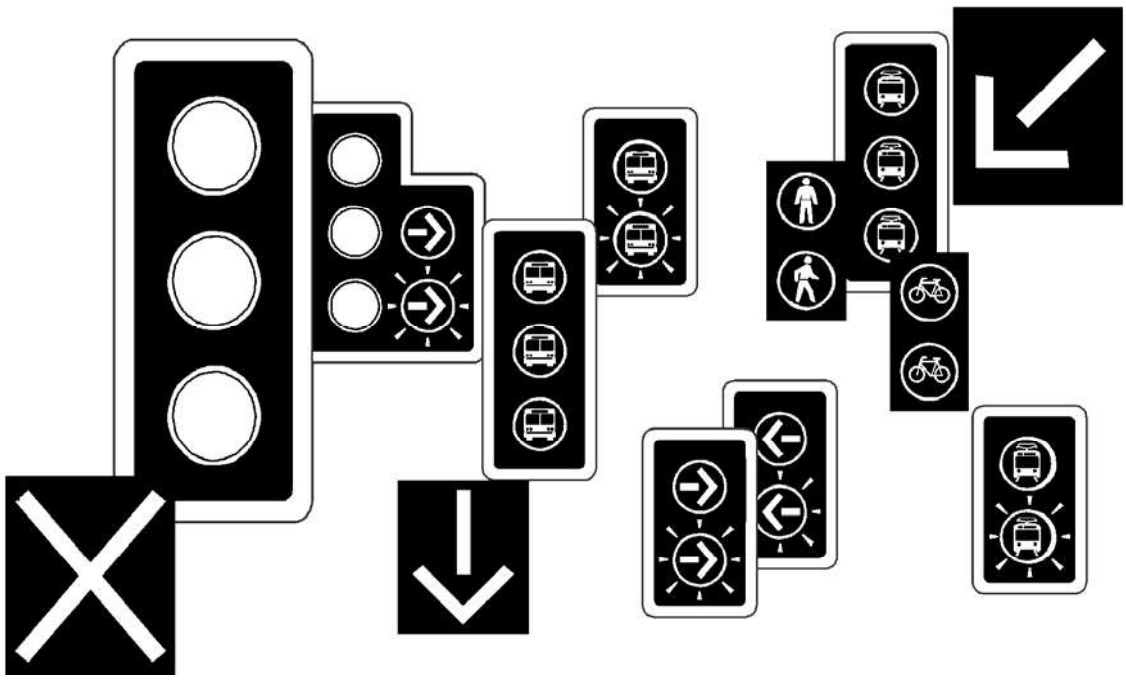
SOUTH AFRICAN ROAD TRAFFIC SIGNS MANUAL

VOLUME 3: TRAFFIC SIGNAL DESIGN

DIGITISED VERSION – May 2012

PART 1 TRAFFIC SIGNAL CONTROL



CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

1 The Road Traffic Signs Manual comprises the following four volumes:

(a) Volume 1: Uniform Traffic Control Devices – Details signing policies and design principles together with specific information on the meaning and individual application of all traffic control devices (including a chapter on traffic signals).

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

(c) Volume 3: Traffic Signal Design (this manual) – Details requirements for the selection and installation of traffic signals and their methods of control.

(d) Volume 4: Traffic Signs Design – Provides dimensional detail for all road traffic signs and their sign face components.

2 This manual is Volume 3 of the Road Traffic Signs Manual. It contains the information and practical guidance required to provide efficient and effective traffic signalling. It covers the most common types of signal installations at road junctions and pedestrian crossings, and offers advice on how the more complex installations and systems might be approached.

3 The manual covers all the information applicable to the "Recommended Traffic Signal System" given in the following publications, and can be read without referring to these documents:

(a) National Road Traffic Act and Regulations.

(b) Chapter 6 of Volume 1 of the SADC Road Traffic Signs Manual.

However, should there be differences between the different documents, the National Road Traffic Act and Regulations have legal precedence, followed by Chapter 6 of Volume 1 of the Manual (followed by this manual).

4 The manual is a design manual and does not contain technical specifications of traffic signals, although some functional requirements are provided that may be considered when installing traffic signals. For information on technical specifications, publications such as the following should be consulted:

(a) Volume 4 of the SADC Road Traffic Signs Manual.

(b) South African Bureau of Standards specification SANS 1459: *Traffic lights*.

(c) South African Bureau of Standards specification SANS 1547: *Traffic signal controllers*.

