Elsternwick ARE 11 Exchange

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On 20 June 1976 the first public ARE 11 exchange to be placed into service in Australia was cutover at Elsternwick, Victoria. This paper describes the installation of Elsternwick exchange which was a new start installation of ARE 11 with ANA 30 control of all ARF switching stages.

INTRODUCTION

On 20 June 1976 the first public ARE 11 exchange to be placed into service in Australia, was cutover at Elsternwick Victoria.

The ARE 11 system comprises ARF switching stages under the control of the ANA 30 SPC register system which replaces ARF electro-mechanical registers. Refs. 1 and 2 describe the ARE 11 system structure and Ref. 2 outlines its proposed application in the Australian network.

Varying degrees of stored program control of the ARF system are available and ARE 11 exchanges can be either conversions of existing ARF exchanges or new start installations. Elsternwick was a new start installation with ANA 30 control of all switching stages as will be the case in all future new start installations in the Australian network (Ref. 2).

This paper aims to provide a description of the installation of the Elsternwick ARE 11 exchange, which was carried out by Telecom Australia staff.

PROJECT DESCRIPTION

The task at Elsternwick was to install 4000 lines of m = 6B ARE 11 equipment as a field trial of a new start installation. The Elsternwick exchange building, which contained 9000 lines of pre-2000 type step-by-step equipment, was extended to provide accommodation for the new ARE 11 equipment. 3000 lines of the new installation replaced the equivalent quantity of step-by-step equipment and 1000 lines was provided for subscriber growth.

The project required the installation of 98 ARF racks, 10 ANA racks and 30 IDF racks; this included 25 racks of three stage (700 availability) group selector equipment. The exchange rectifiers were replaced by two 400 Amp rectifiers and a new 48v distribution system was constructed to the new equipment. A new maintenance control room was established housing subscribers' meters, a PBX interconnection frame (PBX-IDF) and service supervision equipment. A maintenance centre was established at Elsternwick to simulate remote operations functions and contains a teleprinter and visual display unit operating through the switched network via modems. An equipment room layout and a trunking diagram for the project appear in Fig. 1 and Fig. 2 respectively.

HARDWARE DESCRIPTION

The ANA 30 hardware has been designed to blend semi-conductor technology into the electro-mechanical structure and environment of the ARF exchange. The following paragraphs outline the hardware elements of ANA 30 and the methods used to integrate the mechanics of electronic and electro-mechanical technologies:

ANA 30 Components

Integrated circuits and discrete components are used throughout the ANA 30 equipment. Miniature relays are used in units which interface ARF equipment. Components are mounted on printed circuit boards which plug into one, two or four level shelves. Figure 3 shows a one level shelf and associated printed circuit boards.

The processors use integrated circuit random access memories in the data store and programmable read-only memories in the program store. Central stores consist of ferrite core memories.

