CHAPTER 22: POWER SUPPLY

22.1 INTRODUCTION

1 Electrical power is essential at traffic signals for powering signal controllers, detectors, light signals and the central control system.

2 All electrical equipment in South Africa shall comply with the current requirements of:

(a) South African standard specification SANS 10142: *The wiring of premises*. A code of practice that covers general principles for the wiring of premises.

(b) South African standard specifications SANS 10199: *Design and installation of an earth electrode.* Covers methods used to earth electrical systems, including design, installation, testing and maintenance.

(c) Electricity Supply Commission (ESCOM) regulations and requirements.

(d) Any other requirements of the local authority.

22.2 ELECTRICAL REQUIREMENTS

1 A qualified electrician should properly test all electrical elements of a traffic signal installation. Wiring certificates stating that the tests have been successfully carried out should be signed by the electrician and kept on record.

2 All traffic signal components, including signal posts, should be properly earthed to an earth electrode or trench earth. This could even include components such as the door of the controller, by providing earth straps across the hinges. The preferred method of earthing is to run a bare copper conductor with the power supply cable in a trench (of relatively long length). Alternatively, earth spikes can be driven vertically into the ground in the trench bottom.

3 It is recommended that central control systems should be provided with an Uninterruptable Power Supply (UPS) unit with suitable capacity to ensure continued operation for a reasonable period, or until such time as emergency generator facilities can commence supply or full power is resumed.

4 At least one power socket should be provided within the controller cabinet to facilitate the operation of test equipment.

22.3 POWER SUPPLY CABLES

1 There are three distinct types of electrical cabling in traffic signal installations. They are:

(a) The mains power supply to the installation; the part up to the distribution board is usually provided by the electricity supply authority whilst the road authority is responsible for the part from that point to the controller.

(b) Cables connecting the signal lights to the controller. These are usually multi-core cables.

(c) Low voltage cables connecting inductive loop detectors to the detector units housed in the controller cabinet. Similar connections are provided for pedestrian push buttons.

2 During the installation of cables, provision should be made for some slack in the cables, particularly at the footing of each signal post, gantry, cantilever and the controller. Such slack is not only needed for maintenance purposes, but can also reduce the possibility of damage to the cable should a traffic accident occurs.

3 Joints in cables should be avoided as far it is practically possible. No jointed cable should be pulled or drawn through a cable duct.

4 All external cables and wiring should be shaped to provide a drip loop before entry into equipment. An example of such a drip loop is shown in Figure 22.1.

5 Multi-core cables are used for connecting light signals to a controller. Each signal group requires separate cores to power the green, yellow and red light signals. Two or three live cores are required per signal face for this purpose (two are required for two-aspect signal faces such as pedestrian signals). One common neutral core can be used for all signals. The total number of cores required at a signal can be calculated by means of the following formula:

Number of cores = $2 + 2 \cdot N_2 + 3 \cdot N_3$

In which N_2 is the number of signal groups serving two-aspect traffic signal faces (including pedestrian signal faces), and N_3 is the number of signal groups serving three-aspect signal faces.

6 The following additional number of cores are required when pedestrian push buttons are provided:

Number of cores for push buttons = $1 + N_p$

In which N_p is the number of pedestrian signal groups.

7 The first formula given above, allows for one earth wire and one neutral wire in addition to the live wires required for each signal colour. The second formula allows for one neutral wire for push buttons.

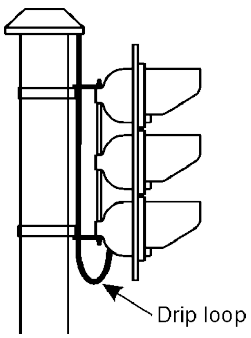

Figure 22.1: Drip loop on a power cable

8 Additional cores should be provided to allow for the possible expansion of signal groups in future. Where a turning phase is not currently provided, consideration can be given to providing an additional two or three cores for such purpose. Where pedestrian signals are currently not installed, additional cores may also be provided.

9 The method of cabling depends on the cost of cables and the type of cable held in stock by a road authority. Cables come in various sizes, such as 3-core, 4-core, 7-core, 12-core, 19-core, 27-core and 37-core.