(d) Other SABS specifications related to electrical work and installations.

(e) SABS specifications related to law enforcement devices (particularly those related to speeding and violation of the red light signal).

1.2 TRAFFIC SIGNAL DESIGN AND APPROVAL

1 The manual is mainly aimed at the traffic engineering profession involved with traffic signals. Some aspects related to the civil, electrical and electronic engineering fields are covered in the manual, with mainly the intention of providing the traffic engineer with an overview of the multi-disciplinary nature of traffic signals as well as the tasks required to provide a complete traffic signal installation.

2 This manual presupposes a basic knowledge of transportation and traffic engineering, and is not intended to be a training manual. It can, however, be used for educational purposes, but additional information and amplification would be required.

3 Due to the complexity of traffic signal systems, decisions concerning the design, installation, and operation of traffic signals, should only be undertaken by professionals with a high level of skill and knowledge of the subject. Such professionals should, as a minimum, have a thorough knowledge and understanding of the contents of this manual.

4 The National Road Traffic Regulations require that a ***"A responsible registered PROFESSIONAL ENGINEER or registered professional TECHNOLOGIST (engineering) of the road authority concerned SHALL approve every traffic signal installation at a signalised junction or pedestrian or pedal cyclist crossing, and sign a declaration containing the following:***

(a) ***scaled drawing of the layout of the junction or crossing, indicating lane markings and road layout;***

(b) ***number, type and location of traffic signal faces;***

(c) ***number, type and location of pedestrian and pedal cyclist facilities, including pedestrian push buttons;***

(d) ***phasing, time plans and offset settings;***

(e) ***date of implementation; and***

(f) ***name, signature and registration number of the engineer or technologist (engineering) who approved the signal, and date of signature."***

5 In addition to the above, the regulations also require that the ***"declaration shall be kept by the road authority in control of the traffic signal concerned".***

6 Checklists are provided in Appendix C of this manual that may be used for the approval of traffic signals. The checklists cover most of the minimum requirements for traffic signals as set out in this manual. The following three checklists are provided:

(a) Traffic signal layout

(b) Traffic signal phasing and timing.

(c) Traffic signal commissioning.

1.3 THE TRAFFIC SIGNAL

1 Although this manual is titled “Traffic Signal Design”, it in fact covers all signals defined in the National Road Traffic Regulations as ***“road signals”***. The regulations classify road signals as follows:

(a) Regulatory signals.

(i) *Traffic signals* used for the regulation of vehicular road traffic, pedestrians and pedal cyclists.

(ii) *Red flashing signals* used at railway crossings.

(iii) *Overhead lane direction control signals*.

(iv) *Other regulatory signals*, including control hand signals used by traffic officers and flag signals.

(b) Warning signals.

(i) *Warning flashing signals*.

(ii) *Warning flag signals*.

2 These signals are shown in the colour plates in the front of this manual. The plates illustrate all traffic signals in colour as if they are illuminated, which obviously does not occur under operational conditions.

3 The above signals can be used for the control of traffic at location such as:

(a) signalised road junctions;

(b) signalised pedestrian and pedal cyclist mid-block crossings;

(c) the intersection of roads with exclusive public transport rights of way;

(d) single traffic lanes that carry two-way traffic;

(e) freeway ramps and toll booths;

(f) roadworks;

(g) reversible lanes; and

(h) railway crossings.

4 The main objective in operating traffic signals is to improve road safety and to reduce excessive vehicular, pedestrian and pedal cyclist delay. Traffic signals may be used for any one or more of the following purposes :

(a) to reduce conflict between vehicles and other traffic, including pedestrians and pedal cyclists;

(b) to enable pedestrians and pedal cyclists to cross the road safely;

(c) to improve the traffic-handling capability or capacity of the road network;

(d) to provide for the safe and orderly movement of traffic;

(e) to reduce delay and stops to side-road or crossing traffic;

(f) to provide for continuity in the movement of vehicles along particular routes;

(g) to give preference to the progression of particular classes of vehicles or a particular directional movement of traffic;

(h) to control the movement of vehicles at specific locations or into selected parts of the road network;

(i) to indicate alterations in the direction of use of lanes (reversible lanes);

(j) to warn of unexpected potential hazards.