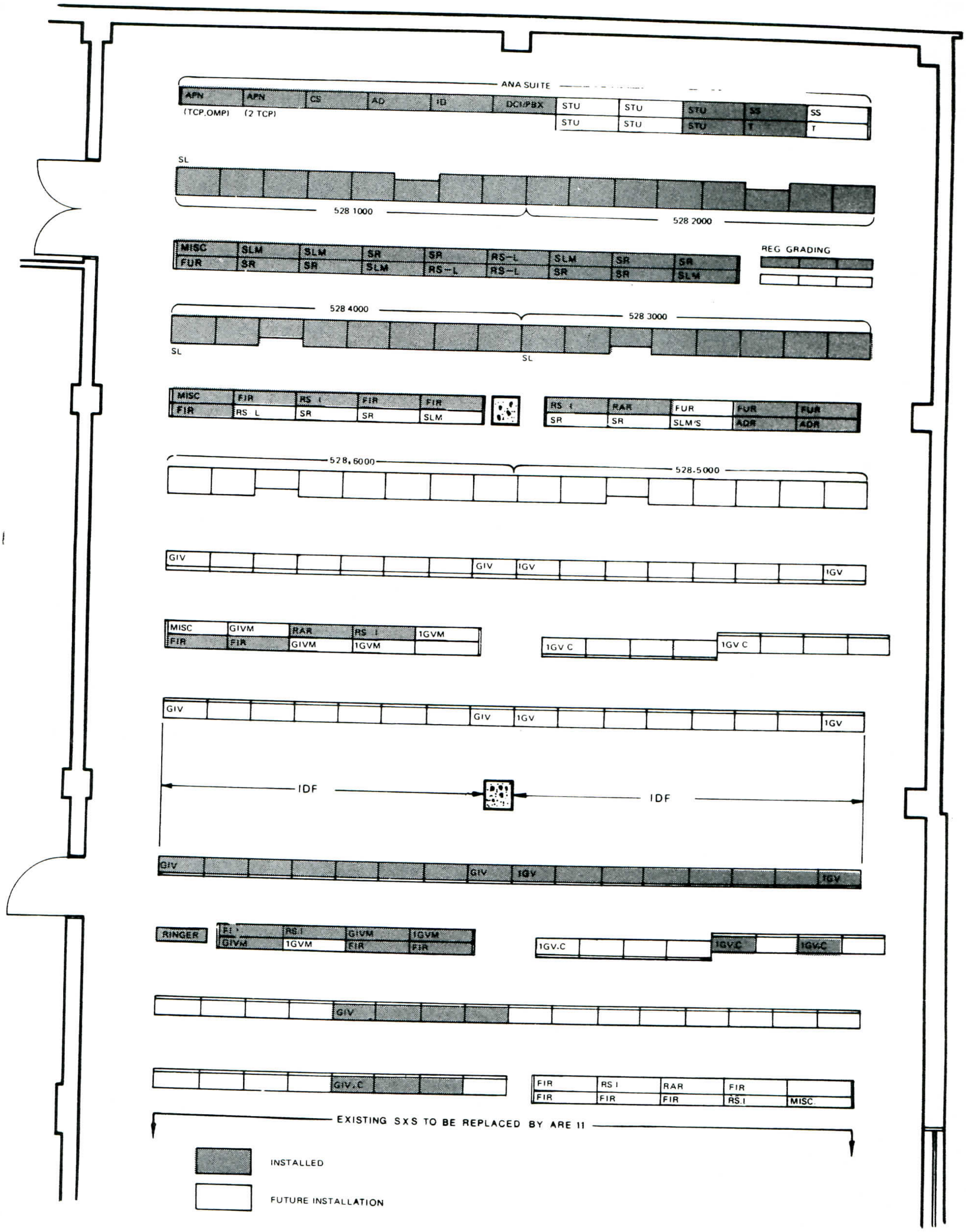

Fig. 1—Equipment Room Layout.

Racks and Shelves

The ANA 30 equipment is mounted on a new BDH type rack. This rack is 23mm deeper than the conventional BDH rack and has only one vertical iron (saw toothed) on the left hand side for shelf mounting; it is secured to the overhead ironwork and floor in the conventional manner. (Figs. 4 and 5).

Shelves mount on racks in the same manner as ARF relay sets and connection is made to 48V rack wiring through 80 point knife jacks on the right hand side of the rack (Fig. 3). To minimise electrical noise problems the conductors for low voltage signalling are connected to shelves by "front cable" connections on the front left hand side of the rack. Components of an equipped ANA 30 rack are illustrated in Figure 6.

Cabling

Cabling from the 80 point knife jacks on racks terminates on 40 point jack units mounted on a jackfield above the rack (Fig. 4). All cabling to ANA 30 racks is terminated by pre-plugged 40 wire cables which connect to these jackfields above the racks and so removes the need for on-site termination of ANA 30 rack cables (Fig. 7).

