SOUTHERN AFRICAN
DEVELOPMENT COMMUNITY

ROAD TRAFFIC SIGNS MANUAL

3rd Edition

VOLUME 1
UNIFORM TRAFFIC CONTROL DEVICES

DIGITISED VERSION – May 2012

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PREFACE

Southern African Development Community (SADC) member states decided, at their meeting in Lusaka in June 1995, to enter into a Protocol Agreement to expand and deepen their co-operation in the areas of infrastructure and services. An important component of this Protocol Agreement is the intention to harmonize road traffic signs and their supporting regulations throughout member states.

South Africa offered to undertake the work required for this harmonization process. The first phase of the work involved an assessment of any differences existing between the current systems, as documented in the Southern Africa Transport and Communications Commission (SATCC) Road Traffic Signs Manual, published in November 1990, and the South African Road Traffic Signs Manual, published in January 1993. This assessment showed that the two systems are very similar, both being based on the European road traffic sign system. The South African system, having recently been developed to conform to European signing principles, but also to satisfy African requirements, contained a significantly greater number of road traffic sign types. These findings were considered by SATCC in September 1995. The Commission appointed a sub-committee comprising members from Lesotho, Malawi, Namibia and South Africa to monitor the work of the South African team in the preparation of the new harmonized Manual and model road traffic sign regulations.

This Third Edition of the SADC Road Traffic Signs Manual is structured to ultimately appear in four volumes. However at present, at the request of the sub-committee, only Volumes 1 and 4 have been prepared. A decision will be taken in the future on the need to adapt Volumes 2 and 3 of the South African Manual to SADC requirements.

Volume 1 of the Manual contains detailed signing policy and design principles. The text covering each sign, marking and signal starts with a statement regarding the meaning, or significance, of the device. These statements are essentially the same as those given in the harmonized model road traffic sign regulations, prepared at the same time as Volume 1. The content of Volume 1 provides an in depth description of the road traffic sign system and working detail on the use of each individual component of the system.

Volume 2, if required, will deal with the collective application of signs, markings, and signals for specific subject areas such as traffic accommodation at roadworks, tourism signing, public transport signing and signing for the control of heavy vehicles.

Volume 3, if required, will provide in depth detail on the selection, installation, operation and control methods for traffic signals.

Volume 4 gives complete dimensional details, together with accurate scalable drawings, of all signs, markings and signals, including details of all letter types used on direction signs.

Absolute harmonization of all aspects of the previous road traffic signs systems is not possible for a number of reasons. In order to accommodate specific needs of member states several chapters in Volume 1 have a final section dealing with what have been termed "national variants". Typical examples of "national variants" are:

(i) "mirror" image signs for use in states where vehicles are required to travel on the right hand side of the road;

(ii) examples of standard text signs in Portuguese - this type of sign has been kept to an absolute minimum by a strong reliance on the use of pictographs or symbols, inherited from the South African system;

(iii) provision for specific member state symbols for such facilities as police services, national monuments etc.

In addition, several significant differences have been noted between the two traffic signal systems as documented in the manuals existing prior to harmonization. The cost implications of total harmonization of the traffic signal systems have been considered unaffordable. Volume 1, Chapter 6: Traffic Signals, therefore covers the differences between the two systems in parallel. One system, considered to be used by a majority of member states, is recommended, and the other system is recorded as an alternative system.

Typical of these differences are:

(i) in the recommended system the primary traffic signals are positioned on the far side of junctions, whilst in the alternative system the primary traffic signals are positioned on the near side of the junction;

(ii) in the recommended system the basic traffic signal sequence is red, green, yellow, red, whereas in the alternative system the basic traffic signal sequence is red, red plus yellow, green, yellow, red.

Due to the size of the Manual, the cost of printing all pages in full colour would have been considerable. To minimise this cost all colour pages have been concentrated at the beginning of each relevant chapter in Volume 1. In this way the whole sign system and each individual sign, marking and signal is illustrated in colour. A reference is also given in these sections to where each individual sign, marking and signal is dealt with in detail in Volume 1, and to where they are dimensioned in Volume 4. Throughout the rest of Volumes 1 arid 4 a coded form of black and white shading is used to represent the sign colours.

Finally, acknowledgements are due to the members of the various committees whose work has led to the publication of this Manual, to South Africa for funding the work, and to the Chief Directorate: Roads in the South African Department of Transport for making this possible

IN WITNESS WHEREOF, WE, the Ministers of Transport and Road Traffic affairs have signed this Manual.

DONE AT ....., on this ..... Day of ....., 1999.

For and on behalf of the Republic of Angola	
For and on behalf of the Republic of Botswana	
For and on behalf of the Democratic Republic of Congo	
For and on behalf of the Kingdom of Lesotho	
For and on behalf of the Republic of Malawi	
For and on behalf of the Republic of Mauritius	
For and on behalf of the Republic of Mozambique	
For and on behalf of the Republic of Namibia	
For and on behalf of the Republic of Seychelles	
For and on behalf of the Republic of South Africa	
For and on behalf of the Kingdom of Swaziland	
For and on behalf of the United Republic of Tanzania	
For and on behalf of the Republic of Zambia	
For and on behalf of the Republic of Zimbabwe	

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SOUTHERN AFRICAN DEVELOPMENT COMMUNITY ROAD TRAFFIC SIGNS MANUAL Volume 1

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MAY 2012

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CHAPTER 1

CHAPTER 1: GENERAL PRINCIPLES

1.1 INTRODUCTION

1.1.1 General

1 The Third Edition of the Southern African Development Community Road Traffic Signs Manual comprises four volumes:

Volume 1: *Uniform Traffic Control Devices:* Detailing signing policies and design principles together with specific information on the meaning and individual application of all traffic control devices.

Volume 2: *Traffic Control Device Applications:* Covers the use of sets of signs, markings and signals for specific applications.

Volume 3: *Traffic Signal Design:* Detailing, in depth, requirements for the selection and installation of traffic signals and their methods of control.

Volume 4: *Traffic Signs Design:* Dimensional detail for all road traffic signs and their signface components.

2 This Third Edition has been developed from a harmonization of the earlier SATCC Road Traffic Signs Manual, and the Third Edition of the South African Road Traffic Signs Manual which contained a wider range of signs. Initially only Volumes 1 and 4 will be published. Volumes 2 and 3 may be published at a later stage. In a relatively small number of instances it has been necessary to deal with one or more signs specifically for one member country. Primarily this need arises from the fact that in Angola drivers travel on the right-hand side of the road, and from the occasional need to display Portuguese text for Angolan or Mozambican conditions. Any such signs are identified in the chapter contents section and are then described at the end of the chapter in a section called "National Variants".

3 This volume therefore covers the meaning and application of individual traffic control devices available to authorities having the necessary jurisdiction to place or erect such devices in a public road.

4 Traffic control devices include all road traffic signs and other devices, including delineation devices, used to regulate, warn, guide or inform road users. Traffic control devices are thus used to achieve an acceptable level of road safety by providing for the orderly and predictable movement of all traffic, vehicular and pedestrian, throughout all levels of the road network.

5 Road traffic signs, by legal definition, include all prescribed road signs, road markings and traffic signals, and are to be used solely for the purpose of traffic control and are not an advertising medium.

6 The meanings given to traffic control devices in this volume are in accord with the meanings given in the relevant Road Traffic Legislation. **The meanings given in the Legislation have legal precedence.**

1.1.2 Structure and Layout

1 For convenience of binding on a loose leaf basis Volumes are subdivided into a number of Parts.

2 The text is subdivided into the following numbered components {the examples indicate Chapter 7):

(a) Chapters - 7;
(b) Sections- 7.1;
(c) Subsections -7.1.1;
(d) Paragraphs- 7.1.1.1;
(e) Figures - 7.1;
(f) Details (within Figures) - 7.1.1;
(g) Tables- 7.1.

These numbers should be used for reference purposes. They are used as such throughout the text.

3 The page layout includes a "header" at the top in which the section name and page number are indicated. Page numbers are restarted in each section e.g.7.1.1, 7.2.1, 7.3.1 etc. A "footer" is located at the bottom of the page and this indicates the date of publication (or re-publication in the case of future amendments), the name of the manual and the volume number, and the chapter name. Figures 1.1 and1.2 illustrate the above elements.

4 At the front of each Part a basic list of contents for the complete volume is included. At the front of those chapters which deal with numbered road traffic signs a chapter contents in colour is included for convenience. Each such contents lists the included road traffic signs pictorially, in colour and in numerical order, together with references to subsections and page numbers. The main index to the volume is given in Part 3.

1.1.3 Text Conventions

1 The text in the Manual is primarily provided in Arial 8.5 point typeface.

2 A range of text conventions have been used to place emphasis where this has been deemed necessary. The conventions used and their functions are as follows:

(a) ***bold italic***- to indicate the significance of a specific road traffic sign;
(b) **bold** - to place particular emphasis on a word or section of text, including titles and section headings;
(c) *italic* - to indicate the name of a chapter or other document referred to in the text AND to indicate foreign terms used in the text;
(d) UPPERCASE (or CAPITAL) letters - as a lower level of emphasis, but particularly to indicate the specific names given to road traffic signs.

The use of CAPITAL letters may be superimposed in the ***BOLD ITALIC*** *or* **BOLD** conventions (see Figures1.1 and 1.2).

1.1.4 Terminology

1 A considerable effort has been made to obtain close correlation between the language of the manual with that used in Legislation.

2 The meaning attached to many terms represents, in many instances, a *de facto* definition of the term. The

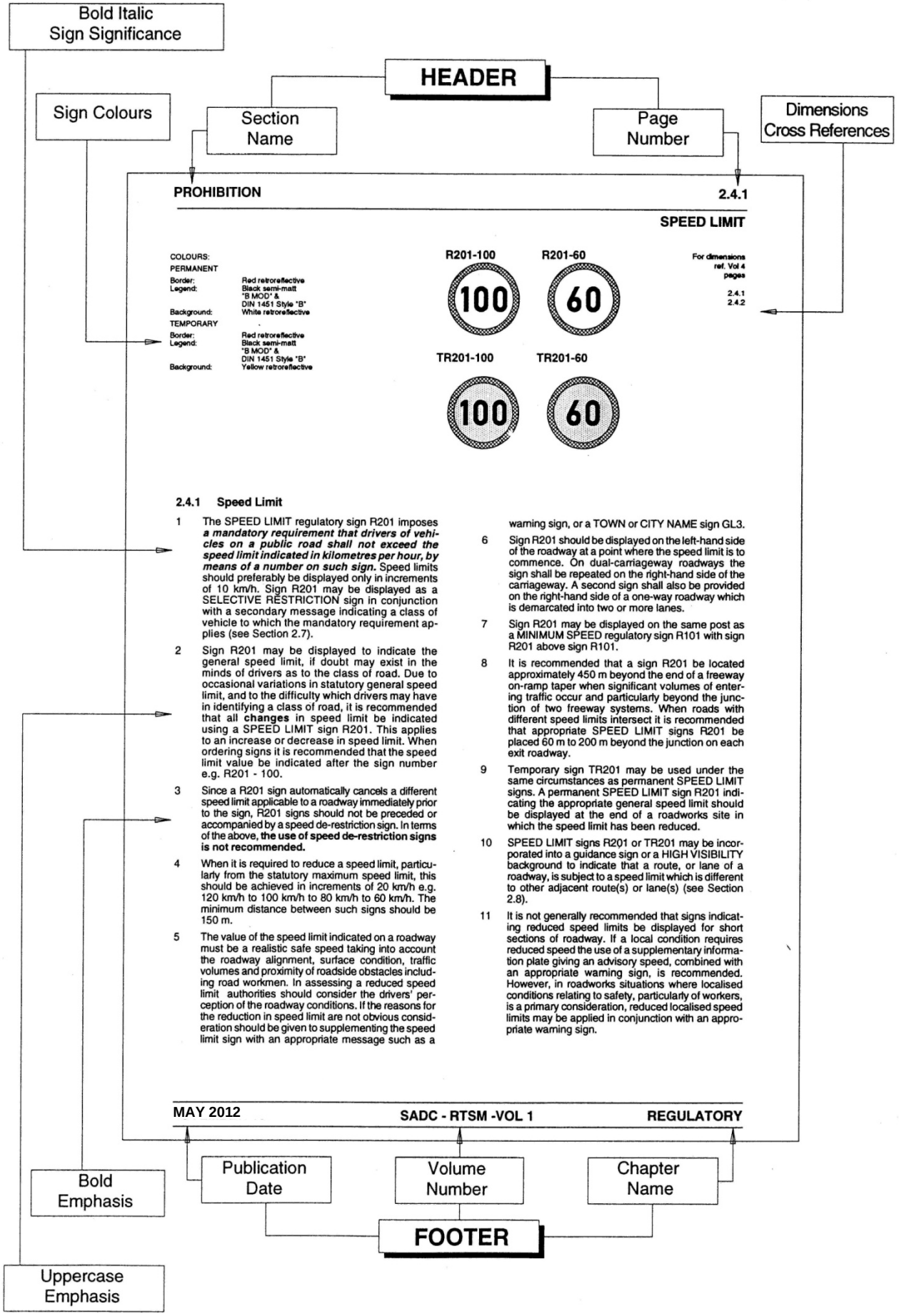


Fig 1.1 Typical Page Layout and Text Conventions

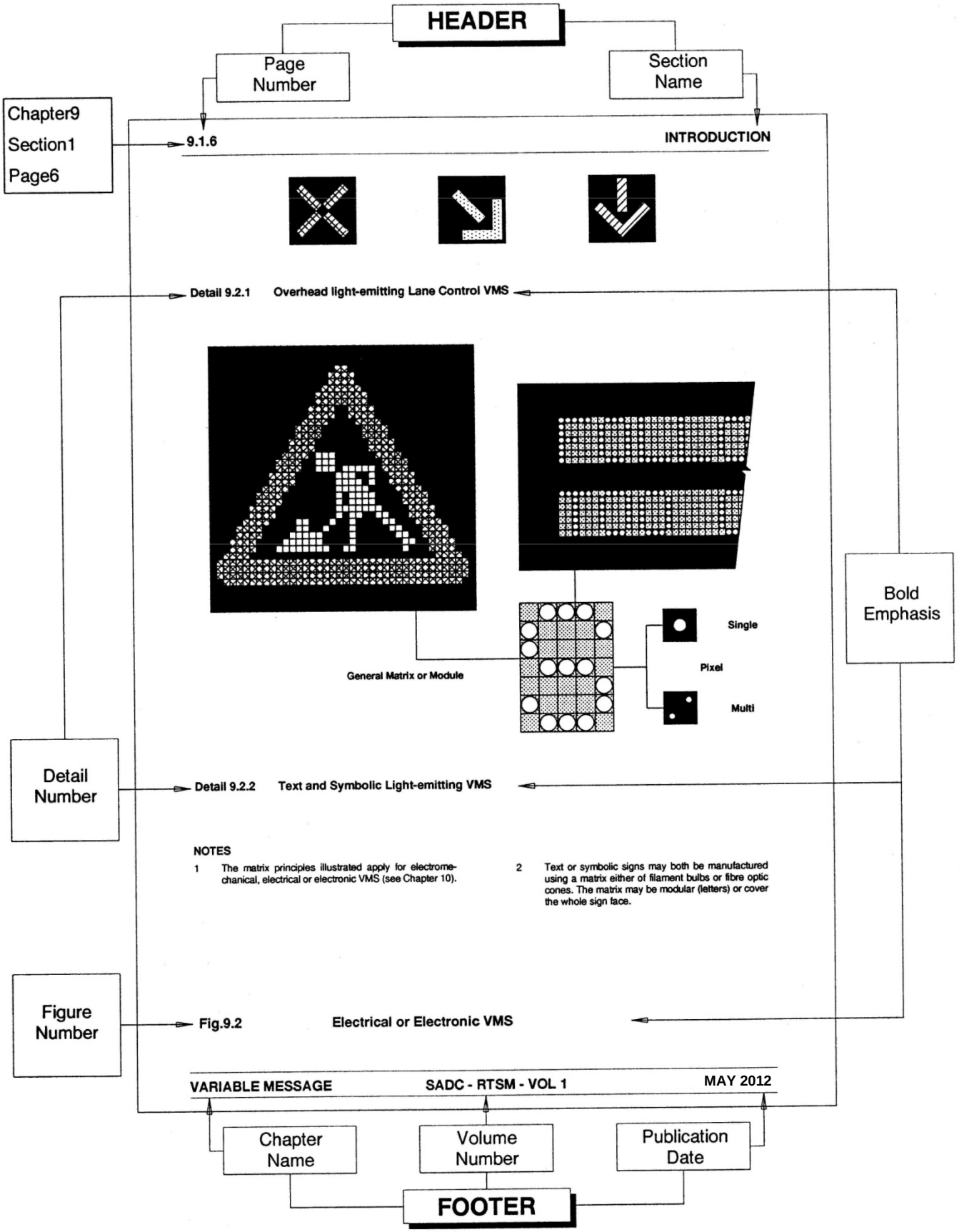


Fig 1.2 **Typical Figure Page Layout**

Manual does not, however, set out to define terms and no attempt has been made to obtain agreement on the meaning accorded many of the terms used. The meaning attached to these terms. for the purpose of understanding the interpretation and application of the terms, in the context of the Manual, is given in Chapter 10 : *Glossary of Terms.* It should be noted that there are many documents, including legislation, in which terms are defined. Users of the Manual should adhere to such definitions in relation to the legal application of such other documents.

3 There are three words used throughout the Manual dealing with the function, design and application of traffic control devices, the interpretation of which is fundamental to the use of the Manual. These words are the very common words **"SHALL", "SHOULD"** and **"MAY"**. The meanings attached to these words for the purpose of interpreting the Manual shall be:

(a) **"SHALL"** – a mandatory condition - when this word is used it means that the conditon or conditions referred to must be complied with;

(b) **"SHOULD"** – an advisory condition – when this word is used it is advisable or recommended to comply with the condition or conditions referred to (see also **"RECOMMENDED"** in paragraph 1.1.4.6);

(c) **"MAY"**- a permissive condition - the conditions referred to are optional.

The legal significance of these terms must be understood by users of the Manual. It is very likely that authorities will be subject to greater levels of legal action in the future. Failure to adhere to the intention of the Manual as indicated above could affect the outcome of such action to the detriment of the authority.

4 The word "SHALL" is used in two ways. "SHALL" is used to refer to the actions required of road users and in this context the provisions of the regulations take legal precedence. "SHALL" is also used to refer to actions required of authorities in the use of traffic control devices. In many instances such a mandate is also provided for in the regulations.

5 When the word "SHOULD" is used the condition referred to is open to a measure of interpretation. This is recognised in the Manual where, occasionally, the word "RECOMMENDED" is used in place of "SHOULD". "RECOMMENDED" should be understood to have a stronger implication than "SHOULD". If an authority chooses not to conform to the recommended action, it would be well advised to record why it has chosen not to do so.

6 The use of the word "MAY" is much wider and less specific than the other two words. It is used directly in relation to the actions road users and/or authorities can take, at their discretion, with regard to the function and use of road traffic signs. "May" is also widely used in a general sense throughout the text of the Manual.

7 The word "yellow" is used throughout the Manual in place of "amber" with respect to traffic signal indications. "Yellow" is the more common international term.

8 The attention of users of the Manual is drawn particularly to the differences in the meanings of the following terms (see Chapter 10) :

(a) standard signs and variable message signs (VMS);
(b) permanent signs and temporary signs;
(c) retroreflective surface and reflective surface.

1.1.5 Requirements for Traffic Control Devices

1 The functions of traffic control devices include:

(a) the regulation of traffic by assigning right-of-way and indicating regulations in force;
(b) the warning of road users of hazards and of hazards ahead, or of regulatory controls ahead; they may often be temporary devices warning of the hazards to road users or to workers and plant working on the road;
(c) the guidance of traffic by the indication of direction, distance, location and other navigational information; and locally in the selection of the correct portion of the roadway;
(d) the provision of additional information to road users.

2 In order that they may best fulfil their required function traffic control devices shall:

(a) fulfil a need;
(b) command attention;
(c) convey a clear, simple meaning at a glance;
(d) command the respect of road users;
(e) allow adequate time for the correct response from road users.

3 Failure to fulfil the required functions may be the result of:

(a) inadequate engineering study prior to installation;

(b) disregard for specific site conditions such as gradient, sight distance, or road surface and the local effects of human factors. vehicle limitations or weather conditions;

(c) lack of maintenance or misuse which encourages disrespect;

(d) inadequate geometric design - traffic control devices cannot be expected to correct or alleviate deficiencies in geometric layout.

4 The following criteria should be employed to ensure that the required functions are met:

(a) design (see Section 1.4 and Chapters 2 to 7);

(b) placement (see Section 1.6);
(c) application (see all Chapters and Volume 2);
(d) maintenance (see Sections 1.10 and 1.11);
(e) uniformity.

5 To achieve these objectives, road traffic signs should comply with the following requirements:

(a) **conformity** involving disciplined compliance with nationwide policy so that road users may be assured of the same signing principles and standards wherever they may be in the system;

(b) **accuracy** of signface display to eliminate confusion which may be experienced by road users if sign messages do not relate to what can be seen on the road ahead;

(c) **uniformity** of signface layout, colour code and sign display sequence to enhance road users' abilities to get the best from the system by reducing reading times;

(d) **consistency** of signing practice so that like situ-

ations are signed in a like manner;

(e) **continuity** of message display until the information is no longer relevant.

6 Consistent with the requirement that they shall fulfil a need, care shall be exercised not to install too many signs thereby risking bringing the sign system into disrespect. It is recommended that the use of regulatory and warning signs be undertaken conservatively so that those that are really needed are effective. However, to achieve reassurance and continuity of navigational information route markers and direction signs should be displayed at regular intervals.

1.1.6 Uniformity of Traffic Control Devices

1 Uniformity of practice means treating similar situations in the same way. The use of a uniform specified or manufactured traffic control device does not in itself constitute uniformity. Standard devices used in a standard manner, in appropriate circumstances, reduce the time road users need to recognise and understand the message and to choose a course of action. The meaning of the device should ideally be apparent at a glance.

2 Uniformity of device and application is essential to law enforcement and for traffic safety. A standard device used in an incorrect manner can be as bad or worse than a non-standard device, and can cause significant disrespect and disregard for the law.

3 The need for uniformity is becoming more important for the following reasons:

(a) present-day driving is becoming increasingly complex;

(b) the liability of government, at all levels, for public safety is increasing;

(c) uniformity of design and manufacture result in economic unit rates;

(d) a wide range of driver capabilities have to be catered for;

(e) the amount of travel in unfamiliar road and street systems is increasing.

1.1.7 Placement of Traffic Control Devices

1 Traffic control devices and their supports shall be placed for the purpose of regulating, warning, guiding and informing road users only on the authority of a public body or official having jurisdiction. No traffic control device or its support shall bear any advertising message or any other message not essential to the control of traffic, with the exception of STREET NAME signs GL1 and SUBURB NAME signs GL2 (see Section 1.9).

2 Details of the orientation and longitudinal, lateral and vertical placement of signs is given in Section 1.6.

3 Ministers, Administrators, or duly authorised officials, have the power in terms of Road Traffic Legislation, to remove, or order the removal of, any non-prescribed or unauthorised sign.

1.1.8 Engineering Study

1 This Manual includes warrants and specific guidelines in relation to the use of many of the traffic control devices it covers. The Manual is, however ,not a substitute for good engineering judgement.

2 The decision whether or not to use a particular device, and, if one is to be used, the decision on how it shall be used, should be made at the very least on the basis of an inspection of the site. Specific site factors and the presence of other devices will influence the use of a proposed new device. It is strongly recommended that engineering studies be undertaken by qualified traffic engineers or traffic officers. If an authority does not have suitably qualified personnel they should seek assistance from larger authorities or a traffic engineering consultant.

1.1.9 Principles of Signing

1 The principles of design and application of road traffic signs are detailed in the chapters of this volume. These principles are summarised in this subsection.

2 All road traffic signs shall conform to the requirements of paragraph 1.1.5.2. The guidelines given in the Manual conform, in general terms, to the following basic principles or assumptions:

(a) give a positive message in preference to a negative message whenever such a choice is available;

(b) use symbols or diagrams in preference to words;

(c) signs should preferably have the same appearance by day and by night (use of retroreflective material);

(d) limit the amount of information given at any one time to what can reasonably be observed and processed by road users; however,

(e) when two required messages are linked or complement each other, such as a regulatory message and a warning message, it will commonly improve the effectiveness of message transfer to mount the relevant signs together;

(f) the overall approach to signing should embody the principles of positive guidance (see Section 1.8);

(g) all candidate destination names cannot be displayed at any given point;

(h) pre-trip planning is essential;

(i) regional, area or district names are not a precise enough source of information.

3 The design and use of guidance signs further requires a disciplined approach to the understanding and application of principles as follows :

(a) navigation (see Chapters 4 and 8):

(i) primary aids :

- route maps
- route numbers
- interchange (EXIT) and junction numbers
- selective destination display to provide orientation
- distances to high speed exits;

(ii) sign information functions :

- location (you are here)
- direction
- orientation
- confirmation;

(b) system efficiency:

(i) functional requirements (see paragraph 1.1.5.2);

(ii) criteria to meet required functions (see paragraph 1.1.5.4);

(c) signface design function (see Chapter 4) :

(i) clear and simple message transfer to enable road users to :

- see sign (conspicuity)
- recognise sign function (class identification)
- read the sign (legibility)
- interpret the message (comprehension)
- make a decision
- act on the decision timeously;

(ii) important message transfer factors:

- amount of information
- length of words
- similarity of words
- letter/background contrast
- upper/lower case letters
- letter size and style
- legibility distance/reading time
- angle of display;

(d) information display (see Chapter 4) :

(i) use standard symbols rather than words;

(ii) display a standard quantity of information in a standard way;

(iii) limit total amount of information.

1.1.10 Use of Numbers on Direction Signs

1 Numbers have been allocated to the main routes in the road network to give a concise collective description to what is commonly a lengthy piece of road (in a similar way that postal codes serve to identify fairly large areas). In addition distances are displayed on many types of direction sign. These types of numbers are differentiated by colour code (see Section 1.4).

2 Certain direction signs may also display the interchange exit or junction number which is also exclusively colour coded.

3 Use of these numbers may assist message transfer because:

(a) they are short and can be read at a glance;
(b) primary navigational decisions can be made on the basis of their message;
(c) they permit accurate and quick correlation with maps;
(d) they are not language dependant.

1.1.11 Selection of Destinations

1 Full details on destination selection for direction signs are covered in Chapters 4 and 8.

2 The following criteria are important in deciding which destination will be most effective:

(a) availability at the destination of motorist services;
(b) ability to provide navigational orientation (familiarity);
(c) the next destination;
(d) the proximity of other destinations;
(e) importance in terms of:

(i) population;

(ii) regional centre (economic activity);

(iii) traffic generation;

(iv) transient tourist population;

(f) junction or termination of routes.

1.1.12 Additional Signs and Symbols

1 This Edition of the Manual introduces a wide range of new symbols for use on regulatory, warning, guidance and information signs, markings and signals. The pro- vision of these symbols is often based on anticipated future requirements.

2 A number of rules apply to the design of symbols to make them effective at high traffic approach speeds. These rules differ for different sign types.

3 In terms of Road Traffic Legislation Ministers or duly authorised officials may authorise the use of an experimental sign for a limited period of time so that the suitability and effectiveness may be determined. No new sign or symbol shall be used without prior approval. A draft sign or symbol design may be submitted but should not be used until it has been refined and approved in terms of the standard design rules.

4 It is desirable, in the interests of uniformity, that the need for a new symbol or sign be submitted, with motivation, to:

The Secretary of the relevant countries' Road Traffic Signs Technical Committee.

1.1.13 Lettering

1 This Edition has adopted the German DIN (Standard) 1451 Part 2, Styles "A" and "8", lettering for use on all signs. All letter dimensions and spacings are fully proportional for all sizes. This simplifies sign design and results in a general reduction in the size of direction signs.

2 DIN 1451 Part 2 lettering is reproduced by permission of *DIN Deutsches Institut fur Normung e.V.* The definitive version for the implementation of the standard is the edition of this standard bearing the most recent date of issue, obtainable from *Beuth Verlag GmbH,* Burggrafenstrasse 6, D-1000 Berlin 30.

3 All words used on road signs should be displayed in the manner normal for printed matter, using upper and lower case letters, with the exception that the names on all LOCATION signs or LOCATION information

panels displayed as part of a larger sign, shall be displayed in uppercase letters only. The use of uppercase letters is part of the coding system used to identify locational ("you are here") information. A modified letter style is specified for this application. This style, designated "B MOD", has an increased letter stroke width to reduce the risk of "overglow", which could result under high levels of illumination due to the high contrast between the specified white retroreflective background and the semi-matt black letters. Only uppercase letters and numerals are available in this letter style.

1.1.14 Maps

1 Nothing symbolizes better than maps our human dependence on knowing our location, or where we are. Without knowing where we are we can hardly expect to know how to proceed to where we want to be!

