

CHAPTER 25: MANPOWER REQUIREMENTS

25.1 INTRODUCTION

- 1 The availability of knowledgeable and skilled professionals and technicians is an important prerequisite for effective and safe traffic signalisation. Traffic signal installations have become highly complex and their impact can impede traffic operations substantially. It is therefore important that priority should be given to ensuring that the highest levels of skill be employed by road authorities.
- 2 In this chapter, minimum skill levels and educational requirements are discussed for professionals involved with traffic signals. Attention is also given to minimum staffing requirements and the utilisation of consulting engineers and contractors.
- 3 Differentiation is made between the two main professional disciplines involved with traffic signals, namely traffic and electrical/electronic engineering. The traffic engineering discipline is involved with traffic operations and the setting of traffic signals, while the electrical and electronic engineering discipline is more involved with the installation, wiring and maintenance of the signals.
- 4 A third discipline not covered in this chapter is the civil engineering discipline. At a signalised junction, this discipline would be involved with all work related to aspects such as the provision and construction of the road pavement, drainage structures, earth works, road signs, etc.
- 5 The traffic and electrical/electronic disciplines directly involved with traffic signalisation should preferably be located within one traffic signal division. There is a definite need for a close relationship between the two groups.
- 6 Larger road authorities are probably in a position where they can employ some of the professionals required from both professional disciplines, although they may have to supplement their own staff levels by appointing consulting engineers or contractors. Smaller road authorities, however, would not have sufficient numbers of traffic signals in operation to warrant the employment of such a range of professionals, and would therefore have to rely on consulting engineers and contractors to supply the necessary services.
- 2 Distinction can be made between the following three levels of professionals involved with traffic engineering work:
 - (a) Professional engineers.
 - (b) Professional engineering technologists.
 - (c) Support personnel such as technicians, computer programmers, CAD (computer aided design) operators and administrative staff.
- 3 Both the professional engineers and the professional engineering technologists should have received specialist training specifically in the discipline of transportation and traffic engineering, and should preferably have postgraduate qualifications in this discipline.
- 4 Professional engineers would normally be responsible for functions such as:
 - (a) Management and control of the traffic signal department or division (including the electrical and electronic section).
 - (b) Development of methods, procedures and standards and the investigation of new or alternative traffic signalisation techniques.
 - (c) Overall control of functions such as signal design, intersection layout, traffic data collection, etc.
 - (d) Provide guidance in the design of more complex signal installations, central control, signal co-ordination, non-standard intersection layouts, etc.
 - (e) Prepare and review traffic management plans, including traffic impact studies.
- 5 Professional engineering technologists would normally be involved with the functions of signal design, intersection layout, traffic data collection, traffic signal configuration, etc. In addition to these, technologists can also become involved with the other functions identified above.
- 6 The work of the traffic signal division would include tasks such as:
 - (a) Overall management of the traffic signal division, including budget control and reporting.
 - (b) Traffic data collection, including traffic volumes, speeds, saturation flows, accident rates, etc.
 - (c) Conceptual design and layout of signalised junctions.
 - (d) Design of traffic signal layouts, timings, phasing, and the co-ordination of traffic signals.
 - (e) Warrant studies for the installation of new traffic signals.
 - (f) Prioritisation of new installations and upgrading of existing installations.
 - (g) Investigations into new traffic signal control systems.
 - (h) Development of methods, procedures and standards.

25.2 TRAFFIC ENGINEERING

- 1 Traffic engineering professionals are those skilled in ensuring the safe and efficient flow of traffic through a signalised junction or crossing. These professionals would normally be involved with tasks such as warranting signal installations, the design and layout of signalised junctions and crossings, establishing traffic signal timing and phasing, signal co-ordination, and the collection of traffic data.

