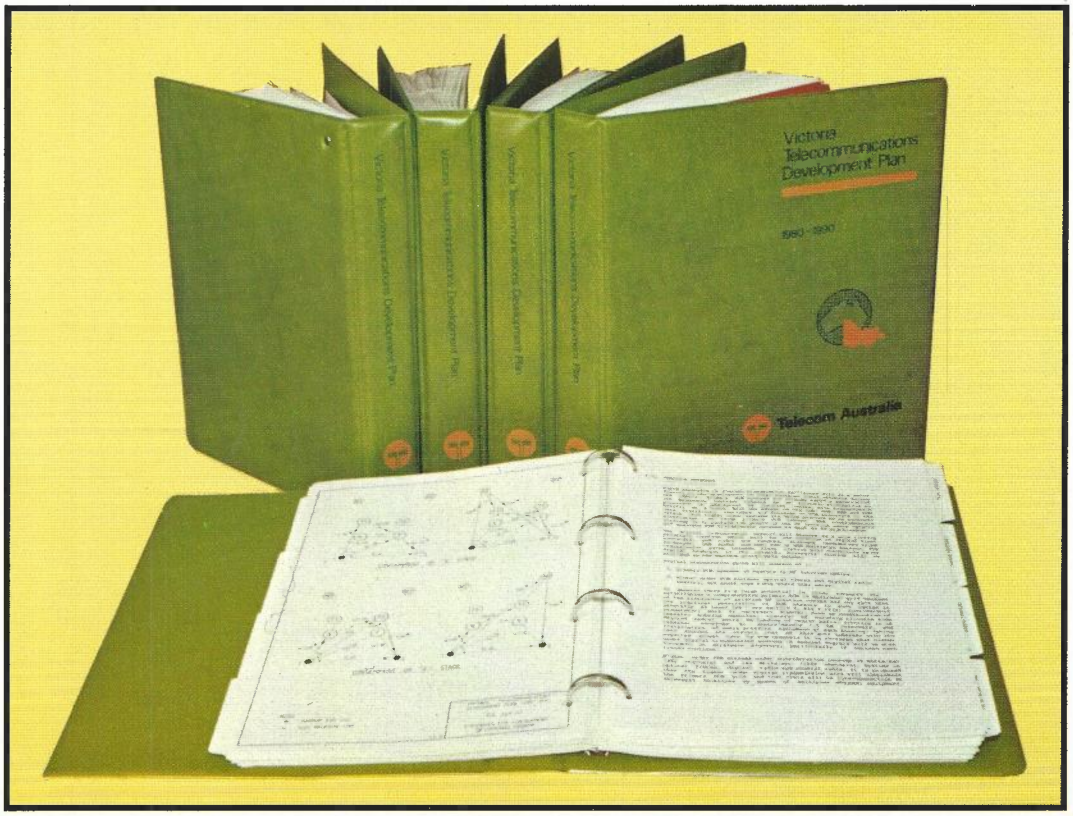
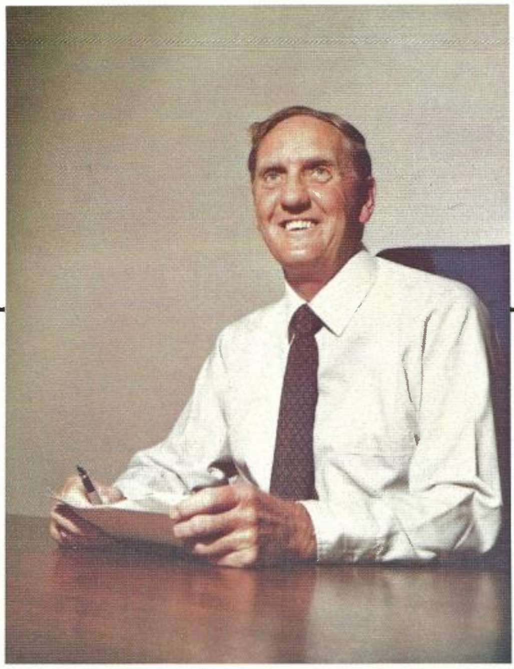
ISSUE NO 1 JUNE 1982 □ ENGINEERING DEPARTMENT (VIC) TEL 03 657 2706