10 The cabling method also depends on the junction layout as well as the cable ducts available at a junction. When a road is newly constructed, ducts should preferably be provided across all legs of a junction.

11 Different cabling methods have been developed and are used, such as the ring and radial systems. In the ring system, only one main core is used for all light aspects of a specific colour in one signal group. The main core is laid in a ring around the junction or crossing, and branch cores are used to provide power to individual light signals. In the radial system, a main core is used for each individual light signal – all branching occurs from the controller.

12 The ring system has the disadvantage that damage of the main core could cause the entire installation to be out of operation. The radial system, while more costly to implement initially, has considerable maintenance and functional advantages.

22.4 TRENCHING AND DUCTING

1 Cables should be installed underground, for both operational benefits and aesthetic reasons.

2 All cables laid across roads and other paved areas should preferably be laid in ducts terminating in draw boxes. One or two ducts should be provided depending on the number of cables to be installed (also taking possible future requirements into account). An example of the provision of ducts and draw boxes at a junction is shown in Figure 22.2.

3 Cables should be pulled through the ducts manually and no mechanical means should be used for this purpose. Dry talc may be used to lubricate cables for pulling (grease should not be used).

4 A suitably marked yellow PVC or polythene *marker tape* may be laid in all trenches above the cables as a safety measure.

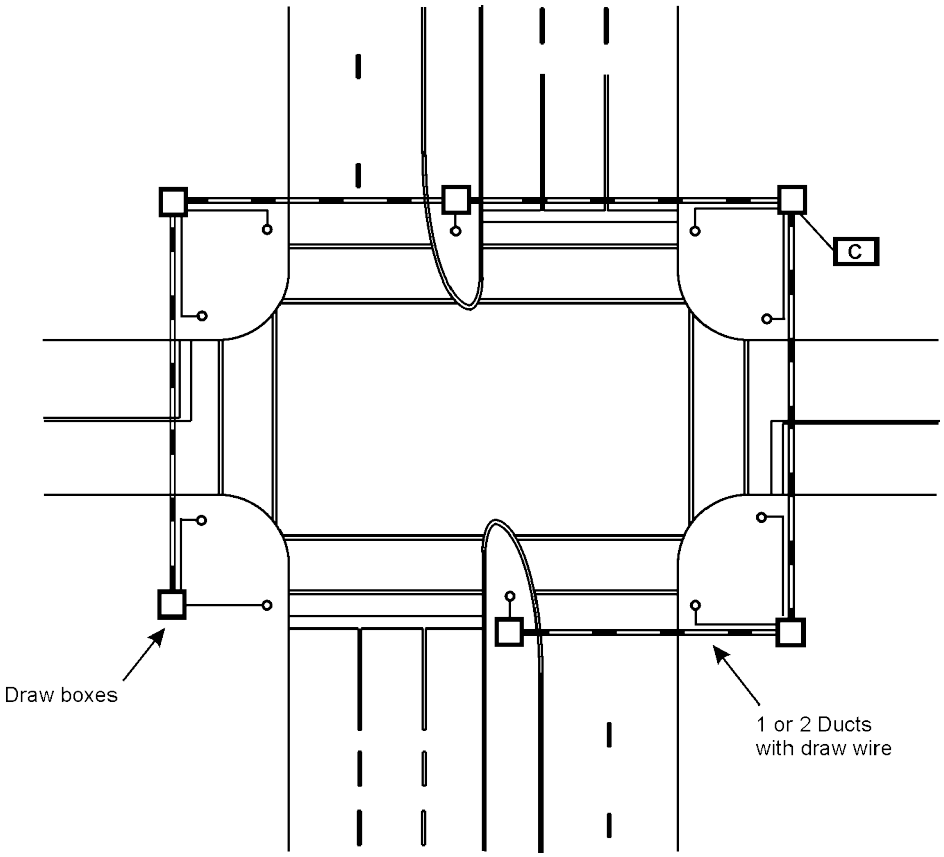

Figure 22.2: Example of duct and draw box layout at a junction