25.3 ELECTRICAL AND ELECTRONIC ENGINEERING

- 1 Electrical and electronic engineering professionals are those skilled in the electrical and electronic aspects of traffic signals. Most modern traffic signals involve the use of digital electronic devices and advanced telecommunication and data transmission systems; the installation, maintenance and repair of which require specialist knowledge in the discipline of electronics. All electrical work at a signal should also only be carried out by a qualified electrician.
- 2 It would normally not be necessary to involve professional engineers in the electrical or electronic side of signals. The following skill levels would typically be required for this purpose:
 - (a) Professional engineering technologists.
 - (b) Qualified electricians.
 - (c) Electronic technicians.
 - (d) Line workers.
 - (e) Worker assistants.
 - (f) Administrative staff.
- 3 The professional engineering technologists should be qualified in the disciplines of electrical and electronic engineering. The technologists will be responsible for the management and control of the electrical and electronic side of traffic signals.
- 4 The electricians will be responsible for the maintenance and repair of electrical components while electronic technicians will be responsible for electronic components of traffic signals. Line workers will undertake tasks such as lamp replacement, cleaning of lenses, painting of posts and alignment of signals. All three groups may be assisted by worker assistants.
- 5 The task of the electrical and electronic section includes:
 - (a) Management, supervision and control of all aspects related to the electrical and electronic side of traffic signals.
 - (b) Management and control of personnel, material, spares and tools.
 - (c) Keeping of records of all activities and inventory controls.
 - (d) Budgeting for new installations, maintenance and repair as well as controlling such budgets.
 - (e) Installation, maintenance and repair of all traffic signal equipment, including controllers and computers.
 - (f) Planning and scheduling of traffic signal installation, upgrading, modification, maintenance and repair.
 - (g) Management, supervision and control of installation and maintenance contracts undertaken by private contractors.
 - (h) Inspection of installations during various stages of completion and final acceptance on contract completion.
 - (i) Investigations into new developments in the discipline of signalisation.
 - (j) Providing advice to traffic engineers on the capabilities and limitations of traffic signal equipment.

- (k) Planning and implementing maintenance and upgrading programmes. Developing procedures for the establishment of maintenance and upgrading priorities.
- (l) Training of personnel in all electrical and electronic related aspects of traffic signals.
- (m) Appearing as expert witnesses in litigation involving the electrical and electronic aspects regarding operation and maintenance of traffic signals.

25.4 STAFFING LEVELS

- 1 In this section, broad guidelines are provided on staffing levels required to run a traffic signal division. Exact and detailed guidelines cannot be provided since the required staffing levels depend on a variety of factors, such as the number and age of traffic signal installations, the utilisation of Area Traffic Control (ATC) systems, the complexity of traffic patterns in an area as well as skill levels of available personnel. It is thus not possible to compare staffing levels of two road authorities, even if they control exactly the same number of signalised junctions.
- 2 A general indication of desirable staffing levels is given in Table 25.1 in terms of work-hours per signalised junction or crossing. The staffing levels for a particular road authority can be estimated by means of the following formula (in which it is assumed that a person works 1 760 hours per annum):

$$\text{Staffing level} = \frac{\text{Work hours} \times \text{No of Signals}}{1760}$$
- 3 A road authority does not have to employ all the personnel indicated in Table 25.1, but can opt to appoint consulting engineers and contractors on a contractual basis.

TABLE 25.1: DESIRABLE STAFFING LEVELS

Qualification	Work-hours per signal
Traffic engineering discipline	
Manager/ Professional traffic engineers	8,0
Professional traffic engineering technologists and technicians	24,0
Traffic engineering administrative staff	4,0
Electronic and electrical engineering discipline	
Manager/Foremen	6,0
Qualified electricians	20,0
Electronic technicians	6,0
Line workers	12,0
Worker assistants	40,0
Administrative staff (including operators of fault report telephone)	6,0

- 4 Road authorities controlling 200 or more signal installations should have a traffic signal division and employ the full complement of staff, including at least one professional traffic engineer and one professional electronic and/or electrical engineering technologist.
- 5 Smaller road authorities should where possible co-operate with each other and form a combined traffic signal division, with the full complement of staff as discussed above. Even larger road authorities may co-operate and provide a combined traffic signal division with the purpose of sharing resources.
- 6 Where it is not possible to combine resources, small road authorities controlling 50 signal installations or less, may utilise a qualified electrician for general low-level maintenance of traffic signals. Such road authorities would rely on consulting engineers and contractors to provide the other required services.
- 7 Road authorities controlling between 50 and 200 signal installations should employ at least one professional traffic engineering technologist and one qualified electrician with specialist knowledge of traffic signals.
- 8 Even if a road authority has an adequate staffing level, it is recommended that traffic engineering consultants be employed to provide expert advice. Authorities should always be aware of the danger of stagnation within the signal divisions, and should implement measures that would ensure that personnel are always informed of the latest available methods and technology.

25.5 EDUCATION AND TECHNOLOGY TRANSFER

- 1 The continued education and transfer of skills and knowledge to personnel involved with traffic signals are of fundamental importance to ensure efficient and safe signal operations, and to allow personnel to be aware of the rapid development in the discipline of signalisation. Very high priority should be given to education and technology transfer.
- 2 Road authorities must be made aware of the levels of knowledge and skills necessary to perform the broad range of functions required and the consequence of not providing the requisite training and technology transfer programmes.
- 3 It is also the responsibility of road authorities to ensure that adequate training and technology transfer programmes are available to their personnel, consultants and contractors. Where necessary, road authorities can fund educational or other institutions for the development of such courses.

