraak
								Uniondale
								Van Wyksdorp
								Voorspoed
								Wemmershoek

TABLE 8.18 NO LEVEL ALLOCATED ORIENTATION POINTS - RSA TABLE 8.18

Eastern Cape	Free State	Gauteng	Kwazulu/ Natal	Mpumalanga	Northern Cape	Limpopo	NorthWest	Western Cape
Alice	Vegkop			Hekpoort	Babanango	Crocodile		Cango Caves
					Orpen Gate	Mabopane		
				Bridge Gate				
Coega								Kuilsrivier
Kidds Beach		Walkerville	Balgowan	Malelane Gate		Pafuri Gate	Pudimore	Waenhuiskrans
Lady Frere			Bulwer	NumbiGate		Paul Kruger Gate	Sun City	Yzerfontein
Mqanduli			Inchanga	Roossenekal		Phalaborwa Gate		
			Lions River			Punda Maria Gate		
Ngqeleni			Midmar					
Rhodes			Notthingham Road					
Willowvale			Park Rynie					
Tsole								
			Rosetta					
			Umlaas Road					

TABLE8.19 BORDER POST ORIENTATION POINTS- RSA TABLE 8.19

Botswana	Lesotho	Mozambique	Namibia	Swaziland	Zimbabwe
Bray	Maseru Bridge	Lebombo	Nakop	Border Gate	Beit Bridge
Groblersbrug	Van Rooyenshek	Ressano Garcia	Vioolsdrif	Jeppe's Reef	
Pioneer Gate				Mahamba Border Post	
Pontdrif				Nerston	
Stockpoort				Oshoek	
Werda					
Zanzibar Border Port					

1	2	3	4	5	6	7	8
Orientation Place Name	Orientation Point Category	Junction Routes	Distances km	Basic Classification	To be up-graded?		FINAL CLASSIFICATION
					Distance Criteria	I/S Route Criteria	
Pretoria	LEVEL 1	N1, R21, R28		Familiar	N/A	N/A	FAMILIAR
Bronkhorstspruit	LEVEL 3	R25, R42	57	Service	No	No	SERVICE
Balmoral	LEVEL 5	R545, R104	24	Service	No	No	SERVICE
Witbank	LEVEL 2	N12, R544, R555	24	Control	No	Yes	FAMILIAR
Middelburg	LEVEL 2	N11, R35, R555	32	Control	No	Yes	FAMILIAR
	National Class A1 and A2		45				
	National Class B						
Belfast	LEVEL 4	R33, R540	77	Service	No	No	SERVICE
Machadodorp	LEVEL 5	R36, R541	22	Service	No	No	SERVICE
Waterval Boven	LEVEL 4	-	13	Service	No	No	SERVICE
Montrose	LEVEL 5	R539	65	Service	No	No	SERVICE
Nelspruit	LEVEL 1	R37, R40	31	Familiar	N/A	N/A	FAMILIAR
Karino	LEVEL 6	R538	39	Service	No	No	SERVICE
Kaapmuiden	LEVEL 5	R38	26	Service	No	No	SERVICE
Malelane	LEVEL 4	R570	19	Service	No	No	SERVICE
Hectorspruit	LEVEL 4	-	18	Service	No	No	SERVICE
Komatipoort	LEVEL 4	R571	26	Service	No	No	SERVICE
Lebombo	LEVEL 2	-	3	Control	*Border Post		CONTROL
Maputo	LEVEL 1	-		Familiar	N/A	N/A	FAMILIAR

Fig 8.3 Example of Destination Selection for a Rural National Route

(Continued from page 8.6.1)

10 Similarly evaluate the intersecting route criteria for possible upgrading (Yes/No) (Figure 8.3- Column 7).

11 Bearing in mind the recommendations of paragraph 8.5.3.5 the **FINAL ORIENTATION LEVEL CLASSIFICATION**, i.e. FAMILIAR, CONTROL or SERVICE is entered in the last Column (Figure 8.3 - Column 8). It is upon these classifications that the destinations appearing on the directions will be established.

12 The destinations to appear on the DIRECTION signs at the interchange and intersections can now be determined. As a rule, only FAMILIAR destinations are shown on these signs. Should a roads authority wish, a policy of showing CONTROL destinations on lower class roads may be implemented.

13 Examples of destinations to be displayed at various intersections on the N4 are as follows:

(a) interchange R25 with N4 at Bronkhorstspruit: eastbound - Witbank; westbound - Pretoria;

(b) intersection R36 at Machadodorp: eastbound - Nelspruit; westbound - Middelburg;

(c) intersection R38 at Kaapmuiden: eastbound - Maputo; westbound - Nelspruit.

14 The use of CONFIRMATION signs has a two-fold function. It enables the display of CONTROL and SERVICE destinations, simultaneously indicating to the motorists the travelling distances involved. The CONFIRMATION signs on the route should display the next "Service", and either the next "Control" or the next "Familiar" destination, depending on the policy adopted, together with the distances to them. The FIRST CONFIRMATION sign following an orientation point used as a destination, or following a junction with a route classified as an equal or a higher order route, should display the next Service destination, and either the next Control or Familiar destination, as well as the last Familiar destination on the route (if this is not already displayed) and the distances to them. For example in this case when departing from Nelspruit in the direction of Pretoria the FIRST CONFIRMATION sign shall display:

Next Service destination	:Montrose	31
Next Control destination	:Middelburg	*222*
Last Familiar destination	:Pretoria	333

Subsequent CONFIRMATION signs at 10 km intervals shall only display the next Service, and either the next Control or Familiar destination. These signs should be positioned in such a way that the distance to the Service destination is in multiples of 10 km, for example:

	N4
Montrose	20
Middleburg*	211

*In this case there is no subsequent CONTROL destination so that Middelburg has to be used

15 **Care must be taken to ensure that once a destination is shown on any guidance sign, that the destination is repeated and carried through on all relevant successive signs until that destination is reached.**

16 Subsections 4.8.7 and 4.9.17 deal with the display and location of CONFIRMATION signs. Notwithstanding the recommendations in these subsections the following policy with respect to CONFIRMATION signs are suggested:

(a) confirmation signs shall show two destinations, except after Systems Interchanges and major route intersections, when there shall be three destinations. In addition a three destination display may be provided at 100 km intervals;

(b) the top destination shall be the next orientation point (regardless of classification);

(c) the bottom destination shall be the first destination of the next higher orientation classification. Simply put a CONFIRMATION sign display will normally show the following:

Service Control	or	Service Familiar
Control Familiar	or	Familiar Familiar

The second destination shall never be of a lower orientation classification than the first (upper) destination.

8.6.5 South Africa – Rural Destination Selection- Junction Procedure

1 At certain junctions, or splits of primary routes it will be necessary to display two orientation points for each leg of the junction, with the proviso that sufficient space is available on the signs. The first orientation name for each leg must be that name derived in the manner described in Subsection 8.5.4, while the second name must be the next familiar orientation point for that particular leg as given in Table 8.12.

2 As an example, the junction between the N1 and N9 National Routes at Colesberg may be considered. Travelling in a southbound direction the following destination selection for display on direction signs at this junction is appropriate:

(a) the N11eg should firstly display "Beaufort West", as a control destination, together with the route number "N1", (this is derived from the described procedure); the second destination to be shown on signs for the N1 leg is "Cape Town", which is the next Basic FAMILIAR orientation point on that route as given in Table 8.12;

(b) the N9 leg should firstly display "Middelburg", as a control destination, together with the route number "N9" (this is derived in the described procedure); the second destination to be shown on signs for the N91eg is "Port Elizabeth", together with the "(N10)" indirect route number, because the N10 continues from Middelburg in the general direction of Port Elizabeth, while the N9 continues towards Graaff Reneit (the N10 route does not terminate in Port Elizabeth, but at a distance of approximately 25 kilometres to the east of Port Elizabeth on the N2 it is not considered necessary to indicate the (N2) on the signs at this point).

(c) the above amount of information falls within the maximum number of "bits" allowed;

(d) the first confirmation sign on the N1 route beyond the junction should show the following:

N1

Hanover	72
Beaufort West	242
Cape Town	778

While the **next** confirmation on the N should show:

N1

Hanover	60
Beaufort West	230

(e) the **first** confirmation sign on the N9 route beyond the junction should show the following :

N9

Noupoort	55
Middelburg	96
(N10) Port Elizabeth	453

Due to the route configuration, a **second** confirmation sign may be positioned on this route showing:

N9

Graaff Reniet	202
Geaorge	544

8.6.6 South Africa - Destination Selection for National Freeways in Metropolitan Areas

1 The prescribed procedure shall also be followed for the selection of destinations on National Route freeways in metropolitan areas as these routes may be regarded as long distance routes which continue through, or "by-pass" these areas. At certain interchanges on such routes it is required that the next FAMILIAR orientation point, as given in Table 8.12 also be shown together with the selected control destinations, with the proviso that the maximum allowable amount of information on individual signs is not exceeded. In cases where the allowable maximum amount of information on signs will be exceeded, the selected control destinations for particular routes shall be omitted, and only the FAMILIAR destinations shall be shown (together with the standard interchange/route information).

2 As an example, the junction between the N3 and N12 National Routes to the east of Johannesburg may be considered:

(a) travelling in a westerly direction, towards Johannesburg, destinations for three routes, or directions, beyond the interchange have to be considered for display on overhead signs; these routes are:

- N3- north
- N3- south and the N 2- south
- R24- west;

(b) the candidate destinations to be shown are the following:

- N3- north:	Sandton
	(N1) Midrand
	(NI) Pretoria
- N3- south:	Alberton (N3)
	Heidelberg (N3)
	Durban (N3)
	(M2) Johannesburg (N3)
- N12- south:	(R26) Vereniging (N12)
	Soweto (N12)
	((N1) Kroonstad (N12)
	(N1) Bloemfontein (N12)
	Potchefstroom (N12)
	Kimberley (N12)
R24 - west	Johannesburg

(c) the requirements clearly exceed by far the available space, and the maximum allowable amount of information; even in selecting only the most needed destinations to be shown, together with other essential information (arrows, distance, route and interchange exit numbers) it is difficult to keep within the required limits (see paragraph 8.6.6.2(d));

(d) in this case it is clear that the derived destinations (including amongst others Heidelberg, Kroonstad and Potchefstroom) will have to be omitted, and ONLY familiar or LEVEL 1 destinations indicated; the destinations to be shown should, therefore, be as follows:

- N3- north:	(N1) Pretoria
- N3 and N2 south:	Durban
	(M2) Johannesburg
	Soweto
	(N1) Bloemfontein
	Kimberley
- R24:	Johannesburg,

(This is still somewhat in excess of the required maximum.)

(e) confirmation signs, preferably not more than two, may, however be provided on each of the routes leaving the interchange, on which the distances to the destinations which were omitted, may be shown.

3 The above example serves to illustrate that if the prescribed procedure of selecting only one destination per junction leg from LEVEL 2 or 3 destinations, insufficient information would have been provided to adequately serve as orientation information.

8.6.7 South Africa - The Selection of Destinations at Smaller Urban Areas and Towns which are By-passed by Freeways

1 When a Class A road, or freeway, by-passes a smaller urban area or town, the type of signface display on the freeway will need to be chosen, i.e. rural signface layout or urban signface layout. Since there are a number of established rules of signface layout, some of which have been described in earlier subsections, certain existing factors will dictate whether the signface treatment should be rural or urban. These factors include:

(a) wether the roads intersecting the freeway have already been allocated street names;
(b) the proximity of the freeway to the urban area;
(c) the number of interchanges serving the urban area.

2 When a smaller urban area or town is by-passed by a freeway, and the roads which intersect the freeway, and give access to the urban area, have been allocated street names, the freeway signs shall be designed according to the urban signface design principles. This

requires the inclusion of the town name in a panel at the top of the signs, next to the interchange/exit number, and the use of the street name, in addition to any allocated route number, as the first exit "destination". "CBD" symbol GDS - 8 should precede the most appropriate street name (or only street name in the case of a single access). In addition the name of a destination which can be reached using the crossroad in question, in the opposite direction to the town, should be given. The selection of this destination should be according to normal rural destination selection principles, as applicable to the intersecting crossroad.

3 When a smaller urban area or town is by-passed by a freeway, and the freeway is close to the town, the freeway signs may be designed according to either urban signface design principles or rural signface design principles. In the context stated, "close" can be considered to be in a range between one kilometre and 10 kilometres. The closer the freeway is to the town, the more appropriate, and likely, the use of an urban signface treatment should be. If development of the urban area is likely to move up to, and/or even be stimulated on the outer side of the freeway (this is a common result of the construction of by-passing freeways), then the use of urban signface design principles is recommended. This may require a request to the local authority to name the relevant street, or streets, giving access to the town. In the same manner as described in paragraph 8.6.7.2, "CBD" symbol GDS -8 and the name of a destination which can be reached using the crossroad in question, in the opposite direction to the town, should be given in addition to the normal urban information.

4 If prevailing or planned conditions indicate that the freeway/town environment is likely to be a rural one for the life of the freeway signs (7 to 10 years), then the manner of freeway signface design shall be according to rural signface principles. Exactly how this is achieved will depend on the number of inter- changes which provide access to the town. The information on the signfaces shall include the inter- change/exit number, any route number allocated to the crossing road, and at least two orientational destination names, one to the right of the freeway and one to the left of the freeway. The following procedure is recommended regarding the indication of the town name as one of these orientational destinations, according to the number of intersecting roads which give access to the town :

(a) when only ONE interchange on the freeway gives access, the signs shall be designed according to rural signface design principles;

(b) when TWO interchanges on the freeway provide access to the town, the name of the town will appear at both interchanges; in order to improve the quality of the orientation provided under these circumstances, the cardinal or "compass" area of the town reached from each interchange shall be indicated, after the town name in capital letters and within brackets, e.g. Howick (NORTH) and Howick (SOUTH);

(c) when THREE interchanges on the freeway provide access to the town, the name of the town will appear at all three interchanges; in order to improve the quality of the orientation provided under these circumstances, the cardinal or "compass" area of the town reached from the two "outer" interchanges shall be indicated, after the town name in capital letters and within brackets, e.g. Mossel Bay (EAST) and Mossel Bay (WEST); if the central interchange serves the central business area of the town then the "CBD" symbol GDS- 8 should precede the town name on the signs for this interchange, OR this interchange should be signed according to urban signface design principles, including the use of "CBD" symbol with the relevant street name.