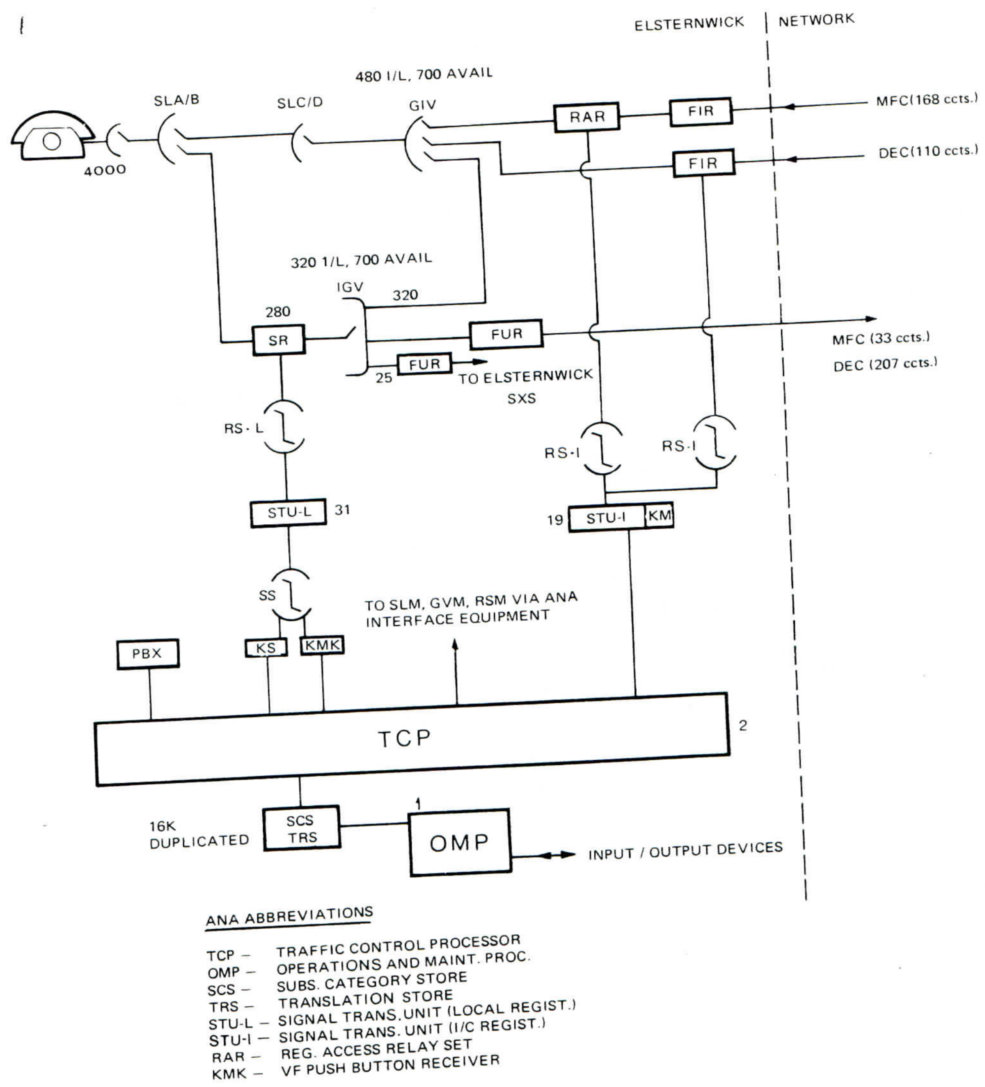

Fig. 2—Simplified Trunking Diagram.

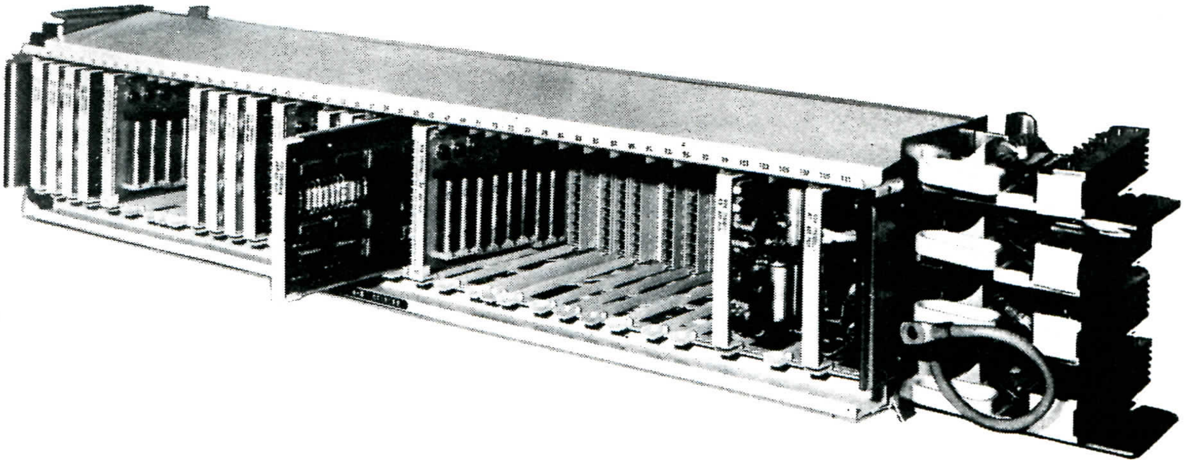

Fig. 3—One Level Shelf and Boards.