2 The use of maps is fundamental to the navigation process. It is not reasonable for travellers to get into their motor cars and drive off, heading for unknown territory, and expect the road traffic sign system to guide them there. Their acquired knowledge will vary from almost nothing, to an intimate knowledge of their own surroundings, but little or no knowledge of their ultimate destination. It is therefore very important that impending travellers undertake adequate pre-trip planning. Maps are essential for this purpose.

3 For maps to fulfil their function, road users must have confidence in them. They must be regularly updated and they must reflect as closely as possible the information travellers will find along the road. There is therefore a responsibility on road authorities to ensure that changes in the road network are communicated to map-makers.

1.1.15 The Road Traffic Sign System

1 The shape and colour code of the SADC road traffic sign system conforms very closely to the principles of the European interpretation of the international shape and colour code. There are, however, several variations in practice within Europe - e.g. the use of blue and green for freeway and non-freeway direction signs is not universal - some countries reverse the colour application. There are other practices which have not yet received universal acceptance - e.g. the use of a yellow background colour for temporary road signs and the brown background colour for tourism signs (see Section 1.4).

2 Significant differences from the European sign system, with particular reference to the regulatory class of signs, are:

(a) ONE WAY ROADWAY signs R4 have a red background colour in the SADC system and a blue one in the European system;

(b) PROHIBITION signs in the SADC system dealing with actions and objects (rather than limits) use a diagonal red slash to indicate the prohibition - the same signs in the European system do not use the diagonal slash.

3 Apart from the changes to letter styles and the use of symbols, guidance sign design has undergone numerous detail changes. A new class of LOCATION signs, which includes STREET NAME signs, has been incorporated. This class of sign indicates to drivers where they are, rather than where they may want to be (DIRECTION signs). In addition two new classes of supplementary direction signs are included in the system. These are the TOURISM DIRECTION sign class which uses a unique brown background colour and utilises symbols extensively and the LOCAL DIRECTION sign class, which is similar but uses black symbols and letters on a white background with a blue border (see Chapter 4, Sections 4.10 and 4.11).

4 A major new sign group for both permanent and temporary use is the DIAGRAMMATIC guidance sign group. This class of sign uses the principle of a diagrammatic display of the (change in) road condition ahead rather than attempting to put such a message into words (see Chapter 4, Section 4.12).

5 The classification of road markings has been improved. New markings have been added, and the significance of the following markings has been changed (see Chapter 7):

(a) PROHIBITORY LINE markings have been reclassified as two markings, the NO OVERTAKING LINE marking RM1 and the NO CROSSING LINE marking RM2;

(b) WARNING LINE marking - is replaced by CONTINUITY LINE marking WM2;

(c) EDGE LINE marking RM4.1's significance has been altered under certain circumstances (see Chapter 7);

(d) PEDESTRIAN CROSSING LINE marking Type B - is replaced by transverse marking PEDESTRIAN CROSSING LINES RTM3.

1.1.16 Signing for Heavy Vehicles

1 Much of the motivation for expansion of the road traffic sign system has been derived from the need to improve upon the way in which the use of public roads by heavy vehicles may be controlled. As a result many of the new regulatory, warning and diagrammatic signs, often using new symbols, have been provided to meet this need.

2 The term "heavy vehicle" is generally used to describe ALL vehicles with a GVM over 3500 kg, and includes buses. If buses over such a mass are to be excluded from a signing exercise, the signing should be designed based on the class of vehicle known as "goods vehicle" (see Chapters 2 and 3 and Volume 2).

1.1.17 Signing for Public Transport Vehicles

1 It has also been noted that there may be a future need for improved signing for this class of traffic. Provision has been made for the signing of a much wider range of types of public transport vehicles.

2 The majority of new signs are regulatory signs and several new symbols have been provided. Generally these symbols utilize side views of the vehicles.

3 The provision also now exists to use symbols in place of words on direction signs when a public transport terminal warrants inclusion on such signs. Generally these signs use front view symbols. **Care should be exercised not to use these symbols on the wrong class of sign.**

1.1.18 Roadworks Signing

1 Motivation for an exclusive signing system for use at roadworks has also been a major factor in the technical revision process. A system of temporary signs has therefore been created for use at roadworks and other temporary situations.

2 The range of temporary signs is comprehensive. The following important aspects should be noted:

(a) there is no temporary version of STOP sign R1, YIELD sign R2, NO ENTRY sign R3 or ONE WAY ROADWAY sign R4 - the standard permanent forms of these signs shall be used in all circumstances;
(b) certain signs are ONLY available in a temporary form;
(c) certain signs are ONLY available in a permanent form (in addition to those mentioned in (a) above).

3 The significance and application of all individual temporary signs is covered in this volume. The collective use of temporary signs at roadworks is covered in Volume 2, Chapter 13.

1.1.19 Implementation

1 It is a requirement of the Legislation that all aspects of the signing system conform to the provisions of the regulations, and thereby of the Manual, by 31 December 2000 in South Africa. With the adoption of this manual, and its relevant legislation, this dead- line may vary from one member country to another. Whilst authorities may come under pressure to accelerate change it is recommended that, in the interests of economy, the updating of signs be generally achieved through planned maintenance or as a result of new capital works.

2 It is, however, recommended that early attention be given to the use of, or conversion to, the following road traffic signs:

(a) 3- and 4- WAY STOP signs R1.3 and R1.4;
(b) YIELD AT MINI CIRCLE sign R2.2;
(c) ONE WAY ROADWAY signs R4;
(d) BUSES ONLY signs R121 and BUS and BUS LANE RESERVATION signs R301, R302 and R303;
(e) BUS STOP sign R325;
(f) FREEWAY BEGINS signs R401 and R402;
(g) NO STOPPING LINE marking RM12.

1.1.20 Environmental Impact

1 The provision of a road traffic sign represents a conflict of interests. On the one hand it is considered necessary to communicate a message to road users and in order to do this, the necessary road traffic sign is designed to intrude into the field of view of road users. On the other hand this field of view may have some particular environmental or aesthetic value.

2 This conflict of interests is, in practice, rarely avoidable in the interests of road safety. However, its effect should be recognised and considered, particularly in visually sensitive environments and the impact minimised if possible. **In almost any environment the oversupply of road traffic signs, or indeed any other form of sign, can be considered to have an unacceptable environmental impact.**

1.1.21 Awareness and Education

1 The extent of change in the sign system incorporated in this Edition makes it obligatory on all authorities to co-ordinate awareness and educational campaigns directed at:

(a) road users;
(b) road authority officials;
(c) traffic officers;
(d) those involved in vehicle driver training;
(e) traffic control device manufacturers;
(f) international visitors.

2 Awareness and educational effort should be directed at the operational principles of the signing system.

1.1.22 Legal Aspects

1 References are made regularly to the legal implications of the material contained in this Manual and in the relevant regulations. Authorities should be aware that in many instances the principles of common law also apply to their actions in addition to those of Road Traffic Legislation.

1.1.23 Sign Colour Indication

1 It was originally intended to publish the Manual fully in colour. As an economy measure colour printing has been limited to a number of introductory pages, and the contents pages for numbered road traffic signs covered by Chapters 2 to 7. These pages do not cover all possible colour examples or combinations. A black and white shading system as indicated in Figure 1.3 has been used to portray the colours throughout the rest of Volume 1 and in Volume 4.

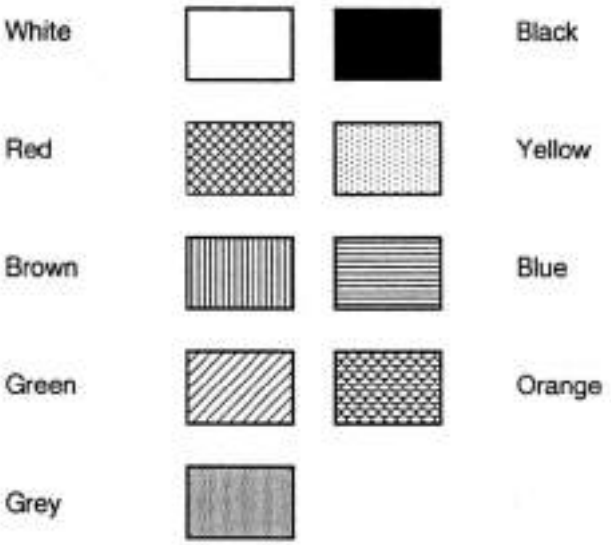


Fig 1.3 Key to Colour Coding

1.2 ROAD CLASSIFICATION

1.2.1 General

1 If GUIDANCE signing is to be effective in metropolitan areas, in towns, and in a rural setting, at all levels of the road network, for local drivers and for drivers unfamiliar with the area in which they are travelling, it is desirable that there shall be a good measure of uniformity of signing practices throughout the member countries.

2 The road networks in each country have been classified for different functional purposes. In or- der to aim for the objective of signing uniformity the various existing classifications have been assessed and in general terms were found to offer too wide a range of categories for the purpose of GUIDANCE signing. A road classification for signing purposes has therefore been developed.

1.2.2 Road Classification for Signing Purposes

1 This road classification is basic because there are definite limits to the number of ways in which GUIDANCE signs, and specifically DIRECTION signs, can be made to indicate with sufficient immediate recognition potential, the different classes into which the road network is divided for signing purposes.

2 It is considered necessary to treat the signing of different classes of road in recognisably different ways so that road users may be readily aware of the class of road on which they are travelling, or which they are about to enter. Such a state of awareness is necessary to achieve the attention levels appropriate to the complexity of the driving task likely to be experienced on a given class of road, and thereby to the navigational requirements appropriate to the road class. In such a way drivers are likely to develop an appropriate level of expectation with respect to the provision of GUIDANCE signs on different classes of road. It is the duly of road authorities to satisfy such expectations.

3 The class of road may be indicated directly, through differences in the guidance sign colour code e.g. by the use of blue, green or other background colours. It may also be made obvious by the use of signs with visibly different appearances e.g. FINGERBOARD signs. Alternatively a more subtle difference may be indicated by the provision of a greater or lesser number of guidance signs. The overall objective, however, should remain that of obtaining an adequate state of awareness in drivers, to changes in the levels of the road hierarchy.

4 Different classes of road can also be indicated by means of the route number allocated to the road al- though this is not applicable throughout the whole road network (see Sections 4.1 and 4.6). It should be noted, however, that different designatory letters are used in member countries to identify classes of route which have essentially the same characteristics as similar classes of route in other member countries.

5 Roads are therefore broadly classified as RURAL or URBAN and specific differences in signface display rules are related to these basic categories. Within these classes the road types have been further subdivided into four groups, namely CLASSES A, B, C and D, as indicated in Figure 1.4. If a need exists, each of these classes may be further subdivided, provided recognisably different methods of signing can be provided for each class. CLASS A roads and URBAN CLASS B streets are sub-classified as indicated in Figure 1.4. The signing of roads in peri-urban areas requires particularly careful attention since the operational boundary between RURAL and URBAN classes is rarely as clear-cut as a line on a map.

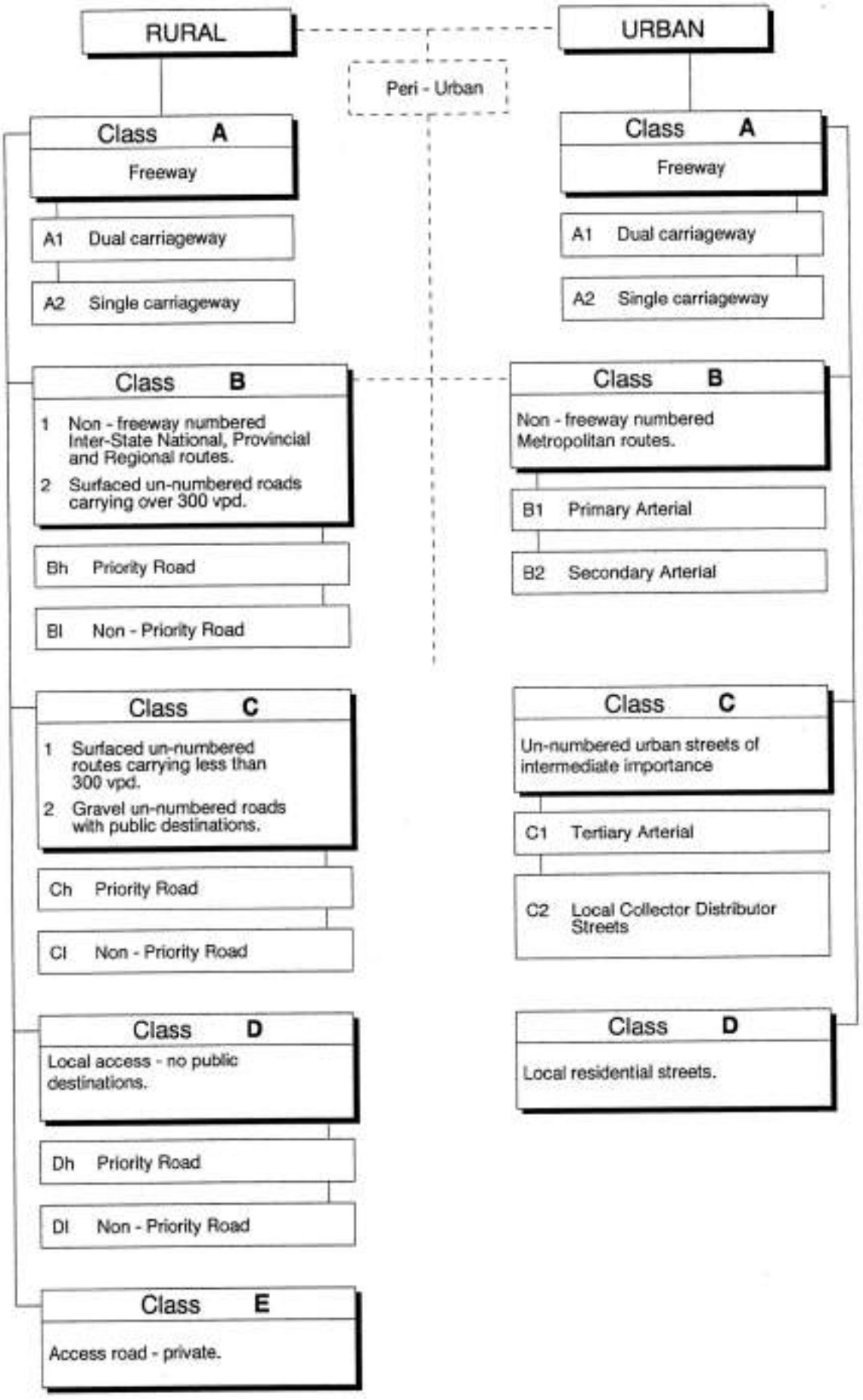


Fig 1.4 Road Classification for Signing Purposes

1.3 ROAD TRAFFIC SIGN CLASSIFICATION

1.3.1 General

1 The term ROAD TRAFFIC SIGN is the collective term used in legislation to include all ROAD SIGNS, ROAD MARKINGS and TRAFFIC SIGNALS. The classification detailed in this section therefore covers all three sub-categories of road traffic signs. Whilst road traffic signs are directed at road users in general the majority of signs are for drivers of vehicles (including bicycles). Signs are broadly classified by function as REGULATORY, WARNING, GUIDANCE and INFORMATION road traffic signs (see Figure 1.5).

2 In addition to selected specific road traffic signs incorporated into the overall signing system which relate to pedestrians, for the first time this edition of the Manual includes details of a GUIDANCE sign sub-class for pedestrians.

1.3.2 Road Signs

1 ROAD SIGNS represent by far the biggest numerical group in the overall road traffic sign classification. The further classification of road signs is necessary to assist in the development of specific primary properties i.e. a sign shape and colour code. Since the various classes of road sign have significant functional differences it is important that road users, observing a road sign, instantly recognise its function, based on the primary properties, prior to comprehending the specific signface message that is being conveyed. In doing so they should, virtually automatically, be in a state of readiness to act in accordance with the message once this is observed and understood, and have determined that such message has immediate application to them.

2 The basic ROAD SIGN classification is as follows:

(a) REGULATORY signs - R numbering series and generally a circular shape
(b) WARNING signs - W numbering series and generally a triangular shape;
(c) GUIDANCE signs - G numbering series and generally a rectangular shape;
(d) INFORMATION signs - IN numbering series and generally a rectangular shape.

3 The shape, size and colour characteristics of each of these classes are described fully in Section 1.4. The harmonisation process identified a lack of clarity in the subdivision of the main classes of road traffic signs, to the extent that occasionally new signs were being proposed out of their correct class. This factor, together with the relatively large increase in the number of signs, motivated for the creation of clearly identified sub-classifications within the main classes. This in turn made it advantageous to re-number all but a very few road traffic signs. To do otherwise would have resulted in significant confusion (see Figure 1.6).

4 Virtually all road signs may be used in either a PERMANENT or TEMPORARY form. Those that should only be used in the one or the other form are clearly identified on the individual sign description pages. PERMANENT signs include all road signs used to indicate normal conditions - the *status quo*. A SELECTIVE RESTRICTION regulatory sign which limits the applicability of a regulation, for instance to only a part of the day but every day, remains classified as a PERMANENT sign because its application, although only for part of the day, is constant.

5 A TEMPORARY sign on the other hand, is any sign which is placed in view of road users to indicate a change to normal circumstances, whether this be for a few minutes or for several months. The message which should be inferred by an observer of TEMPORARY signs is that normal standards may not apply, and as a result, a higher level of attention to surrounding circumstances, which are not normal, is required. The interpretation of what is permanent and what is temporary has presented difficulties for some sign practitioners. A roadworks site that has been in operation for several months could, for instance, be considered to be a normal circumstance. It clearly is not, <%2>because although it is of long duration, there may be daily or even hourly variations of traffic accommodation detail. Drivers must be sufficiently attentive to these variations to deal with them safely - hence the use of TEMPORARY signs to attempt to create the required attention levels. Typical TEMPORARY signing circumstances include:

(a) roadworks, maintenance, construction and other building sites;
(b) accident sites;
(c) temporary traffic accommodation or control, including school sites and scholar patrols;
(d) the temporary display and removal of a NO PARKING or NO STOPPING prohibition during events for example (not to be confused with the use of a SELECTIVE RESTRICTION NO PARKING or NO STOPPING sign which is permanently displayed).

6 Road signs may also be displayed in a STANDARD or a VARIABLE MESSAGE form. The majority of road signs covered by this Manual are standard signs. Variable message signs are covered in Chapter 9 and in Volume 2.

7 REGULATORY signs have legal significance. Their function is to control or restrict the actions of road users. Disregard of such signs constitutes an offence. This group of signs is subdivided into a wider classification as follows:

(a) CONTROL signs;
(b) COMMAND signs;
(c) PROHIBITION signs;
(d) RESERVATION signs;
(e) COMPREHENSIVE signs;
(f) SECONDARY MESSAGE signs;
(g) DE-RESTRICTION signs.

8 The function of WARNING signs is to indicate circumstances that are hazardous or potentially hazardous to road users and they are classified as:

(a) ADVANCE WARNING signs - located before a hazard;
(b) HAZARD MARKER signs - located at the hazard.

9 GUIDANCE signs are essentially those signs previously classified as INFORMATION signs, which had a directional or guidance (navigational) function rather than simply an information function. GUIDANCE signs are further classified as:

(a) LOCATION signs;
(b) ROUTE MARKER and TRAILBLAZER signs;
(c) DIRECTION signs;
(d) FREEWAY DIRECTION signs;
(e) TOURISM signs;
(f) LOCAL DIRECTION signs;
(g) DIAGRAMMATIC signs
(h) PEDESTRIAN signs.

10 Signs which do not include a directional or navigational message component are classified as INFORMATION signs. All INFORMATION sign numbers have been changed - see Chapter 5.

1.3.3 Road Markings

1 ROAD MARKINGS are broadly classified as:

(a) REGULATORY markings - RTM and RM numbering series;
(b) WARNING markings - WM numbering series;
(c) GUIDANCE markings - GM numbering series.

2 Regulatory road markings have a legal significance and they are widely used to control the actions of road users. Disregard of such markings constitutes an offence. It should be noted that the road marking colour code is not as specifically developed around regulatory markings as is the colour code for regulatory road signs (see paragraph 1.4.4.10). Regulatory road markings are subdivided into:

(a) TRANSVERSE markings - RTM numbering series;
(b) LONGITUDINAL markings - RM numbering series.

For details of road markings refer to Chapter 7, and for application examples to Volume 2, Chapter 2.

1.3.4 Traffic Signals

1 The vast majority of TRAFFIC SIGNAL applications have a regulatory function. Failure to obey a TRAFFIC SIGNAL constitutes an offence. One or more yellow flashing lights may be used to supplement a road sign message to increase its conspicuity and thereby warn of its presence (see Chapter 6).

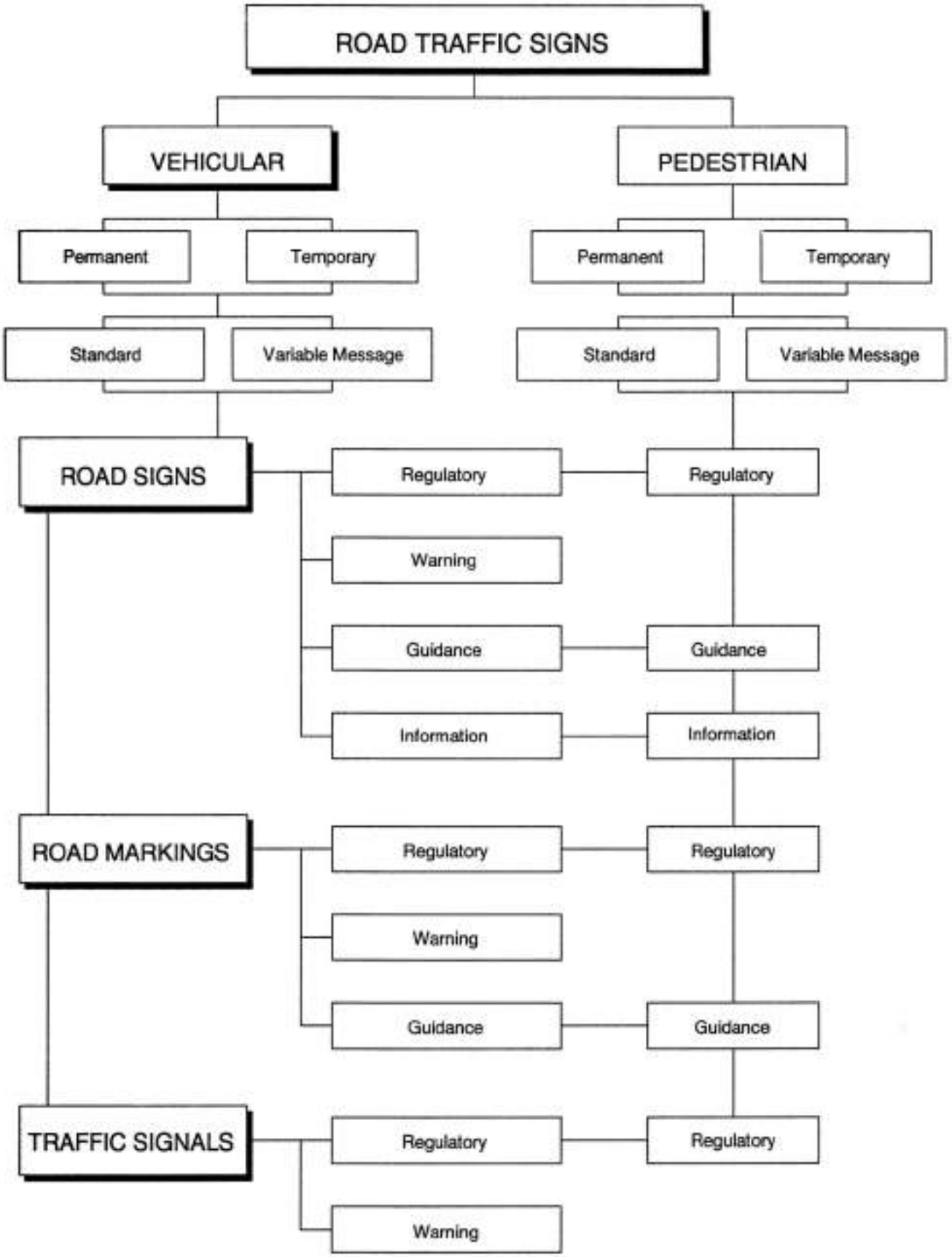


Fig1.5 **Road Traffic Sign Classification**

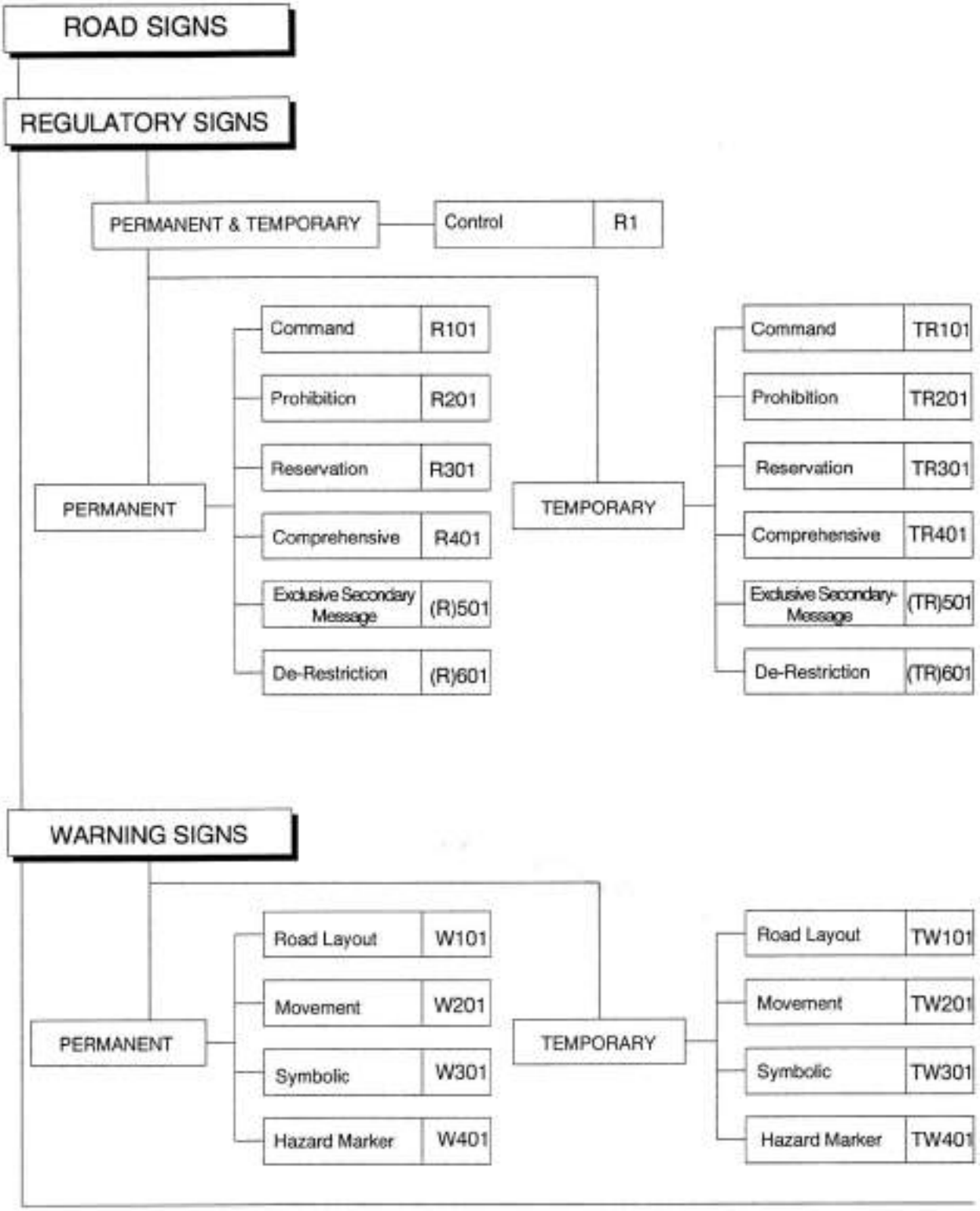


Fig 1.6 Detailed Classification with Numbering Series

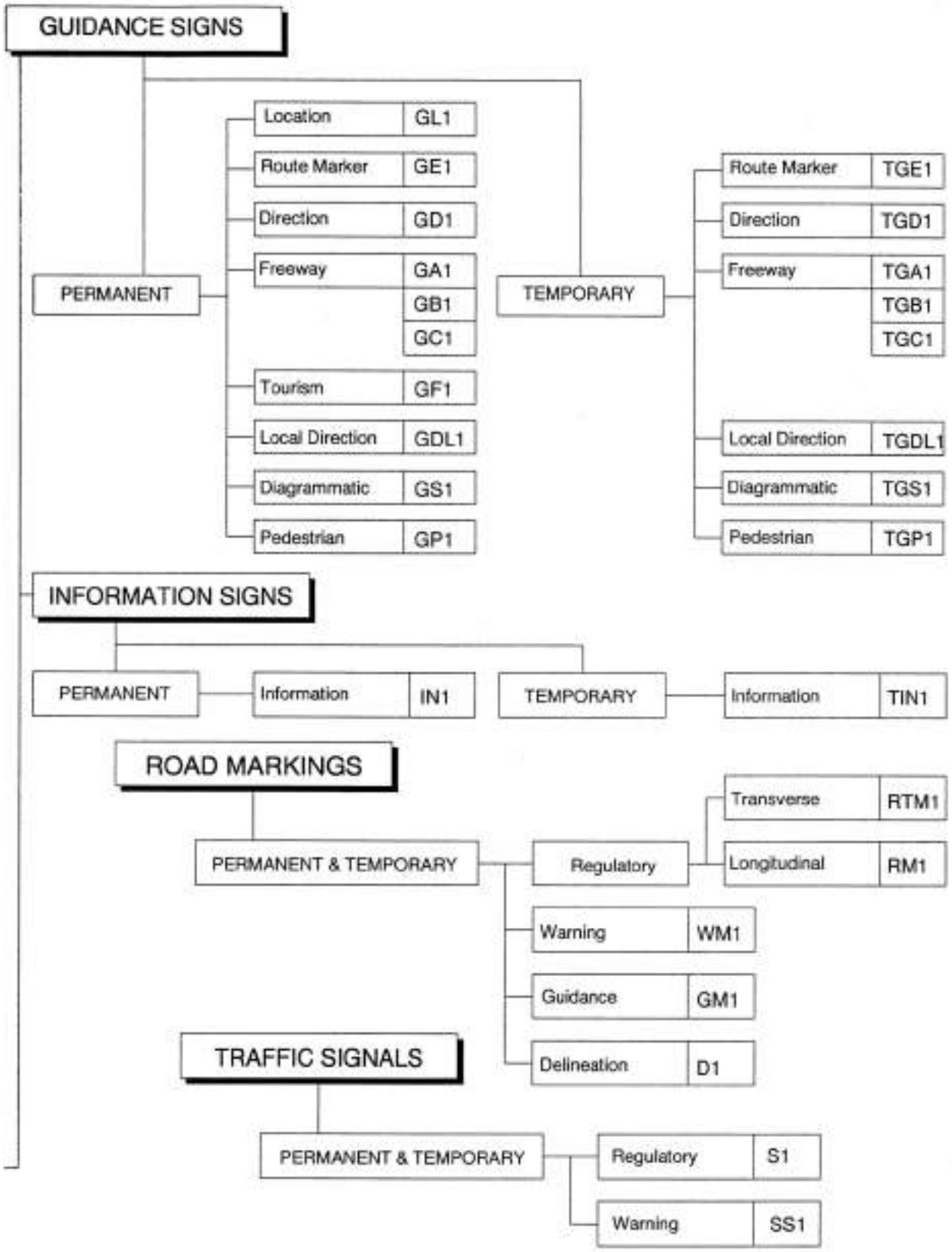


Fig 1.6 Detailed Classification with Numbering Series

1.4 SHAPE, SIZE AND COLOUR

1.4.1 General

1 A road traffic sign is more easily seen, identified and read if different classes of sign conform to different shape and colour codes.