5 If the geographical layout of a town served by three interchanges does not suit the signing described in paragraph 8.6.7.4(c), or the town is served by more than three interchanges, urban signface design principles shall be used, after the allocation of street names to the relevant roads by the local authority.

8.6.8 South Africa - Destination Display

1 Full details of the rules relating to destination display on guidance signs are covered in Chapter 4, Sections 4.1 to 4.4, as well as in the individual sign type Subsections of Chapter 4.

2 In general, only destinations on or near the optimum route should be displayed for that route. A destination not served by the optimum route should only be dis- played if treated as a trailblazer or "indirect• display. Only the actual route number by which the destination can ultimately be reached should be treated as an "indirect" component. In this context it should appear on the sign face in brackets. TRAILBLAZER signs and trailblazing information are covered more fully in Sections 4.7 to 4.9.

3 As rural roads continue through, or by-pass non metropolitan urban areas it is necessary that the derived "ideal" primary guidance signing system be communicated to these affected authorities. A procedure should be adopted and whereby urban authorities, the Auto- mobile Association, Tourism Board, Regional Development Associations etc. discuss and agree to guidance signing proposals, according to the principles, and where necessary contribute to the development of the Motorist Information System. Formal acceptance of the proposals by urban authorities is essential.

8.6.9 Namibia- Destination Tables

1 Tables 8.20 to 8.23 show the Namibian destination classification resulting from a similar destination selection process to that described in the paragraphs above for South Africa.

2 This selection process, and the tabulation of the destinations, enables any road authority or their agent (a consulting engineer for example) to prepare correctly designed direction signs for any node or intersection in the Namibian road network.

TABLE 8.20 LEVEL 1 (FAMILIAR) DESTINATIONS- Nam TABLE8.20

Ariamsvlei	Keetmanshoop	Noordoewer	Otjiwarongo	Tsumeb
Ecnhana	Luderitz	Opuwo	Rundu	Uutapi
Gobabis	Mariental	Oshakati	Swakopmund	Walvis Bay
Katima Mulilo	Ngoma	Oshikango	Trans-Kalahari	Wndhoek

TABLE 8.21 LEVEL 2 (CONTROL) DESTINATIONS- Nam TABLE 8.21

Aranos	Henties Bay	MaltahOha	Omaruru	Terrace Bay
Aroab	Hohlweg	Mala Mata	Ondangwa	Tsumkwe
Aus	Kalkrand	Mohembo	Oranjemund	Uis
Bethanien	Kamanjab	Namutoni	Otavi	Usakos
Divundu	Karasburg	Okahandja	Outjo	Velloorsdrif
Gansvlei	Karibib	Okahao	Rehoboth	Walvis Bay Airport
GrOnau	Khorixas	Okakarara	Rosh Pinah	Wenela
Grootfontein	Klein Manassa	Okaukuejo	Ruacana	Husea Kutako Airport
Helmeringhausen	Leonardville	Omahenene	Sendelingsdrif	

TABLE 8.22 LEVEL 3 (SERVICE) DESTINATIONS - Nam TABLE8.22

Ai-Ais	Epukiro	Nkurenkuru	Oshivelo	Sukses
Aminuis	Gibeon	Ogongo	Otjinene	Tsandi
Arandis	Goageb	Okalongo	Palmwag	Uhlenhorst
Asab	Gochas	Okamatapati	Rietoog	Witvlei
Berseba	Hochfeld	Omafo-Engela	Schlip	
Bukalo	Kombat	Onesi	Sesfontein	
BOIIspoort	Kongola	Ongandjera	Sesriem	
Dordabis	Mukwe	Ongwediva	Solitaire	
Drimiopsis	Mururani	Oshikuku	Stampriet	

TABLE 8.23 NO LEVEL ALLOCATED (LOCAL) DESTINATIONS- Nam TABLE 8.23

Aasvoelnes	Kaisosi	Nakayale	Omeege	Rietfontein
Abenab	Kalembesa	Nauta	Omega	Sangwali
Andara	Kaliangile	Ncamakora	Omitara	Seeheim
Aris	Kalkfeld	Ncaute	Ompundja	Sesheke
Bagani	Kaoko Otavi	Ndonga	Omungwelume	Shamundambo
Biro	Kasese	Nepara	Onaanda	Sheetekela
Cape Cross	Katima Mulilo Airport	Nhoma	Onamundini	Shiguru
Chetto	Katungu	Nyangana	Onathinge	Shinyungwo
Chinchimane	Kayaru	Nyonda	Onayena	Shitemo
Coblenz	Kayengona	Ohalngu	Onderombapa	Sibinda
Dobra	Klein Aub	Ohakafiya	Ondimbwa	Sigeretti
Elago	Koes	Oilyateko	Ondobe	Silenge
Elim	Kongongo	Okambebe	Onelago	Siongo
Elundu	Kosheshe	Okanjengedi	Ongenga	Steinhausen
Endola	Kosis	Okankolo	Ongongo	Summerdown
Epembe	Kubona	Okatana	Oniipa	Tallsmanis
Etanga	Kuseka	Okatope	Oshifo	Tavauka
Eunda	Linyandi	Okatuwa	Oshikwiyu	Tjeye
Gam	Lisauli	Okaulukwa	Othijanjasemo	Terra Bay
Goanikontes	Luhebu	Okombahe	Otjimbingwe	Tses
Gove	Lusese	Okondjatu	Otjitanda	Tsintsabis
Groot Aub	Matushe	Okongo	Otjituuo	Utokota
Gross Barmen	Makena	Okovimburu	Otjiyarwa	Uukango
Guma	Mashari	Ombathi	Otjondeka	Vungu Vungu
Hardap	Mayara	Ombombo	Otjosondu	Warmbad
Helena	Mile 108		Otumborombonga	Wilhelstal
Hoachanas	Mile 14		Ozondje	Wlotzkabaken
Holoog	Mile 68			
lipandayamite	Mile72			
liwiyongo	Mpungu			
Jakkalsputz	Mukuvi			

SOUTHERN

AFRICAN

DEVELOPMENT

COMMUNITY

VARIABLE MESSAGE SIGNS

SECTIONS

MAY 2012

SADC RTSM - VOL1

CHAPTER 9

CHAPTER 9: VARIABLE MESSAGE SIGNS

9.1 INTRODUCTION

9.1.1 General

1 The growing traffic congestion on sections of the road network, in combination with its ever-increasing complexity, requires that road authorities consider special management methods to control and optimise the use of the network. Such needs may exist in major metropolitan areas, on by-passes or on rural sections of roadway during peak holiday seasons.

2 Variable message road traffic signs may be used as a component of a Road Traffic and Safety Management System. The type of sign covered by the description VARIABLE MESSAGE SIGN varies extremely widely, from the well-known STOP/GO sign R1.5A/R1.5B, which is manually operated, to highly sophisticated, computer operated, gantry mounted fibre optic signs which offer the option of many different messages.

3 Economic considerations are often such that funding cannot be made available to build new roads. It becomes necessary as congestion develops that the best possible utilization is achieved from the road space available. In addition this will limit the environmental impact of a growing road network, and in cases where land is scarce, will allow a wider range of land use activities.

4 VARIABLE MESSAGE SIGNS can play an important role in the safe optimization of available road space whether it is in and around our cities, or on other sections of the network subject to operational break- downs due to bad weather, accidents or maintenance activities. In assessing the need for major variable message sign installations the economic considerations of not doing so must be thoroughly investigated. Roads, and in particular freeways, represent a major capital investment and the best return on this investment should be achieved.

5 Safety is undeniably of paramount importance, but although safety is obviously important from the point of view of relieving human suffering in the form of accidents, it also has major economic implications. On a national scale accidents and congestion cost vast sums of money. These costs occur in the form of damage to vehicles and public utilities and in hospitalisation, and in lengthy delays to thousands of people at a time. The less direct costs involved in providing emergency, ambulance, tow-away services and emergency traffic control together with the cost of administrative overheads add significantly to the national cost. Road traffic and safety management techniques aimed at reducing these costs are likely to produce worthwhile returns on the investment involved.

6 The harmonizing and stabilizing of traffic speed are vital factors in road safety. Harmonising traffic speed will increase the dynamic capacity of a roadway significantly and this is particularly important when the static capacity of the roadway has been reduced as a result of a lane closure due to an accident or roadworks. Drivers instinctively adjust their speed under adverse conditions. They will, however be unaware of conditions three or four kilometres ahead of them. If those conditions become unstable drivers are not able to react so as to maintain harmonious flow conditions. If a traffic control management system is provided, however, advice can be given remote from the site of an incident location, which will allow harmonious flow conditions to be maintained.

7 As a general example, due to reduced headways required, a reduction in running speed by some 35% could result in 150% more capacity on a given section of roadway.

9.1.2 Objectives of VMS

1 The introduction of VARIABLE MESSAGE SIGNS should be aimed at achieving one, or more, of the objectives listed in the following paragraphs.

2 The primary objective should be greater safety, achieved by:

(a) reducing the risk of primary accidents;
(b) giving advance warning of conditions which may result in traffic queues so that the increased likelihood of secondary accidents is reduced.

3 The next major objective should be better utilization of road capacity and therefore a reduction in the cost of congestion by:

(a) distributing traffic more evenly in the road network;
(b) achieving stable traffic flow conditions;
(c) avoiding localised congestion resulting in long delays.

4 It should also be an objective to make the task of the police, road construction units and other authorities responsible for the safe use of the roadway easier by:

(a) providing the means for rapid and effective action for incident management;
(b) offering aids which will enable roadworks to be carried out more quickly and efficiently.

5 In addition when a sophisticated system is under consideration it should be designed to collect traffic data with the objective of:

(a) facilitating an assessment of the state of the system;
(b) using the data to assist decision-making in order to optimize use of the system;
(c) developing new strategies which can be used to amplify the system at a later date.

6 The achievement of these objectives will best be realised by designing the system to provide one or more of the following:

(a) a facility for advising a constant (normally reduced) speed in special circumstances e.g.. mist, fog, accident;
(b) detection of disruptions in traffic flow and translating this into warnings to reduce speeds;
(c) adequate warning of changes in road situation e.g. roadworks, maintenance etc.;
(d) the use of the system to close off a lane simply and clearly with the emphasis on simplicity and speed;
(e) by making it possible for the police to close a lane

and/or introduce speed controls in the event of an accident;

(f) a flexible system of data collection and recording which allows for all forms of data to be collected simultaneously at a large number of points.

9.1.3 Applications for VMS

1 The number of applications for VARIABLE MESSAGE SIGNS in the traffic and transportation field is constantly growing. Typical of current applications are the following:

(a) hazard warning;
(b) speed regulation or advice;
(c) specific vehicle routing (including bus lanes);
(d) alternative routing;
(e) road construction and maintenance;
(f) lane control and reversal of lane use;
(g) parking availability;
(h) transport terminal information, both externally and internally.

2 Collectively these applications may be considered to come under the general description of Road Traffic and Safety Management Systems.

9.1.4 Types of VMS

1 The range of VARIABLE MESSAGE SIGN types is large. A number of examples of basic types are illustrated in Figures 9.1 and 9.2.The range in sophistication is also large and this is a factor which makes the selection of the most appropriate type for a specific task difficult. Ultimately the final decision is likely to be based on economic considerations and the more ex- pensive installations must only be chosen after a comprehensive cost benefit analysis has been carried out. Due to the lack of direct Southern African experience of VMS's, it is likely that pilot projects will be required over a number of years to determine the ideal parameters for a comprehensive variable message sign traffic management system.

2 The sign types listed below will be covered in more detail in subsequent Subsections. The more commonly used types of variable message sign, from the simplest to the most complex, are:

(a) manually operated (light reflecting) - Figure 9.1:

(i) rotating sign on a stand or easel such as the STOP/GO sign R1.5A/R1.5B;

(ii) flip sign;

(iii) hanging or clamped message;

(b) electro-mechanical involving moving parts (light reflecting) - Figure 9.1:

(i) various combinations of roller blind or belt;

(ii) different arrangements of rigid plates;

(iii) rotating plank or prism;

(iv) matrix with rotating discs *(lamella);*

(c) electrical or electronic with no moving parts (or a very limited number) (light emitting) - Figure 9.2:

(i) matrix of illuminated bulbs;

(ii) matrix of fibre-optic cones.

3 This volume does not cover details of the electrical characteristics of various types of variable message sign, however, a specific problem may relate to the use of such signs. The option to have a mains electricity supply in a rural situation will often not exist or will be prohibitively expensive. Considerable technological advances are occurring in the use of solar energy panels to maintain battery operated systems for long periods of time. Alternatively signs may be trailer mounted in conjunction with a portable generator. The possibility of using such power sources should be investigated in respect of potential rural installations.

9.1.5 VMS: Message Types

1 VARIABLE MESSAGE SIGNS may be used to transfer any of the traditional road traffic sign message types, namely:

(a) regulatory;

(b) warning;

(c) guidance;

(d) information.

9.1.6 Colour Code for VMS

1 Variable message sign types which do not require internal illumination can operate within the standard road traffic sign colour code without any difficulty.

2 Light emitting or internally illuminated electrical or electronic signs which are most likely to be of the matrix type, can, with existing levels of technology, illustrate symbols and text with acceptable legibility. However, the ability to provide a fully illuminated regulatory or warning sign background in WHITE, or BLUE for a PERMANENT sign or YELLOW for a TEMPORARY sign, in conformity with the Southern African road traffic sign colour code, whilst technologically possible, requires high electrical power levels. This requirement would, at present, rule out the use of battery or solar power, and if provided from a mains supply would be extremely costly.