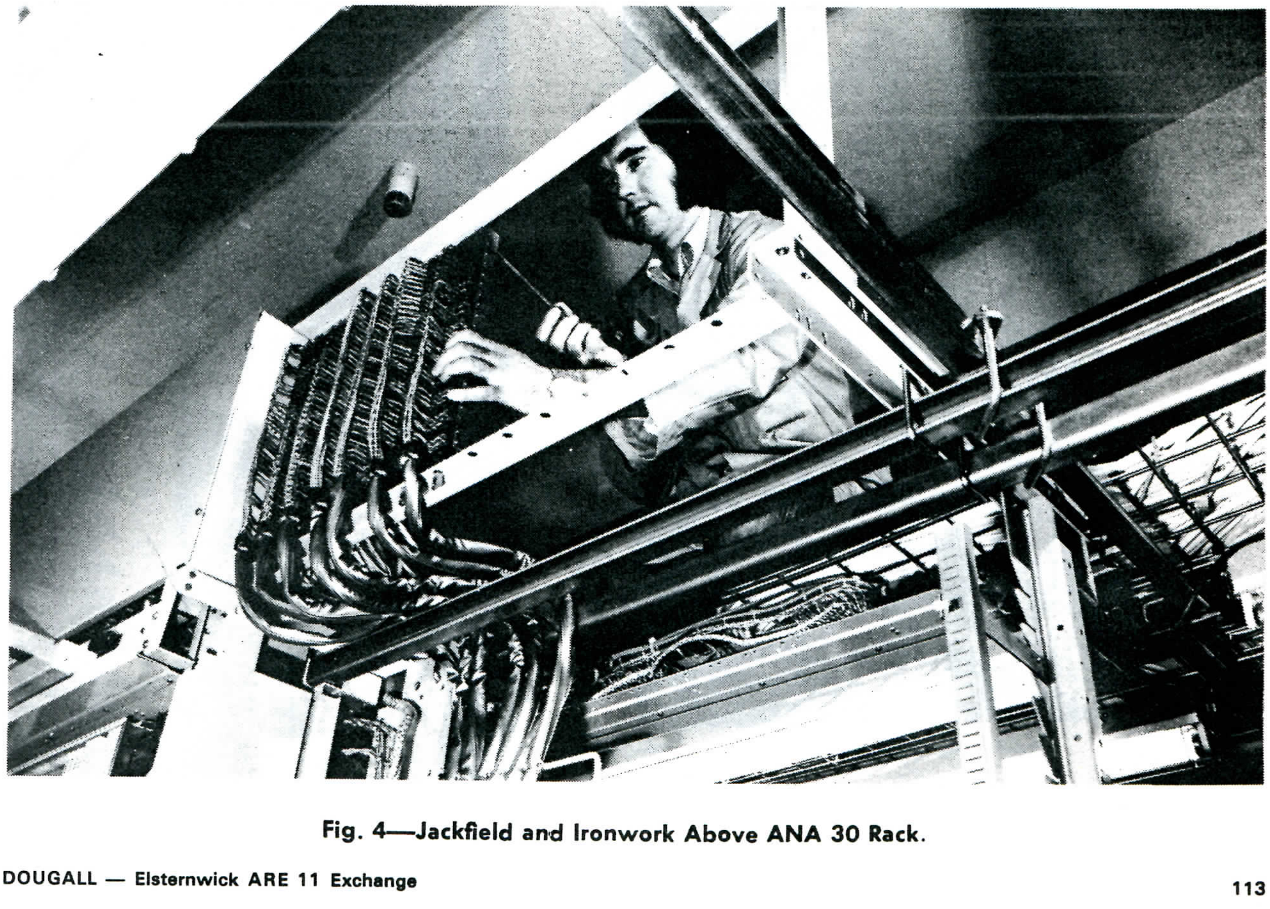

Fig. 4—Jackfield and Ironwork Above ANA 30 Rack.

Cabling between ANA 30 and ARF equipment terminates at the ARF end in either 40 pin plug termination on above-rack jackfields or hardwired rack termination.

Fig. 8 is a simplified cabling diagram of the ARF-ANA 30 interface and demonstrates density of cabling and method of termination in the ANA 30 suite and between ANA 30 and ARF equipment.

PBX jumpering is done on a special IDF where 'c' wires from SLA/B racks are interconnected with wires from new PBXC connect relays. This PBX-IDF, which uses solderless terminations is shown in Fig. 9.

Power

ANA 30 electronic equipment is powered by duplicated rack mounted dc/dc converters (Fig. 6) which are supplied with —48V from the standard exchange distribution system. Capacitor/diode units, however are required at the power input to each rack to minimise the effect of voltage transients which could result from disturbances in the distribution system anywhere in the exchange. These units are secured to the ironwork above each rack.

Exchange Environment

ANA 30 equipment is designed for installation in the same exchange environment as ARF equipment and relies on free convection for cooling of components.