2 The shape, size and colour of a road traffic sign contribute to its conspicuity and to the transfer of its primary function or class, and its specific signface message. The conspicuity achieved by a sign may result from any or all of these physical attributes of signs. Within reasonable limits it is desirable to achieve effective conspicuity in a particular road scene with the smallest possible sign. In this way an acceptable compromise between the conflicting objectives, for a road traffic sign, of being seen by road users but of not causing an unacceptable environmental intrusion, may be achieved.

3 Effective message transfer will not be achieved if there is not an adequate colour contrast between the colour of the text or symbol used on a road traffic sign and the colour of the sign background. It should be noted that some colour combinations (message and background) which are effective during daytime may not work as well at night, and *vice versa*. In this regard the use of retroreflective materials to achieve adequate conspicuity of a sign at night may reduce the night-time legibility of the message compared to that achieved in daytime. For this reason it is recommended that organisations purchasing road signs have an adequate checking process to ensure that the signface materials used conform to specifications (see Sections 1.1 and 1.5).

4 The colour of the reverse side of road signs shall be grey, UNLESS:

(a) the signboard material is aluminium;
(b) the sign is a STOP sign R1, or one of its derivatives, in which case the colour of the reverse side shall be white:
(c) the sign is a portable sign in which case the reverse side should be marked with yellow retroreflective stripes on a black semi-matt background so that a pattern of alternating 150 mm wide yellow and black stripes is created;
(d) the sign is double-sided.

5 The colour of any post specifically erected for the display of a road sign shall be as follows:

(a) if the post is steel - grey, or the natural colour if plated {galvanised);
(b) if the post is wood - the colour of the wood as treated;
(c) if the post is concrete - the natural colour of concrete.

If the road sign is mounted on the same post as a traffic signal, the above requirements shall not apply and the colour of such a post shall be the golden yellow specified as standard for traffic signal supports.

6 Road signs may be provided as PERMANENT or TEMPORARY signs and the colours used for a specific sign change according to such use (see Subsection 1.4.4 and Chapter 10).

7 The use of VARIABLE MESSAGE signs is growing. If a variable message is of the light reflecting type it shall retain the shape, size and colours of standard signs (permanent or temporary).If a variable message sign is of the light emitting variety it shall accurately represent the shape and the border colour of regulatory and warning signs, whereas the colours of the text or symbol, and the background for such signs, should be reversed so that the text and background colours are white and black respectively (see Chapter 9).

8 Light emitting variable message signs, displaying worded messages only, should do so within a rectangular shape in white letters or numerals on a black background. The provision of a border on such signs is optional but recommended. The border may be provided in white retroreflective material.

9 Shape, size and colour are also relevant for road markings and traffic signals, however, the colour code of road markings is not specifically related to function such as "regulation" or "warning", and traffic signals have limited variations in shape, size and colour.

1.4.2 Shape

1 The shape and size of a road sign play an important part in ensuring that drivers actually see the sign. This function is termed the "attention conspicuity" of the sign and refers to the ability of a sign to attract attention when an observer's (driver's) attention is not specifically directed to the probable occurrence of the sign.

2 Signs which are traditionally small, because their message is short in terms of text or because it is represented by a symbol, have been assigned to shapes that stand out effectively from the background clutter. These shapes give a better quality of edge definition, and therefore shape recognition, to road signs seen against a complex background. For these reasons more important regulatory signs, those that are MANDATORY and PROHIBITORY, are CIRCULAR, although there are some exceptions, namely:

(a) STOP sign R1 - OCTAGONAL;
(b) YIELD sign R2- TRIANGULAR;
(c) PEDESTRIAN PRIORITY sign R5- DIAMOND.

All other regulatory signs are RECTANGULAR e.g. ONE WAY ROADWAY sign R4, and all RESERVATION and COMPREHENSIVE signs.

3 Signs which WARN of a hazard ahead are TRIANGULAR.

4 Guidance and information signs are RECTANGULAR with a few exceptions as follows:

(a) ROUTE MARKER sign GE15 (RSA National) - PENTAGON;
(b) ROUTE MARKER sign GE14 (RSA Provincial) - DIAMOND;
(c) RIGHT OF WAY sign IN7 - DIAMOND.

5 When the message is brief rectangular signs are also small, however, those used for guidance purposes of some complexity are relatively large. Shape and colour codes assigned to various classes of road sign are illustrated in Figure 1.7.

6 As a general rule sign classes are differentiated from each other by shape, whereas subdivisions within a class are differentiated from each other by colour. Therefore, the first message to be interpreted by drivers on seeing a sign, is the type or class of message that the sign is to transfer.

7 Notwithstanding the development of a road sign shape code, account should be taken of the nature of the background environment in which a sign is to be located, and the competition existing for the attention of drivers. This applies particularly when de- signing and erecting signs in complex environments such as shopping areas or city centres. In such cases the positioning of signs should also be considered carefully to maximise their target value. It may be necessary to consider the use of elevated or overhead signs or the use of a HIGH VISIBILITY background to a regulatory or warning sign, to improve the attention conspicuity of the sign. This practice is well established for traffic signals in the form of a black backing board with a white border.

8 Whilst a high visibility background is rectangular and may itself offer a lower level of edge definition against the background, its function is to significantly improve the target value of the whole sign, and to give better edge definition, and hence shape recognition, to the superimposed sign. When building a new road, landscaping can be used to provide a suitable background for signs.

1.4.3 Size

1 Road Traffic Legislation lays down, through its regulations, the minimum size of regulatory and warning signs. These sizes are noted in Tables 2.4 and 3.1.

2 Minimum sized signs should only be used when the environment in which the sign is located is conducive to good attention conspicuity. The sign function should become evident when the sign lies just within a driver's cone of vision forming an angle of the order of 6° with the normal to the direction of travel. If this parameter cannot be met, the sign size should be increased so that its shape is recognisable from a distance that places it within the desired cone of vision.

3 The effective size of a sign can be increased by using a larger standard sign size or by providing a HIGH VISIBILITY background. The effects of choosing a larger standard size of sign are likely to be of the order of a doubling of conspicuity when using a 900 mm diameter sign instead of a 600 mm diameter sign, or an increase in conspicuity of five times if a 1200 mm diameter sign is used in place of a 600 mm diameter one (see Subsection 1.4.2 and Sections 2.8, 3.6 and 4.4).

1.4.4 Colour

1 Colour on its own is not considered a significant factor affecting the **conspicuity** of a road traffic sign when compared, message for message, with a white sign with black text (an "achromatic" sign). This is because the introduction of colour is likely to reduce the sign luminance. The conspicuity of a sign can be attributed in part to the luminance contrast between the sign and the surrounding background. When there is little luminance contrast between an achromatic sign and the background the introduction of even one colour (say as a border colour) serves to create a colour contrast between the sign and the background (a "chromatic" sign).

2 The contrast between the colours used on a sign also affects the **legibility** of the sign message. As a general rule a luminance ratio and a coefficient of retroreflection ratio between the text or symbol colour, and the signface background colour, should be at least 7 to 1 and preferably 10 to 1. These contrast ratios can be reduced to around 4 to 1 for large areas of different colours. Chromaticity charts covering the different colours used on road traffic signs are given in Section 1.5 and full specifications of colours are covered by SASS 1519: Road Signs, SASS 1459: Traffic Lights, SASS 731: Road Markings and SASS 1442: Roadstuds.

3 The different colours, used on different shapes of sign contribute to the early comprehension of the sign class or the level of the sign within the overall sign hierarchy. The use of a yellow background for all classes of TEMPORARY sign is a specific example of this principle (see Figure 1.10). Figure 1.7 illustrates the hierarchy of the sign shape and colour code.

4 In Section 2.0, Figure 2.2 shows the colour code within the REGULATORY sign class where border colour, background colour and symbol colour are used to differentiate between the sub-categories of regulatory sign so that:

(a) CONTROL signs, which vary in shape, are always white on red;

(b) COMMAND and PROHIBITION signs, which are circular in shape, are differentiated by their colour code:

(i) COMMAND -white on blue with a white border;

(ii) PROHIBITION - black on white with a red order;

(c) RESERVATION and COMPREHENSIVE signs which are rectangular in shape are differentiated by their colour code:

(i) RESERVATION- white on blue with a white border;

(ii) COMPREHENSIVE - white on blue with a red border.

5 Figure 1.8 expands the basic regulatory sign colour code given in Section 2.0 Figure 2.2, by using as an example, regulatory signs for heavy vehicle control.

6 In Section 2.0, pages 2.0.18 to 2.0.20, a variety of examples of SELECTIVE RESTRICTION regulatory signs, and of regulatory signs used within HIGH VISIBILITY backgrounds are shown. The secondary message portion of selective restriction signs shall use the same background, symbol and border colour code as the main sign above it. High visibility signs with their increased area of white or yellow background may be used to increase the target value of the superimposed sign(s).

7 Section 3.0, page 3.0.1, shows the colour code used for the warning sign class, for both PERMANENT and TEMPORARY categories. If additional information is required this shall be provided on a SUPPLEMENTARY PLATE IN11, below the warning sign as shown on page 3.0.8. **This colour code also applies if a supplementary plate is required below a regulatory sign or a HIGH VISIBILITY sign.**

8 Figure 4.1 in Chapter 4, Section 4.0 shows the

Guidance Sign Classification for permanent Guidance signs in colour.

9 Figure 4.2 in Section 4.0 shows the background colour code for freeway signs, and illustrates the supplementary code used for the various numbers which may appear on such signs:

(a) INTERCHANGE (EXID or JUNCTION NUMBER - black on white (location);
(b) ROUTE NUMBER - yellow;
(c) DISTANCE - white.

This figure also illustrates the function of the different elements of information used on ground-mounted and overhead freeway direction signs.

10 Figure 1.9 shows typical details of road markings and their colours. It should be noted that there is no distinct colour code establishing a clear functional distinction between the regulatory, warning and guidance classes of road marking. Regulatory markings for instance are variously white, yellow and red. Yellow is, however, only used for regulatory marking applications.

11 Section 6.0, pages 6.0.3 and 6.0.4, illustrate the range of traffic signal shapes and the relative positions of the various standard colour indications.

12 Examples of TEMPORARY signs in the regulatory, warning and guidance sign classes, including examples of temporary selective restriction regulatory signs and high visibility signs, may be found in their respective chapters and in Figure 1.10.

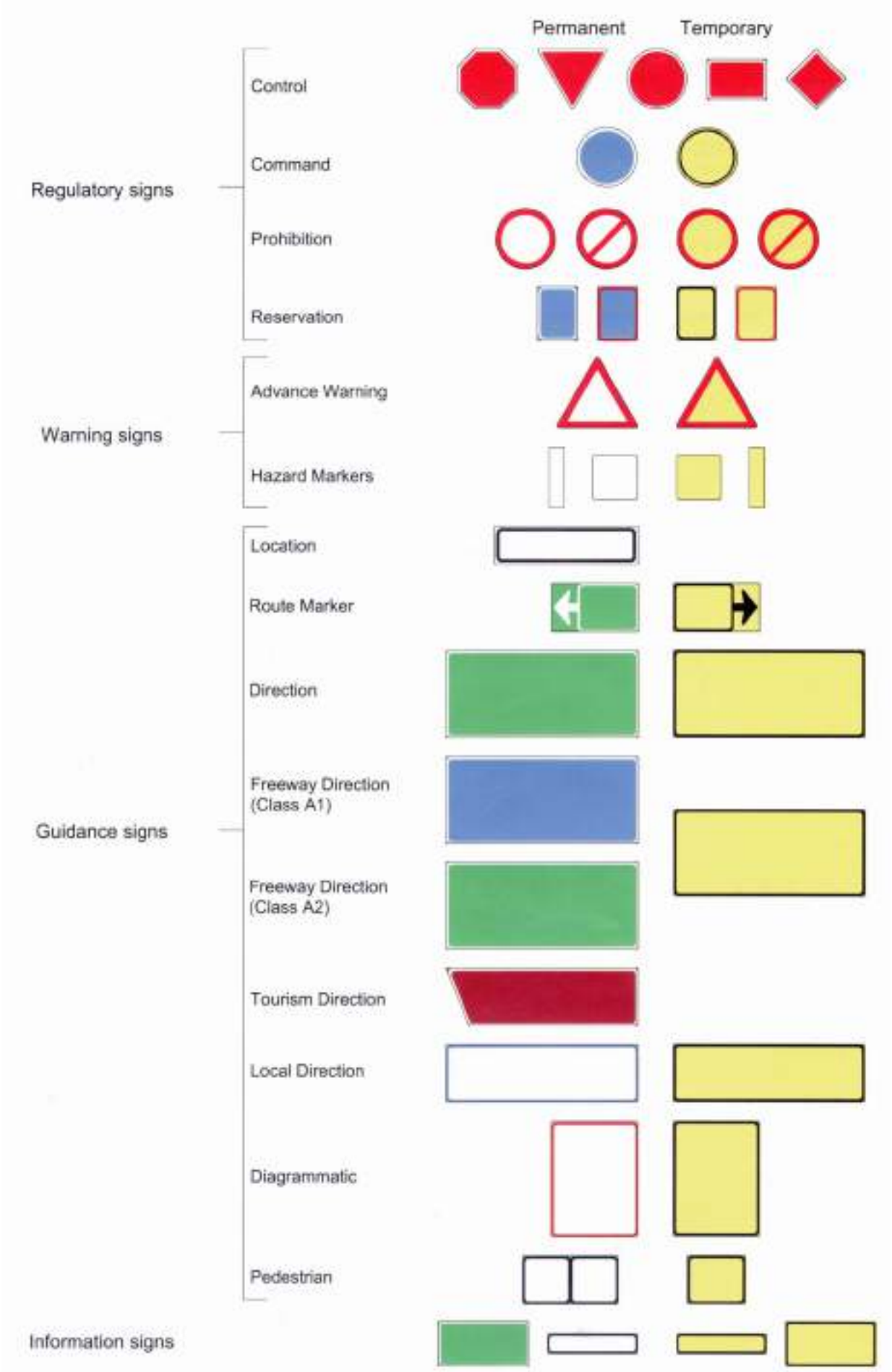


Fig 1.7 **Basic Sign Shape and Colour Code**

All heavy vehicles exceeding 10 tonnes (GVM/GCM) only/must.

All goods vehicles exceeding 3500 kg (GVM/GCM) only/must.

All goods vehicles exceeding 10 tonnes (GVM/GCM) only/must.

Detail 1.8.1 Mandatory Command

No heavy vehicles exceeding 10 tonnes (GVM/GCM).

No goods vehicles exceeding 3500 kg (GVM/GCM).

No goods vehicles exceeding 10 tonnes (GVM/GCM).

Detail 1.8.2 Mandatory Prohibition

Reserved for all goods vehicles exceeding 3500 kg (GVM/GCM).

Parking reserved for goods vehicles exceeding 10 tonnes (GVM/GCM).

Detail 1.8.3 Conditional Reservation

Speed limit for vehicles over 10 tonnes (GVM/GCM).

Temporary speed limit for goods vehicles - 3500 kg (GVM/GCM).

Speed limit for goods vehicles over 10 tonnes (GVM/GCM).

Detail 1.8.4 Selective Restriction

Fig 1.8 **Typical Examples of the Application of the Regulatory Sign Colour Code to a Vehicle Class**

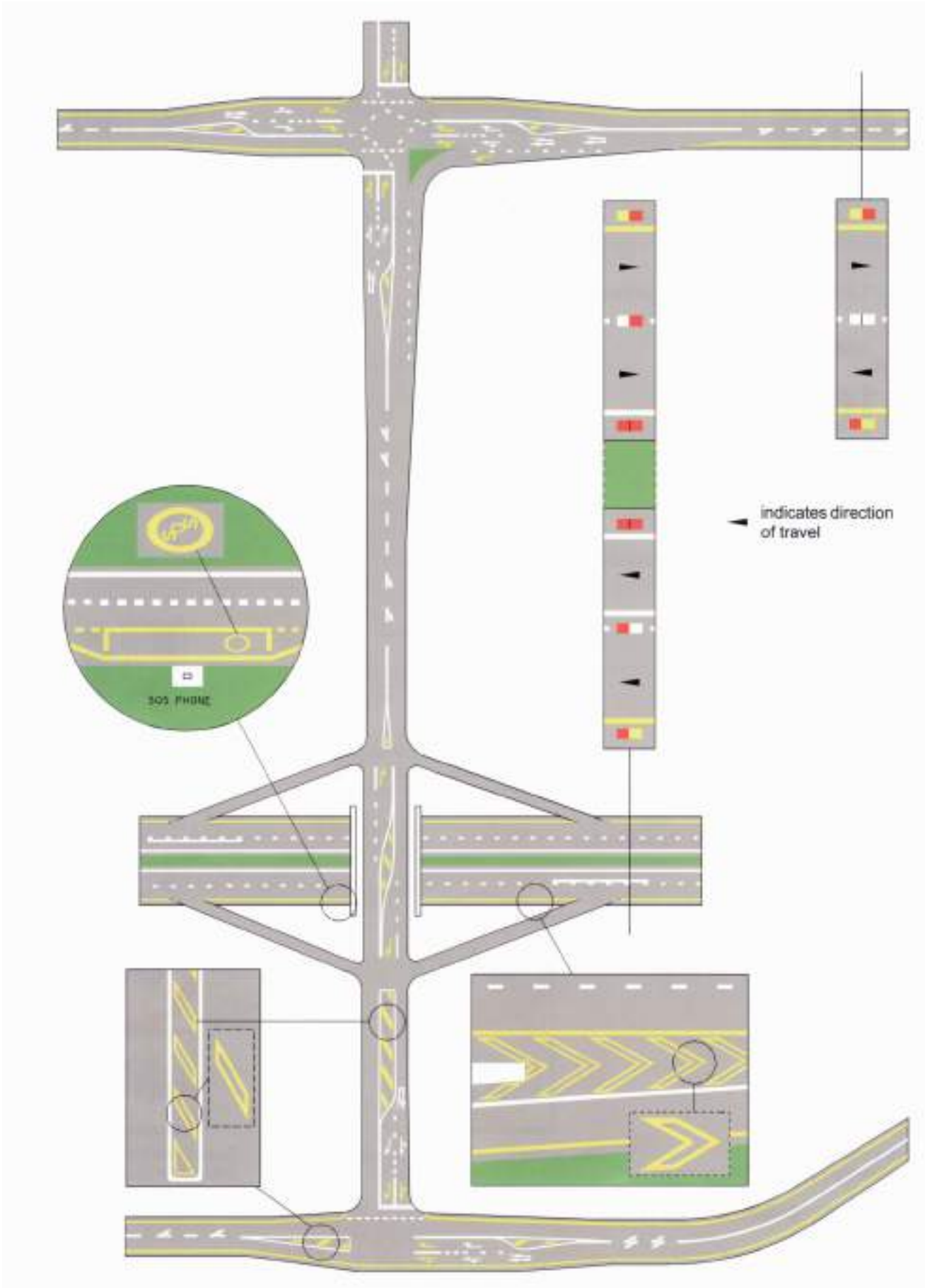
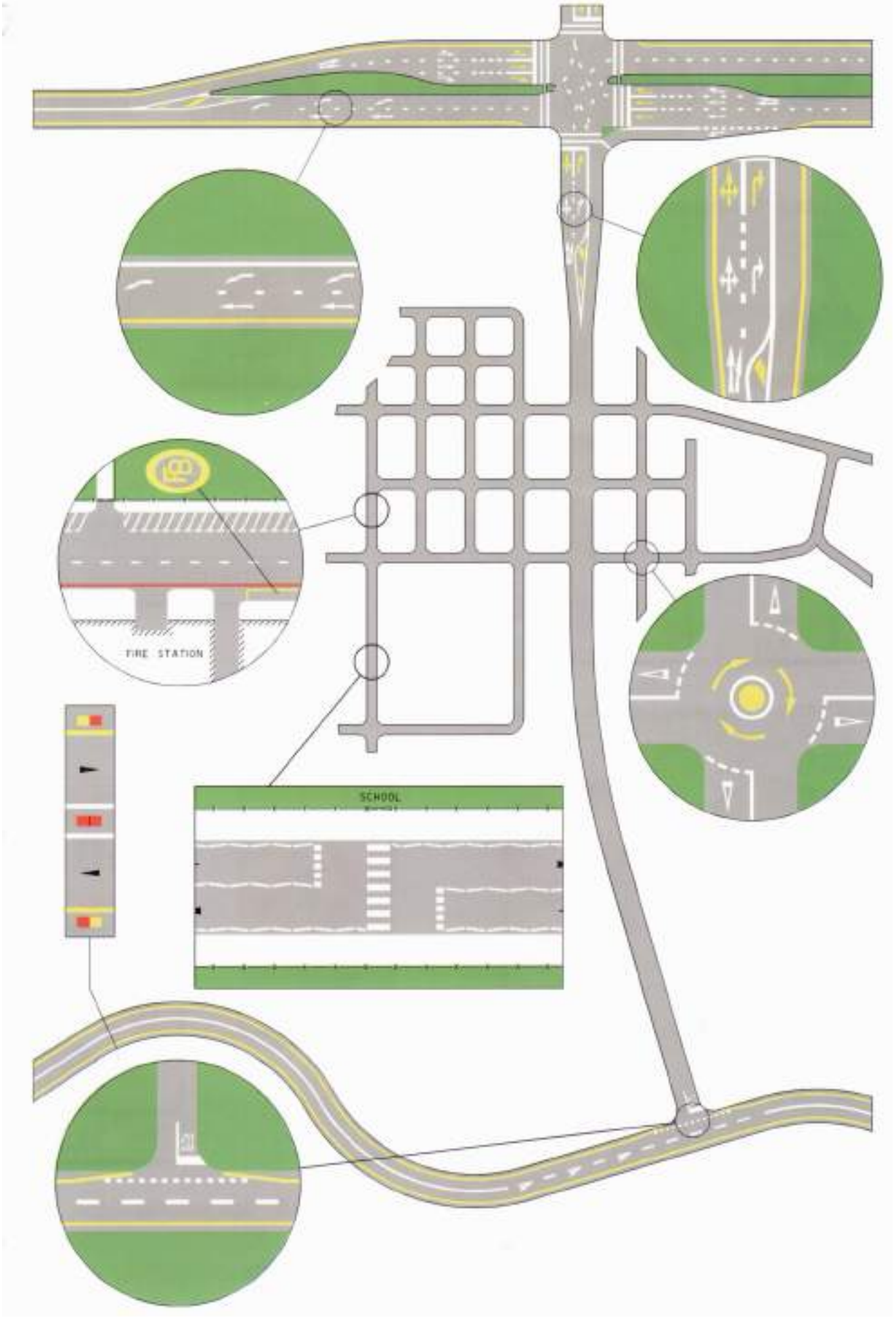
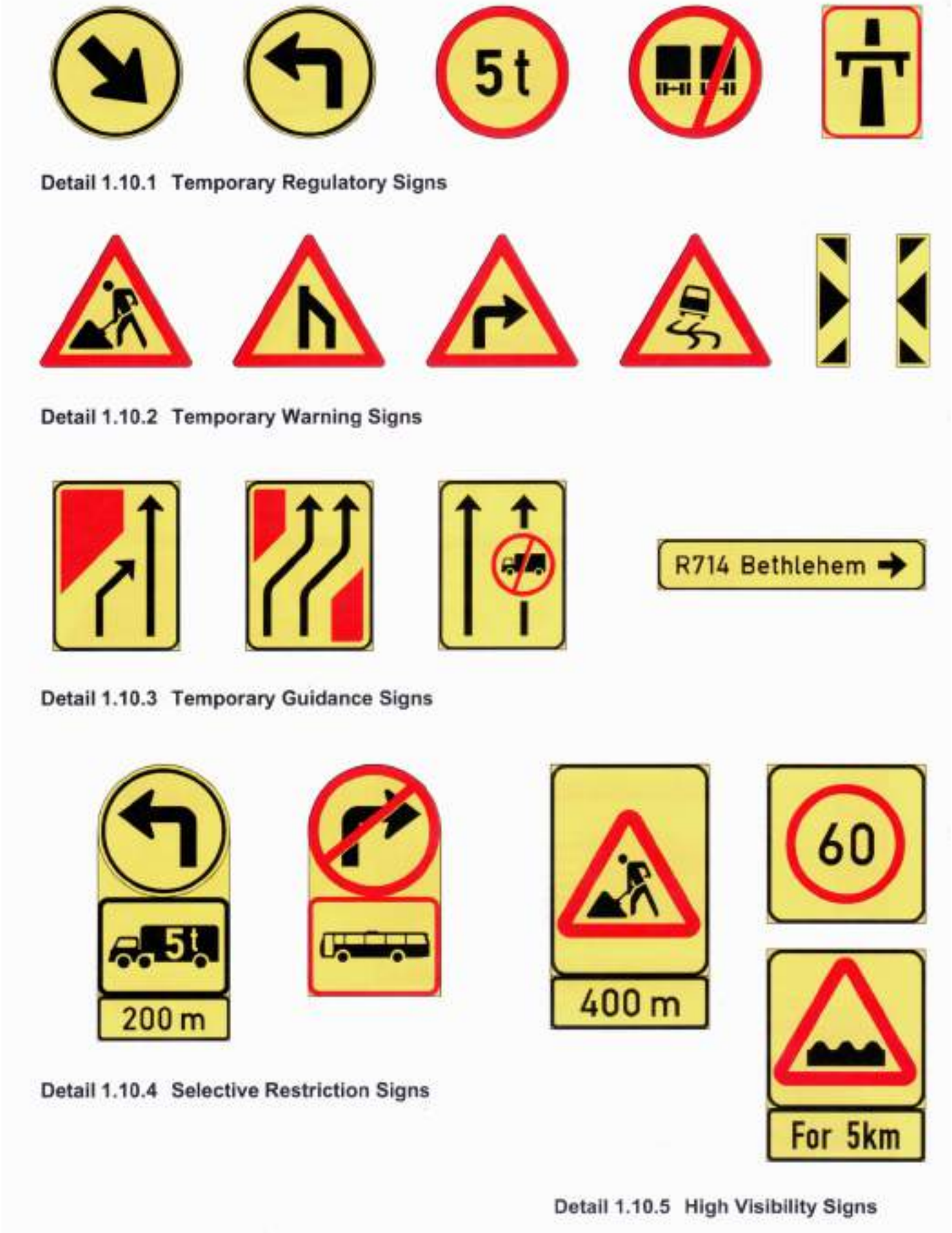


Fig 1.9 Typical Road Marking Shapes and Colours


FIRE STATION
SCHOOL



Detail 1.10.1 Temporary Regulatory Signs

Detail 1.10.2 Temporary Warning Signs

Detail 1.10.3 Temporary Guidance Signs

Detail 1.10.4 Selective Restriction Signs

Detail 1.10.5 High Visibility Signs

Fig 1.10 **Temporary Sign Colour Code Examples**

1.5 SPECIFICATION AND MANUFACTURE

1.5.1 General

1 In South Africa the Bureau of Standards has a number of "Specifications" (CKS) and "Standard Specifications" (SANS) which are relevant to the manufacture and appearance of road traffic signs. The most relevant of these are:
   (a) SANS 1519-1 – 2006/1519-2 - 2004: *Road Signs*
   (b) SANS 731-1 – 2006/731-2 - 2006: *Road Marking Paint*
   (c) CKS 192 - 1971: *Drop-on Type Reflectorised Road-Marking Paint*;
   (d) CKS 501 - 1981: *Road Marking Paint, High Build, Non-Skid;*
   (e) SANS 1442 - 2008: *Roadstuds*;
   (f) SANS 1459 - 2004: *Traffic Lights*

2 Where these specifications do not include a colour specification, such as for paints, this is covered by:
   (a) SANS 1091 - 2004: *National Colour Standards for Paint*; or
   (b) CKS - 279 - 1971: *Colours for Paints*.