ENGINEERING 82



Victoria-Telecommunications Development Plan 1980-1990

Two hundred copies of the plan have been distributed recently to Headquarters, other States, Department Heads, Engineering Branch and Section Heads and District Telephone Managers. It is the key strategic document through which State Management obtains approval-in-principle from the Chief General Manager for individual strategies associated with total development of the State telecommunications network. Some 90 key strategies are included some of which have yet to be developed and confirmed as Telecom policy. Interested staff are advised to seek out and peruse a copy of the plan to gain an appreciation of the many directions in which the State telecommunications network is heading during the 1980s. Some extracts relating to development of the Melbourne telephony network are included in this issue of Engineering '82. Future issues will highlight anticipated country developments as well as plans for expansion of non-telephony networks.



From the Office of the Chief State Engineer

"To efficiently and effectively engineer the State networks, systems and facilities in accordance with commission policies, plans and strategies". That is what we are in business to do – it means finding common sense, practical engineering solutions to the problems of today and to the problems of tomorrow.

Some of our work is pitched well into the future – this issue as well as including other items of information, deals with the new State Plan which sets out the engineering strategies which we plan to adopt. This plan encompasses the Commercial Department's Marketing Plan which reflects marketing strategies. It is in times of uncertainty, when the role of the organisation as a whole is being subject to public debate and investigation by consultants, that it is particularly important we understand our basic objectives.

It is clear that the functions of the Engineering Department are not going to lessen in importance in the future. We also need to do some re-grouping of our organisation to optimise our resources of initiative, imagination and skill to grapple with the twin problems of a more competitive environment and complex new technology.

In the meantime, Engineering '82 will share with the 5000 people who work in the Engineering Department an appreciation of what our basic thrusts are and how we intend to meet our objectives. We shall highlight also aspects of our progress in bringing better and cheaper communications to the people of Australia.

I am indebted to the editorial board for producing such a fine first edition and I hope you find it interesting.

CUSTOMER SERVICES OF THE '80s

With more than 80% of homes in Victoria now provided with an automatic telephone service, planning emphasis is transferring to enhancement of the service with additional facilities and to development of data communications. The range of customer services envisaged includes enhancements to be offered by modernization of exchange equipment, application of special customer terminal equipment to operate over the telephone network, and provision of special overlay networks.

PROCESSOR CONTROL

of telephone exchanges will cater for the following subscriber facilities –

- Call Charge Recording (CCR) for ISD and STD calls
- Voice Frequency (VF) Push Button Telephones and other "intelligent" instruments
- Expansion of Subscriber Classifications eg ISD barred
- Automatic Redirection of Calls

Processor control of exchanges is being progressively achieved through Project REMO (see page 8) and through installation of new switching equipment types ARE and AXE. Approx. 90% of metropolitan exchanges and a number of key urban provincial exchanges are expected to be under processor control by 1990.

SPECIAL TERMINAL EQUIPMENT

either on the subscriber end or the exchange end, or both, will enable expansion of –

- Recorded Information Services (RIS)
- Public Automatic Mobile Telephone Service (PAMTS)
- Radio Paging Service (TELEFINDER)
- INWATS
- Facsimile Transmission
- PABX Services
- Teletex Transmission