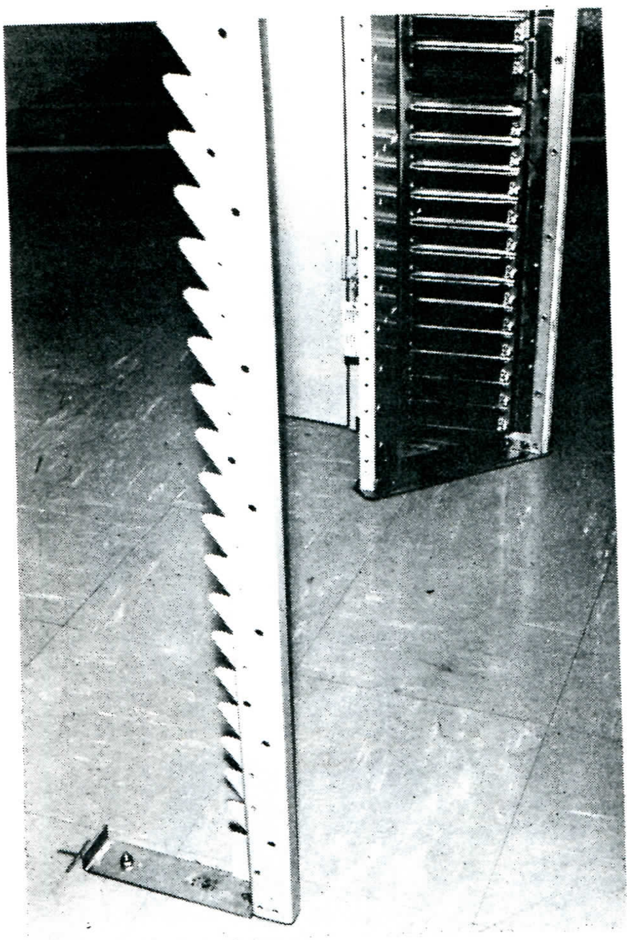

Fig. 5—Bottom Section of Unequipped ANA 30 Rack.

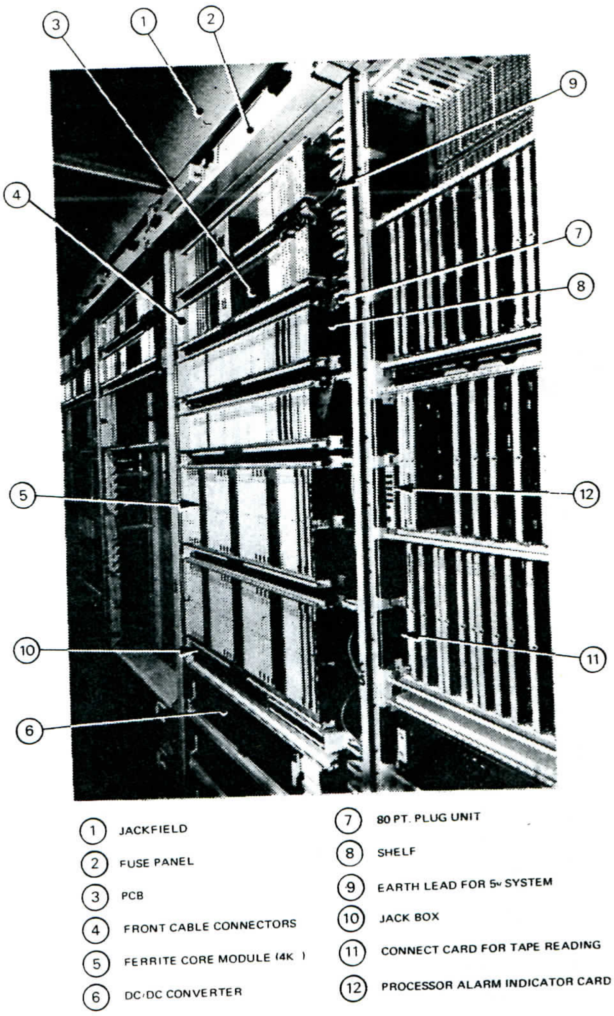

Fig. 6—Components of Equipped ANA 30 Rack.

ARF Subsystem

The mechanical structure of the ARF equipment in the ARE 11 system remains unaltered and crossbar switching stages are retained. However substantial amounts of ARF hardware are made redundant by the introduction of the ANA 30 stored program controlled register system. These changes, which apply to an ARE 11 exchange with ANA 30 control of all ARF switching stages, are briefly summarised as follows:

- Redundant ARF functions:
  - — register system
  - — GV analysis
  - — internal MFC control
  - — subscriber categories
  - — PBX functions.
- The GV marker is simplified and some remaining relay sets are redesigned. One GVM rack (based on 2/160 marker) now contains two markers and controls two groups of 160 GV inlets.
- MFC inlets require access via RS.I to the ANA 30. A new relay set RAR is required to adapt FIR to RS.I.