3 The above specifications do not cover the manner in which signs, markings or signals shall be erected or marked on the road surface. Such standards are either under development or are provided as part of contract documentation or departmental specifications.

4 This Manual supplements the standard specifications by supplying sufficient detail for the accurate dimensional design and manufacture of signs and signals so that they appear to road users as intended. It also covers the widths and line-to-gap ratios for all road markings.

5 Road Traffic Legislation, specifies a range of minimum sizes for various, but not all, road traffic signs

6 In addition, the manner in which road traffic signs should be installed in relation to each other (sometimes in a sequential order) is covered by the Manual. More specific details in this regard are covered in Volume 2.

7 Public authorities, will, from time to time, also make available standard details in the form of manuals, standard plans or additional specifications to cover interpretations of the various factors covered by this Manual to suit their geometric design and other standards.

8 The manufacture and positioning of road traffic signs shall be accurately specified, **AND they should be checked for compliance with specification.**

1.5.2 Dimensional Tolerances

1 SANS 1519 refers to this Manual stating that "the layout of the message on the signface shall conform to the layout, given in the applicable drawings of the Manual, so that no deviation exceeds 5% of the layout of the applicable drawings". Legislation also permits a tolerance of 5% below the minimum dimensions for certain signs. The effect of these requirements, from a manufacturing and checking point of view, is that the following elements of a regulatory, warning, guidance or information sign shall not be more than 5% under the stated dimensions nor more than 5% over the stated dimensions:
   (a) the overall height, length or diameter of a sign
   (b) any border;
   (c) any internal space;
   (d) the height, length or diameter of any arrow, symbol, numeral or letter;
   (e) any internal part of any arrow, symbol, numeral or letter.

2 In terms of the provisions of paragraph 1.5.2.1 the internal part of any arrow, symbol or letter shall, in addition, not deviate BOTH over AND under the stated dimensions so that the total deviation exceeds 5% (for example - one part shall not be more than 2,5% under dimension if another part is 2,5% over dimension).

3 In all other respects all lettering used on road signs shall conform to the details of German DIN 1451 - Part 2 Styles A and B (see Volume 4 - Chapter 11).

4 Legislation requires that a road marking has a minimum width of 100 mm with a tolerance of up to 10% under such dimension. Any wider road marking line dimensions shall not deviate from the required width by more than 10 mm.

5 The length of broken lines and the gaps between them shall, when either or both exceeds 1,5 m in length not deviate from the lengths specified in Chapter 7 by more than 150 mm. The longitudinal tolerance for road marking line and gap dimensions under 1,5 m in length shall be 50 mm.

6 SANS 1459 specifies a maximum centre to centre dimension for traffic signal aspects and permits a tolerance of 10 mm on 210 mm diameter aspects and 20 mm on 300 mm diameter aspects.

1.5.3 The Use of Retroreflective Materials

1 In general, any road sign or part of a road sign (typically the message), the significance of which is to be identifiable during the hours of darkness or low ambient light levels, shall be retroreflective. This requirement is covered on a sign-by-sign basis in the Regulations and Volumes 1 and 4 of this Manual. Table 1.1 summarises this information.

2 An authority may specify a retroreflective background for signs which are not required by regulations to have a retroreflective background. Such action is recommended when it is necessary that the colour code used on the sign be recognisable at night as well as by day. Whilst it can be argued that this requirement applies at all times, the cost implications of using retroreflective backgrounds on larger guidance signs are significant. Table 1.1 indicates sign retroreflective backgrounds.

3 Retroreflective material is available in many grades of quality. Three of these grades are specified in SANS 1519, namely Class I, Class II and Class III. Whilst the standard specification requires compliance with durability tests, the suppliers of materials are commonly prepared to provide a warranty for the above classes of material, provided various conditions are complied with during manufacture. A warrantied Class I material is considered to have an acceptable level of degradation due to weathering over a 7 year life, whereas warrantied Class II and Class III materials are considered acceptable over a

TABLE 1.1 RETROREFLECTIVE MATERIALS FOR ROAD SIGNS TABLE 1.1

Permanent Road Signs – Recommended Class of Retroreflective Material

Type	Series	Background	Border	Text	Symbols/ Arrows	Notes
REGULATORY						
Control	R1 - R6	1	1	1	1	
Command	R101 – R140	1	1	•	•	
Prohibition	R201 – R242	1	1	1	1	
Reservation	R301 – R354	*/1	1	1	1	
Comprehensive	R401 – R403	1	1	1	1	
WARNING						
Advance	W101 – W363	1	1	•	•	
Hazard	W401 – W415	1	1	-	1	
GUIDANCE						
Location	GL	1	•	•	•	River 1
Route Marker/Trailblazer	GE	1	1	1	1	
Direction	GD	*/1	1	1	1	
Freeway Direction	GA GB GC	1	1	1/3	1/3	
Tourism	GF	*/1	1	1	1	
Local Direction	GDL	1	1	•	•	
Diagrammatic	GS	1	1	•	•	“Block” 1
Pedestrian	GP	*/1	•	•	•	
INFORMATION	IN	1	1	1	1	

NOTES:

(1) All temporary road signs shall have a retroreflective background, and semi-matt border, symbol or letter.

(2) An authority may specify Class III in place of Class II if satisfied that this is cost effective (see Subsection 1.5.3).

(3) Check luminance factor before specifying higher than Class I.

(4) Due to their small size STREET NAME signs GL1 are recommended to be retroreflective.

(5) Certain signs are specified as retroreflective (see Regulations).

KEY:

1 Class I
3 Class III
• Semi-matt
- Not Applicable
* Semi-matt instead of Class I when only for daytime applications

10 year life. The manufacturers provide these grades of material with a watermark or other permanent identifying mark indicating the class and manufacturer of the material. Whilst there are obvious cost implications to the use of Class I, II or III materials in preference to shorter life materials it is strongly recommended that purchasers of road signs specify at least Class I materials, even for temporary signs. This will enable effective checking of the quality of the material supplied and will almost certainly result in a sign life which is cost effective over time.

4 When specifying the manufacture of a road sign, which requires the superimposition of one colour of retroreflective material on another, care must be taken to ensure that adequate luminance and retroreflective contrast rates are achieved by the combination of materials from the sign for the message to be legible. The minimum coefficient of retroreflection for the three standard classes of material for each colour is given in SANS 1519. The actual coefficient of retroreflection for a given sample and colour may vary widely from the minimum, and for new materials is commonly higher than the value given in SANS 1519. Colour contrast, and therefore legibility, is normally sought by placing a dark

letter on a light background, or vice versa. When retroreflective materials are used it is possible that, for instance, a poorer quality white placed on an above minimum specification green background may result in a low retroreflective colour contrast (under illumination at night) which may be inadequate for good legibility at night, although the luminance contrast (under ambient daylight) is unlikely to ever be inadequate. This effect can also occur with certain combinations of class of retroreflective material e.g. a Class I (white) on a Class III (green) might result in a similar effect at night. As a general rule a contrast ratio of the coefficients of retroreflection of colours placed on each other, irrespective of class, is recommended as follows:

(a) for small, finely detailed areas (letters and symbols)- a minimum ratio for light-to-dark of 7 to 1, with a preference for 10 to 1 or more;
(b) for large areas (arrows or blocks) - a minimum ratio of 3,5 to 1, with a preference for 5 to 1; or recommended retroreflective material class combinations are given in Table 1.1.

1.5.4 Road Sign Materials

1 Sign board materials are specified at the discretion of the purchaser. If a road sign is to be fully faced with retroreflective materials the sign board or backing material must have a life expectancy at least equal to that of the specified retroreflective material.

1.5.5 Road Marking Materials

1 Limited comments on specifications of road marking materials are given in Chapter 7.

2 SANS 1442 covers three categories of roadstud, namely:

(a) Category A - corner cube retroreflectors;
(b) Category B - biconvex retroreflectors;
(c) Category C -omnidirectional retroreflectors.

The specification does not cover temporary roadstuds nor the manner in which roadstuds should be secured to the road surface (see Chapter 7,Section 7.5).

1.5.6 Traffic Signals

1 The specification of all aspects of traffic signals not covered by SANS 1459 is covered in Chapter 6 of Volume 1, Volume 3 and Chapter 10 of Volume 4.

1.5.7 Colour Specification

1 The study of colour is a complex science and beyond the scope of this Manual. However, since the use of colour is considered fundamental to the functioning of the road traffic sign system it is worth considering some aspects of the use of colour. This may assist in the understanding of why the use of some colours is more effective than others.

2 There is general acceptance of the method of specifying colour in terms of the trichromatic system recommended mended by the International Commission of Illumination (CIE). The colour of light reflected from a surface may be defined in terms of its chromaticity co-ordinates "x", "y" and "z", the sum of which is unity. Co-ordinate "x" is an indication of the proportion of RED present in the colour sample, "y" the proportion of GREEN, and "z" the proportion of BLUE.

3 For practical purposes all ordinary surfaces can be considered as REFLECTIVE. In effect an object absorbs some light and reflects some light so that an observer sees the object and experiences a colour sensation. The relative brightness of the object, or its parts, if it has several colours, is expressed as its luminance factor(s).Thus a light colour will have a high luminance factor and a dark colour will have a low luminance factor. An ordinary surface in the context of road signs can be considered as a painted surface.

4 If a surface is covered with a RETROREFLECTIVE material light is reflected in quite a different way. Due to the internal structure of the retroreflective material incident light is reflected more or less back along the incident path over a wide range of angles of incidence. As a result of this, under diffuse daylight illumination, a retroreflective surface may have lower luminance factors than an ordinary surface. Only when illuminated by a focused light source will the surface appear significantly brighter than a similarly illuminated ordinary surface, because the ordinary surface scatters the light directed on it.

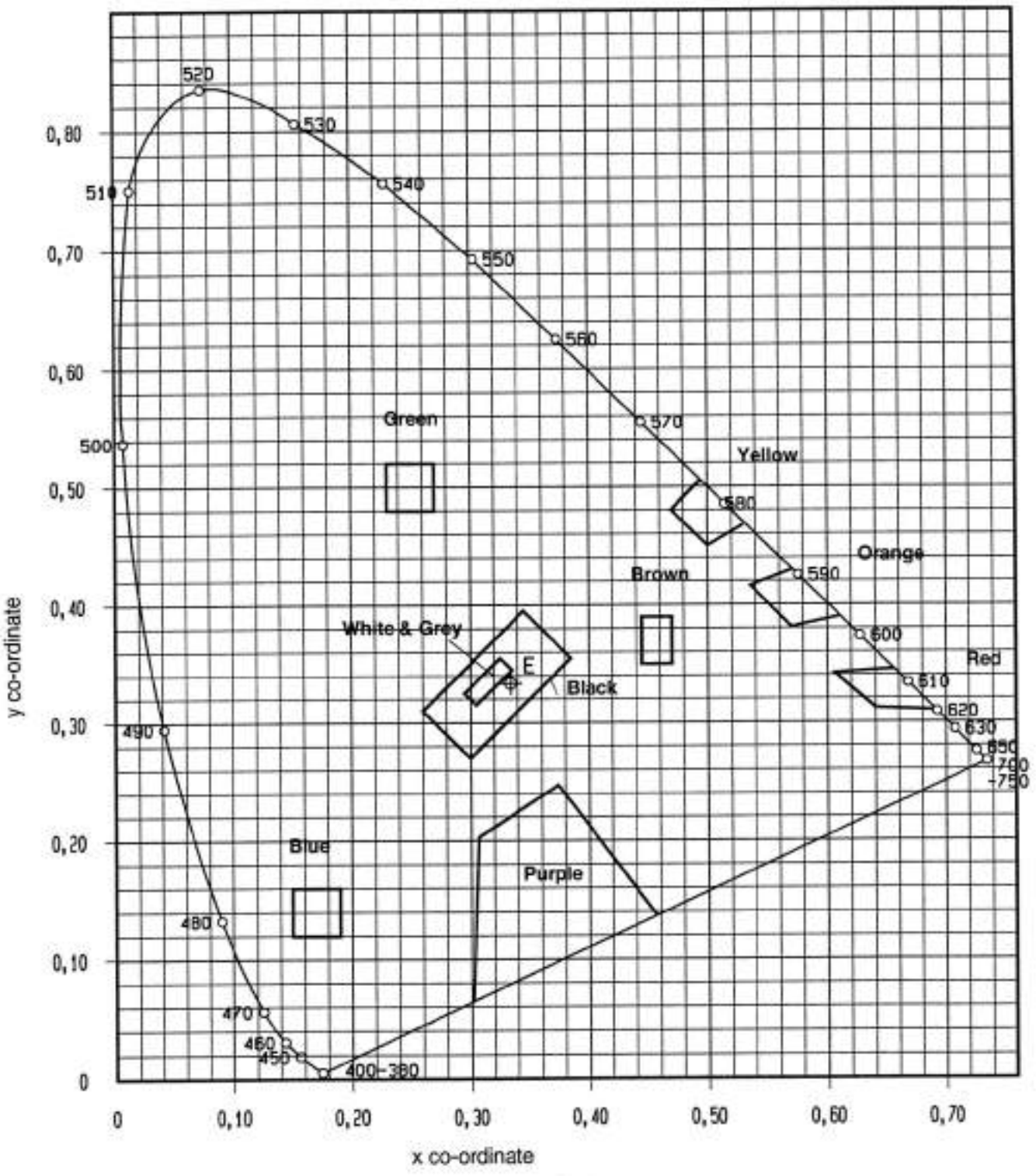
5 As a result of these factors, the apparent colours of reflective and retroreflective surfaces of the same colour, will appear different to an observer under different types of illumination (natural daylight and external light sources at night).

6 For manufacturing control purposes the required colours have been specified in terms of an area on the "Chromaticity Chart". The limits of the area are thus defined by four "x" and "y" co-ordinates for each colour. Chromaticity Charts for a range of road traffic sign materials are given for illustration purposes in Figures 1.11 to 1.14 as follows:

(a) painted sign surfaces;
(b) retroreflective sign surfaces;
(c) roadstuds;
(d) traffic signals.

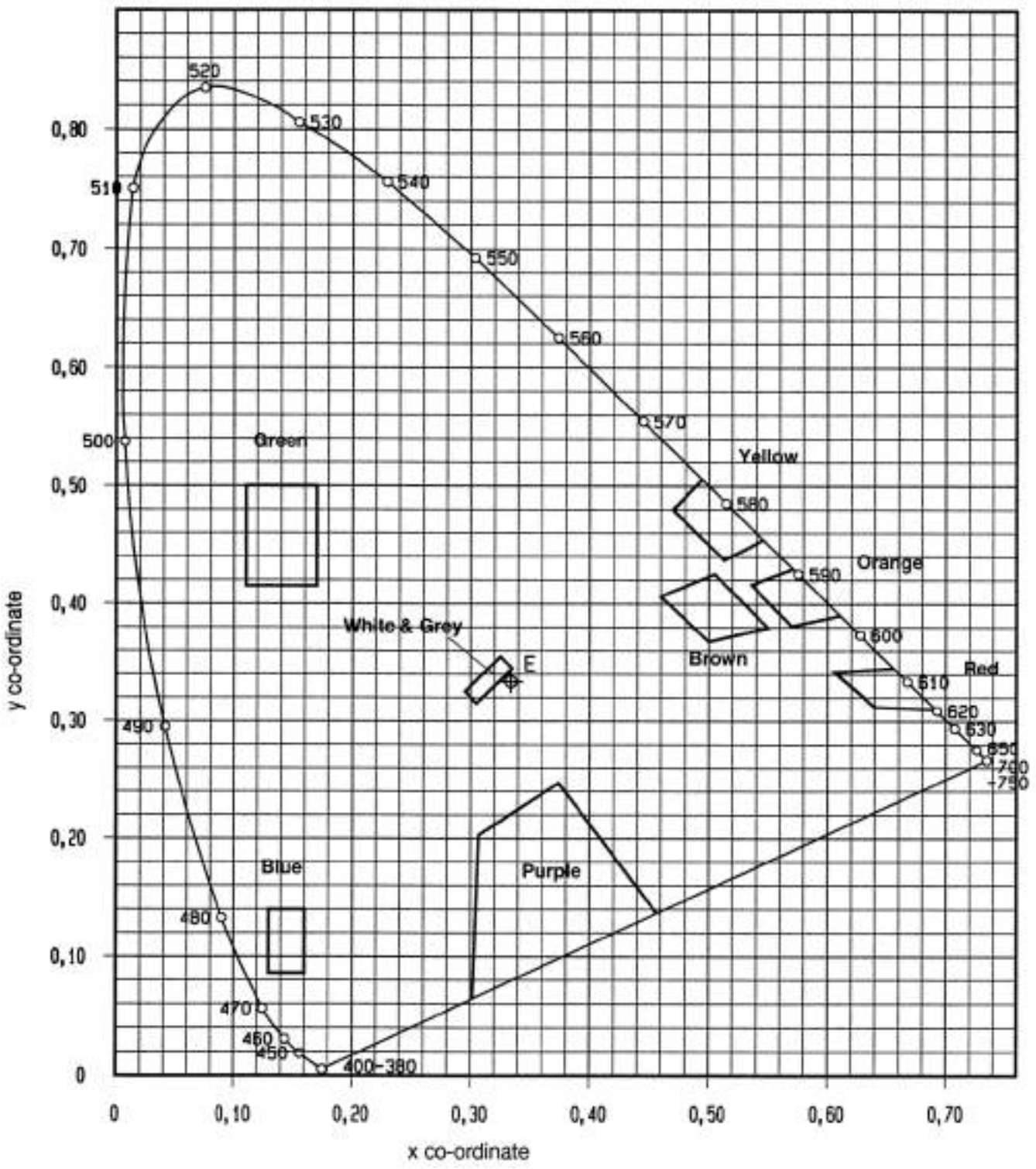
For more complete information on these specification requirements the relevant SABS document should be consulted (see paragraph 1.5.1.1).

7 The degradation or fading of the road traffic sign colours is a factor relevant in the formulation of maintenance programmes. Cut-off values to indicate a need for replacement are not established in all cases but SANS 1519 does include an indication of colour change as a result of weathering. Equipment capable of measuring the appropriated values is becoming more freely available and any authority setting up a road traffic sign management system should initiate a programme of sign measurement to establish sign life prediction patterns.



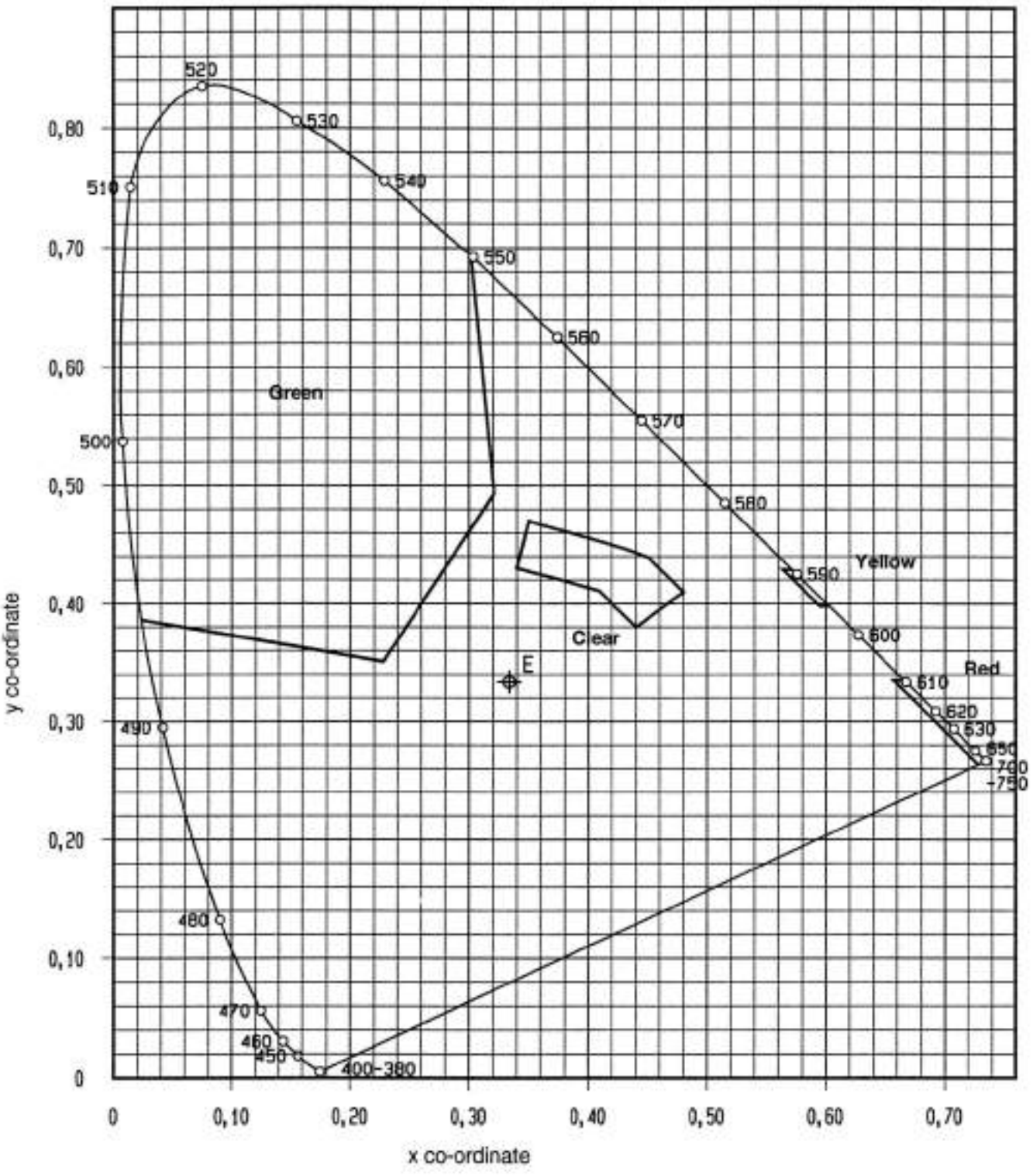
Refer to SANS 1519 for specification and colour co-ordinates

Fig 1.11 Chromaticity Chart: Road Sign Paint



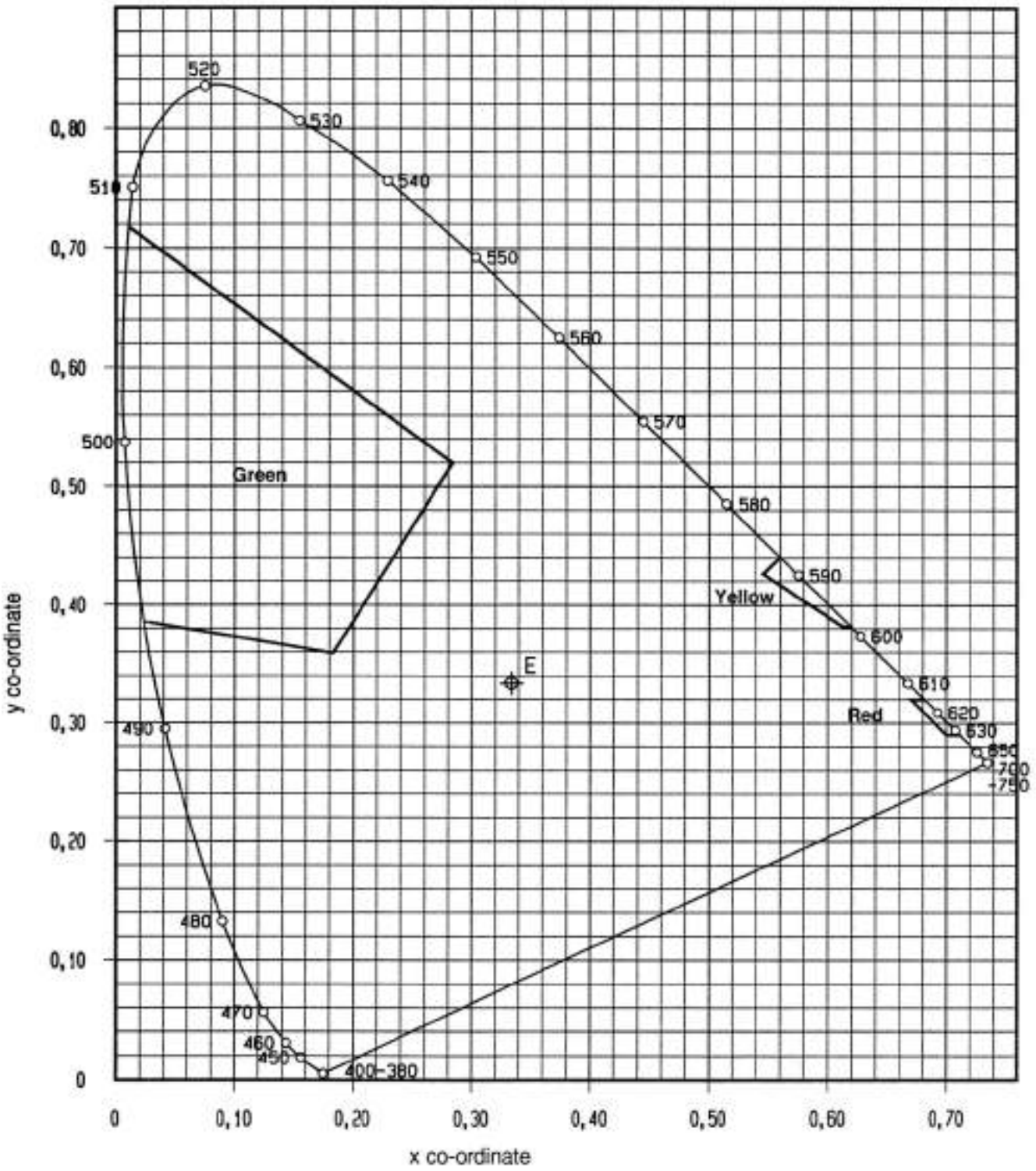
Refer to SANS 1519 for specification and colour co-ordinates

Fig 1.12 **Chromaticity Chart: Retroreflective Materials**



Refer to SANS 1442 for specification and colour co-ordinates

Fig 1.13 Chromaticity Chart: Roadstuds



Refer to SANS 1459 for specification and colour co-ordinates

Fig 1.14 Chromaticity Chart: Traffic Lights

1.6 SIGN PLACEMENT

1.6.1 General

1 This section deals mainly with the positioning of permanent road signs. The positioning of road markings is covered partially in Chapter 7, and is dealt with more comprehensively in Volume 2, Chapter 2. The positioning of traffic signals is covered in Chapter 6 and in Volume 3.

2 The position of a sign can be specified in three ways, namely:

(a) longitudinally in relation to the roadway alignment;
(b) laterally in relation to the roadway cross-section;
(c) vertically.

Relatively wide tolerances may be assumed for any guidelines given in relation longitudinal sign placing, whereas tolerances in relation to lateral and vertical positioning are much less and are given in Table 1.3 for permanent road signs. **The guidelines given in this section do not apply to the positioning of temporary road signs. For details of temporary road sign applications see Volume 2, Chapter 3, Section 3.5 and Chapter 13.**

3 Unless noted specifically in the text covering an individual sign, all permanent road signs should be located on the left side of the road, or, if they are mounted overhead, as close as possible over the centre of the lane(s) to which they apply. Duplicate signs may also be used on the right side of the road for extra emphasis particularly on one-way roadways.