3 In the interests of safety, and because of the conspicuity effectiveness of red at long range, the RED border shall be retained for circular PROHIBITION signs and triangular WARNING signs, when it is intended to enforce the prohibition message. If it is not intended to enforce such a message, the message should be given in an advisory manner as a text message commonly in association with a triangular warning sign indicating the reason for the advisory message. For practical considerations, however, all internally illuminated electrical or electronic variable message signs may use a WHITE or YELLOW symbol or text on a BLACK background.

4 Examples of regulatory, warning and advisory messages are given in Figure 9.3.1. Detail 9.3.1 illustrates two stages of a typical gantry mounted lane control VMS. These stages would normally be preceded by a default indication showing 80 km/h over all lanes, or, alternatively, a downward pointing arrow over each lane.

9.17 Manually Operated VMS

1 In order to realise the benefits of variable message signing in as many situations as possible the use of properly designed manually operated signs is recom-

mended. In fact, if some warning or guidance message is not applicable at all times at a specific site an inexpensive manually operated sign should be used. The initial cost of such signs is unlikely to exceed two or three times the cost of a conventional warning (or regulatory) sign, however, there is a manpower requirement in seeing that the correct message is displayed at all times.

2 It is pointless utilizing a variable message sign if it is not going to be used properly. Road users will quickly notice if a sign is displaying the incorrect message and will ignore it on subsequent viewings, perhaps with extremely serious consequences. This in turn will bring the whole road traffic signing system into disrepute.

3 Typical examples of manually operated variable message signs, which may commonly include as one of their two or perhaps three messages, a "NIL" message or blank signface, are :

(a) the STOP/GO sign R1.5AIR1.5B;

(b) various warning signs which ONLY have a temporary application, such as TRAFFIC CONTROL AHEAD sign TW304, SCHOLAR PATROL AHEAD sign TW305, ROADWORKS sign TW336, which may for reasons of convenience be permanently erected but displayed for a limited time, should therefore, when not relevant, have their message hidden leaving a blank sign face;

(c) this same technique may be used with certain SELECTIVE RESTRICTION signs which are applicable only for certain times of the day;

(d) some warning signs which have a "handed" message may be easily converted from a "left" side message to a "right" side message e.g. SURFACE STEP signs TW340 and TW341;

(e) combination warning and advisory messages, where the manual changing of a range of advisory messages may be expected. (The reason for the need for caution e.g., smoke, fog, flooding, etc., can be linked to an appropriate advisory speed, and perhaps the distance for which the condition may be expected can also be indicated.).

4 Examples of manually operated variable message signs are included in Figure 9.1. (See Section 9.2 for dimensional requirements).

5 Although such signs are simple in their operation it is recommended that in the case of the type covered in paragraph 9.1.7.3(e) a log of the number of alterations to the sign be kept. This data will be useful in justifying a decision to upgrade the sign to a more costly but more automated system.

9.1.8 Electromechanical VMS

1 Variable message signs of this type allow a wider variation in available messages from one sign face. The roller blind or be. could display a wide range of messages provided there is sufficient space to allow a long roller or be to be accommodated. Such a situation could be cost-effective at a toll plaza where segregation of vehicles by toll-class may be necessary. Normally if used at the roadside the number of messages will be limited to two or three, one of which may be a blank display.

2 Rigid plate, rotating shutter and rotating plank or prism signs are all likely to have a limitation on the range of messages. If the requirement is for a limited display these types may be cost effective. These signs will normally also have a manual override capacity in case of a loss of power.

3 As the technology develops the use of matrices comprising two-state (bi-stable) display elements known as the" *lamella* technique" will become more attractive for road traffic sign messages. Each individual element in the matrix is electronically separately controlled. A short current impulse of about 350 ms is sufficient to turn the *"lamellas•* or discs. A very wide range of messages is possible and later developments with up to four faces per element may allow full colour display. Such systems have to be computer controlled and are extremely expensive on a unit rate (per m^2) basis. However, with greater use, costs may come down to the extent that this sign type becomes cost effective. The sign type is widely used in USA and Canada, and in advertising.

4 Even in a normal environment this group of signs is likely to require regular maintenance. The ingress of water, dust or other foreign matter can cause break- down due to the often small spatial clearance between elements.

5 Manually operated and electromechanical variable message signs are light reflecting signs. As such they shall conform to the daytime luminance and night-time luminous Intensity requirements laid down for standard signs.

9.1.9 Electrical or Electronic VMS

1 This type of variable message sign may be used for individual regulatory, warning or guidance signs, or for combinations of these categories of sign. Electrically or electronically operated matrices are most commonly used in comprehensive and dynamic real-time Road Traffic and Safety Management Systems.

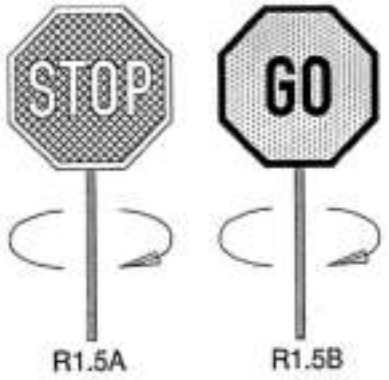
2 Technological advances in light emitting components are tending to result in the replacement of matrices using illuminated bulbs by matrices using fibre-optics or LED's (light emitting diodes). The image definition achieved using fibre-optics or LED's and the luminous intensity of the display make these types of variable message sign extremely effective in all-weather conditions.

3 Examples of typical electrical and electronic sign matrices are illustrated in Figure 9.2, 9.4, 9.5 and 9.7.

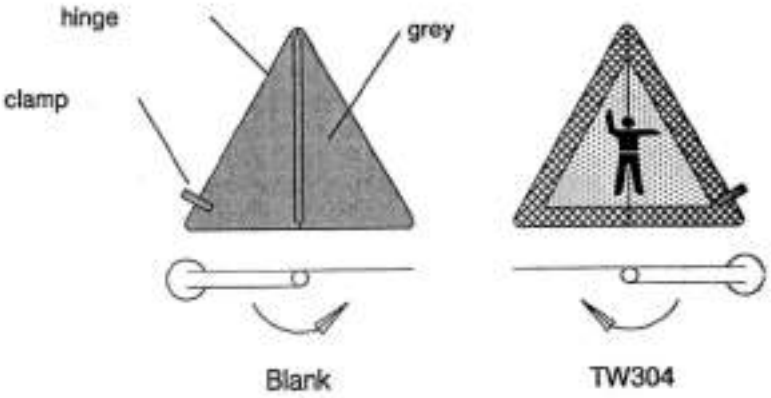
4 The cost of electronic fibre-optic or LED signs is likely to be high, however, they are extremely reliable and relatively maintenance free. These characteristics may make them cost effective for relatively small installations.

5 Due to the high level of reliability and the common practice of providing duplicate light sources and partial operation, electronic systems can be designed which are extremely safe in that system security can be built in to give default modes of operation and battery power back-up.

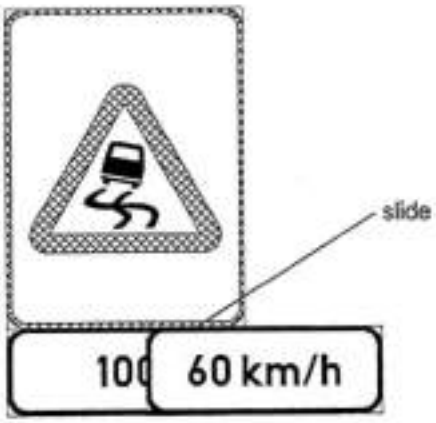
6 Examples of approved symbols for use on regulatory and warning matrix variable message signs are illustrated in Figure 9.7. These symbols shall be used when regulatory and warning variable messages signs are to be used and the regulatory signs will be enforced.



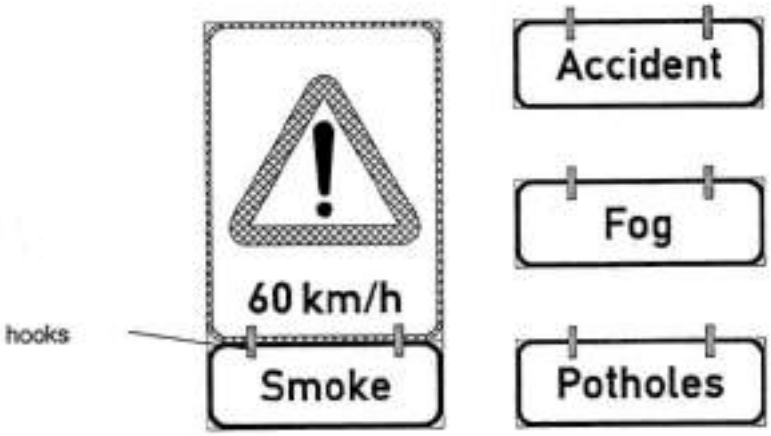
Detail 9.1.1 Back-to-Back Rotating Signs



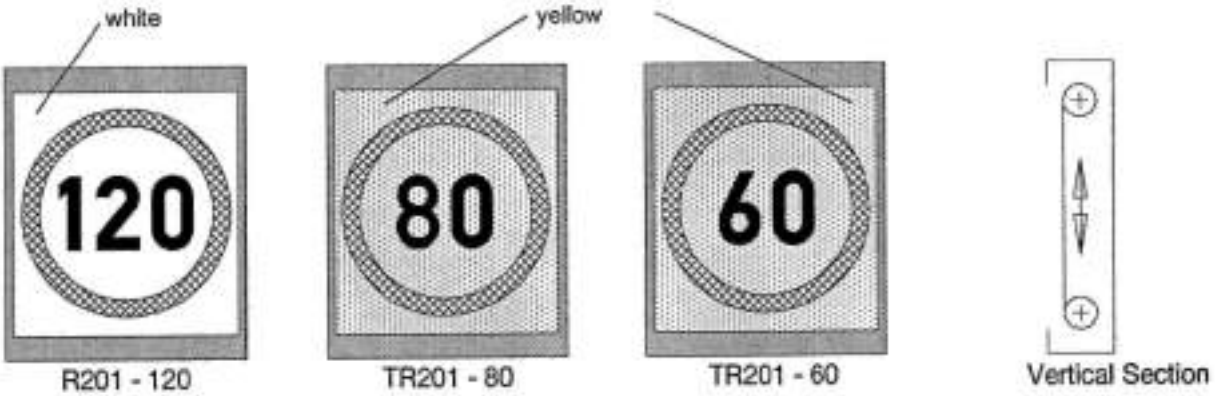
Detail 9.1.2 Flip Sign



Detail 9.1.3 Slide Alternative

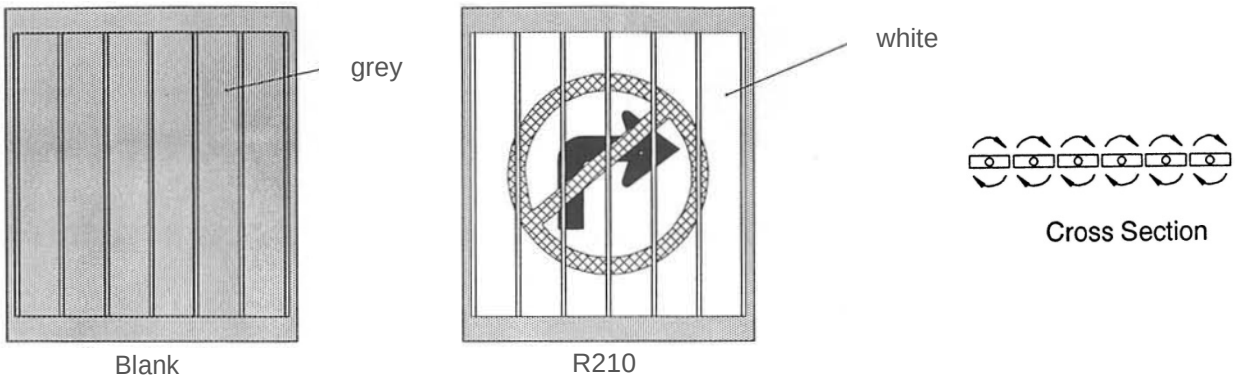


Detail 9.1.4 Hanging or Clamped Alternative

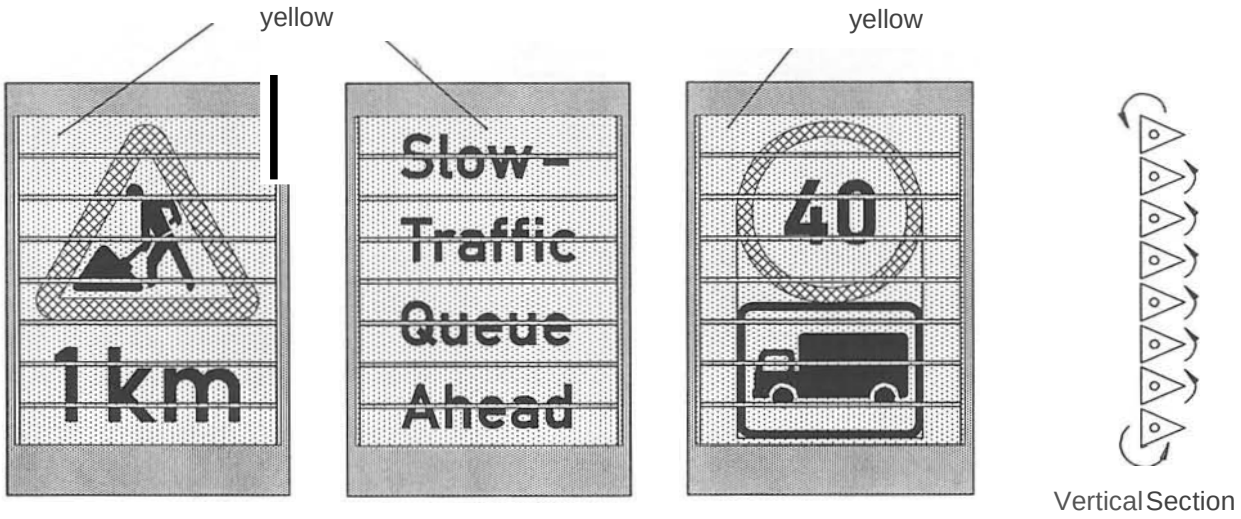


Detail 9.1.5 Roller Blind

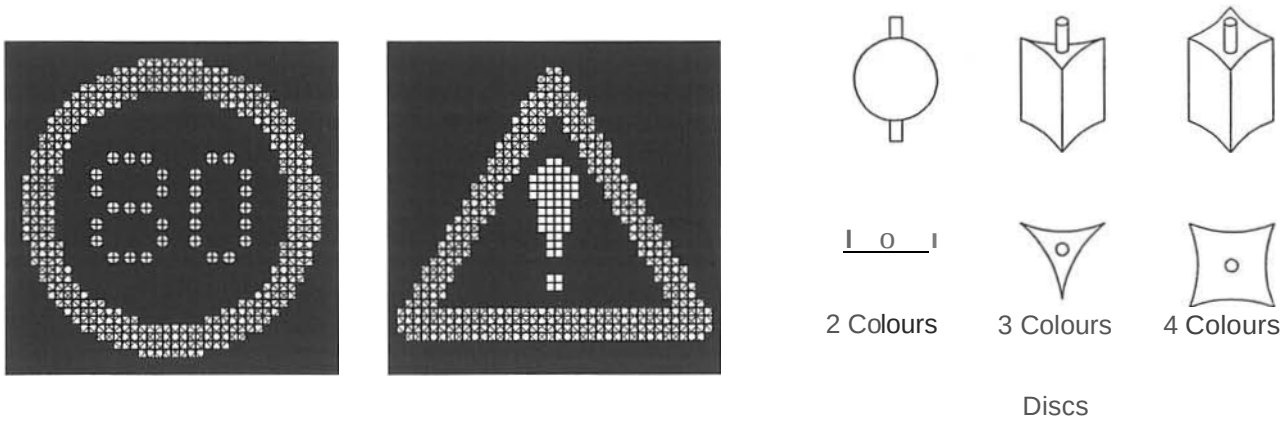
Fig. 9.1 Manually Operated / Electromechanical VMS