INSTALLATION

The installation procedure was structured according to the clear demarcation that exists between the ANA 30 and ARF subsystems of the ARE 11 system. Two teams working in parallel were formed to carry out the installation. A small team trained in the ARE 11 system was responsible for the ANA 30 installation and testing and for co-ordination of full ARE 11 system testing. A second larger team was responsible for installation and testing of the ARF and ancillary portions of the exchange.

The ANA 30 subsystem was installed and tested in isolation from the ARF subsystem. Concurrently, the ARF equipment was installed and statically tested in isolation from any ANA 30 control. The ARF and ANA 30 subsystems were then combined to form the ARE 11 system and full functional, load and pre-cutover system testing was conducted.

This procedure divided the project into four distinct stages, viz:

- Ironwork
- ARF installation and subsystem testing
- ANA 30 installation and subsystem testing
- ARE 11 system testing and cutover.

Fig. 7—Jackfield Cabling above ANA 30 Suite.

Organisation of the installation around these stages and parallel installation and testing of ARF and ANA 30 equipment by two teams permitted effective deployment of the limited number of staff trained in the ARE 11 system and enabled completion of installation of this new equipment within a short time period.

TESTING

The ANA 30 testing procedure commenced with separate preparatory functional tests of all units of the subsystem and required the use of special test equipment and diagnostic off-line programs.

Following completion of unit tests, system testing of the ANA 30 group was conducted. This test, called the TCP Group Test, was conducted with all programs and final Translation Store (TRS) and Subscriber Category Store (SCS) data loaded and was a simulation test of ANA 30 traffic handling functions prior to amalgamation of the ANA 30 and ARF subsystems. The TCP Group Test was also used to develop and rigorously test TRS data which was being applied for the first time in Australia to a public exchange. This testing highlighted assembler deficiencies and provided Telecom Australia staff with experience in the writing and handling of TRS data.

Hardware and software testing was pursued at the Telecom Australia Headquarters model ARE 11 exchange in Melbourne prior to and in parallel with testing at Elsternwick. This enabled the early detection and correction of design faults and reduced testing delays by limiting the number of design problems encountered at Elsternwick. L. M. Ericsson personnel participated in hardware and software testing and development at the model and also provided technical assistance, as required, to Elsternwick installation staff.

The majority of faults encountered in the ANA 30 subsystem during testing were software oriented