4 As a general rule a road sign should be visible from a distance in metres numerically equal to the operating speed of the road in kilometres per hour.

5 Signs and their supports should be positioned so as not to obstruct sidewalks.

6 It should be recognised that sign supports may represent significant hazards to road users. They must therefore be sited to minimise this risk and be provided with protective devices if necessary. Various road authorities have standards in this regard which should be complied with.

1.6.2 Longitudinal Placement

1 Road signs generally fall into one of two groups with regard to their longitudinal position. They are either located at the point of reference, or at a determined distance in advance of the point of reference. The point of reference may be one of:

(a) the commencement of a regulatory control;
(b) a hazard to road users;
(c) a road junction.

2 REGULATORY signs are placed at, or as close as possible to the point on the roadway **from which their message is to apply.** Certain regulatory signs, such as the NO OVERTAKING signs R214 and R215, NO PARKING sign R216 and NO STOPPING sign R217 have specific longitudinal conditions relating to their use. Signs R214/R215 are applicable for a distance of 500 m beyond the sign, and should be repeated if the prohibition is required for a greater distance. Signs R216 and R217 are required to be repeated so that the distance between signs does not exceed 150 m when a prohibition is required for a greater distance. The majority of regulations brought into effect by a regulatory sign therefore apply from the point where the sign is located. Such regulations remain in effect until changed by another sign of the same type but a different value e.g. a speed limit sign, or until de-restricted by a DE-RESTRICTION sign (R)600. **Notwithstanding this provision, it is recommended that signs be repeated where necessary (after major junctions for instance) to reinforce the regulatory message.** The following regulatory signs have a limited application. For details of the actual limit see the individual sign subsections in Chapter 2:

(a) NO EXCESSIVE NOISE sign R206;
(b) NO HITCHHIKING sign R207;
(c) NO OVERTAKING signs R214 and R215;
(d) NO PARKING sign R216;
(e) NO STOPPING sign R217;
(f) PARKING RESERVATION sign R305 - P;
(g) LIMITED PARKING RESERVATION sign R306 - P;
(h) ALL other PARKING RESERVATION signs R307 - P to R323 - P;
(i) ANY selective restriction version of the above signs.

3 Regulatory signs may also appear on the face of a guidance sign. They may be located in advance of their intended point of application to advise road users of the approaching control. When used in advance, or on another sign the regulatory sign should always be associated with a distance, if necessary on a SUPPLEMENTARY PLATE IN11 (see Section 2.8).

4 The longitudinal position of a WARNING sign used in advance of the hazard to which it refers is covered by Figure 3.1. The distances derived from Figure 3.1 should be considered to be guidelines. If some obstruction exists at the recommended distance the sign should normally be located at a greater (and NOT a smaller) distance from the hazard than that given in Figure 3.1 (see Figure 1.15). If it is necessary to position the sign significantly further from the hazard than indicated in Figure 3.1 consideration should be given to adding a distance SUPPLEMENTARY PLATE IN11.3 (see Section 3.6).

5 Hazard marker warning signs are located at, or very close to the hazard. (See Figure 1.17 for details of the location of hazard markers in relation to bridges, guard-rails etc.) Certain hazard marker signs are used at regular spacings. Details of recommended spacings are given in Section 3.5. Figure 1.17 illustrates additional guidelines for the placing of SHARP CURVE CHEVRON signs W405 or W406.

6 GUIDANCE signs are commonly located in advance of a junction, or at a junction or other roadside feature such as a rest/service area or a layby. Recommended advance distances are given in Figure 4.43. However, for FREEWAY DIRECTION signs, which are placed in sequential order, the recommended positions are given in the text for each individual sign type. (Figures 4.41, 4.42, 4.46 to 4.53, 4.57 to 4.60, 4.68 and 4.69 all refer to guidance sign sequence details.) The distances

derived from Figure 4.43 should be considered to be guidelines. If some obstruction exists which impairs sight distance to a sign, or the location of the sign itself, the tendency should always be to move the sign further from the junction rather than closer to it (see Figure 1.15).Particular care must be taken when erecting advance direction signs to avoid confusion with minor junctions or driveways.

7 Guidance signs located at a junction should, where possible, be positioned so that turning traffic passes in front of the sign rather than behind it, particularly if the approach is subject to control by a STOP or YIELD sign or by traffic signals. The sign will then be in view for a maximum period of time, although it can be obscured occasionally by large turning vehicles.

8 Care must be exercised to avoid signs being too closely spaced along the roadway. An absolute minimum spacing on rural roads with an operating speed up to 100 km/h should be 80 m. If the first of two signs is a large sign, a specific study should be made to determine whether it will obscure the second sign at a distance at which the second sign should be read by drivers. A longitudinal separation of 150 m to 300 m is recommended for rural roads and a minimum spacing of 200m should be observed on freeways. In urban areas spatial constraints are significantly greater. However, the principles relating to sign visibility are the same. Those erecting signs in an urban environment must take note of ALL other street furniture, trees etc. when siting road signs. There is no point in putting up signs if they cannot be seen.

9 If longitudinal separation of smaller signs such as regulatory and warning signs is difficult to achieve adequately, two such signs may be mounted on the same support, particularly if their messages are complementary. This technique is particularly appropriate in roadworks situations (see Figure 1.16 and Subsection 1.6.4).

10 The mixing of different messages in a sign sequence should be avoided as far as possible. During the geometric design of roads, streets and junctions, this aspect shall be carefully considered. For example the provision of lane drops immediately in advance of, within, or immediately after an intersection or junction which would require the display of warning signs within the sequence of direction signs, should be avoided.

1.6.3 Lateral Placement

1 Details of recommended lateral offsets of permanent road signs from the edge of roadway or edge of the shoulder are given in Figures 1.17 and 1.18.

2 It is not recommended that signs be placed significantly further from the roadway or shoulder edge than indicated in Figures 1.17 or 1.18 because this will reduce sign conspicuity and therefore drivers' chances of seeing the signs.

3 If the combination of longitudinal, lateral and vertical positioning result in a guidance sign being partially obscured at the appropriate reading distance by a cut side slope, consideration must be given to modifying this side slope to permit effective reading of the sign (see Figure 1.16).

1.6.4 Vertical Placement

1 Details of recommended vertical mounting heights for permanent road signs are given in Figures 1.17 and 1.18.

2 Research has shown that there is a risk, when a single support, carrying a regulatory, warning or other small sign at a height of 1600 mm to 2000 mm, is impacted by a motor car, that the sign may be flung forward by the collapse of the support through the vehicle windscreen. This risk is greatest for signs mounted on steel supports.

3 Signs which are mounted very low are liable to become easily obscured and will collect dirt. They are also more susceptible to damage in the event of grass fires and during roadside maintenance work. Temporary DELINEATOR PLATE signs TW401 and TW402 are particularly susceptible to collect dirt and cleaning programmes must be put into operation. In a roadworks environment there is little advantage to raising the level of right side delineators because this will quickly put them out of cut-off range of dipped headlamps.

4 Signs which are mounted very high, including over-head signs, are difficult to see at night, particularly if headlamps are dipped due to oncoming traffic.

1.6.5 Display Angle

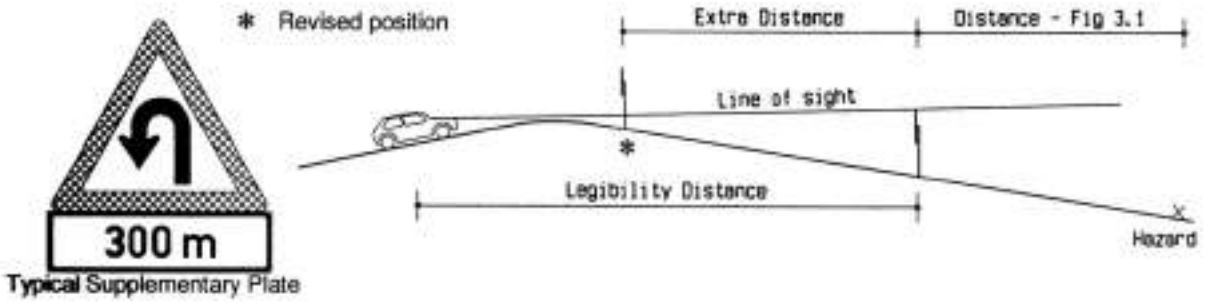
1 Fully retroreflective ground mounted signs, particularly the larger guidance signs, should be mounted with attention to detail. The signface should be angled at approximately 93° to the direction of travel. If the sign is located on the outside of a curve it should be placed at 93° to the tangent to the curve from the expected point from which the sign will be read. This will maximise the retroreflection and eliminate specular or mirror-like glare resulting from the otherwise glossy retroreflective sign surface (see Figure 1.19).

2 If the road gradient, when approaching an overhead fully retroreflective sign is at +2,0% or greater the vertical axis of the sign should be parallel to a plumb line. If the road gradient is less than +2,0% the sign should be aligned so that the vertical axis is inclined to face upward at a rate of 10 mm per metre of vertical signface for each 1% the road gradient differs from +2,0% (see Figure 1.18).

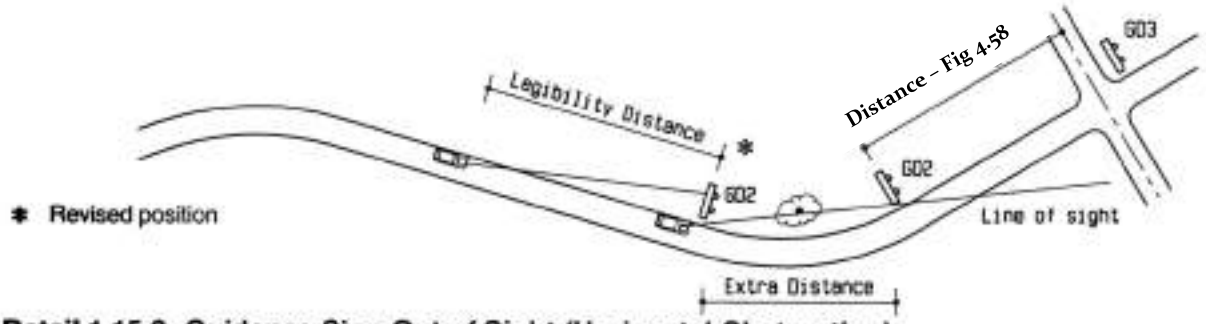
3 Large signs should be inspected after installation for the effectiveness of the above measures and adjusted further in one or both axes, if necessary, to reduce specular glare from vehicle headlamps, street lighting or other sources. The vertical setback may aggravate the collection of bird droppings on the signface (from birds perched on top of the signs), particularly in coastal areas. In such circumstances the sign may be mounted with its signface vertical or a capping plate may be used on top of the sign which projects a sufficient distance away from the signface to reduce the risk of contact of bird droppings with the retroreflective material.

1.6.6 Other Delineation Devices

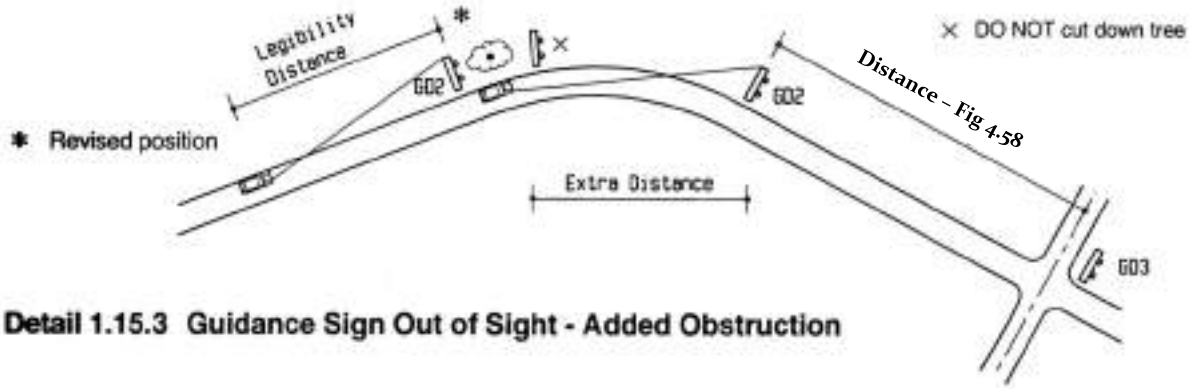
1 A range of delineation devices is detailed in Chapter 7, Section 7.6. These will be most effective if not placed too far to the left of the edge of the shoulder, and if kept relatively low, subject to the likelihood of being obscured by grass. All such devices should be placed at the recommended spacings. At worst at least three



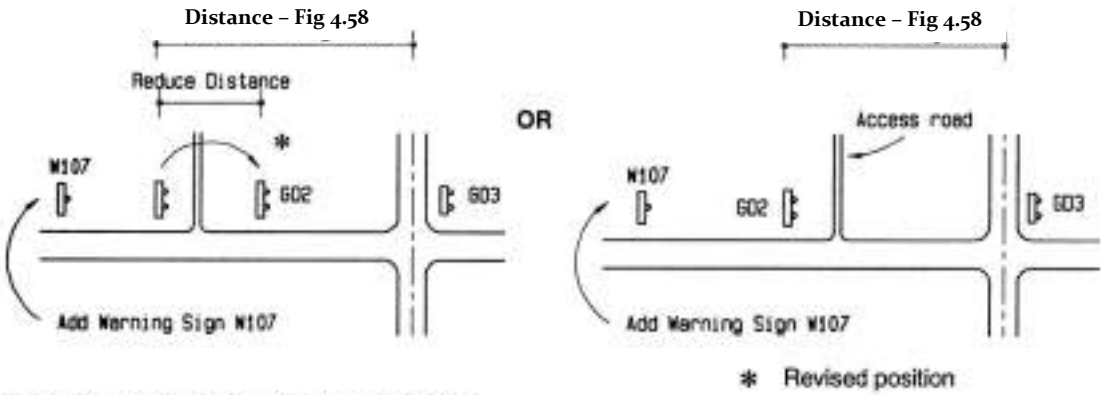
Detail 1.15.1 Warning Sign Out of Sight (Vertical Obstruction)



Detail 1.15.2 Guidance Sign Out of Sight (Horizontal Obstruction)



Detail 1.15.3 Guidance Sign Out of Sight - Added Obstruction



Detail 1.15.4 Closely Spaced Junctions

Fig 1.15 Typical Problems with Longitudinal Positioning of Road Signs

devices must be in the view of drivers at any time to provide adequate delineation.

1.6.7 Obscuration of Road Signs

1 A driver's view ahead to a road sign or traffic signal, or in some instances to important road markings, may be obscured by other vehicles. The masking effect of other traffic may be total, partial or intermittent. Drivers may therefore need to adjust their speed and/or position on the road to improve their opportunity of targeting the necessary information. Such adjustments are only likely to be attempted when the driver's level of expectation of being presented with information is high. A driver is not likely to take corrective action in relation to obscured signs which are not expected. These circumstances should be understood by road designers, and particularly those dealing with the design and placement of road traffic signs, and should be anticipated in the detail design of the information sources provided for drivers.

2 As a result of the obscuration of a road traffic sign a driver may pass such sign without being able to read the message. This may result in drivers being unaware of a hazard thereby increasing accident risks, or it may result in a missed turn or exit with a subsequent in- crease in travel time and distance. In either event drivers may undertake hazardous manoeuvres at risk to themselves and to other road users.

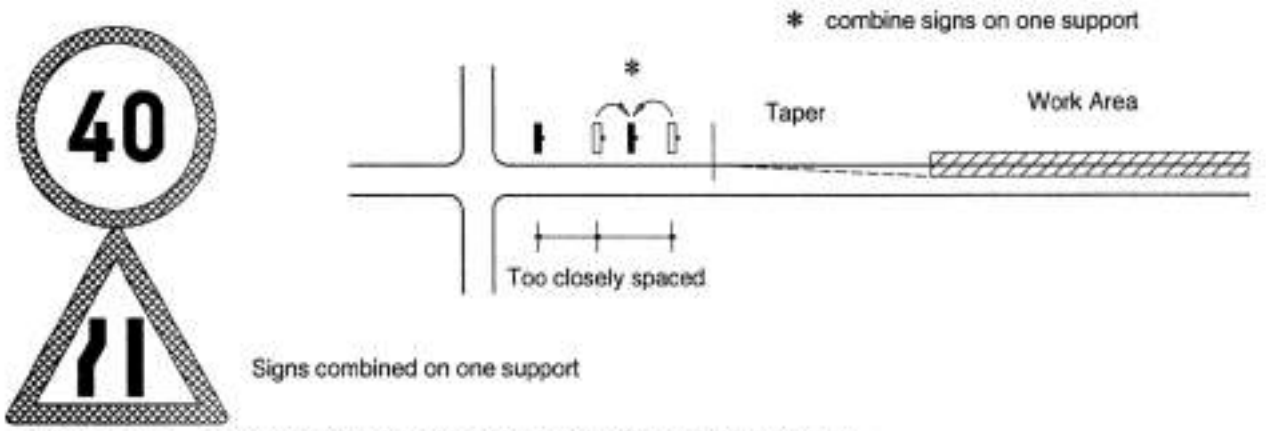
3 Features of the driving environment which may have an influence on sign obscuration, and which should be considered before finally positioning signs, are:

(a) sign and signal design and reading characteristics (see Chapters 4 and 6);

(b) driver and vehicle dimensions (the size of obscuring vehicles and driver's eye position and field of view);

(c) characteristics of the traffic (percentage of large vehicles, traffic volumes, lane usage, speeds and headways may all affect the degree of obscuration experienced);

(d) geometric road features (horizontal and vertical alignment, number of lanes, merging and weaving sections etc.).



Detail 1.16.1 Insufficient Longitudinal Space for Several Signs

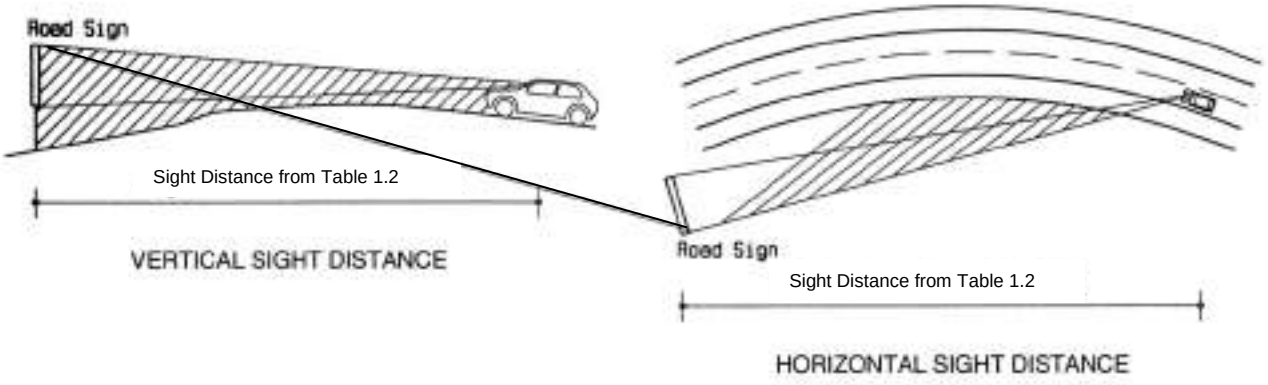


TABLE 1.2 CLEAR SIGHT DISTANCE REQUIREMENTS TABLE 1.2

Letter Size (mm)	Minimum Sight Distance (m)
490	380
420	340
350	300
280	260
210	220
140	180
112	160

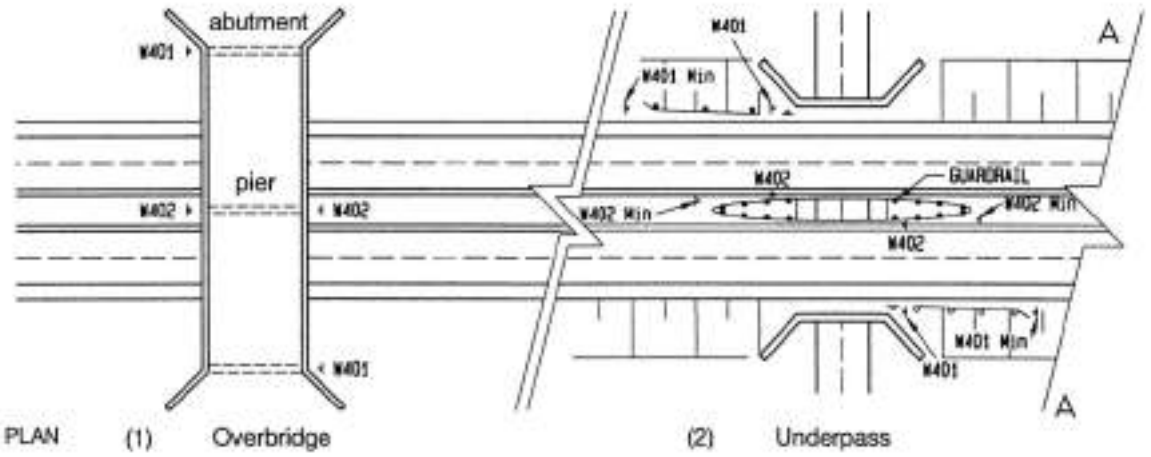
NOTES:

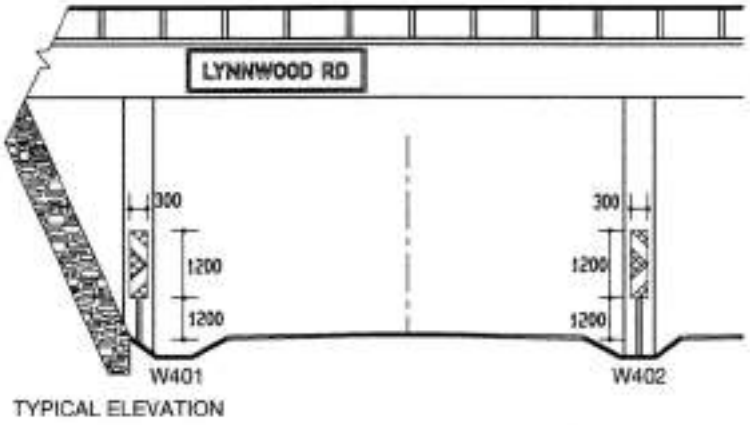
(1) As an alternative to repositioning signs the shaded area may be cleared or obstructions.

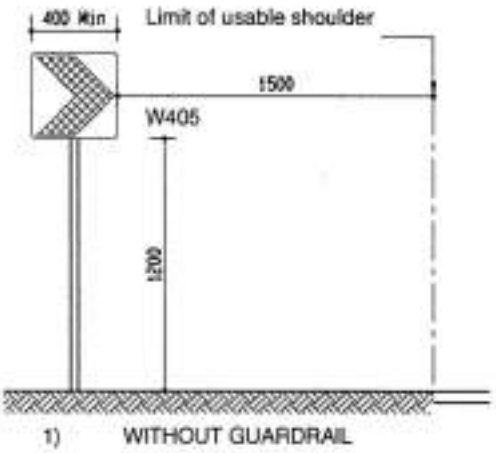
(2) The "Clear Sight Distance" values include the legibility distance for the letter size PLUS 100m to allow for observation of the sign prior to reading.

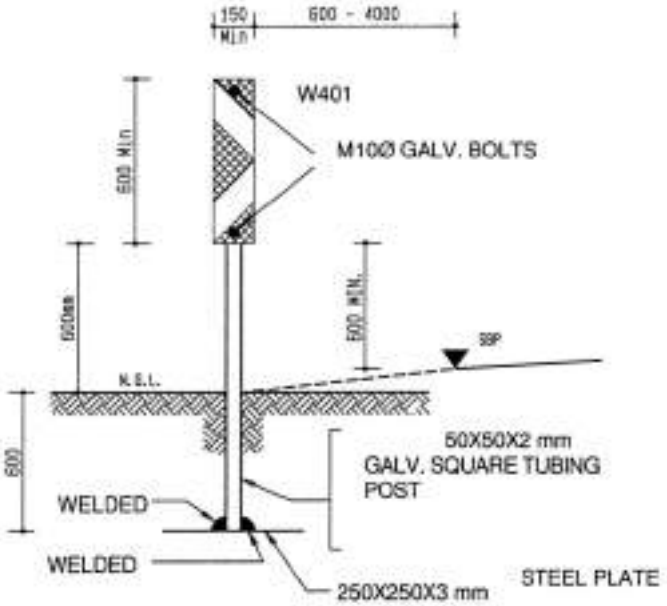
Detail 1.16.2 Clear Line of Sight to Larger Guidance Signs

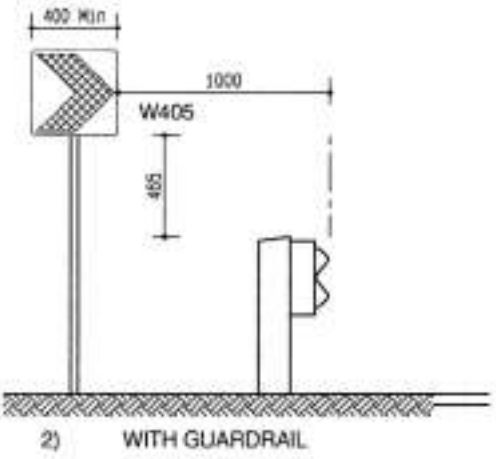
Fig 1.16 Further Aspects of Longitudinal Positioning of Road Signs





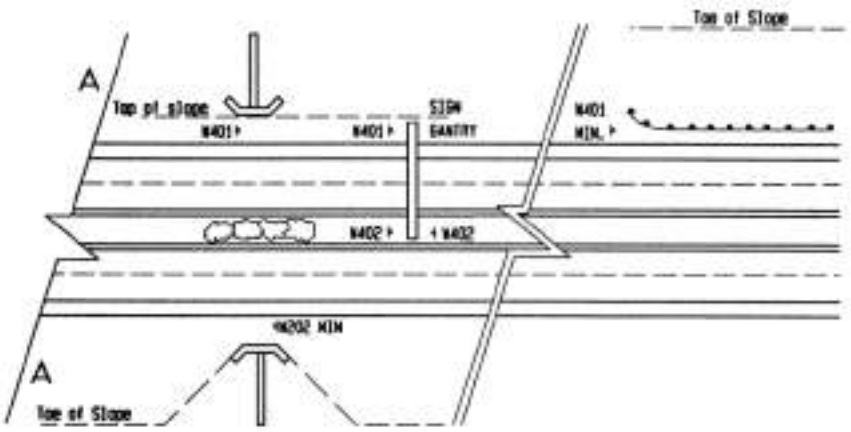






TYPICAL PLACING DETAILS - SHARP CURVE CHEVRONS
W405 / W406

Fig 1.17 **Positioning of Hazard Markers**



(3) Culvert (4) Guardrail

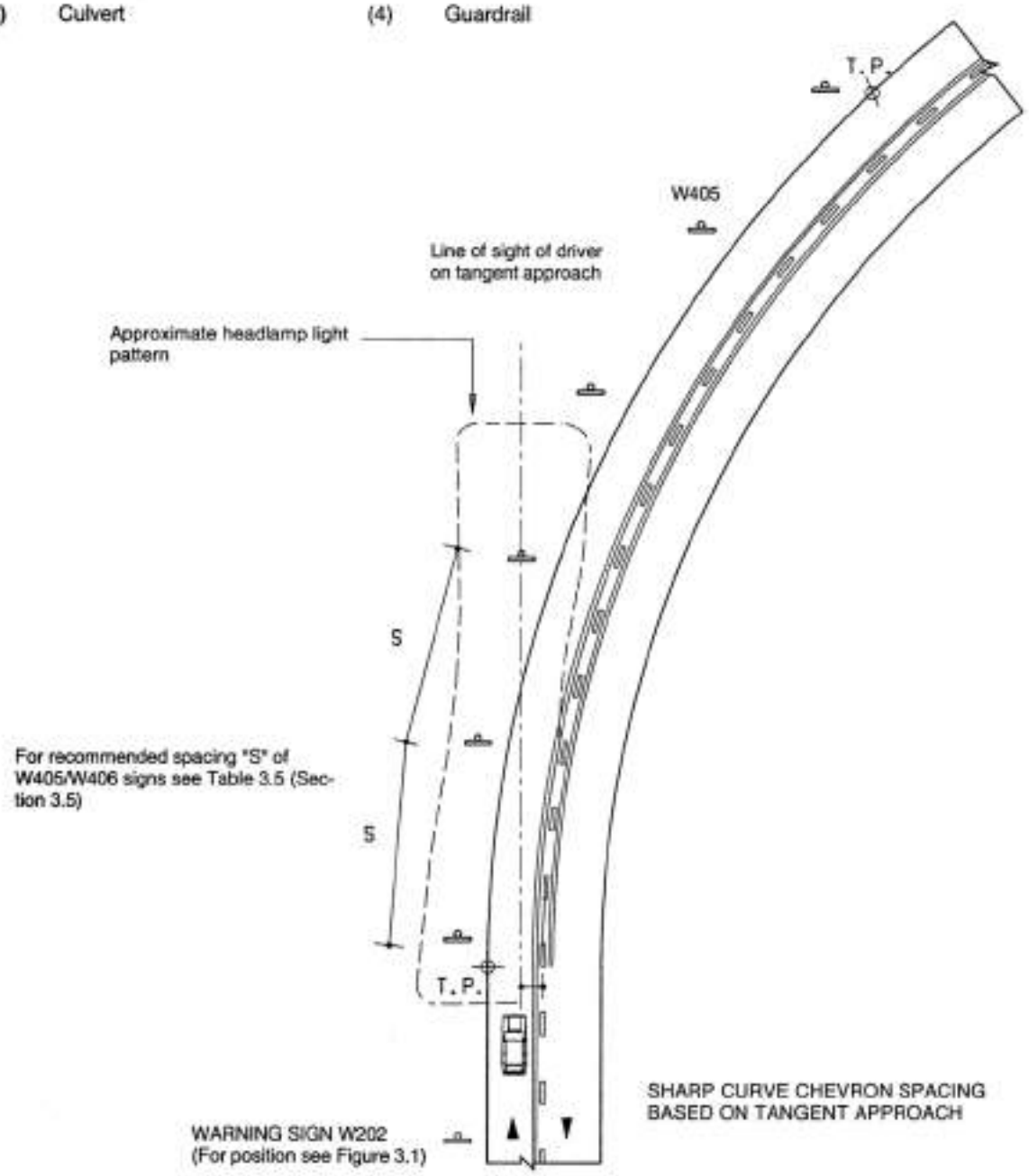


Fig 1.17 Positioning of Hazard Markers

TABLE 1.3 LATERAL AND VERTICAL PERMANENT SIGN PLACEMENT DIMENSIONS TABLE 1.3

Dimension	Minimum (mm)	Preferred (mm)	Maximum (mm)	Remarks
A	1200	1500	2000	See note (8)
8	500	750		See "R" and note (9)
c	600(300)	2100	2500	See note (10)
D	2100	2500	3000	See note (11)
E	0	0	200	See Chapter 3
F	600	1200	2000	
G	800	1200	1600	
H			6000	See note (12)
J	2000	4000		See note (13)
K	1600	2000	2400	See note (12) and (14)
L	750			
M	5200	5700	6200	
N	1000	1500		See "R" and note (9)
p	50	1000		
R	600	1500		See "8", "N" and note (8)
T	1800		4200	See note (15)

NOTES:

(Supplementary to Figures 1.17 and 1.18.)