Detail9.1.6 Rotating Plank - Two Message (including "Blank")



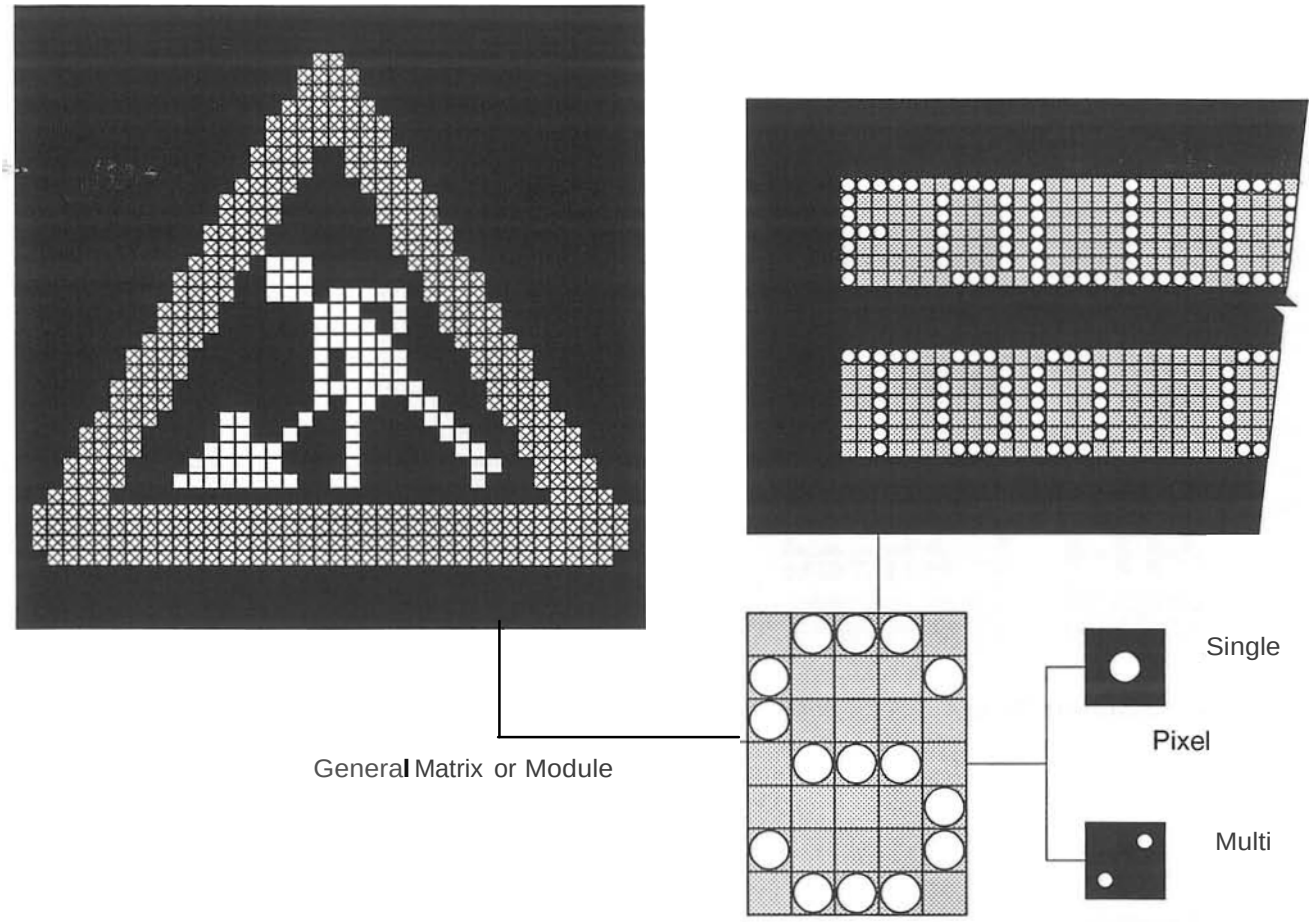
Detail 9.17 Rotating Prism - Three Message



Detail 9.1.8 Matrix of Rotating Discs - Multiple Message

Fig. 9.1 Manually Operated / Electromechanical VMS

Detail 9.2.1 Overhead Light-emitting Lane Control VMS



Detail 9.2.2 Text and Symbolic Light-emitting VMS

NOTES

1 The matrix principles illustrated apply for electromechanical, electrical or electronic VMS (see Chapter 10).

2 Text or symbolic signs may both be manufactured using a matrix either of filament bulbs, LED's or fibre optic cones. The matrix may be modular (letters) or cover the whole sign face.

Fig. 9.2 Electrical or Electronic VMS

9.1.10 Design Considerations for Electrical or Electronic VMS

1 The photometric and geometric (or dimensional) requirements for light emitting variable message signs are based on the following functional requirements, which are relevant to all road traffic sign design :

(a) conspicuity
(b) legibility;
(c) comprehensibility;
(d) credibility.

2 These aspects can be expressed in values of the required visibility distance provided details of the task and the observer population are known.

3 Messages may include symbols, numerals, and letters or words. These messages are normally ones to which the driver should adhere (regulatory) and react. It is common practice to supplement a regulatory or warning message with a measure of explanation. Parts of the message may be discerned individually as with numerals or as an entity with words or symbols. To be effective the message(s) must be perceived in time. Relevant factors in determining the "time" are:

(a) approach speed;
(b) sign content including type of message and amount of message;
(c) type of decision to be made by the driver;
(d) familiarity of message type;
(e) experience, motivation, age and visual capability of observer.

4 These factors are common to all road traffic sign design requirements. In general, in view of the large potential for variation in the different parameters, it is likely that it will be difficult to obtain meaningful local data relevant to the various variable message sign design parameters.

5 A number of overall values relevant to electronic variable message signs can be given which serve as practical guidelines, however. These are:

(a) the type of message i.e. regulatory, warning or guidance should be clearly recognisable from a distance of at least 200 m;
(b) essential messages, such as speed limit value or other legend must be clearly legible from a distance of at least 150 m;
(c) the light intensity of the optical signal should be adaptable to ambient brightness and a night-time mode should be offered;
(d) should the principal light source fail, a back-up bulb should come into operation in such a way that the essential characteristics of light intensity, visibility etc. are not affected;
(e) the system should be designed so that the sign is visible from a distance as close as 35 m, even when approached from a wide angle of vision.

6 The values given in paragraph 9.1.10.5 are relevant for freeways, major rural roads, or urban arterials. The likelihood that a variable message sign will be used, say in a residential environment, is limited. If sight distance falls below the recognition or legibility distances given, the use of an additional sign should be considered.

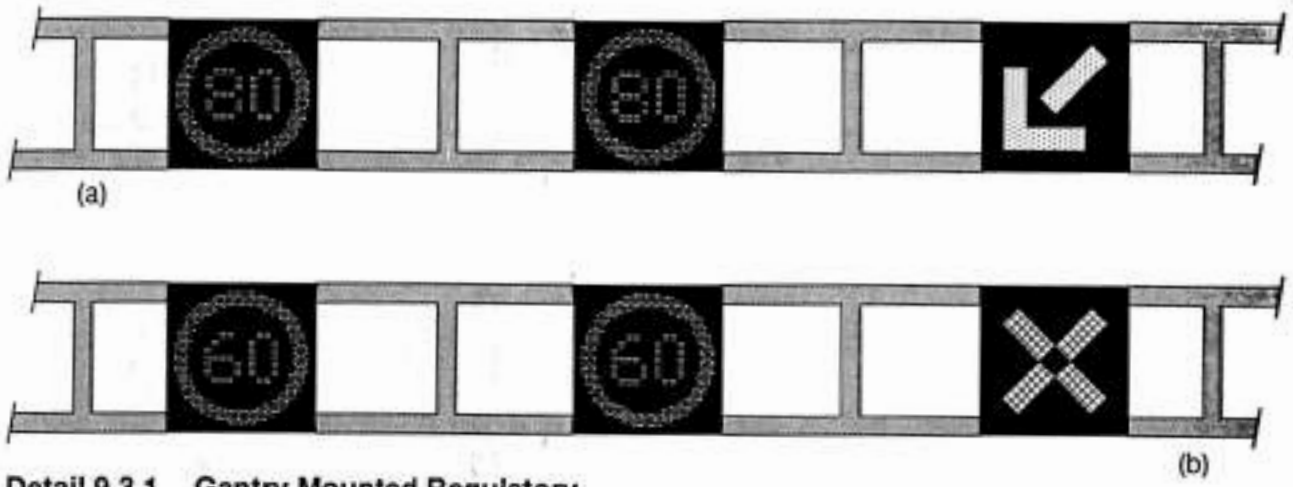
7 Experts consider that there is a sufficient influence of regional factors, such as ambient light, population characteristics and available technology that it is premature to prescribe a standard alphabet and set of symbols for use on dot matrix variable message signs. A set of 7 x 5 character matrices for upper case letters and for numerals is illustrated in Figure 9.4 and is recommended for development purposes. Other standard characters and limited matrix details are given in Figure 9.5. Typical symbols are illustrated in Figure 9.6.

8 The internal and external dimensional requirements for electrical and electronic VMS are not fully developed for Southern African conditions. Basic guide- lines are given in Section 9.2. Research is needed in this respect as experience of installations, particularly in Europe, is tending to indicate that the letter shape ratio may be better for matrix signs if it tends towards a height to width ratio of 2 to 1, rather than the presently used ratio of 7 to 5. There are also indications that letter spacings need to be greater than those given by DIN 1451 for use with conventional retroreflective letters (see Figure 9.6).

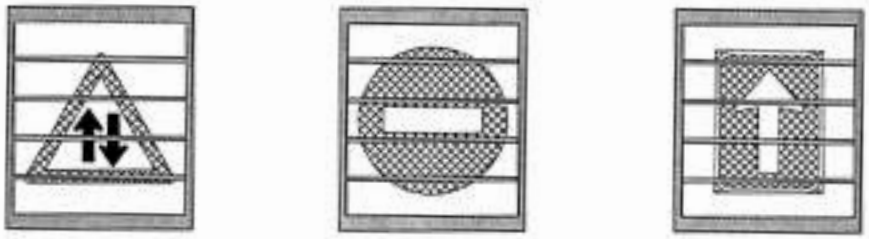
9 Light emitting matrix signs consist of a large number of dots or separate light units. In order that the observer can perceive the intended message these dots or light units must be seen both as a continuum when required and as separate entities when required. To achieve this, the spacing of certain of the dots must be less than a certain value and the separation of others greater than another value. Acceptable limits for these values depend on the conditions of observation, the characteristics of the observer, and all other factors mentioned earlier in this Section. The most important two factors are, however, the luminous intensity of the individual dots or light units and the background or adaptation luminance (see Figure 9.6).

10 The manner in which variable messages are switched is likely to affect the comprehension and credibility of VMS. This factor, although applicable to the switching of symbolic and text messages, will have a greater effect on the quality of a text message, particularly a relatively long one. If a number of text messages are to be given a driver is only likely to be able to read one message per sign, unless the messages are very short indeed. A number of signs may therefore be required if several messages have to be transmitted. A specific message must also be in view for sufficient time to allow a driver to read it. The reading time details given in Chapter 4 are relevant to this VMS design parameter. When a message is changed it may be changed totally in one operation or in a "flowing" movement. Many VMS requirements may appear similar to switchable advertising signs. Designers are cautioned against using advertising techniques without careful consideration of the road sign message transfer requirements. Although not substantiated the "flowing" switching movement appears more aesthetically acceptable. If the flowing movement of the change is from left- to- right and top- to- bottom (for larger messages in two lines) a reader will have the first message in view for a maximum reading period.