5 Traffic signals that are not properly installed, or that are not warranted, should not be in operation. Traffic signals that are not warranted, incorrectly designed, badly placed, wrongly timed or poorly maintained may result in problems such as:

(a) unnecessary delay;

(b) disobedience of traffic signals;

(c) increased collisions, particularly of the rear-end type; and

(d) diversion to less-adequate alternative routes or "rat-runs".

1.4 RECOMMENDED AND ALTERNATIVE SYSTEMS

1 Two basic types of traffic signal systems are used in the Southern African Development Community (SADC) region, namely the Recommended and Alternative systems. The Recommended system is used in South Africa and in most of the SADC states. Some states, however, use the Alternative system and it would be financially or operationally impractical for these states to harmonise with the rest of the region in the short term.

2 The most significant differences between the two systems are as follows:

(a) In the Recommended System the traffic signal switching cycle is GREEN - YELLOW - RED, whereas in the Alternative System the switching cycle is RED plus YELLOW - GREEN - YELLOW - RED.

(b) The Recommended System utilises a FLASHING GREEN ARROW LIGHT SIGNAL instead of a STEADY GREEN ARROW SIGNAL when giving right of way to turning movements.

(c) The Recommended System uses FLASHING RED LIGHT SIGNALS on all approaches to indicate an out of order traffic signal. The Alternative System utilises FLASHING YELLOW LIGHT SIGNALS for this purpose.

(d) In the Recommended System the pedestrian/ cyclist "do not start to cross" message is given by a FLASHING RED LIGHT SIGNAL, whereas in the Alternative System this same message is given by a FLASHING GREEN LIGHT SIGNAL.

(e) In the Recommended System the required principal traffic signal faces are required to be mounted on the far and near side of the intersection, whereas the Alternative System requires these traffic signal faces to be mounted only on the near side of the intersection.

(f) In the Recommended System the FLASHING RED DISC LIGHT SIGNAL used at railway crossings is displayed with a STOP sign R1; in the Alternative System a no STOP sign is used and a FLASHING WHITE DISC LIGHT SIGNAL may be used when no train is approaching.

3 Only the “Recommended Traffic Signal System” as used in South Africa is covered in this document. More details on the “Alternative Traffic Signal System” are given in Chapter 6 of Volume 1 of the Road Traffic Signs Manual.

1.5 TERMINOLOGY

1 A considerable effort has been made to ensure that the terminology used in this manual corresponds with normal traffic engineering practice. **In some instances, however, it was necessary to deviate from practice in order to preserve correspondence with other volumes of the manual, particularly with the National Road Traffic Act and Regulations.**

2 A glossary of terms is given in Appendix A of this manual. Most of the technical terms used in this manual (Volume 3) are listed in the glossary.

3 There are three words used throughout the Road Traffic Signs Manual - the interpretation of which is fundamental to the use of the manual. These words are the following:

(a) **"SHALL"** – a mandatory condition that means that the condition or conditions referred to must be complied with. In many instances, such requirements are not only stated in the manual, but also in the regulations.

(b) **"SHOULD"** – an advisory condition which means that it is advisable or recommended to comply with the condition or conditions referred to. Although there is a measure of interpretation in applying the condition, a road authority would be well advised to record why it has not conformed, if it chooses not to conform to the recommended action.

(c) **"MAY"** – a permissive condition that means that the conditions referred to are optional. The conditions are less specific and allow for actions that may be taken at the discretion of the road authority.

4 The legal significance of the above terms is important and must be understood by users of the manual. In the advent of legal actions, the failure to adhere to the intention of the manual as indicated above, could affect the outcome of such legal actions to the detriment of the authority.

1.6 ORGANISATION OF THE MANUAL

1 This manual (Volume 3) is subdivided into three main parts, namely:

(a) Part 1: Traffic signal control;

(b) Part 2: Traffic signal equipment; and

(c) Part 3: Traffic signal management.

2 Part 1 covers aspects related to the traffic control function of traffic signals. Topics such as light signals, traffic signal faces, junction and crossing layout as well as various applications of traffic signals are covered.

3 Part 2 covers aspects related to the equipment (hardware) used in traffic signals. Equipment is discussed in generic terms and reference to particular commercial systems is restricted. The intention is to provide a broad overview of signal equipment and no detailed technical specifications are included. Such specifications are provided by relevant SABS standard specifications.

4 Part 3 covers aspects related to the management of traffic signals. Aspects covered in this part include the duties and responsibilities of road authorities regarding traffic signals, management of liability risks, manpower requirements, maintenance management, etc.