(1) The minimum size of DANGER PLATE signs W401 and W402 is 600 mm x 150 mm and the maximum size1200 mm x 300 mm. The maximum size should be used on roads with an operating speed of 100 km/h or more at all bridge abutments, piers or parapets not protected by a guardrail. (Figure 1.17)

(2) A DANGER PLATE sign should not be used if is likely to represent a greater hazard than the hazard it is intended to mark e.g. cross-drain/culvert ends. (Figure 1.17)

(3) Any dimension given in relation to guardrails presumes these are installed to correct safety standards. (Figures 1.17 and 1.18)

(4) SHARP CURVE CHEVRON signs W405 and W406 should only be displayed in minimum sets of three, either as a connected set pointed in one direction, or as a spaced set (see Table 3.5), also pointing in one direction. (Figure 1.17)

(5) When SHARP CURVE CHEVRON signs are used on a long curve at least three signs must always be visible through vertical and horizontal curves. This requirement overrides any recommended spacing given in Table 3.5. (Figure 1.17)

(6) In order to position SHARP CURVE CHEVRONS to best advantage on a long curve it is recommended that the first sign to be positioned should be placed on the approximate line of sight of drivers approaching on the tangent to the curve. Subsequent signs should then be spaced at a distance "S", backwards and forwards around the curve from this point (Table 3.5). For the purpose of such an exercise the value of the offset of the drivers' line of sight to the left of the road centre line can be assumed to be between 1200 mm and 1600 mm. (Figure 1.17)

(7) Temporary SHARP CURVE CHEVRON signs may be used as an alternative to DELINEATOR signs for greater impact, in a similar manner, at roadworks sites and detours.

(8) Dimension "A" is measured from the shoulder break point (refer to Figure 1.18).

(9) In an urban environment, where signs are commonly located behind a kerb, dimension "8" is suitable for small signs. Dimension "R" is more appropriate for larger signs such as DIRECTION signs. On higher speed urban or peri-urban roads dimension "N" may be used in preference to "R" or "8". (Figure 1.18)

(10) The range of mounting heights between 1500 mm and 2000 mm should be avoided for single pole mounted signs (Dimension "C") because there is a significant risk that, on impact by a motor car, the failure of a steel pole may result in such a sign penetrating the car windscreen. For a limited number of applications

NOTES: (continued from page 1.6.8)

certain regulatory and warning signs may be mounted with a minimum vertical clearance of as little as 300 mm. Such signs are commonly located in the nose of dual carriageway median islands or to demarcate a bell-mouth at a junction.

(11) Dimension "D" should be used in any situation where pedestrians are likely to walk in close proximity to a road sign OR the sign should be mounted at the minimum value of dimension "C". (Figure 1.18)

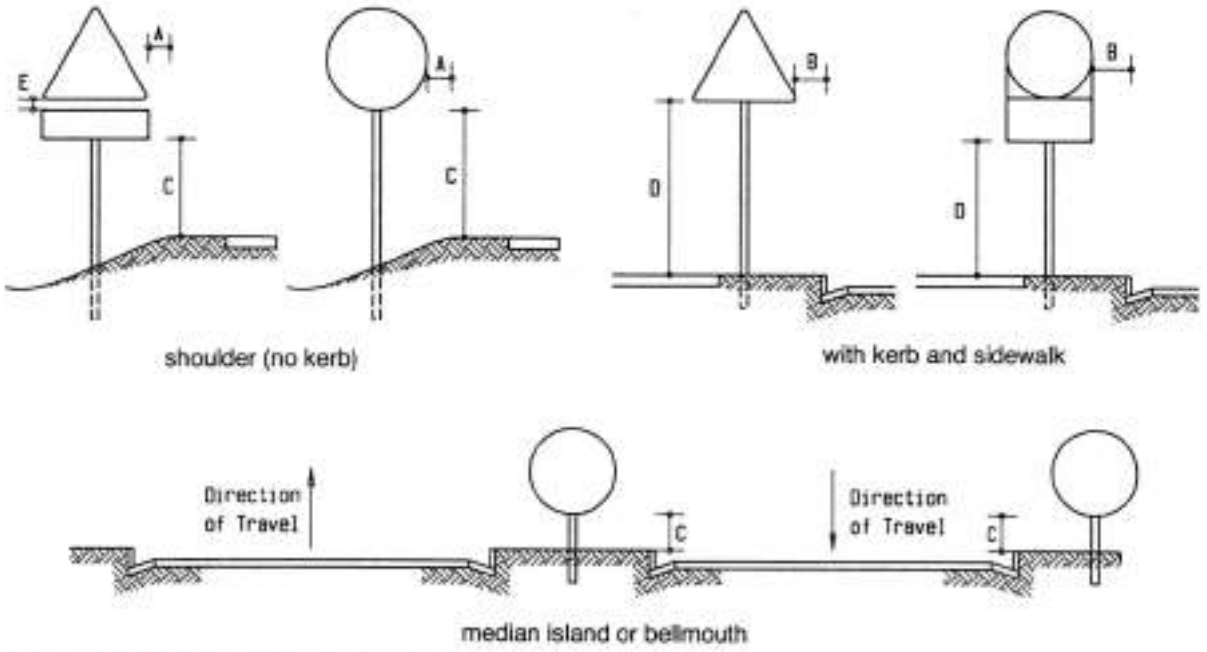
(12) The maximum value given for dimension "H" should be considered a guideline. It is not desirable to exceed this value due to the limitations on light from vehicle headlamps reaching the top of such a sign. This value allows for a sign 4800 mm in height to be mounted at the minimum value of dimension "K".

(13) Dimension "J" is preferred for rural and high speed urban roads. In a low speed urban environment the lower values of dimension "R" may be considered. (Figure 1.18)

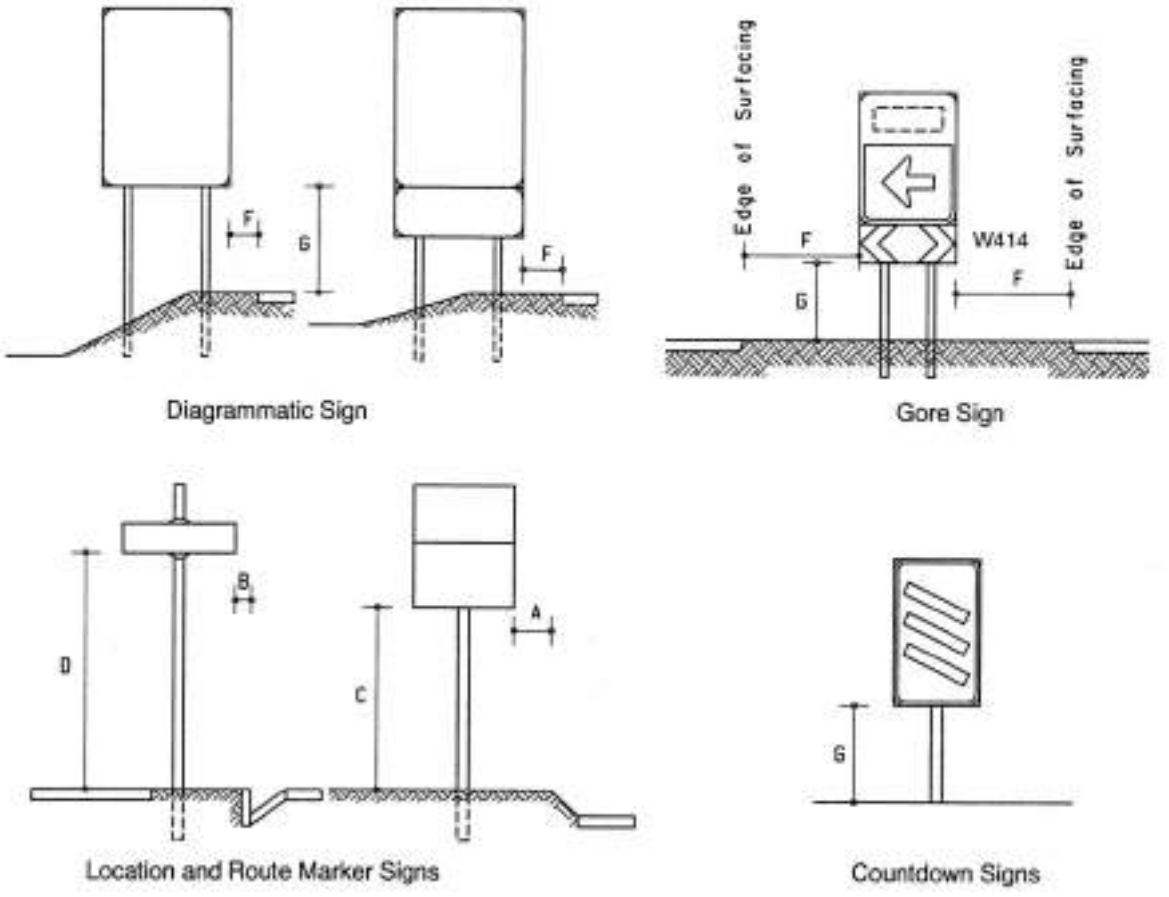
(14) The maximum value for dimension "K" is preferred for FREEWAY DIRECTION signs.

(15) The minimum height appropriate for an overhead sign in the upward pointing arrow system is 30"d". A letter size of 420 mm/300 mm ("d" = 60 mm) will therefore result in a minimum sign height of 1800 mm. A sign height less than this Dimension "T" is likely to look ill-proportioned. (Figure 1.18)

(16) Countdown signs can, under certain conditions of alignment (particularly on a left hand curve) obscure the Exit Direction sign. It is recommended that the COUNTDOWN signs be positioned so that they are in a straight line with sign IN1 which is located further from the edge of the shoulder than sign IN3. (Figure 1.19)

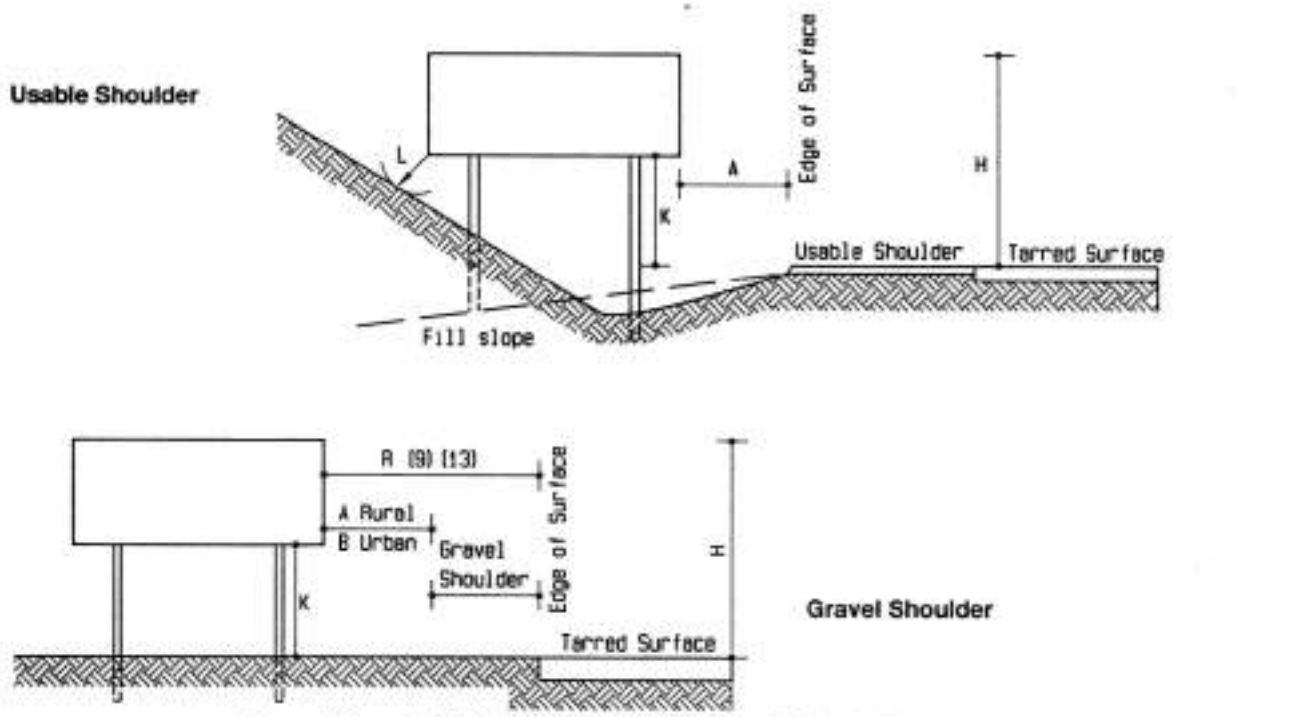


Detail 1.18.1 Regulatory and Warning Signs

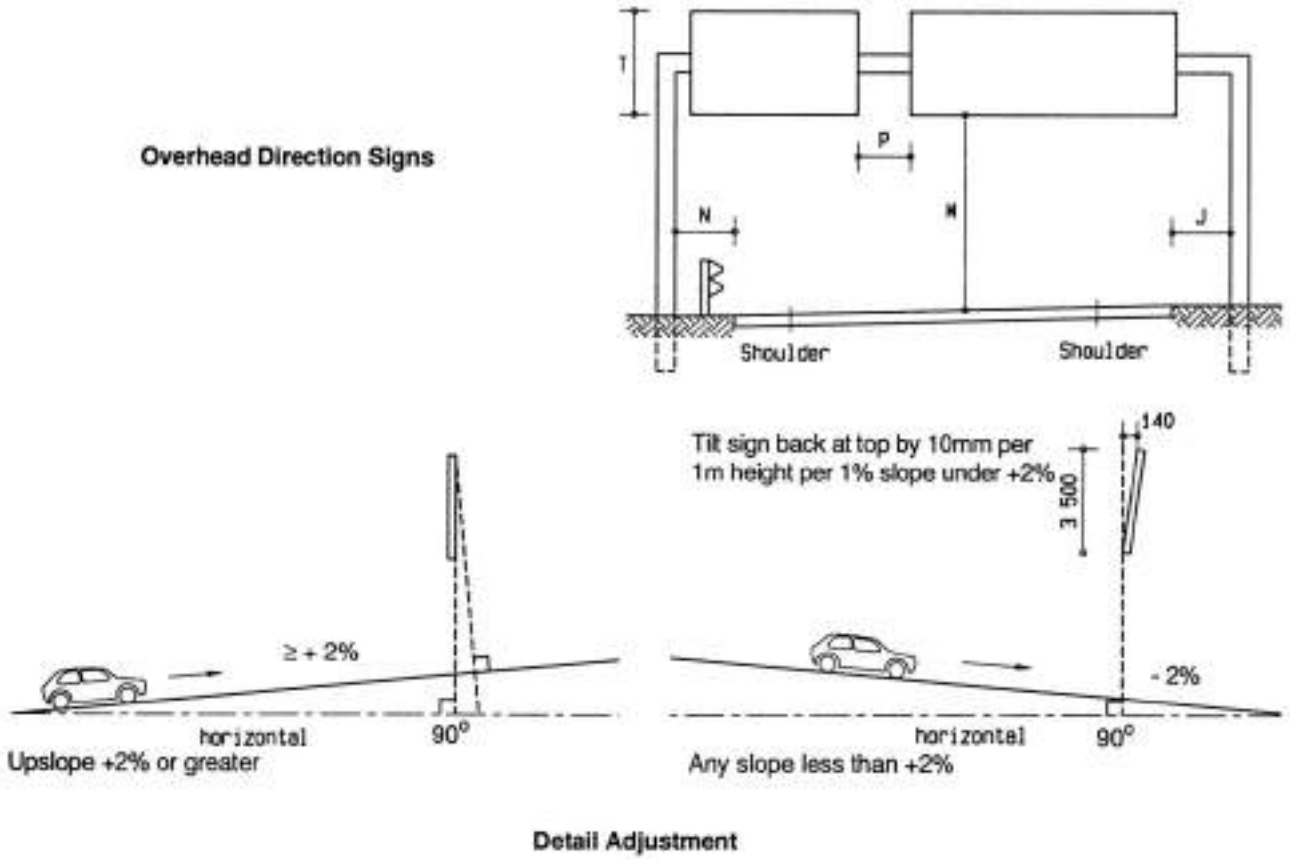


Detail 1.18.2 Small to Medium Sized Guidance and Information Signs

Fig 1.18 Lateral and Vertical Positioning of Road Signs



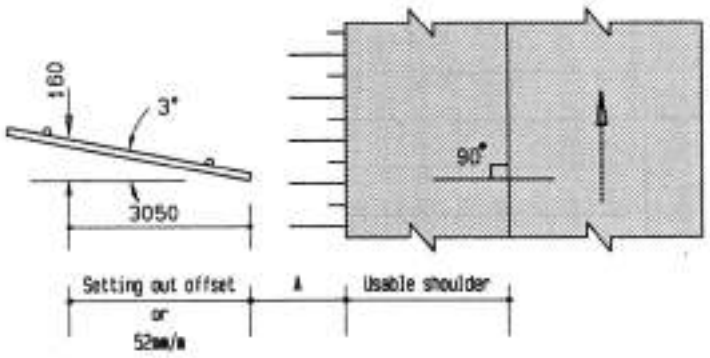
Ground Mounted Direction Signs - Class A and Class B Roads



Detail Adjustment

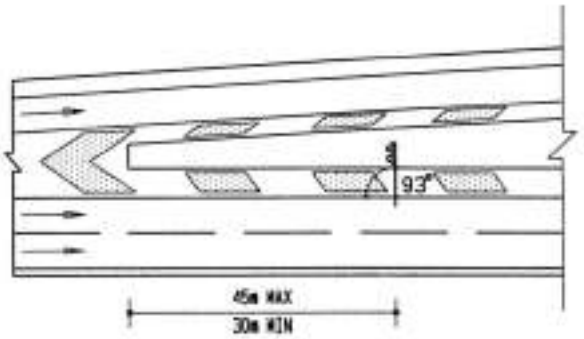
Fig 1.18.3 Larger Guidance Signs

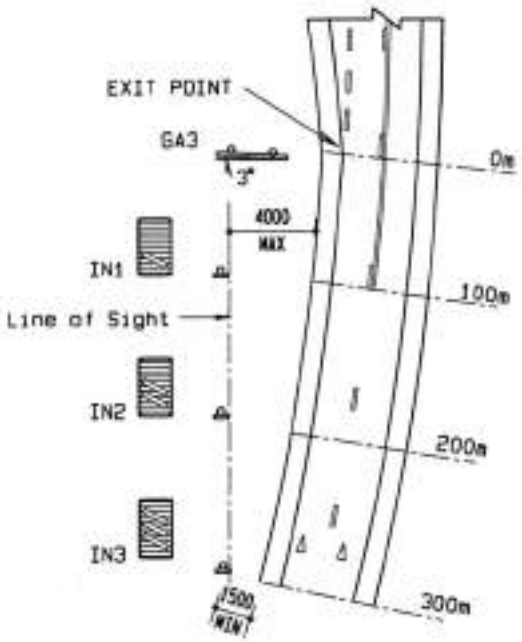
Fig 1.18 Lateral and Vertical Positioning of Road Signs



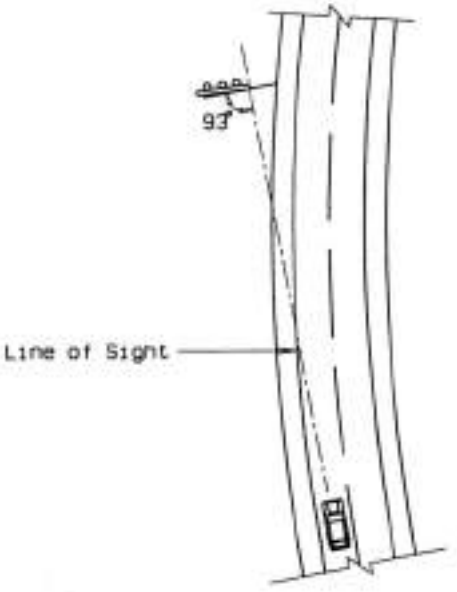
Typical Direction Sign

Gore Sign





Lateral Setback of Countdown Signs to Avoid Obscuring of Exit Sign - GA3



Adjustment to Sign Orientation on Right Hand Curve

NB : See Detail 1.18.3 also.

Fig 1.19 Offsets to Reduce Specular Glare from Retroreflective Surfaces

1.7 HUMAN FACTORS

1.7.1 General

1 The term "human factors" is used to describe the interaction of man with man-made objects and various processes within the natural and man-made environment. This interaction of man in the roadway environment is largely realised in the form of "driver behaviour". The efficient operation of the road traffic system ultimately depends on the performance of the system users, who are mainly drivers but can include pedestrians, AND on the understanding by road designers of the human factors involved in driver behaviour in the road environment.

2 It is for this latter reason that this section is included in the Manual. The coverage has, however, been limited. Those readers involved in the design of roads and in traffic engineering aspects of road use, are encouraged to read further on the subject. Research is on-going on a world wide basis (see Section 1.8).

3 It is generally agreed that the prime cause of almost 95% of all accidents involves human factors. The understanding of human factors and the incorporation of this understanding into road design is therefore important to the safety performance of the road traffic system.

4 The human factors interaction process has four main components:

(a) man - the road user;
(b) machine – broadly any object or process which man uses to complete a driver related task - man and machine interact so that man receives sensory information from the machine and manipulates the ma- chine by the use of controls;
(c) workspace - the space in which man and machine function;
(d) environment -the man - machine - workspace combination exist in an environment which affects individual performance - a working environment including such aspects as illumination, sound, vibration, climate and the psychological environment.

This information is illustrated simplistically in Figure 1.20.

5 It is important, when considering human factors, to realise that there is no "a-typical" person. All the relevant human factors are subject to wide variations in value. Designers have to attempt to design to accommodate the widest possible range of values, yet, in doing so, will set limits outside which some percentage of the population will fall e.g. the visual acuity of drivers.

1.7.2 The Driving System

1 The driving process can be broken down into four main tasks:

(a) pre-trip planning (macro-performance);
(b) control(micro-performance);
(c) guidance (vehicle manoeuvring - situational performance);
(d) navigation (macro-performance).

The information needs of these tasks is covered in Sub-section 1.7.4 (see Figure 1.21).

2 The driving system tasks require an "input - output" operation which can be described as an "information-decision-action-observation" sequence. A driver's task is to receive and process mainly visual inputs – be stimulated by some, make predictions and decisions about actions, execute the necessary actions, and observe the outputs of the actions through the receipt and processing of new information inputs. This is an intermittent rather than a continuous process, varying ac- cording to the changing complexity of the environment. The driver is therefore acting as part of a "driver-vehicle-road" closed-loop system.

3 These concepts are illustrated in a "Task Demand Model" in Figure 1.20.This model does not however indicate the following:

(a) inadequate input for a given task e.g. negotiating a complex junction;
(b) out-of-range inputs e.g. uncommon events;
(c) incorrect input sampling or slow processing by a driver (see Section 4.4);
(d) an information overbad resulting in the shedding of load, and on judgement decisions on the relative importance of information;
(e) comparisons and decisions are affected by stress, arousal, motivation and type of input;
(f) drivers may make serious errors.

1.7.3 Driver Characteristics

1 The major aspects of driver behaviour are:

(a) psychological traits - intelligence, learning ability, motivation, skills, attitudes and desires;
(b) sensory abilities- vision and hearing;
(c) physical abilities - response or reaction time;
(d) medical condition - alcohol, drugs, disease or physical impairment.

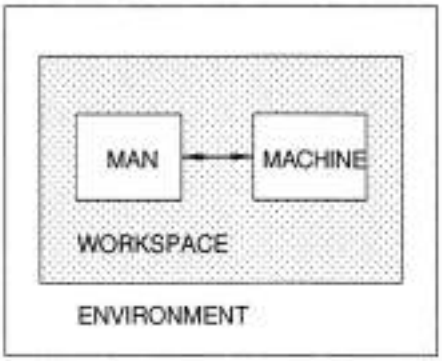
This section only deals with the sensory and physical abilities as they relate to the provision of road traffic signs. Figure 1.20 illustrates a "Cognitive - Motivational Model" dealing with driver behaviour.

2 It must be assumed that driving is the same as any other human skill in that drivers carry out tasks using values, norms, attitudes, motives and expectations which reflect the views of their peer or social groups. Since these factors form part of driver's social value structure they are difficult to influence or change. It should also be accepted that there are drivers who have below normal levels of experience or even literacy.

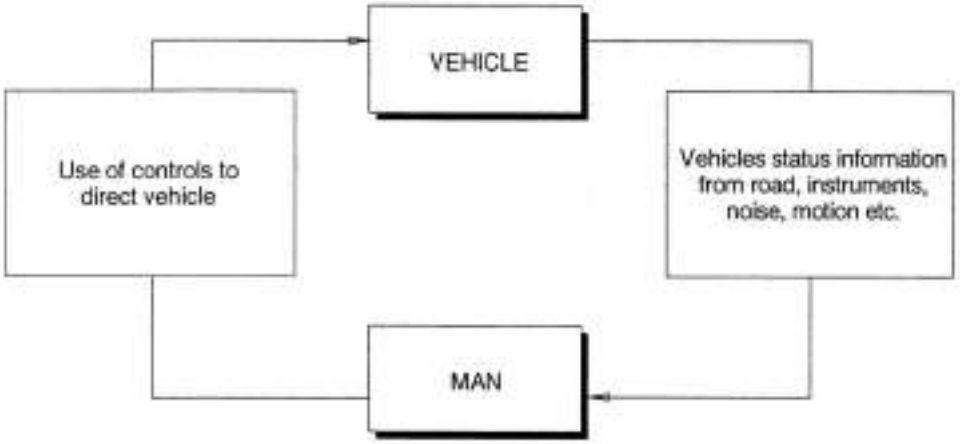
3 Information input is received by drivers' sensory systems as follows (in order of importance):

(a) visual (sight);
(b) kinesthetic (movement);
(c) vestibular (equilibrium);
(d) auditory (hearing).