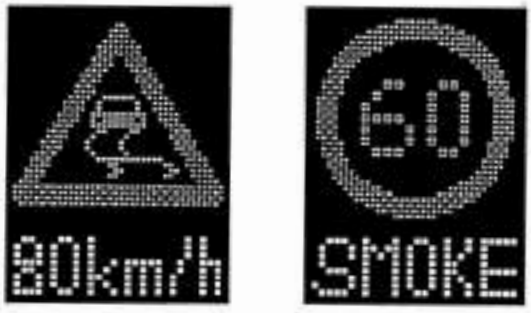
11 The quality of a light emitting variable message sign depends on:



Detail 9.3.1 Gantry Mounted Regulatory VMS

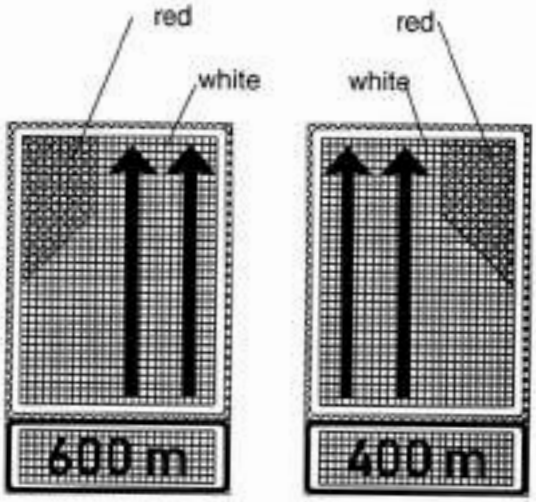


Detail 9.3.2 Regulatory / Warning VMS



Multiple message capability

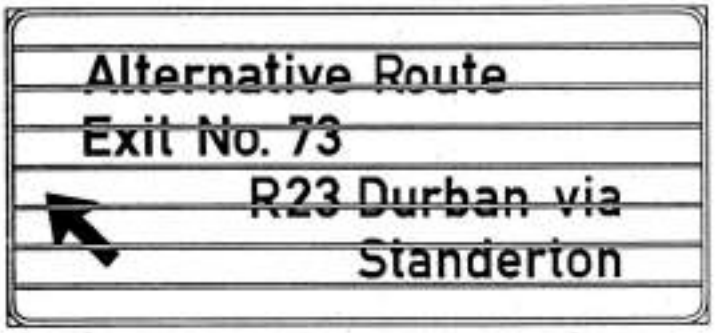
Detail 9.3.3 Warning / Regulatory VMS



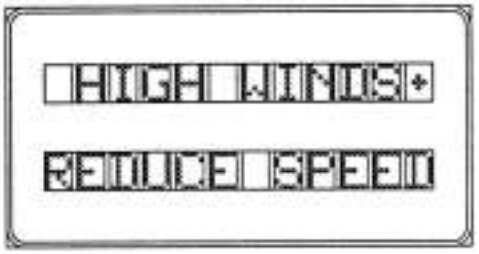
Only changing area provided with discs

Detail 9.3.4 Guidance VMS

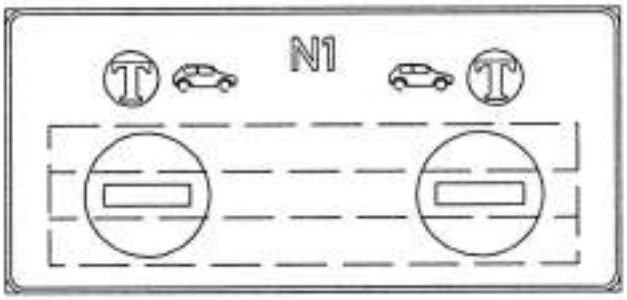
Fig. 9.3 Typical Regulatory, Warning, Guidance and Information VMS



Detail 9.3.5 Guidance - Direction VMS



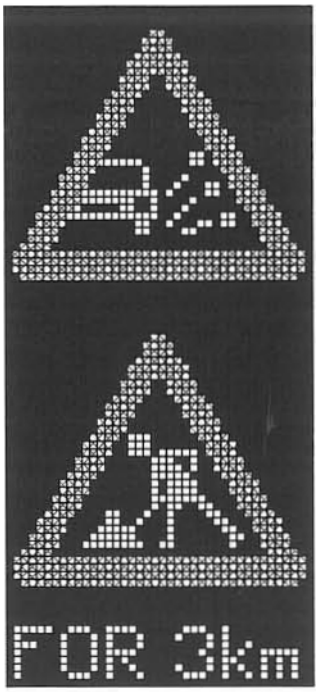
Detail 9.3.6 Information VMS



Detail 9.3.7 Regulatory / Guidance Combination VMS

Detail9.3.8 Combinations

Multiple arrangements of Regulatory, Warning and Information possible



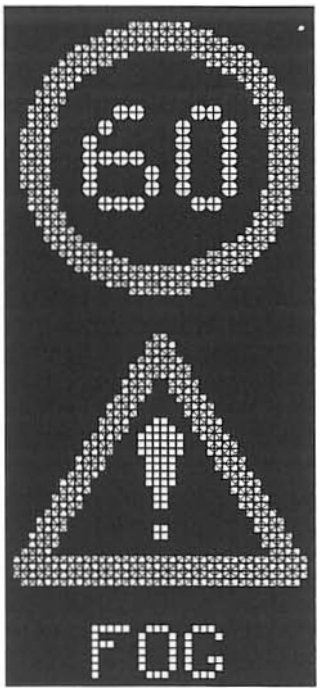


Fig.9.3 Typical Regulatory, Warning, Guidance and Information VMS

(a) light intensity and viewing angle (widely variable according to sign type);
(b) uniformity of illumination;
(c) contrast between the light emitted and the ambient light conditions;
(d) colour.

12 Available research is not conclusive on the best method of specifying performance for light emitting variable message signs. Specification may be made in terms of luminance or luminous intensity for individual light components or for the sign as a whole. For practical purposes the luminous intensity for white characters should be between 600 candela and 1000 candela for day operation, and between 60 cd and 100 cd for night-time operation. The values for red parts of a sign should be between 400 cd and 600 cd during the day and between 40 cd and 60 cd at night. It should be noted that light intensity values of 3800 cd can be obtained on the light axis of fibre-optic units. Losses will reduce this value substantially for the observer but it should also be noted that low values of luminous intensity reduce visibility of a sign whereas high values not only reduce legibility as a result of irradiation, but may also cause glare. As a general rule night-time intensity should be approximately one tenth of the daytime value. However, under bright Southern African sunlight conditions very high ambient light levels occur. In order to achieve adequate contrast levels during daytime the luminous intensity values may need to be significantly higher than those given above, whilst the night-time values will still apply. The day/night intensity ratio will increase under such circumstances. European research has indicated required contrast ratios be- tween the light emitting component and bright ambient conditions in the range of 7-to-1 to 50-to-1. Southern African ambient light levels could require higher ratios. The numerical values given are for illustration purposes only because the actual values achieved are dependent on the number of light units illuminated and on the stroke width of characters. (For further details refer to Volume 2, Chapter 19: *Variable Message Signs).*

13 Visible differences between individual illuminated light units can negatively affect the legibility of a sign or even lead to the misinterpretation of the message. The following guideline can be applied to all fibre-optic systems including those using larger diameter light units. The formula takes into account the interdependence between the number of light points and the clarity/definition of a sign.

$$\frac{I_{average}}{I_{sample}}$$ **should be between 0,7 and 1.3.**

where:

$I_{average}$ is the average light intensity per light unit for all the elements within one sign of the same colour.

and:

I_{sample} is the average light intensity per light unit for a random sample of points on the sign (a 10% sample is a valid sample size).

14 Good legibility is especially dependent on the contrast between the message, the sign background and the ambient background to the whole sign. Elements of character design have been covered, however, when designing fibre-optic signs, it must be remembered that lines of light points appear larger than painted or externally illuminated lines. It is possible to achieve adequate contrast for alpha numeric characters using only one row of light points. Such thin lines of high intensity light will be more clearly perceived by the eye than lines made of double rows. This effect must be compromised with the design requirement to have a back-up system whereby either an additional light source is automatically illuminated when the principal one fails, or a double row of light points is illuminated by two light sources which, on failure of a source will leave one row of light points illuminated. The use of double rows of light points is recommended if fibre-optic signs are used to create LANE DIRECTION CONTROL SIGNALS S16 (Green Arrow) and S17 (Red Cross).The recommended spacings of light points for various colours are given in Table 9.1 in Section 9.2.

15 To improve the contrast of a sign against a distracting ambient background such as the light of a clear sky or other illuminated features such as street lights or advertising boardings a minimum sign background clearance to any character of 1,1 times the letter height in use is recommended.

16 Colour rendition from fibre-optic signs is achieved by use of colour filters. Colours produced by variable message signs should conform to the requirements given in Section 1.5 according to Figures 1.11 to 1.14 – *Chromaticity Chart for Colours for Road Traffic Signs.* It should be noted that colour filters result in a loss of light output which must be taken into account when calculating specific light intensity requirements.

17 Phantom luminance should not exceed 10% of the luminance of the sign symbols for an illuminance of 104 lux.

18 Matrix signs are commonly used on high speed road-ways and are often placed in a regular sequence for lane control or gradual speed reduction purposes. A wide beam of emitted light is not required under these circumstances. Fibre-optic signs utilize optical cones at the signface to control light intensity and direction. Three types of cone are currently available

(a) 6° cone –

designed for high speed approaches with a light intensity on axis of 30 cd per point. The highest output levels occur at +or- 3°;

(b) 14° cone-

designed for intermediate approaching speeds with a light intensity on axis of 19,5 cd. The highest output levels occur at + or – 7°;

(c) 24° cone-

designed for low approaching speeds with an intensity on axis of 6,5 cd. The highest output levels occur at +or- 12°.

19 Variable message signs using dot matrix components need to be built into a housing which has certain characteristics. These characteristics apply to complete signs or modular units and include:

(a) the ability to dissipate heat by adequate ventilation;
(b) ease of access to replace components;
(c) a front screen to protect the light units should have anti-reflection qualities (slight curvature has also been found to help reduce condensation within the housing);

(d) tightly fitting components to eliminate ingress of water or dust (including filtration and protection of ventilation areas);
(e) internal surfaces a matt or semi-matt dark colour to avoid internal light reflection and interference.

20 The total light intensity of a fibre-optic sign is the sum of the light intensities emitted by the individual light points forming the signal. The total intensity depends on the following criteria:

(a) the number of bulbs;
(b) the use of a beam splitter;
(c) luminous flux of the bulb;
(d) efficiency with which light is channelled from the source to the individual light unit (cone)
(e) light transmitting properties of filters;
(f) the number of fibre-optic cables or arms;
(g) the length of the fibre-optic cables or arms in a harness;
(h) the optical characteristics of the cones;
(i) light transmission loss due to the front screen.

21 The total light intensity can be calculated from the formula for symbols of a single colour (a separate calculation should be made for each colour):

$$I_{TOTAL} = n \times I_{LP} \times F_F \times F_{SC} \times F_B \times F_L \times F_A \times F_C \times F_{AN} \times F_{FS}$$

where:

I_{TOTAL}	=	total luminous intensity of the symbol
n	=	number of light points
I_{LP}	=	light intensity per single light point
F_F	=	correction factor for the filter
F_{SC}	=	correction factor for the safety circuit
F_B	=	correction factor for the bulb
F_L	=	correction factor for the harness length
F_A	=	correction factor for the number of cable arms in the harness
F_C	=	correction factor for the cone type
F_{AN}	=	correction factor for the viewing angle
F_{FS}	=	correction factor for the front screen material

22 In an alternative form this formula may be used to determine minimum number of light points required for a given symbol or message. The correction factor "F_A" for the number of cables or arms in the harness is omitted because the value of total light intensity specified, "I_{TOTAL}", will be a minimum requirement. Where "n" is the minimum number of light points required to produce the specified total luminous intensity:

$$n = \frac{ITOTAL}{ILP \times FF \times FSC \times FB \times FL \times FC \times FAN \times FFS}$$

23 The testing of the design of a matrix sign should be done using standard measuring methods and equipment. Until such time as specifications are well established, new designs should be tested under representative traffic conditions by comparison with a "standard" sign. The following points should be borne in mind during testing:

(a) when assessing "visibility distance" as a variable, the light distribution, the angle subtended, and the atmospheric transmission characteristics must be taken into account;
(b) the comparison must involve a large number of observers performing a realistic task;
(c) the test should call for identification of signs and recognition of their components.

9.1.11 VMS and Road Traffic and Safety Management

1 Dynamic real-time traffic control can be achieved by designing an integrated computer operated intelligent system incorporating variable message signs.

2 Sections of roadway experiencing unacceptable levels of congestion and accident rates and therefore high user costs, may warrant such a system. Although the capital cost is likely to be high the benefits to be achieved can be cost-effective.

3 Comprehensive systems have been developed in Europe and the Americas which operate automatically with no need for manual intervention. Such systems are capable of detecting incidents, congestion, and even weather conditions. Components of such a sys- tem are illustrated in Figures 9.8 to 9.10.

4 Figures 9.8 and 9.9 shows diagrammatic representations of how variable message signs fit into a typical road traffic and safety management system. Also illustrated is a schematic arrangement of detectors, detector stations, outstations and sign gantries.