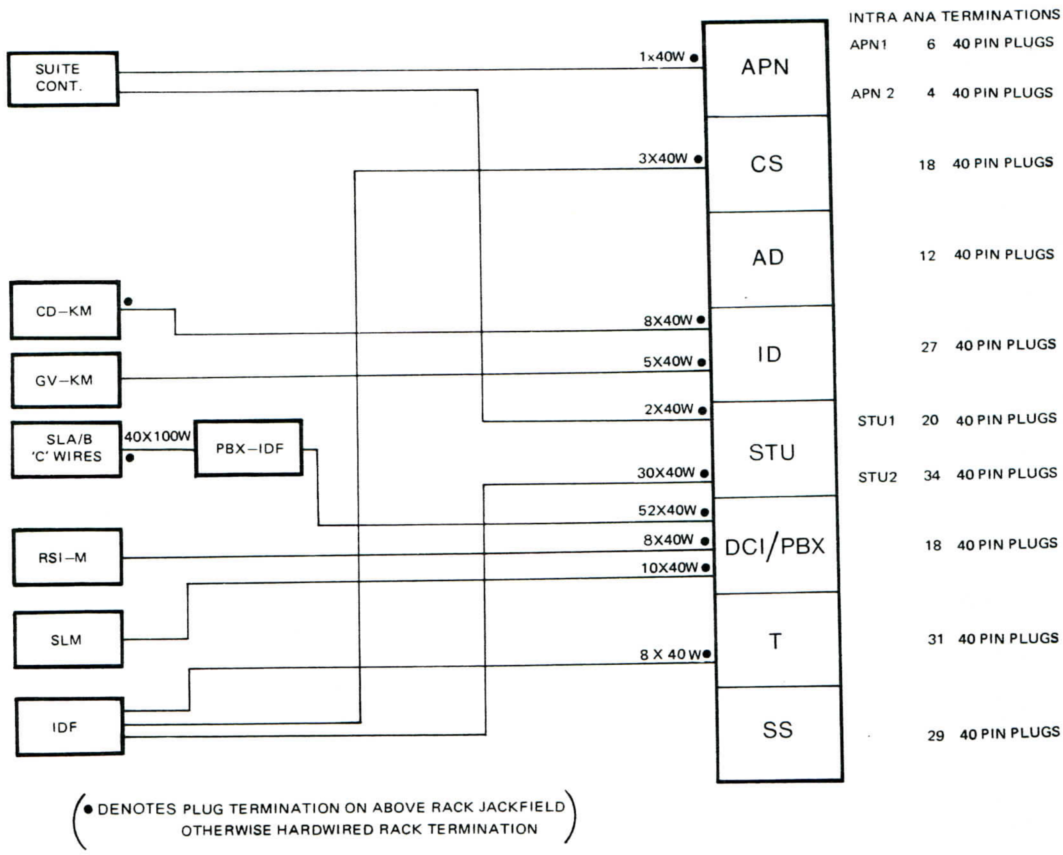

Fig. 8—Cabling Scheme.

and of these the development of TRS data was the most time consuming. Hardware faults did not present a significant problem. These were limited to:

- 27 board faults which included 9 incorrectly programmed PROM boards and 3 RAM board failures (this compares with a total installation of 2200 boards).
- Faulty IC in 4 dc/dc converters.
- 1 faulty store module.
- Minor production errors in rack and shelf wiring.

TIMETABLE

The project commenced in February 1975 and carried through to cutover in June 1976. The bulk of the work carried out during 1975 was involved with the installation of the ARF subsystem.

ANA 30 subsystem and full ARE 11 system testing and the development of SCS and TRS data was concentrated into the last seven months prior to cutover.

The following outlines the major milestones in the installation timetable:

February 1975 — Commenced ironwork and ARF installation.

July 1975 — Commenced ANA 30 installation.

November 1975 — Commenced ANA 30 preliminary unit testing.

February 1976 — Commenced ANA 30 subsystem testing.

March 1976 — Commenced ARE 11 system testing.

May 1976 — Load and network testing.

20 June 1976 — Cutover.

MAINTENANCE FACILITIES

The ANA 30 subsystem is supervised by the Operations and Maintenance Processor (OMP) which monitors disturbances in the system. OMP provides the connection to input/output devices for man-machine communications and enables the following operational functions to be performed via a visual display unit or teleprinter:

- Exchange Supervision.
- Alterations to central store data.
- Traffic statistics.

These functions can be performed at the exchange or at a remote location with input/output devices operating via modems. A remote operations centre has been simulated at Elsternwick to evaluate this facility. This centre is provided with a 24-hour consultative service by a National Support Centre which is also responsible for the preparation of program and data tapes and model verification of new hardware and software designs.

Service supervision facilities for the ARF equipment were also provided as the OMP at Elsternwick only supervised the ANA 30 subsystem.

SERVICE EXPERIENCE

Following the usual settling problems of a new system design, the ARE 11 system has been performing satisfactorily. No significant service disruption due to processor failure has occurred in the seven months to the time of writing. Processor failure only occurred on one occasion soon after cutover when a fault condition resulting from a post-cutover program change caused both Traffic Control Processors to become blocked for 30 seconds.