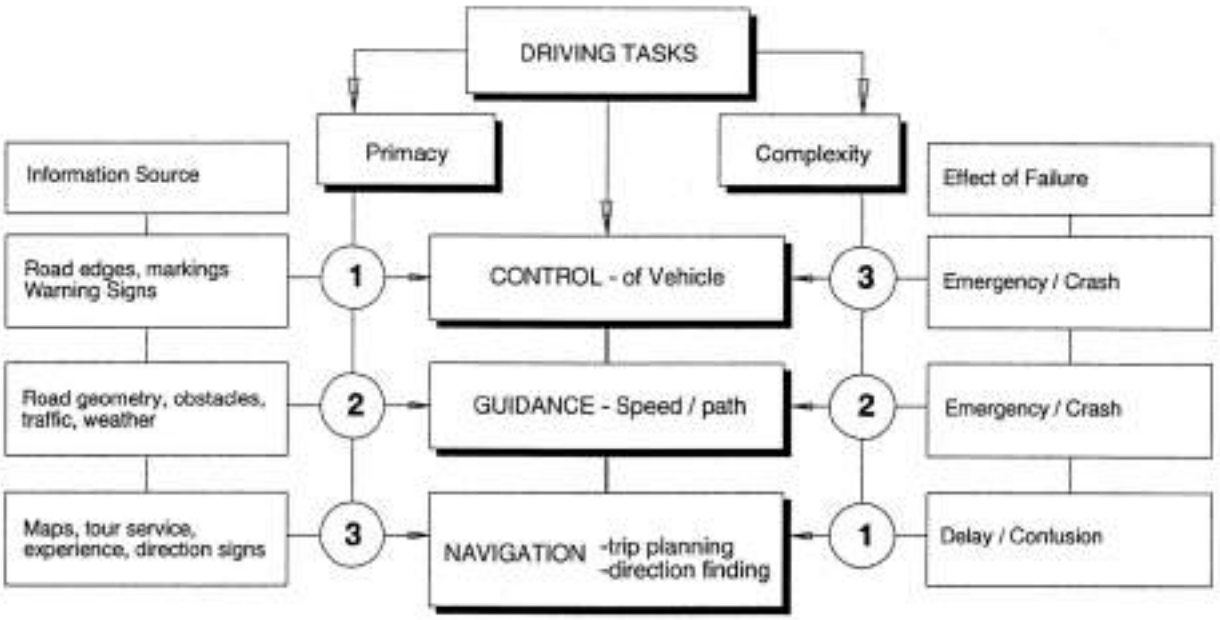
4 In the driving task some 90% of a driver's information is provided by vision. Visual sensory processes are the only ones pertinent to maintaining course, detecting obstacles, and for reading road signs, road markings, traffic signals and other forms of delineation. Drivers do not observe the road ahead continuously. They blink, observe objects well off the line of the road, use the rear view mirror, read the vehicle instruments together with many other functions.



Detail 1.20.1 Basic Model of Man and his Working Environment

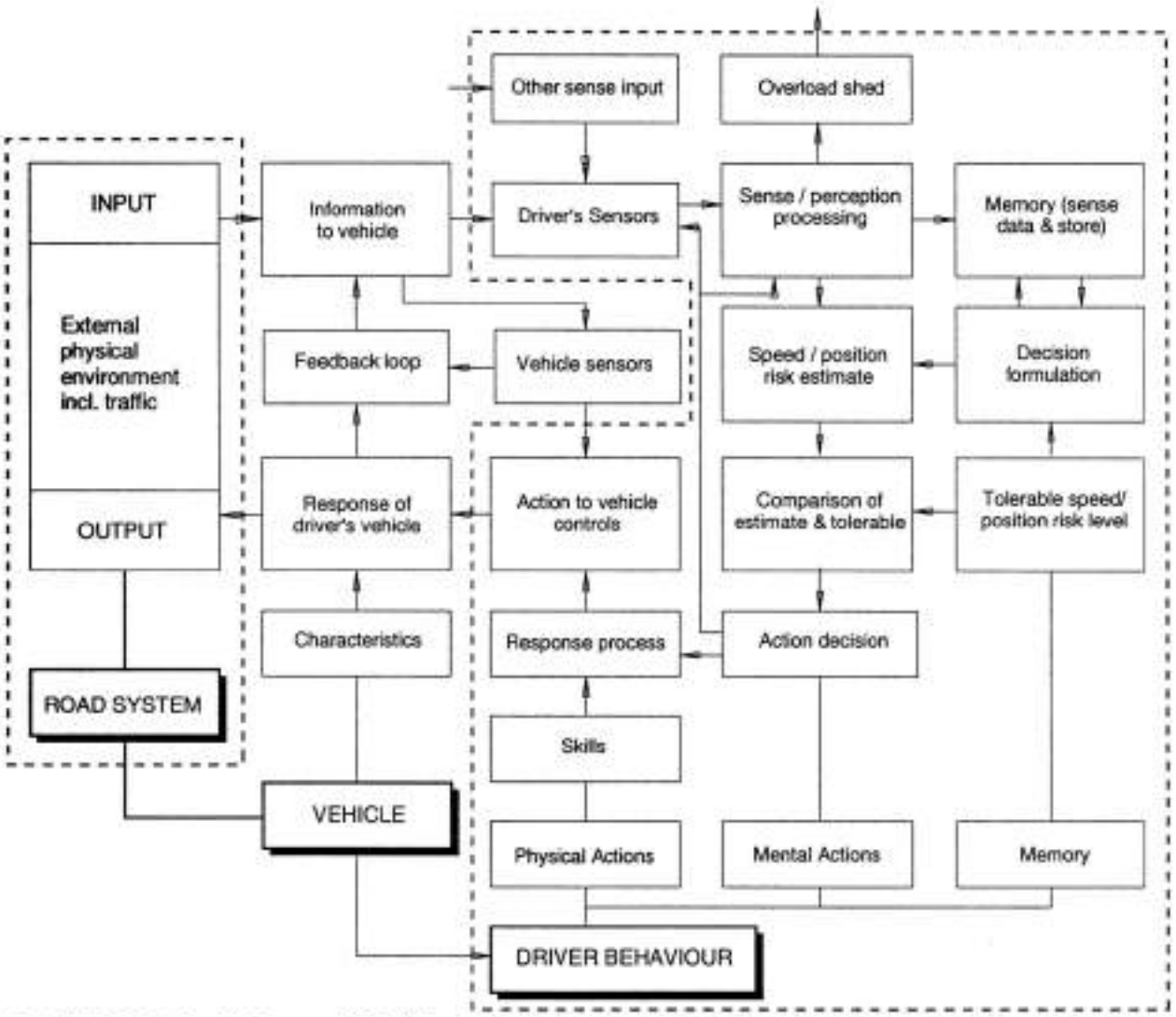


Detail 1.20.2 Man - Machine Interaction Driving a Vehicle

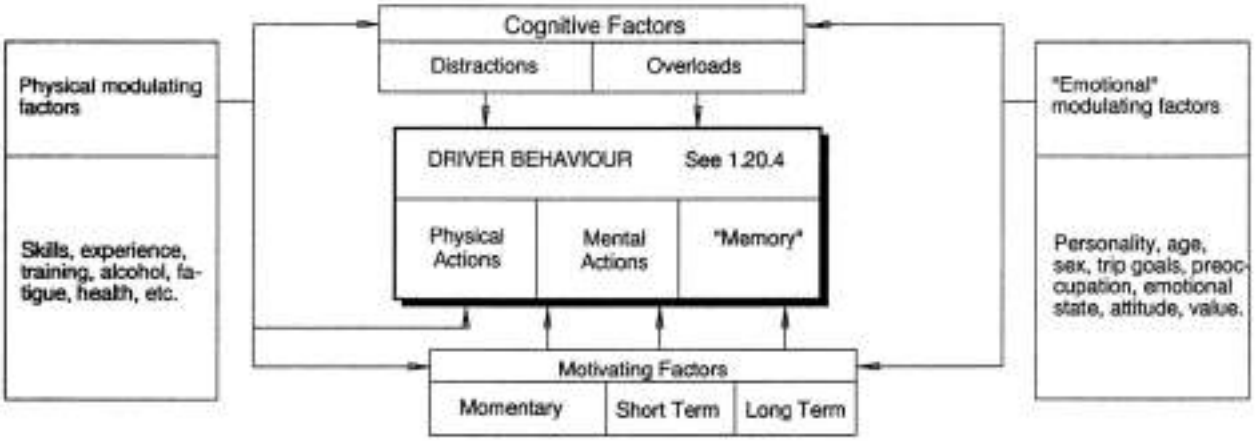


Detail 1.20.3 Human Factors and the Driving Task

Fig 1.20 Human Factors Models



Detail 1.20.4 Task Demand Model : Driver- Vehicle- Road System



Detail 1.20.5 Cognitive - Motivational Model of Driver Behaviour

Fig 1.20 Human Factors Models

The process is a sampling one. Sampling levels are low when a driver has good local knowledge and need to be higher when in an unfamiliar environment, when ambient light levels are low or when traffic volumes are high. When several such factors occur simultaneously, an information overload will likely occur.

5 There are several factors which affect visual ability. The most important of these are;

(a) visual acuity - the ability of the eye to see fine detail - acute vision is limited to very small angles of view and decreases further as drivers age (see Section 4.4);
(b) visual sensibility - permits the detection of luminance and contrast (see Sections 1.4 and 4.4);
(c) colour vision;
(d) perceptual and cognitive factors - including the times for eye movement to occur and to complete a search operation. These factors place a real limit on the amount of new information drivers can obtain because of time limitations.

6 The "Perception-Reaction time" I s the interval between receipt of a secondary input and the initial response output to what has been received. Often termed the "Perception- Intellection-Emotion and Volition", or the PIEV time. This time is made up of:

(a) perception time taken to form a mental image of sensation received via the body;
(b) intellection involves reasoning towards a decision;
(c) emotion is the affective and subjective part of one's consciousness;
(d) volition is the act of making a choice or decision.

1.7.4 Information Needs

1 Drivers must receive reliable, credible and understandable information to minimise uncertainty in order to make sound decisions in relation to driving tasks.

2 Of the four tasks identified in paragraph 1.7.2.1 pre-trip planning provides information which will be remembered during the navigation task. The control task requires information on vehicle position and orientation as well as feedback from actions such as braking, accelerating and steering. The guidance task refers to the selection of speed and path within the roadway. Information is therefore required in order to make decisions relating to such activities as lane changing, overtaking, merging, weaving etc. Information used in the navigation task comes from memory (from pre-trip planning and experience), landmarks and direction signs.

3 The three on-road tasks vary in their complexity and primacy of action. The following five principles have been developed in relation to the systematic presentation of information to drivers:

(a) first things first - primacy;
(b) do not overload- processing limitations;
(c) acquire information before getting on the road- *a priori* knowledge;
(d) keep the information at a consistent level- spreading;
(e) do not surprise- expectancy.

4 The concept of primacy is based on the acceptance that at any given instant some driver information is more important than other information. A task hierarchy of control before guidance or navigation, and guidance before navigation, is thus established. A task failure at the control or guidance level may lead to a catastrophic result whereas a failure at the navigation level is non-catastrophic, unless of course some control or guidance failure follows (see Figure 1.21).

5 If the driver should be presented with several complex situations at the same time or over a very short time span a point may be reached when the driver cannot process the information without error.

6 *A priori* knowledge relates to all three tasks. This knowledge, in an experienced driver, makes the control task almost an automatic one and in a similar way reduces the burden of the guidance task. The more information prepared during the pre-trip planning stage, the less will need to be acquired during a trip to complete the navigation task successfully.

7 It is important that road designer's and those providing road signs recognise the potential for a build-up of information, and take action wherever possible to spread the information by keeping the less important information for less busy areas, e.g. placing confirmation signs close to an interchange but well beyond any other signs.

8 At locations where driver's expectations are not realised, drivers may require longer response time and will have a tendency to make inappropriate or hazardous responses. Although expectancies occur at all task levels, their importance is probably greatest at the guidance level (see Section 1.8).

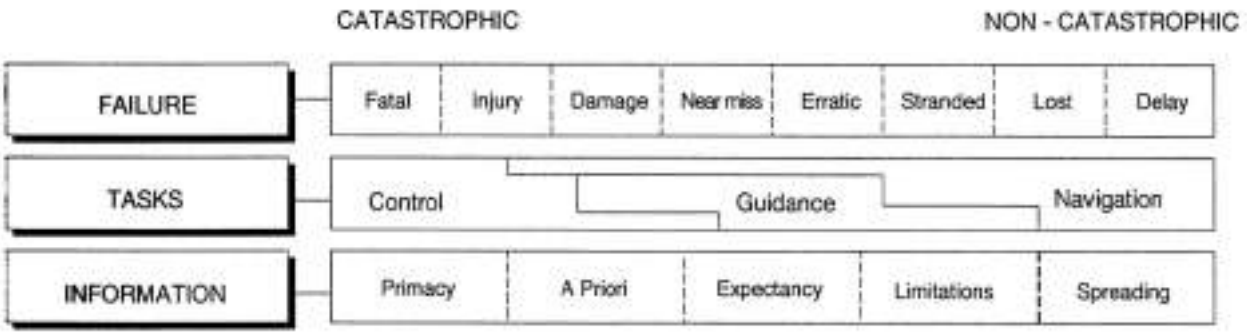
9 In considering what information to put before drivers, designers must therefore use good communication techniques and provide information in a credible manner. Coding is a technique commonly used on road signs to reduce the time required to take in information. Coding can use colour e.g. freeway sign background, or numbers instead of words (route numbers), or symbols in place of words. The use of numbers and symbols also results in a reduced need for the display of word messages in different languages. These codes are, however, likely to be counter-productive if drivers are not adequately made aware of their specific functions. If new codes are introduced education must be undertaken to improve the credibility of the traffic control devices used.

10 The credibility of an individual traffic control device depends not only on its own specific physical context but also on how it is used in relation to other traffic control devices. This implies a clear responsibility on the part of designers to consider not only the specific problem in hand, but also the effect of the proposed solution on the traffic system as a whole. Inconsistent signs and traffic control devices tend to destroy general credibility in the total traffic system.

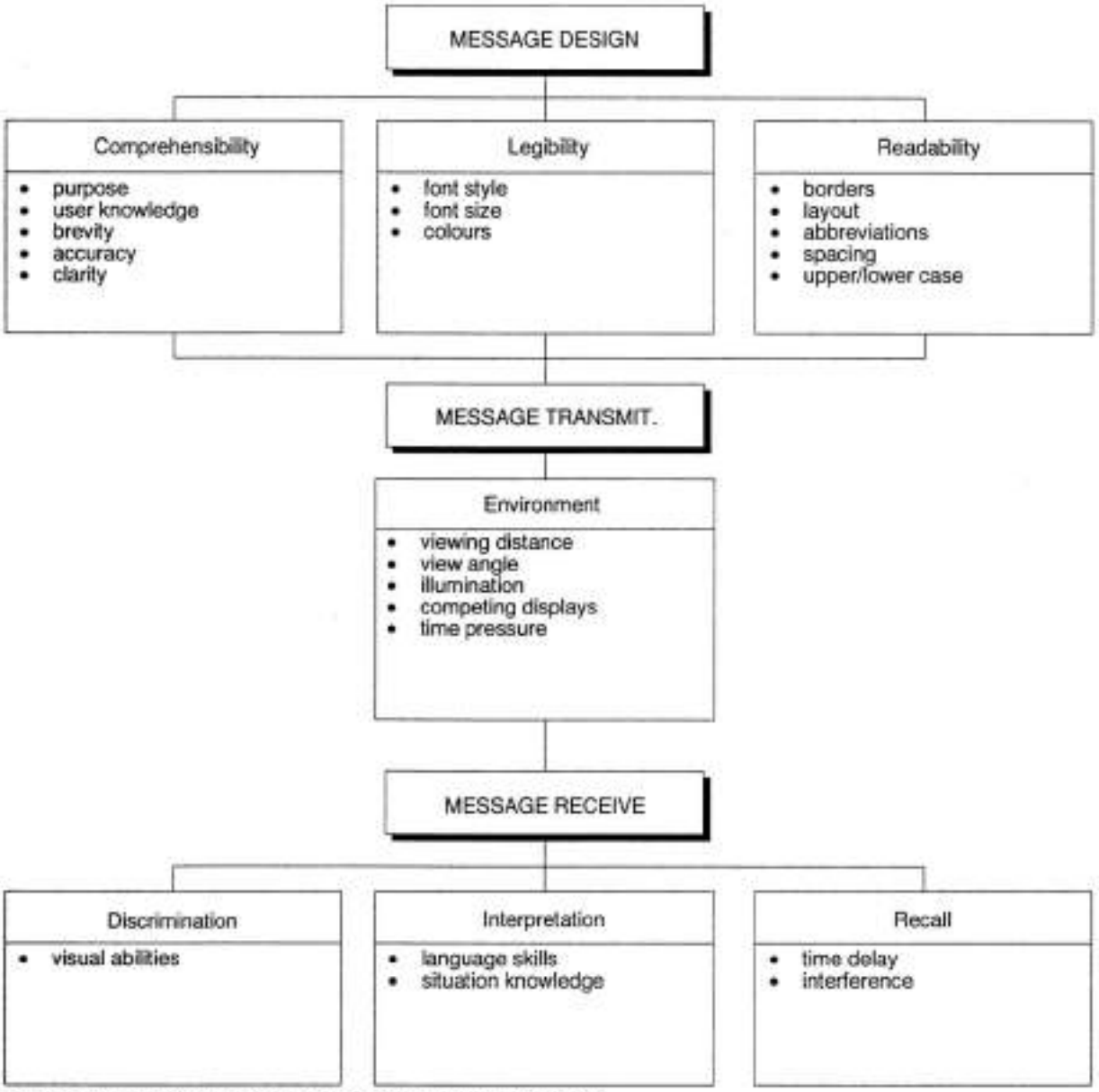
1.7.5 Human Factors Checklist

1 The following critical items should be addressed in any phase of road design:

(a) What is the driver's task?
(b) What is the information need?
(c) What is the information source and when is it provided?
(d) Does the information contradict any other information?
(e) Does the information contradict driver expectation?
(f) Does anything interfere with the information transfer?
(g) What are the likely consequences of an error?



Detail 1.21.1 Failure of the Information System



Detail 1.21.2 Information Communication Process

Fig 1.21 Information System

1.8 POSITIVE GUIDANCE

1.8.1 General

1 "Positive Guidance" is a road safety philosophy that advocates the creation and maintenance of a public road environment which will provide road users with the optimum amount of visual information which is:

(a) useful - the limitation is that non-useful or non-pertinent information takes time to process – this reduces human performance for necessary information processing and reaction;

(b) prioritized for importance - the performance limitation again applies to human reaction;

(c) uniform (and without surprises - expectancy) - man develops response habits as a defence mechanism - driver expectancy results in automatic, and time saving, responses to standard stimuli- the ultimate objective of positive guidance techniques; and

(d) easily visible under the widest range of conditions – standards used must be as close to the ideal as possible.

2 This information is deemed necessary to ensure that competent drivers are given appropriate information about hazards and inefficiencies to avoid errors. Positive guidance combines road/traffic engineering and human factors disciplines to produce a visual information system matched to road facility characteristics and driver attributes.

3 There are few situations where all factors combine in a standard manner. Positive guidance procedures apply standards and policies with sufficient flexibility, but with a high quality, to effect safety at site-specific locations and on a system-wide road network basis.

4 It is not appropriate to cover positive guidance in depth in this Manual. However, in providing an insight into the subject (as with "Human Factors" in Section 1.7) the objective is to make designers aware or the philosophy and to encourage them to incorporate the principles or the Manual to their work.

1.8.2 Positive Guidance and the Manual

1 Although this Manual does not set as a basic concept the practice of designing to 85 percentile values, the practice is advocated occasionally and it is a common traffic engineering practice. Specific requirements, sometimes stated as warrants, are included in the Manual but not universally so. This situation is deliberate because most road user information situations have such a wide range of potential variables, and combinations of variables, that to prescribe these practices too closely is considered inadvisable.

2 The Manual is intended to be used as a basic policy and standards document and as such may at times appear vague in its application. However, it leaves scope for interpretation and extension of policy at, for instance, local levels. In this context the Manual mainly offers minimum requirements, although preferred or desirable values are regularly stated. There is there- fore always scope to provide a greater level of visual information than is perhaps indicated. This is what "positive guidance" is all about - not just doing the minimum.

3 In order to demonstrate the application of design principles various design values have been stated (see Chapter 4). These values are economic values and can, and should, be enhanced if there are indications of inadequacy. Such indications may come from the implementation of positive guidance procedures. It is of fundamental importance that, when enhanced, the enhanced values be adhered to consistently (see Sub-section 1.8.3).

1.8.3 Driver Expectancy

1 The concept of "driver expectancy" is mentioned briefly in Section 1.7 as a human factor. The term relates to the process by which an individual (road user) develops ideas and concepts which, when presented with a stimulus of some sort (visual, tactile, auditory etc.) conditions the response to the stimulus. The response may be directly related to the stimulus or it may be totally unrelated to it, except that the response has been triggered by the stimulus. The predisposition of an individual in the form or ideas and concepts is very influential in determining the manner of response to a stimulus and is referred to as the "expected set" or the "expectancy" of the individual.

2 When these circumstances are applied to the driving task, the expected situation is a constantly changing one, and environmental influences are very pronounced. This in turn reduces the predictability of responses to stimuli. Driver expectancy can therefore be described as an inclination to respond to a roadway or traffic situation in a set manner, based on previous experience. It must be understood that the response is to an "expected" situation and NOT the actual one.

3 When the actual situation conforms to the expected situation there is little likelihood of uncertainty. When the actual situation differs from the expected situation a complex decision making and response process occurs. The process will take the following generalised sequence:

(a) the information available must be sufficient to convince a driver that the expected situation is in fact incorrect (this information is significantly more than would have been required to confirm expectancy);

(b) the incorrect set of expectations must be replaced by a new set;

(c) the normal perception - reaction process may then continue.

4 During the process of formulating expectations for typical situations it is considered that drivers expect the following from the visual information system on public roads:

(a) that the information be uniform in its display and detailing;

(b) that the visual elements will be sufficiently conspicuous at a distance which will permit a safe driver to perform the required manoeuvre(s) within a speed limit related perception – reaction time (when such conspicuity is difficult to achieve additional measures, such as high visibility treatment or

sign repetition must be considered – examples of such techniques are referred to regularly through - out the Manual);

(c) that the information for all road users is appropriate to the circumstances and relevant constraints.

5 Application of positive guidance procedures on a site - specific basis can affect the resultant driver expectation for similar sites elsewhere. This effect may be detrimental if expectancy levels become inflated and common levels of positive guidance treatment do not occur (see Subsection 1.8.5).

1.8.4 Visual Information System

1 The principal components of the roadway visual information system are covered in depth in this Manual. Visual information can be categorised as formal or informal as indicated below:

(a) formal information sources:

(i) road signs (Chapters 2, 3,4 and 5);

(ii) road markings including other delineation devices (Chapter 7);

(iii) traffic signals (Chapter 6 and Volume 3);

(iv) vehicle tail lights;

(v) road maps, brochures etc.;

(b) informal information sources:

(i) road geometry;

(ii) roadside furniture and vegetation;

(iii) personal directions:

(iv) pedestrians and vehicles, both stationary and moving;

(v) *a priori* knowledge.

2 If drivers cannot always be protected from all hazards in their environment they must be given sufficient visual information to protect themselves.

3 In order to set up a uniform system-wide visual information system and to assess specific problem areas, adequate inventories and data must be available.

4 There are many situations where "stopping sight distance" does not allow time for an appropriate, unhurried response to stimuli. This is most likely to be when:

(a) there are complex and/or multiple decisions to be made;

(b) there is visual clutter or "noise";

(c) stopping is not the appropriate hazard avoiding manoeuvre.

Such situations are likely to be common on multi-lane metropolitan freeways carrying heavy volumes of traffic. Under these circumstances designers are recommended to use the "decision sight distance" which is the distance at which a driver can detect a hazard in an environment of visual clutter, recognise it as a threat, select an appropriate speed and path, and perform the required manoeuvre safely and efficiently (see Sub- section 4.8.2.)

1.8.5 Positive Guidance in Practice

1 The primary positive guidance effort should be directed at achieving better design and management of the total visual information system of the road network. In this regard the data requirements and the actions taken should be integrated into established road network planning and management systems, including geographic information systems (GIS). Whilst there is a place for the assessment of accident concentrations from the positive guidance approach, this should be carried out with the objective of determining system safeguards. The use of the term "site" should therefore be understood in the broad context.

2 The US Department of Transportation, Federal Highway Administration, has developed detailed procedures for positive guidance site investigations. The principle components are listed below and diagrammatically in Figure 1.22. Each activity shapes or is shaped by the preceding or following activity. The activities are:

(a) site definition;
(b) site problem description;
(c) site hazard identification;
(d) hazard visibility assessment;
(e) expectancy violation determination;
(f) information load analysis;
(g) information need specification;
(h) system evaluation.

3 A similar system of "Highway Safety Audits" has been developed in the UK. Both systems should be studied and considered by road and local authorities since they offer the prospect of high returns at low cost, or a good cost-benefit ratio.

1.8.6 Example of Driving Task / Information System Assessment

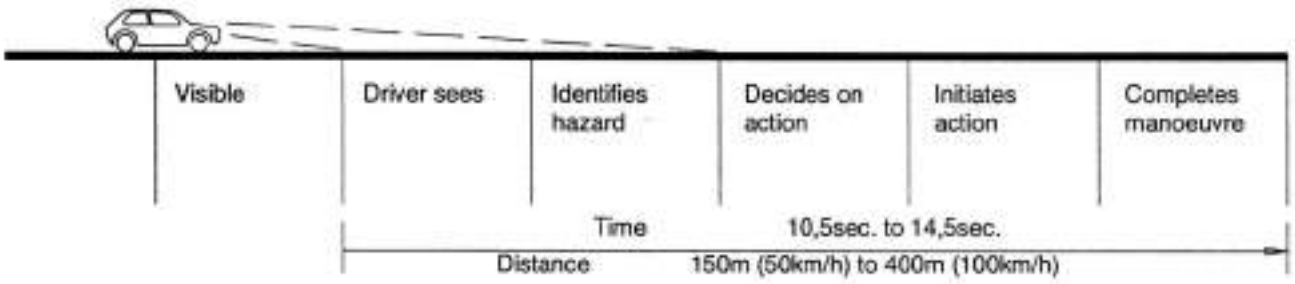
1 Figure 1.23 shows a busy section of three lane freeway carriageway and illustrates a number of typical traffic manoeuvres, which under the circumstances, would probably require greater than minimum time and / or distance to accomplish.

2 The direction signs shown have generally been designed taking the road conditions into account. Overhead signs have been used in the main due to the high risk of ground mounted signs being obscured by the anticipated heavy traffic flows and expected significant numbers of heavy vehicles.

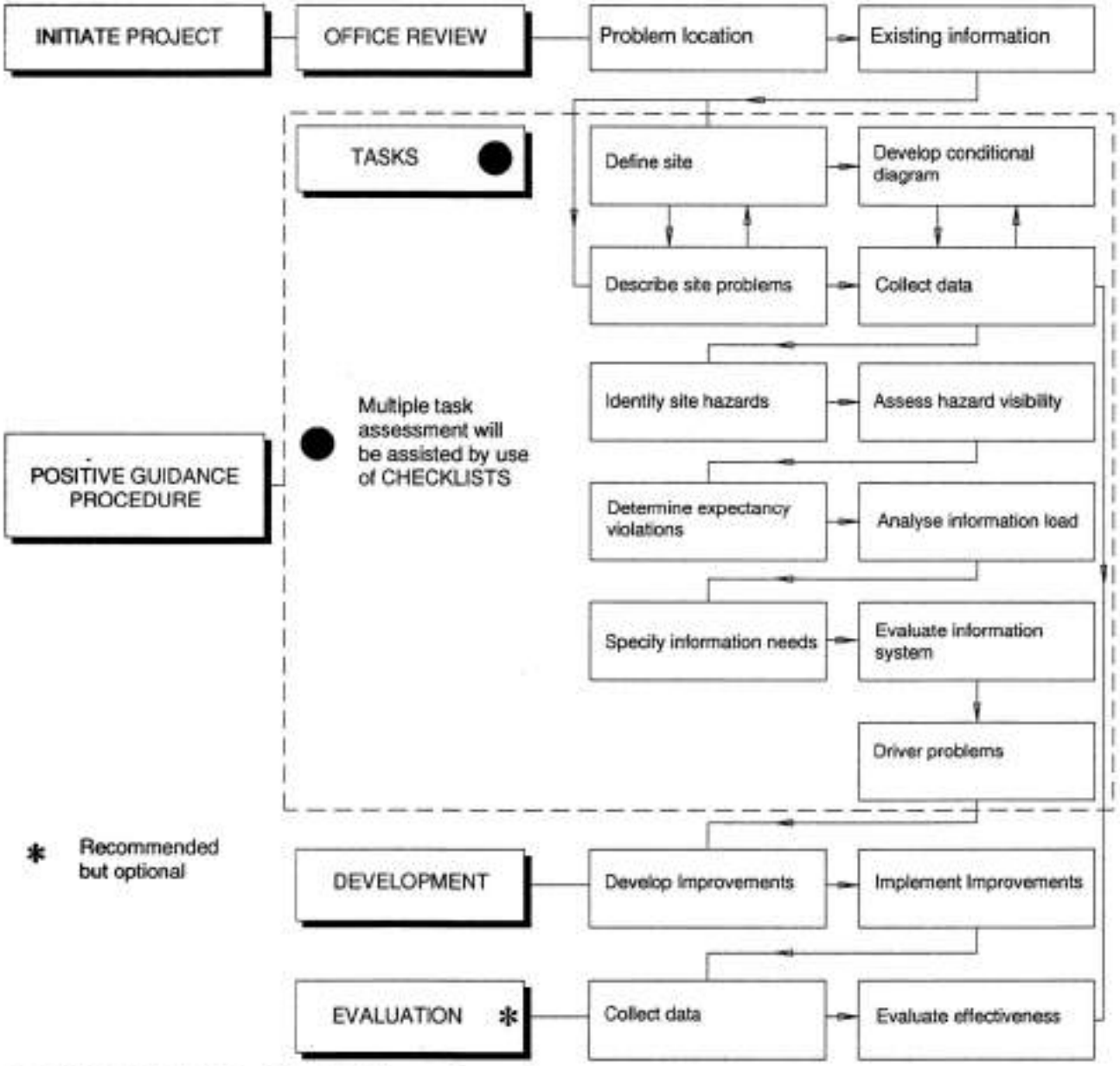
3 Sign GC2U has been sited further from the exit point than normal due to the mix of heavy traffic to allow more time for lane changing manoeuvres by drivers wishing to exit at EXIT "A".