5 Figure 9.10 shows schematically how computerised control may be applied through the use of variable message signs.

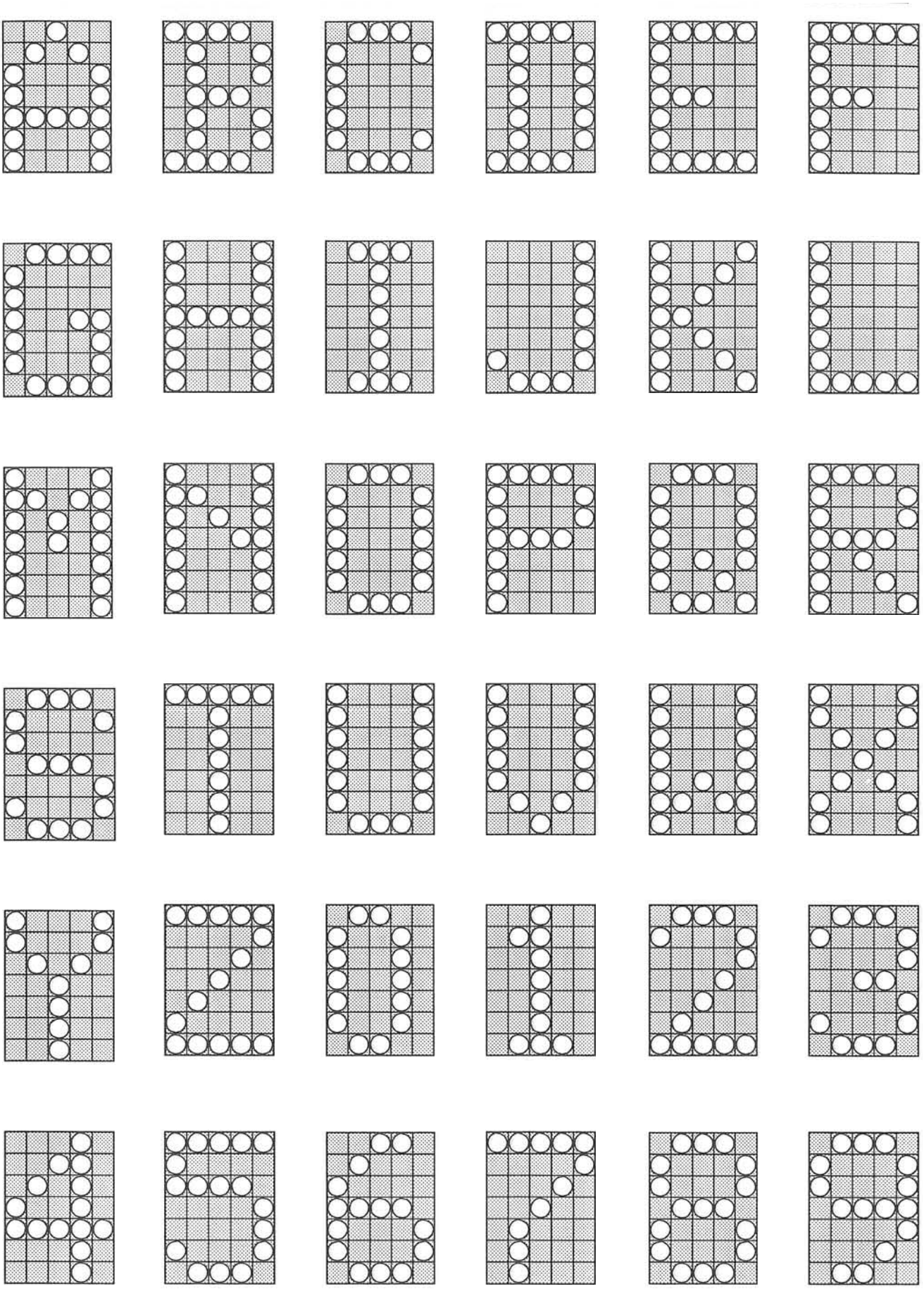
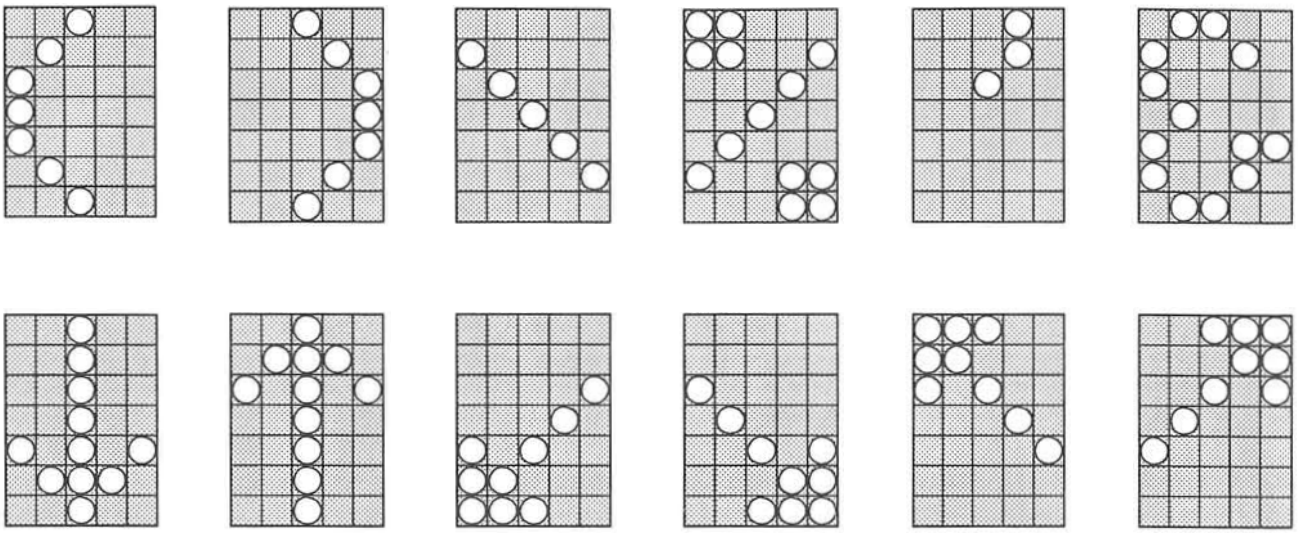
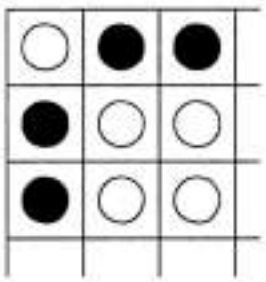


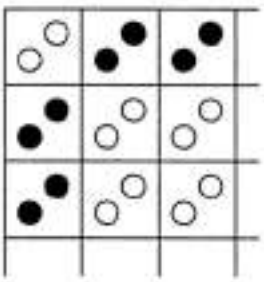
Fig. 9.4 7 - Character x 5 - Character Letters and Numerals



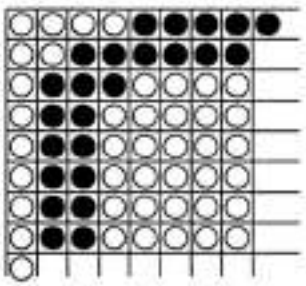
9.5.1 Other Selected Characters on Modular Base



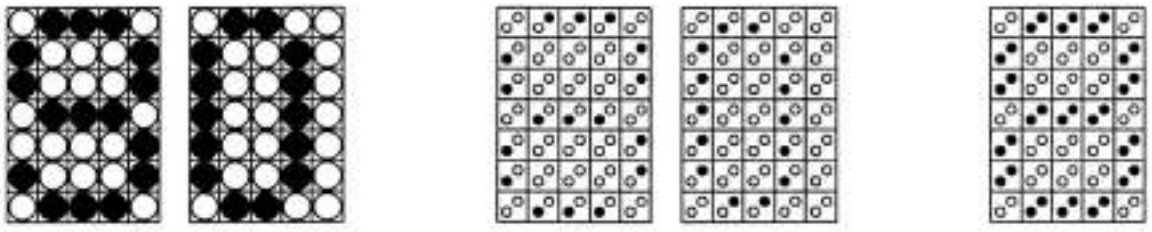
9.5.2



9.5.3



9.5.4



9.5.5 Effects of Bulb Failure - Example Numeral "8"

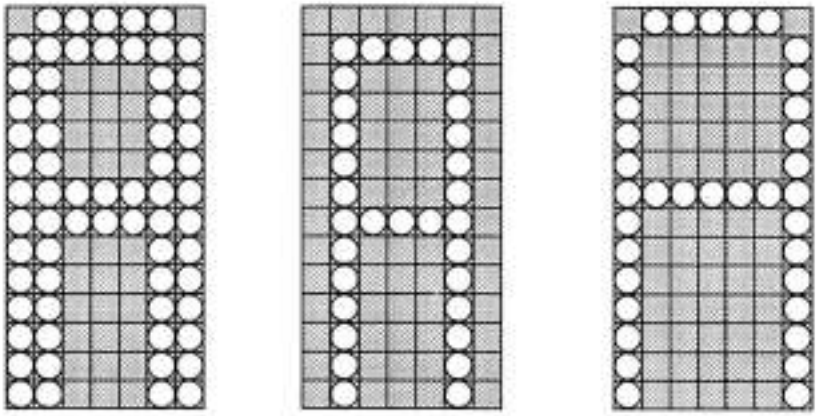
NOTES

1 In Figure 9.4 and Detail 9.5.1 all elements can be illuminated - those required for each letter are indicated by a circle.

2 Details 9.5.2 to 9.5.4 show large and paired small illuminated bulbs, and fibre optic elements respectively.

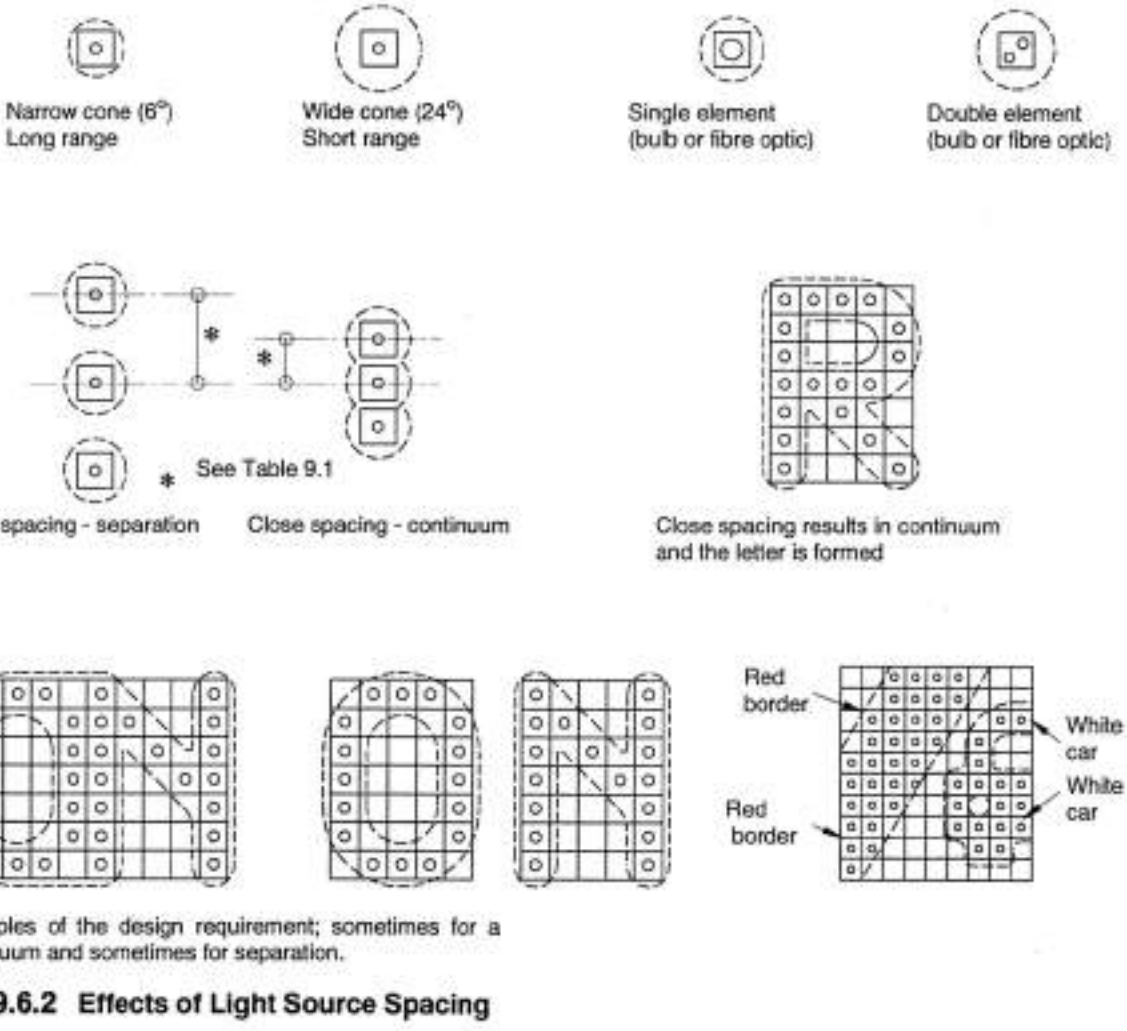
3 Detail 9.5.5 shows the effects of bulb failure. The small element normally has a dual circuit.

Fig. 9.5 Further Details of 7 x 5 Character Matrices



This matrix with a height to width ratio of 2 to 1 may offer better letter shapes and legibility. A dual circuit may also minimise effects of bulb failure.

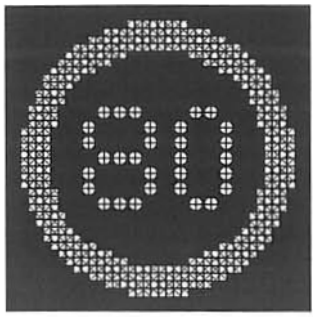
Fig 9.6.1 Alternative Letter / Numeral 14 x 7 Character Matrix



Examples of the design requirement; sometimes for a continuum and sometimes for separation.