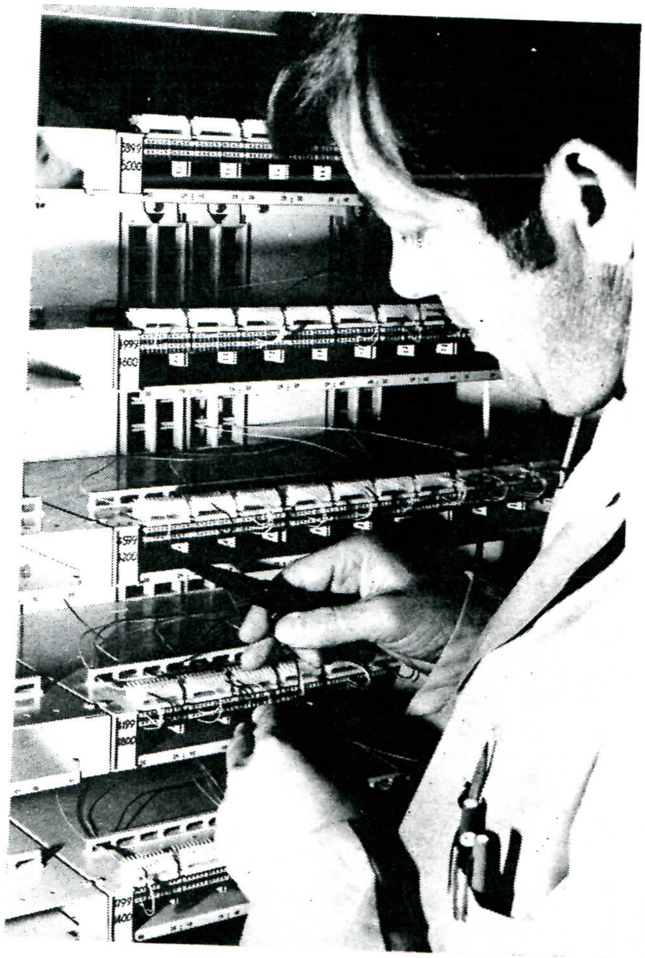

Fig. 9—PBX-IDF.

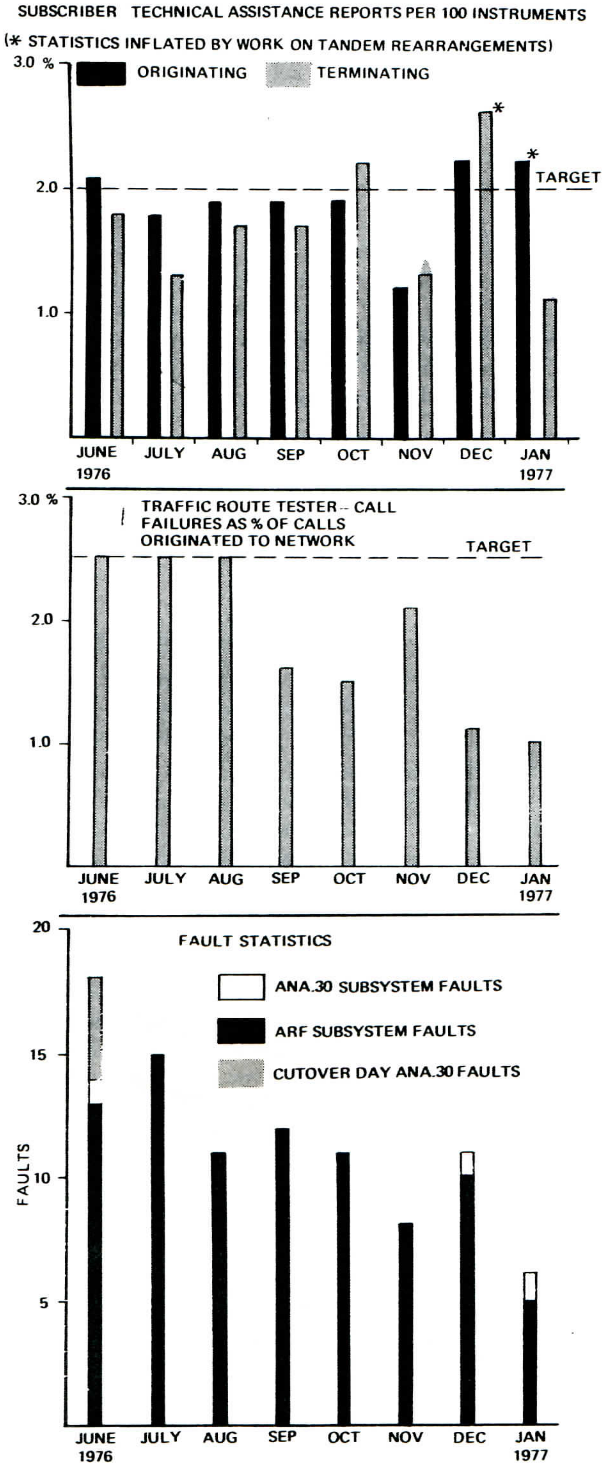

Fig. 10—Service Statistics.

Service statistics (Fig. 10) illustrate that the system is operating satisfactorily within service objectives.

CONCLUSION

Telecom Australia embarked on the Elsternwick project as a field trial to assist in the evaluation of ARE 11 for network wide implementation. Alterations to the ARE 11 system have been made since the Elsternwick installation and these are expected to be incorporated in future installations. These include improved maintenance facilities, higher capacity program and central stores and retention of ARF crossbar SS equipment. ANA 30 testing procedures are also expected to become more automated with the use of new test equipment and software.

Future ANA 30 equipment and maintenance and testing facilities will be improved over those employed at Elsternwick. However the system and hardware structure will remain substantially unchanged and the installation practices and approach adopted at Elsternwick will be applicable at future new start installations.

ACKNOWLEDGEMENT

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