4 Vehicle No. 1 is shown in various positions A, B, C. D. E and F as it progresses along the section of roadway. Prior to position 1A the driver would have seen sign GA8 which indicates an exit some 3 km ahead. The sign gives the interchange number and the destinations for the next three exits. At position 1A the driver is executing an overtaking manoeuvre, moving into the outer lane. In doing so his limited ability to see sign GA1, over the crest, is further diminished by his attention to the manoeuvre. Having moved further to position 1B his sight of sign GA1 is partially obscured by heavy vehicles and he receives virtually no message (if he sees the sign at all). Sign GA1 is also obscured, at the legibility distance, for the driver of Vehicle No.2.

5 At position 1C the driver now receives the exit mes-



Detail 1.22.1 Decision Sight Distance Model



Detail 1.22.2 The Positive Guidance Procedure

Fig 1.22 Positive Guidance in Practice

sage he requires from sign GC2U. To make the exit he will need to make two or three lane change manoeuvres. The sign tells him that there are two exit lanes. Under the volumes of traffic shown such manoeuvres are likely to take considerably more than the minimum time due to the relatively few suitable gaps available. The two manoeuvres are shown at 1D and 1E, taking a total of around 20 seconds to complete at 120 km/h. Confirmation of the exit position is received at position 1E and the decision is taken to move into the dedicated exit lane (position 1F). This decision was taken because a slow moving heavy vehicle had changed lane, out of the dedicated exit lane in front of him (position 4). The driver receives confirmation that he is 300m from the exit some3 seconds after this last manoeuvre as he passes the first countdown sign.

6 Other typical overtaking manoeuvres, of differing complexity, are shown at positions 3,5 and 6. The manoeuvre at position 5 is a complex control guidance manoeuvre because of the movement of the heavy vehicle to the left.

7 Movements at positions 7 and 8 illustrate the complexity of weaving to and from EXIT "8", with a very short length of lane in which to accomplish this. Following distances are likely to fall below safety levels under such circumstances.

8 The location of sign GC3U is limited by the two over-bridges at 450 m and 800 m resulting in limited sight distance.

9 The regular obscuration of sign GA1 could be reduced by relocating it to around 2200 m, and probably eliminated by mounting it in an overhead position. This would reduce pressure on the lane change movements required to exit at EXIT "A" and "8".

10 Other traffic control devices, most of which represent a hazard of some sort, are indicated by a black dol.

1.8.7 Bibliography for Human Factors and Positive Guidance

1 The following documents represent only a limited reading list. Material from these documents has been incorporated into Sections 1.7 and 1.8, particularly into Figures 1.20 to 1.23, and is hereby acknowledged. Most include an extensive list of further references:

1. International Commission on Illumination. Road signs. Publication CIE No.74, 1988;
2. Southern African Road Federation. System Design of Highways for Operational Efficiency and Safety - Human Factors Considerations, 1976;
3. Exter J O. Driver Information - Traffic Control Devices, 1977;
4. Alexander G J and Lunenfeld H. Positive Guidance in Traffic Control, Federal Highways Administration, 1975;
5. Federal Highways Administration. A User's Guide to Positive Guidance, 1977;
6. Federal Highways Administration. A User's Guide to Positive Guidance. 3rd Edition, 1990;
7. Wright PH and Ashford N J. Transportation Engi-Neering - Planning and Design, 3rd Edition, 1989;
8. Krause Ret a. Positive Guidance – New Visions for Safer Highways – Report of the National Advisory Task Force on Positive Guidance, 1990;
9. Lay M G. Handbook of Road Technology, as published in the Journal of the Australian Road Research Board, 1989.
10. The Institution of Highways and Transportation. Guidelines for the Safety Audit of Highways, 1990.

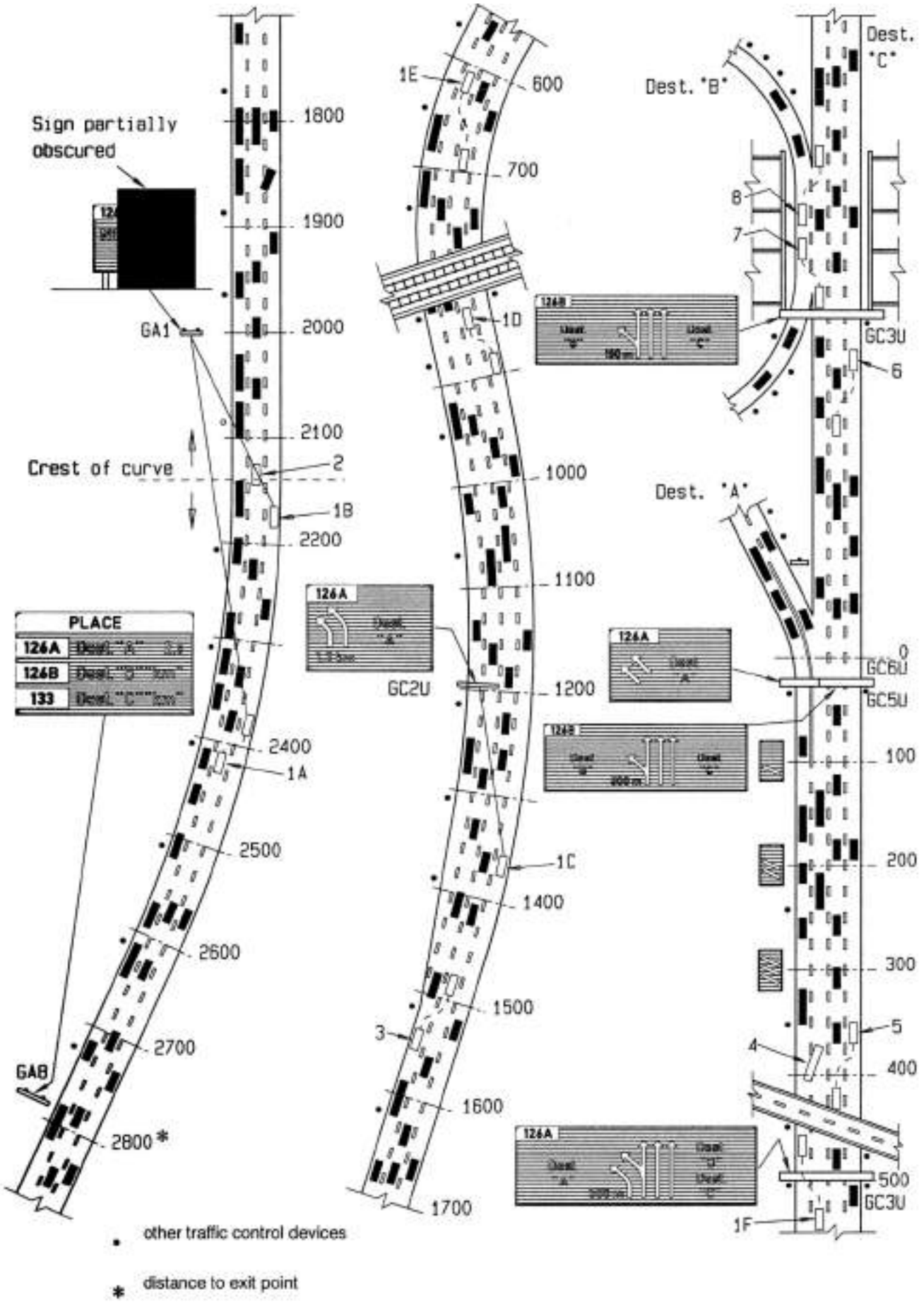


Fig 1.23 Typical Example of Positive Guidance Principles

1.9 OUTDOOR ADVERTISING

1.9.1 General

1 It is outside the scope of this Manual to offer in depth guidance on the management of outdoor advertising. However, the function of outdoor advertising, in the main, is to attract the attention of road users. In this respect such advertising can be considered to be in conflict with the function of road traffic signs if not properly managed.

2 If an outdoor advertisement can be considered to have adverse effects for road users these effects can occur in one of two ways, namely:

(a) environmentally - in the sense that the location of a particular advertisement, or an accumulation of advertisements, detracts from the appearance of an attractive and cared for environment in cities, towns and the countryside; and

(b) road safety - in that the display of an advertisement may have an effect on the safe use and operation of any form of traffic or transportation within or entering a roadway, as a result of the behaviour of drivers of vehicles, cyclists or pedestrians whose attention is distracted by such an advertisement, and also through any possible confusion with any road traffic sign.

3 The information imparted to a road user by an outdoor advertisement can be considered to fall into two broad categories:

(a) in-trip information - aimed at offering specific services or directions required by road users to break, continue or complete their trip e.g. - fuel, food or accommodation advertising; or

(b) non-trip information - general information having no bearing on the fact that the observer is travelling on a road system e.g. cigarette advertising.

4 It is not unreasonable to accept, at least in part, that if uncontrolled advertising attempts to provide in-trip information, that there is likely to be a deficiency in the information given by the official road signing provision. This Manual makes provision in Chapter 4 for a hierarchal range of direction signs including the sub-classifications TOURISM and LOCAL DIRECTION signs. These sign categories are intended to function in a supplementary role to the main direction signing system, and particularly at the local level. Even if pre-trip planning is undertaken by longer distance travellers, there are likely to be gaps in their knowledge at a local level. These gaps may be satisfied by adequate standards and levels of local area road signing, as covered by the Manual, and provided by the responsible road authority, or by informal unco-ordinated and random advertisements. The adequacy of such local level road signs will only be achieved if they are made to conform to conspicuity and legibility guidelines, and if road users are made aware of the manner of the provision of road sign information at a local level.

5 In considering the management of outdoor advertising the following factors are relevant:

(a) the environment;
(b) land use;
(c) the road type (based on traffic characteristics);
(d) the type of advertisement.

6 In the context of a road environment three broad divisions of environment appear to have significance:

(a) rural;
(b) peri-urban;
(c) urban.

7 Land use categories which generate particular demands for advertising, or advertising management, are:

(a) agricultural;
(b) residential;
(c) industrial;
(d) commercial;
(e) public roadway;
(f) railway reserve;
(g) transport terminals - particularly airports and railway stations.

The last of these is included because it represents, in some situations, a major land use where advertising has been traditionally targeted at road users.

8 The road type, in combination with the environment in which it exists and in conjunction with the surrounding land use categories, will dictate the complexity of the driving task to which advertising information is added. Relevant road types are:

(a) freeway;
(b) regional route/arterial;
(c) collector/distributor;
(d) access;
(e) residential.

9 Types of advertisement can be broadly categorised into large and small, and an appropriate division appears to exist in this context over and under an area of 2 square metres. The intrusion of advertising into the driving task, either into spare attention capacity or in addition to an overloaded attention capacity situation, is likely to result from one or more of the following attributes of an outdoor advertisement:

(a) size;
(b) number (repetition);
(c) colour(s);
(d) movement;
(e) concept.

1.9.2 Conspicuity

1 The conspicuity of road traffic signs can be adversely affected by the presence of outdoor advertising signs. When a target road traffic sign has to compete with a visual clutter of advertising and other signs for the attention of drivers, its conspicuity may have to be improved by one or more of a number of measures, such as:

(a) an increase in sign size;
(b) the mounting of the sign on a backing-board or high visibility background;
(c) illumination.

2 Notwithstanding measures to manage outdoor advertising there are certain environments that are unlikely to change significantly with respect to the competition offered to road traffic signs by advertisements. Shopping streets and commercial and industrial areas have well established advertising practices that are unlikely to change. A road authority should therefore recognise this situation, and if it wishes to erect road traffic signs that must be seen, it must take action to ensure that the road traffic sign conspicuity is adequate. Research has shown that, on average, the successful targeting of road traffic signs may occur as little as 11% of the time if drivers are not specifically looking for signs (attention conspicuity), and only 50% of the time if they are actively looking for signs (search conspicuity).

1.9.3 Distraction

1 Limited research indicates that the distraction effect of even large billboard advertisements is not necessarily great. The attention conspicuity capability of an advertisement may, however, be significantly increased by the use of moving components (variable messages, wind rotation), illumination, or fluorescent colours, or all of these factors to the detriment of the attention conspicuity of road traffic signs. A traffic hazard could result from such a level of distraction.

2 It is therefore recommended that, until such time as a code of practice for outdoor advertising is available, all advertising signs to be placed within, over or directed at a public road be required to be submitted to the road authority for approval prior to installation. An authorised official should have the power to order the removal of any advertisement which has been installed without approval, and should refuse approval for the installation of any advertising sign if, in his opinion, the sign is likely to:

(a) distract the attention of a driver in a manner likely to lead to unsafe driving conditions;

(b) conflict with any road traffic sign EXCEPT as provided for in Subsection 1.9.4 - until such time as a code of practice is available in this regard the following controls are recommended:

(i) no advertising should be permitted within an intersection;

(ii) no advertising should be permitted within 50 m of the perimeter of an intersection on an arterial road, or in peri-urban and rural areas;

(iii) no advertising should be permitted within 30 m of the front of any road sign or traffic signal;

(iv) great care should be exercised in permitting advertising within the cone of vision of a driver observing any road sign on a freeway or a traffic signal, including a suitable effective distance behind such signs or signals.

(c) be misunderstood to represent a road traffic sign due to any factor, including the following:

(i) any form of arrow or other directional device;

(ii) any symbol, logo or other device as used on a road traffic sign;

(iii) use of combinations of colours specified for road signs;

(vi) statements calling for a driver to turn off the route on which he is travelling or to make a U-turn;

(d) be aesthetically in conflict with the environment in which it is placed.

1.9.4 Advertising in Association with Road Traffic Signs

1 Advertising material comprising a sign, placard, notice, sticker, or banner shall not be displayed from a road traffic sign, or any road traffic sign support, whether such support has any other purpose or not.

2 It should be noted that some sign manufacturing specifications require sign manufacturers to include their name, in addition to other information, on the reverse side of road signs to identify the manufacturer of the signs. This is not, therefore, classified as advertising.

3 In terms of legislation an association or club providing a road authority with a road sign, as a form of service or sponsorship, may display a badge or token on the signface, under specified conditions.

1.10 ROAD TRAFFIC SIGN MAINTENANCE

1.10.1 General

1 The basic functions of road traffic signs are to regulate, warn, guide and inform road users, during daytime and night-time and under all weather, climatic and traffic conditions.

2 To be effective they should meet the following basic requirements:

(a) fulfil an important need;
(b) command attention;
(c) convey a clear, simple meaning;
(d) command the respect of road users;
(e) give adequate time for response.

3 It is essential that the perception by motorists is influenced positively by the condition of road traffic signs and that signs should comply with driver expectancy.

4 Maintenance of road traffic signs should therefore be undertaken to ensure that the above requirements are met.

1.10.2 Objectives for Road Traffic Sign Maintenance

1 The primary objective for road traffic sign maintenance is to ensure that the signs displayed on the road satisfy criteria like conspicuity, legibility, comprehensibility, credibility and uniformity in a cost-effective way so that information can be clearly transferred to the motorist.

2 Because the physical appearance of signs is apparent to all road users, the quality of this appearance has a high profile in crediting or discrediting the authority or authorities responsible for the provision and/or maintenance of signs.

1.10.3 The Effectiveness of Road Traffic Signs

1 The effectiveness of road traffic signs depends largely on road user interpretation of signs. It is therefore necessary that a road user should see the signs. The message on a sign must be readable or the symbol clearly understandable and the road user must perceive the message to be true or appropriate under that particular condition.

2 Significant factors in determining the effectiveness of road traffic signs are an assessment of the uniformity of the display of signs and an assessment of the performance of the signs based on their condition.

3 Greater standardization of the display of signs should reduce response time and limit the risk of confusion that drivers may experience when driving in an unfamiliar area. Uniformity of design should be pursued to improve recognition and comprehension and will help convey the message to drivers more clearly. Uniformity in application promotes road users' observance and avoids excessive or unwarranted use of road traffic signs. Uniformity of location will reduce the possibility of a driver not seeing a particular sign.

4 The condition of a sign may be determined objectively be measuring the contrast and retroreflectivity of the sign with standardization equipment, or subjectively by assessing the night-time visibility of the sign under bright and dim headlight illumination and its daytime contrast to background clutter.

1.10.4 Road Signs

1 Road signs consist of the following elements that are combined to provide an effective sign:

(a) the signface;
(b) the substrate to which the signface is applied;
(c) the frame support structure or stiffening to the signface and substrate assembly;
(d) posts for ground-mounted signs;
(e) gantries for overhead mounted signs;
(f) lighting components for illuminated signs.

2 Deterioration or failure of road signs can be ascribed to various factors. These may include:

(a) normal deterioration as a result of age or weathering;
(b) vandalism;
(c) signs damaged in vehicle accidents;
(d) accidental damage to signs during other maintenance operations like grading or mowing of grass;
(e) veld fires.

3 Road sign maintenance comprises all actions necessary to ensure an effective road sign. This includes:

(a) periodic cleansing of the signface;
(b) repair of vehicle accident damage;
(c) repair of acts of vandalism or other accidental damage;
(d) cyclic painting of frames, support structures and posts;
(e) inspection of slip base torque where steel break- away posts have been installed;
(f) control of vegetation or parking that might influence the visibility of signs;
(g) structural examination of sign gantries and cantilevers;
(h) replacement of lighting components;
(i) identification and removal of unnecessary signs;
(j) checking for interference from advertising signs.

4 Vandalism creates a significant problem and measures to combat it should be implemented. These may include:

(a) using sign material that will continue to perform even though damaged;

(b) substrate stiffening;
(c) using rods or vanes at the bottom of posts to prevent rotation or removal;
(d) installing signs high enough not to be in easy reach (especially smaller signs);
(e) using the maximum lateral offset from the roadway edge where it is possible;
(f) restoring vandalised signs as soon as possible to curtail a perception that the vandalism of signs may be acceptable practice;
(g) implementing an anti-vandalism programme.

5 It is essential that the effect new (road) works will have on existing signs be assessed, and that changes to the existing signs are made as part of the implementation of the new works.

1.10.5 Road Markings

1 Lines or road markings provide an indispensable contribution to safety and to improved traffic flow on modern roads. The effectiveness of road markings depends to a large extent on the cleanliness of the markings, on the contrast between the markings and the surface to which they are applied and on the night-time visibility of the markings.

2 Several types of road marking materials are in use ranging from the solvent based non-reflectorised paint to thermoplastic retroreflectorised material and preformed reflectorised tapes. Retroreflectorisation is achieved through the introduction of solid glass beads into the material or on top of the newly applied marking

3 Road markings are re-marked or replaced primarily as a result of one or more of the following reasons:
(a) markings deteriorate due to the mechanical action of traffic on them;
(b) markings become obsolete due to changes in operation on the road;
(c) markings lose their visibility due to maintenance activities resulting in resurfacing of part or all of a section of roadway.

4 The service life of the road markings depends primarily on:
(a) traffic volume and type;
(b) the position of the marking (dividing line, lane line etc.);
(c) the type of materials used;
(d) the thickness of the surface to which the material is applied;
(e) the texture of the surface to which the material is applied;
(f) the extent to which bituminous binders in the surfacing have already weathered.

5 Road marking maintenance comprises all actions to ensure daytime and night-time visibility of the road marking. In practice this is simplified merely to painting new lines on new or resurfaced roadways, repainting lines that have become less visible or the removal of unwanted lines.

6 The removal of unwanted lines may be effected by:
(a) burning;
(b) mechanical grinding;
(c) high pressure water, sand or grit-blasting;
(d) chemical treatment;
(e) black preformed tape.

The removal of unwanted road markings by over-painting with black paint is not recommended as it is likely to lead to confusing patterns in wet conditions, particularly with the sun at certain angles and under artificial lighting.

7 The scheduling of any remarking of lines should take proper cognizance of any resurfacing schedules and of possible changes to markings to accommodate changes in traffic patterns. In co-ordinating remarking and resurfacing operations, the effect of an inadequately marked road should be very carefully considered before remarking is postponed for any length of time.

8 From time to time specialised products come on to the market which can be significantly more effective than normal road markings. Whilst these may not be cost-effective in quantity, consideration should be given to their localised use in high accident locations. Road or traffic authority officials should maintain contact with the traditional suppliers of such products for their possible application in specialised circumstances.

1.10.6 Roadstuds

1 Roadstuds provide a method for the delineation of roads in a way superior to retroreflective road markings. The height of a roadstud ensures that the stud protrudes above the film of water that forms on the road surface during rain and which obliterates conventional road markings. The superior retroreflective properties of some classes of roadstuds ensure better visibility of the studs during adverse weather conditions like fog.

2 Different types of roadstuds are available, each being appropriate in a particular application. The different types include those with corner-cube retroreflectors, double convex lenses and an all glass omnidirectional type.

3 Deterioration or failure of roadstuds can be ascribed mainly to:
(a) loss of adhesion to the surface to which they have been applied;
(b) loss of retroreflectivity because of the dulling of the retroreflective elements due to scratching;
(c) loss of retroreflectivity because of a build-up of dirt on the stud; and
(d)insufficient cleaning action by vehicle wheels;
(e)loss of retroreflectivity because of roadway maintenance actions such as fog-spray or resurfacing;

(f) breakage of roadstuds under impact by vehicle wheels.

4 Roadstud maintenance actions are aimed at the replacement of individual studs that have become dislodged or inoperative or the replacement of complete sections of roadstuds after resurfacing operations.

1.10.7 Traffic Signals

1 Traffic signals control the assignment of right-of-way at locations where conflicts exist and where road signs or markings do not provide the flexibility of control to move traffic safely and efficiently.

2 Traffic signals consist of various elements that all have to operate correctly in order for the traffic signal to operate effectively. These elements include:
(a) the traffic signal controller;
(b) signal aspects and signal heads;
(c) signal lamps;
(d) vehicle detectors;
(e) signal supports;
(f) interconnecting cables.

3 To ensure the effective operation of traffic signals and maintaining the integrity of the system it is necessary that all aspects relating to the operation of the various elements be properly maintained. Immediate traffic problems will result when a signal is not operating or when one malfunctions. For emergency maintenance it is therefore essential that an appropriate fault reporting system be established. It must also be recognized that once traffic signals had been installed, they should be periodically evaluated to ensure that the timing plans in operation are co-ordinated with possible changes in traffic demand patterns.

4 Specific routine maintenance tasks on traffic signals include:
(a) functional checking of signal controllers;
(b) cleaning of reflectors and lenses;
(c) inspection of signal head supports or poles;
(d) replacing of signal lamps;
(e) inspection of vehicle detectors for proper functions;
(f) functional checking of pedestrian push-buttons;
(g) inspection of electrical supply cables to the controller and aspects;
(h) inspection of interconnecting signal cables between detectors, push-buttons and other controllers;
(i) inspection for proper earth connections;
(j) monitoring of data communication cabling in urban traffic control systems.

5 Emergency maintenance tasks on traffic signals also include:
(a) repairing damage to signal installations because of vehicle accidents;
(b) repairing damage to vehicle detectors because of excavations or other roadway maintenance operations.

6 It may well be an advantage to display a service telephone number on signal control boxes at junctions. This together with a junction identity number could well contribute to reduced repair times.

1.11 ROAD TRAFFIC SIGNS MANAGEMENT SYSTEMS

1.11.1 General

1 Management has been defined differently by different authors. Most definitions, however, recognize management to be a process of influencing members of an organization and using organizational resources systematically to achieve stated organisational objectives. The process consists of planning, organizing, leading and controlling elements that are applied in an integrated way. Management systems are therefore set up to guide the organization through this process to improve the likelihood of achieving the objectives.

2 Against this background it is necessary to clearly establish the objectives that would be pursued before the management system is set up. For example management systems could be set up to provide information on the condition of the roadway system or roadside features or it could be set up to guide the maintenance of the roadway system or roadside features.

3 Information management systems normally include functions such as the development of infrastructure inventories and procedures for the updating thereof and for periodic or special report generation. Maintenance management systems utilise the inventory information to identify deficiencies, prioritize maintenance needs, schedule maintenance efforts and to monitor conditions.

1.11.2 Road Traffic Sign Management Systems

1 Depending on the objectives of the authority establishing a road traffic sign management system, a system should be set up in such a way that it can be developed into a sign maintenance management system.

2 Such a road traffic sign maintenance management system could include the following components:

(a) inventories of signs, signals and markings;
(b) inspections scheduled at pre-determined intervals to assess and evaluate the condition of the different elements;
(c) maintenance needs determination relative to set standards;
(d) costing of identified maintenance tasks;
(e) determination of priorities;
(f) execution sub-systems including task scheduling and cost allocation;
(g) monitoring.

1.11.3 Inventories

1 Inventories including road signs, traffic signals and road markings should be developed with the objective of providing information that will address some or all of the following applications:

(a) assessing traffic control device adequacy and visibility;
(b) analysing the need to upgrade traffic control devices to meet uniformity and application standards;
(c) providing the means to obtain information about traffic controls for continuous monitoring and adjustment to optimize traffic safety and operations;
(d) planning of road sign, traffic signal and road markings improvement programmes;
(e) controlling and optimizing field maintenance;
(f) analysing the effectiveness of various traffic control devices;
(g) monitoring performance for specification development.

1.11.4 Inspection

1 Inspection of the different elements must be carried out periodically to assess their condition. This can be done through visual inspection which results in subjective assessment or through more objective methods incorporating the use of sophisticated measurement equipment like retroreflectometers.

1.11.5 Needs Determination

1 The determination of maintenance needs is done by comparing the results of the condition assessment with predetermined standards.

2 As use of a management system develops it can be one of the objectives of the system to assist the planning of maintenance well into the future. This will involve the collection and incorporation of data suitable for the development of prediction models covering the deterioration of the different components in the system.

1.11.6 Costing

1 After identifying the maintenance needs it is necessary to estimate the resource requirements necessary to execute the identified tasks.

2 A more accurate and realistic determination of future funding requirements may be achieved using a well-developed prediction model. This should enable an authority to budget adequate funding to cater for the longer term deterioration of the system.

1.11.7 Priorities

1 It is not unreasonable to expect that the cost of all identified maintenance tasks will exceed the available budget. Objective priorities depending on the importance of the task and of the road should be set.

2 The use of a prediction model may help to minimise any accumulative effect of annual budgetary shortfalls by providing effective motivation for maintenance funding well into the future, and not just from one year to the next.

1.11.8 Execution

1 Execution sub-systems could include a wide range of activities like scheduling, procurement, inventory control and cost allocation, all at varying levels of sophistication.

1.11.9 Monitoring

1 The object of monitoring is to ensure that resources are being used in the manner intended and that the desired results are achieved.

1.11.10 Implementation of a Road Traffic Sign Maintenance Management System

1 Before implementing a road traffic sign maintenance management system certain basic issues should be carefully considered:

(a) the size of the network to be maintained;
(b) the level of detail to which analysis would be done within the maintenance management system;
(c) the existence of an unambiguous location referencing system;
(d) access to a computer system that is well supported by staff;
(e) centralization or decentralization of decision making;
(f) existence of appropriate objective standards;
(g) type of information needed from the system;
(h) updating of information;
(i) hierarchal needs of information;
(j) procedures for handling changes to the network.

2 It is therefore necessary that an authority set aside sufficient resources at the conception stage for it to investigate thoroughly a range of alternative strategies and exercise skill and professional judgement before embarking on a project that would have long term financial implications (see also Volume 2, Chapters 17 and 18).

1.11.11 Bibliography

1 The following publications represent a selected reading list for those interested in a road traffic sign management system :

1. Federal Highway Administration. Traffic Control Devices Handbook, Washington DC,1983;
2. Atkinson, K. Highway Maintenance Handbook, Thomas Telford, London, 1990;
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6. Federal Highway Administration. Maintenance and Highway Safety Handbook, Washington DC,1977;
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