Fig 9.6.2 Effects of Light Source Spacing

Fig. 9.6 Other VMS Design Considerations



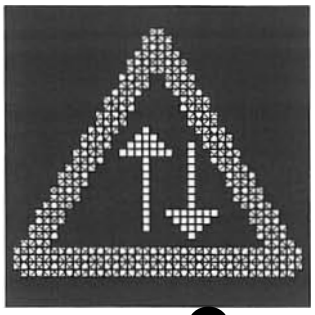
R201/TR201 *

R210/TR210

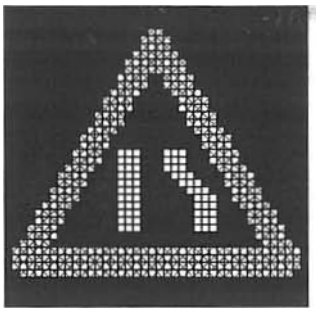
R214/TR214

R215/TR215

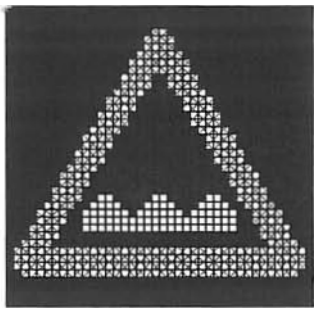
Detail 9.7.1 Regulatory Sign Symbols {Prohibition)



TW212 ●



TW329



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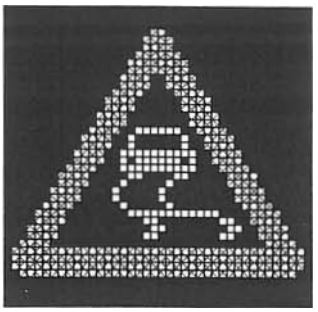

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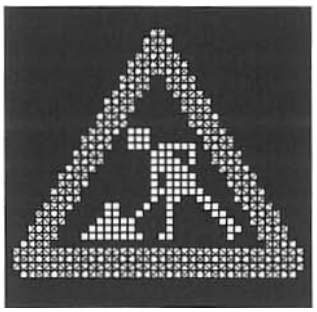

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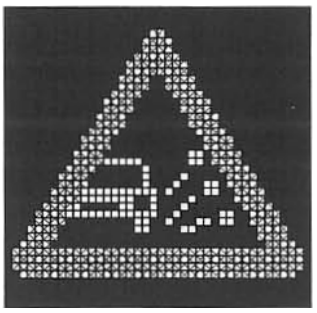

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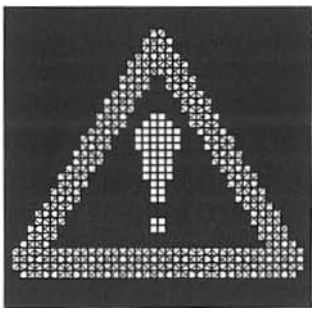
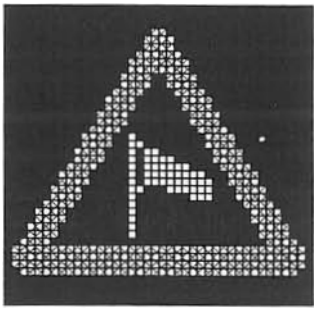
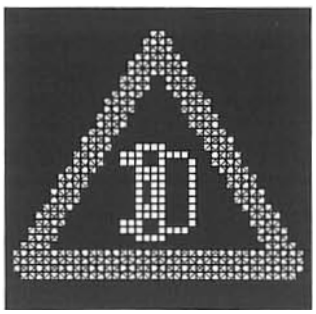


TW339 *



TW349 *



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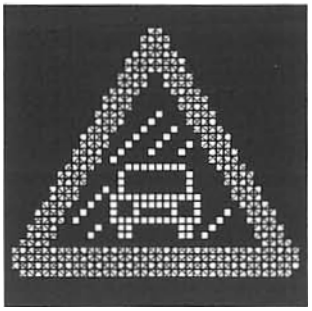

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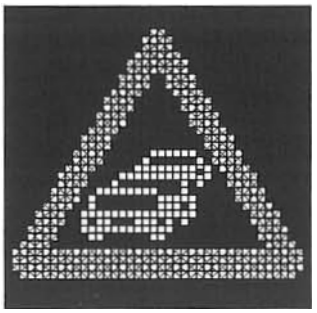

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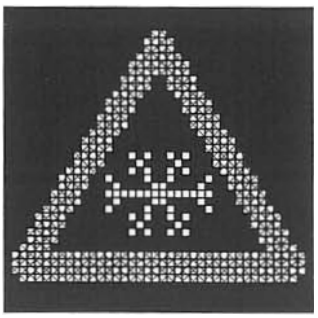

Snow

Detail 9.7.2 Warning Sign Symbols * International

● See Chapter 3, Section 3.7 for variations appropriate to individual countries.

Fig. 9.7 Symbols

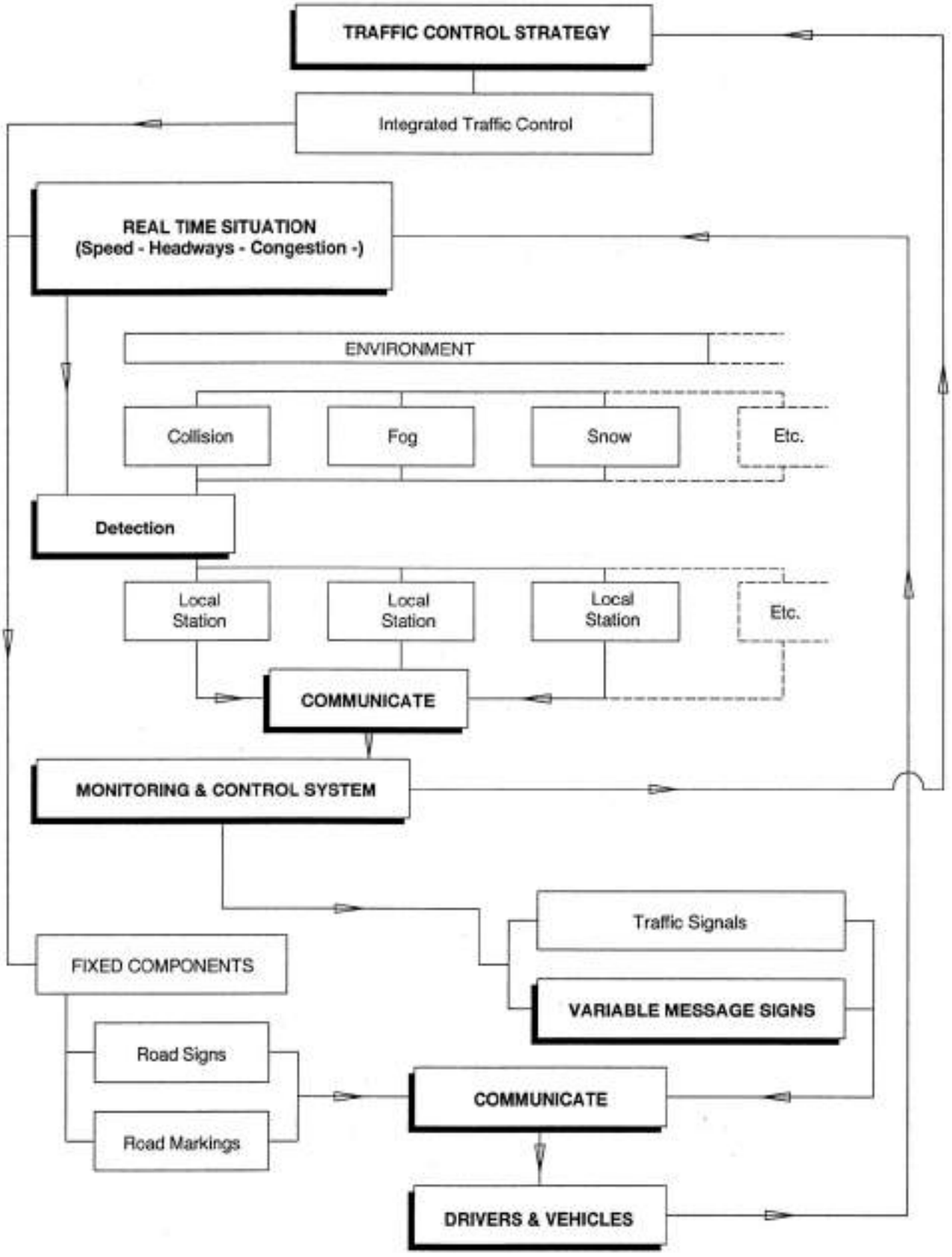

Fig. 9.8 VMS in a Road Traffic and Safety Management System

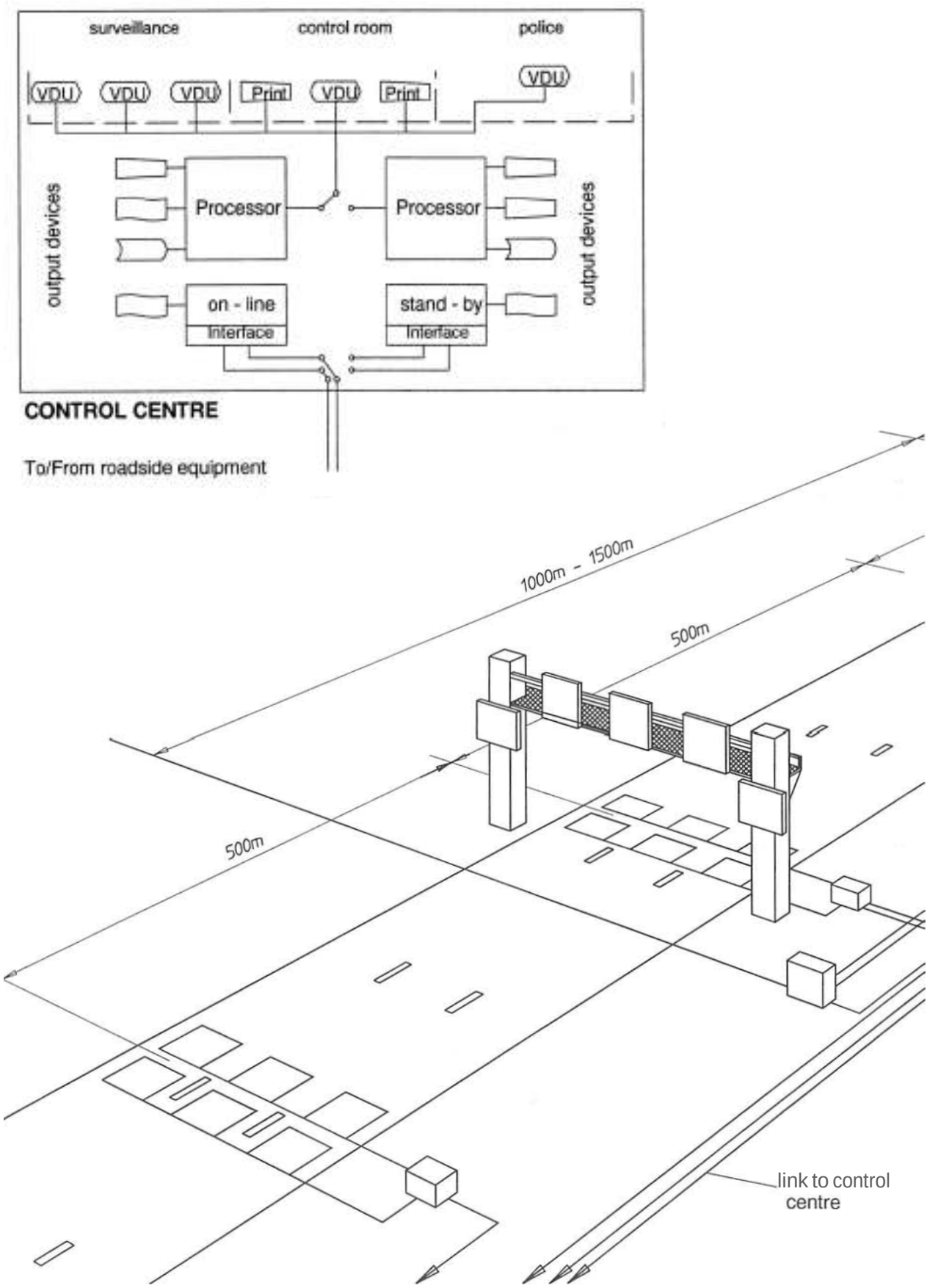

Fig. 9.9 Typical Components of a Freeway Control System

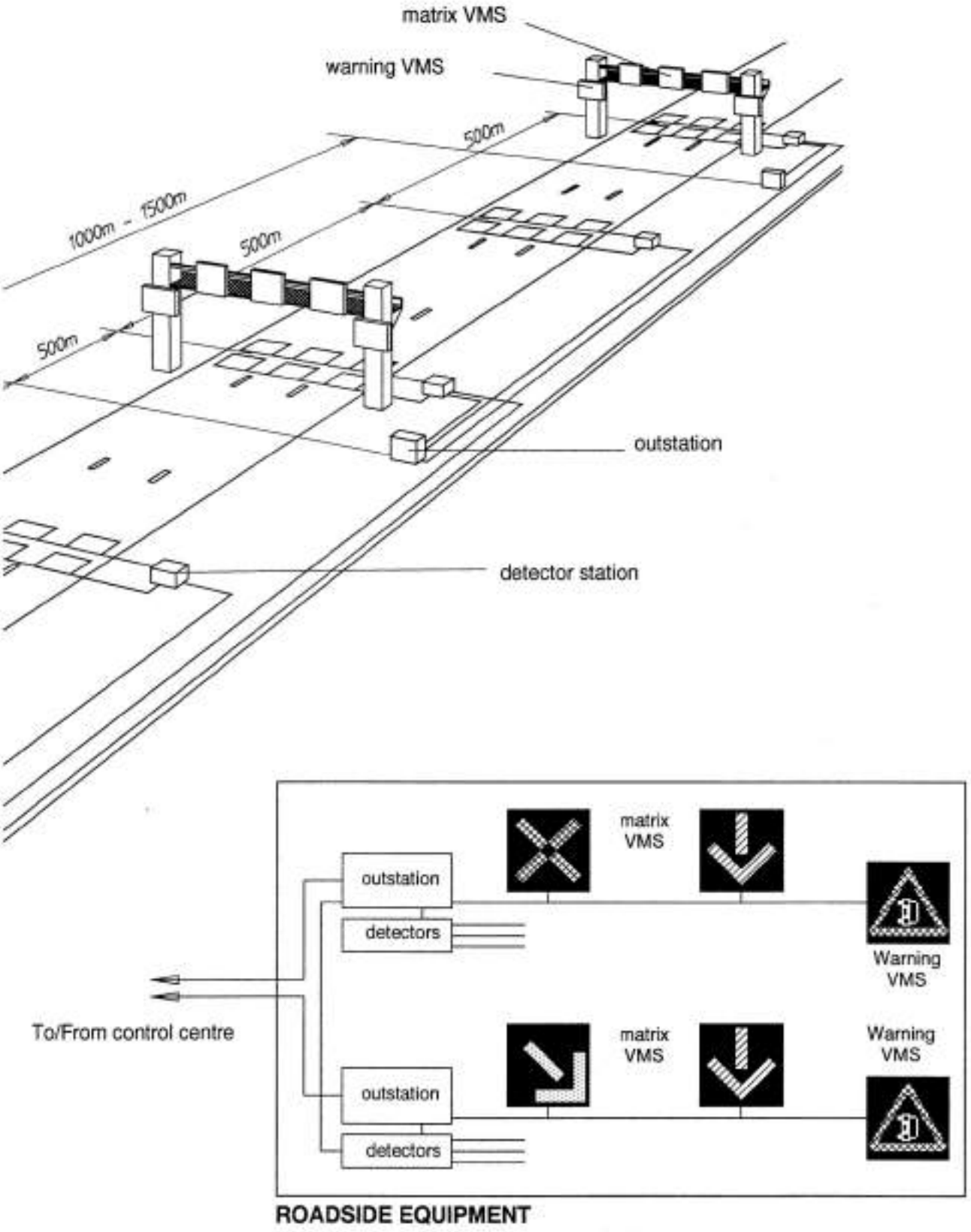

Fig.9.9 Typical Components of a Freeway Control System

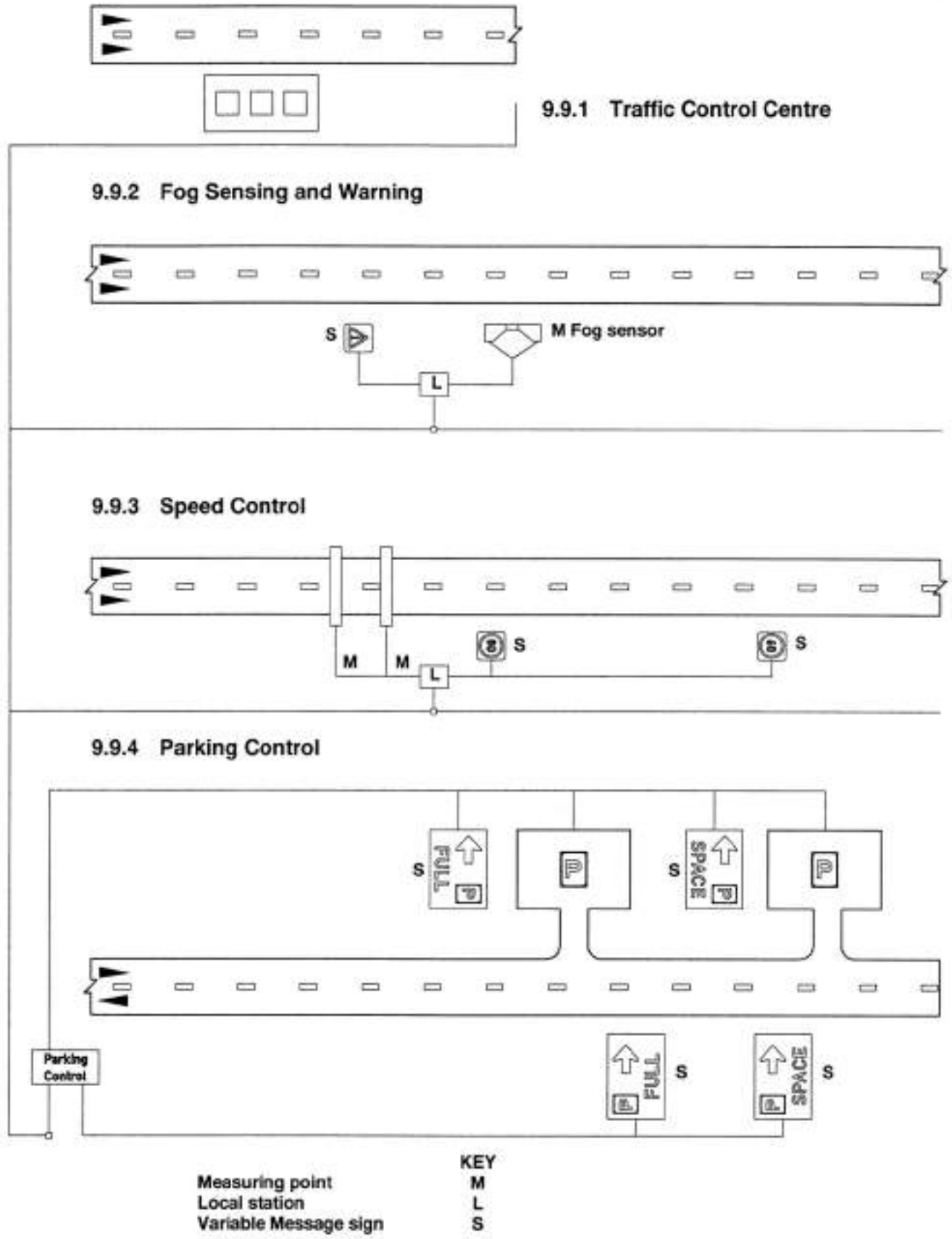

Fig. 9.10 VMS Applications in Road Traffic and Safety Management

9.2 DIMENSIONS FOR VMS

9.2.1 General

1 As has been stated in previous Subsections the design of variable message signs is in a developing stage world-wide and although standards are being developed by the CIE (International Commission on Illumination), these are not yet universally accepted. The number of installations of light emitting VMS in Southern Africa, from which local knowledge may be gained, is, at the time of publishing, very limited. Full dimensional details are therefore not given in this chapter or in Volume 4 at this time.

2 The matrix details given in Figures 9.4 and 9.7 should be considered to be guidelines only although they are based on UK and European practice. The high ambient light levels common in much of Southern Africa are likely to require modification or extension to any European based standard. Such modification is likely to affect dimensional criteria.

3 Until such time as local research indicates otherwise any regulatory or warning sign provided as part of a light reflecting or light emitting variable message sign shall conform to the diameter or side length dimensional requirements for standard regulatory or warning signs given in Tables 2.4 and 3.1.

9.2.2 Light Reflecting VMS

1 The dimensions of any manually operated or electro-mechanical light reflecting VMS depicting a regulatory or warning sign shall conform in all respects to the dimensions appropriate to standard regulatory and warning signs given in Volume 4.

2 It will be common for such signs to be contained within a frame or background. The dimensions of such a background should relate as closely as possible to those used for HIGH VISIBILITY signs.

3 Similarly light reflecting VMS guidance and information signs should conform to the dimensional requirements given in Volume 4.

4 If a combination of standard and light reflecting VMS, or light reflecting and light emitting VMS, is required, it may be necessary to increase certain internal sign spacings to accommodate structural or mechanical aspects of the message changing mechanism.

9.2.3 Light Emitting VMS

1 The dimensions of arrow or cross VMS mounted over individual lanes as part of road traffic and safety management control installations shall conform to those given in Volume 4, Chapter 10 for LANE DIRECTION CONTROL signals S16 to S19.1t should be noted that signals S16to S19 may be identical in appearance to changeable arrow and cross signs, but the signals have a specific function and shall be used in a specific manner (see Chapter 6). Changeable arrow and cross signs may be used as S16 to S19 signals provided they conform to the functional requirements for the latter. They may also be used for other forms of lane use control not involving the DIRECTIONAL, or reversible use of lanes.

2 The effectiveness of letters, numerals and symbols used on light emitting VMS will be dictated by the physical components of the matrix used. Factors which will influence this effectiveness are covered in Subsection 9.1.10. An acceptable visual definition must be achieved by all aspects of a sign. As a general rule the greater the detail required the closer or smaller should be the elements of the matrix used (see Figure 9.6).

3 A matrix may be produced by using off-the shelf modular components or by building up a customised matrix from the individual illuminated components such as bulbs or fibre optic cones. In the case of the modular components, normally forming letters and numerals, the spacing of the bulbs or cones will have been determined by the manufacturer. The 7 x 5 character matrix is not ideal for lower case lettering; therefore, variable message guidance and information signs using a 7 x 5 matrix should use only upper case letters. The use of letter matrices with fewer than 7 vertical components is not recommended. The spacing of the letters to form a word and the spacing between words, both horizontally and vertically needs to be confirmed for Southern African conditions. Figure 9.11 illustrates the basic dimensions used in the DIN 1451 lettering system for standard guidance signs. If a sign is subject to high ambient light levels the outer spaces should be increased from "5d" to "8d" and "6d" to "8d". The between line spacings may be reduced to a minimum of "3d" due to the fact that the signs use only upper case letters.

4 It is recommended that the letter height be derived in the same manner as for standard guidance signs (see Chapter 4). Due to the possibility of obtaining high light intensities from narrow focus elements (6° cones), it is possible that normal legibility distances required for adequate driver response and action may be achievable with smaller letter heights than derived by use of the nomograms in Chapter 4. Road authorities are recommended to require that any such claim by a manufacturer be proven in a representative on-site pilot test before accepting smaller letter sizes. Because the signs are light emitting, it may be practical, with an adequate approach distance to use very large letters to obtain reading distances far in excess of those obtainable under vehicle headlamp illumination of retroreflective letters. Characters as high as 1500 mm are available in European systems.

5 The recommended minimum spacing between letters is "1d" or the equivalent one vertical row of matrix elements. The minimum recommended spacing between words shall be the equivalent of two vertical rows of matrix elements. In all the above examples the matrix "element" dimension should be taken as the centre to centre dimension of the elements, normally "1d", NOT the diameter of the element itself.

6 The size of individual matrix elements will be "1d" square, based on a 7 x 5 matrix. The size of the illuminated element will be dependent on the technology in use and the manufacturers design. Sizes range from 50 mm or more in diameter for larger bulbs, down to small cones for fibre optics of 5 mm diameter. Recommended spacings of illuminated light points of different colours for more general message requirements such as regulatory or warning sign symbols, or for larger custom made matrices are given in Table 9.1.

TABLE 9.1	RECOMMENDED LIGHT POINT SPACINGS- FIBRE OPTIC SIGNS	TABLE 9.1
Light point Colour	Spacing (mm)	
White	30 - 35	
Red	15 - 20	
Yellow	20 - 25	
Green	20 - 25	

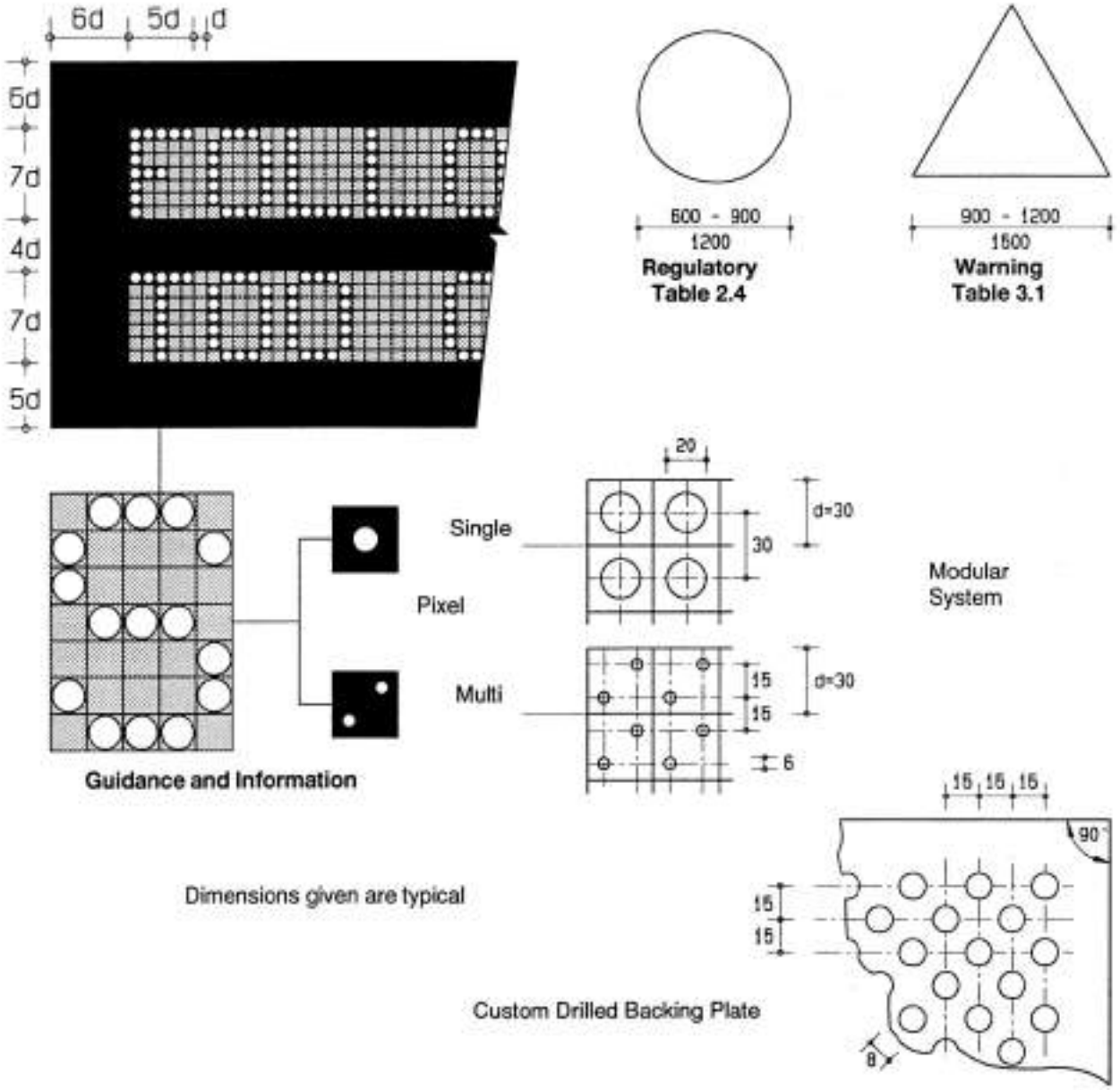

Fig. 9.11 Guidelines for Dimensions of VMS