SPECIAL OVERLAY NETWORKS

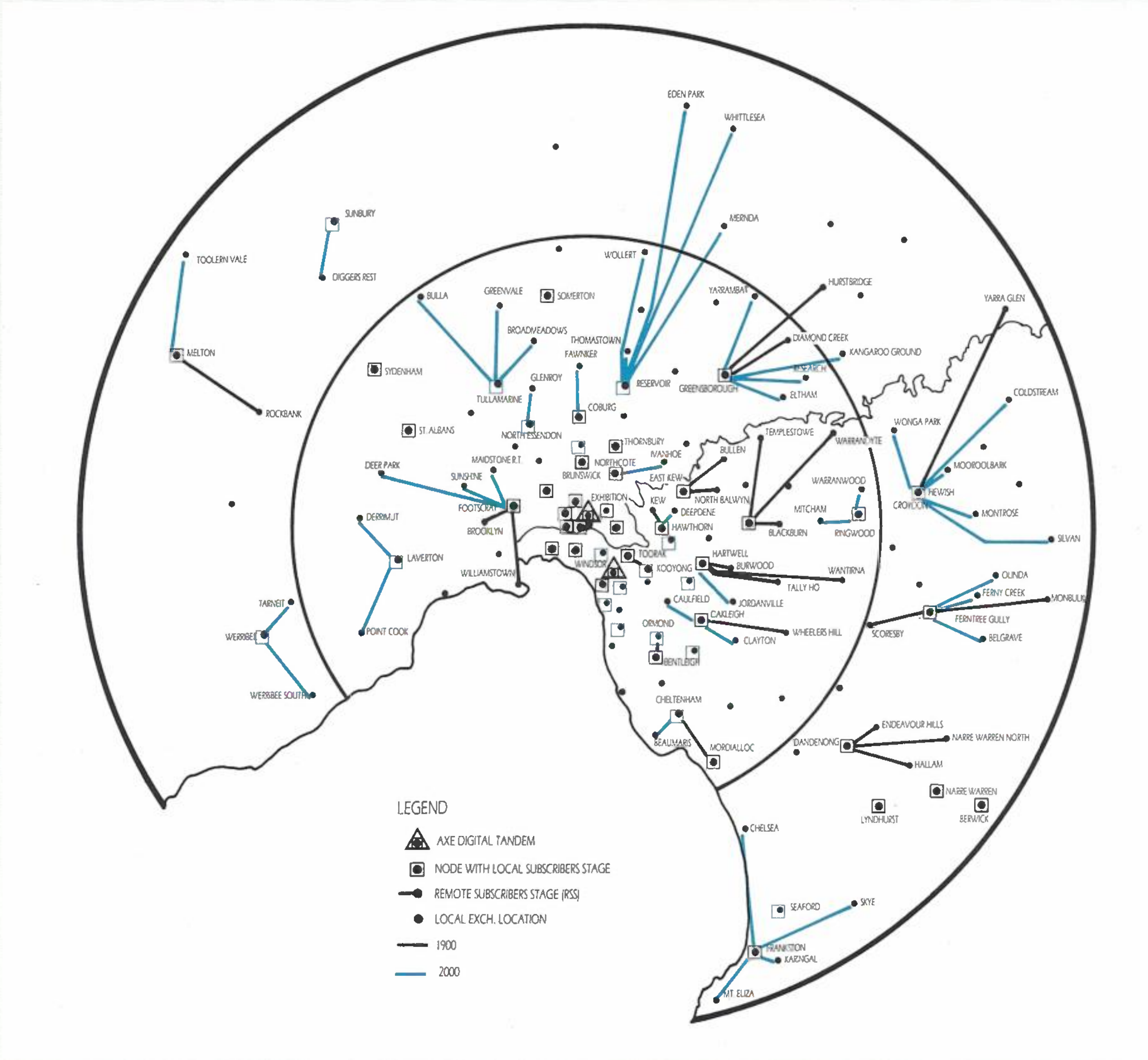
existing, being developed, or under consideration are –

- Telex
- Tress
- Digital Data Network (DDN)
- Packet Switched Network (PSN)
- Special Services Network (SSN)
- Wideband Services Network (WSN)
- Teleconferencing – Video

The majority of new customer services will be provided more economically, more satisfactorily and more expeditiously through development of digital switching and digital transmission equipment as outlined on following pages.

Gondola – wall & table phone with last number re-dialling.

THE MELBOURNE INTEGRATED DIGITAL NETWORK – SWITCHING



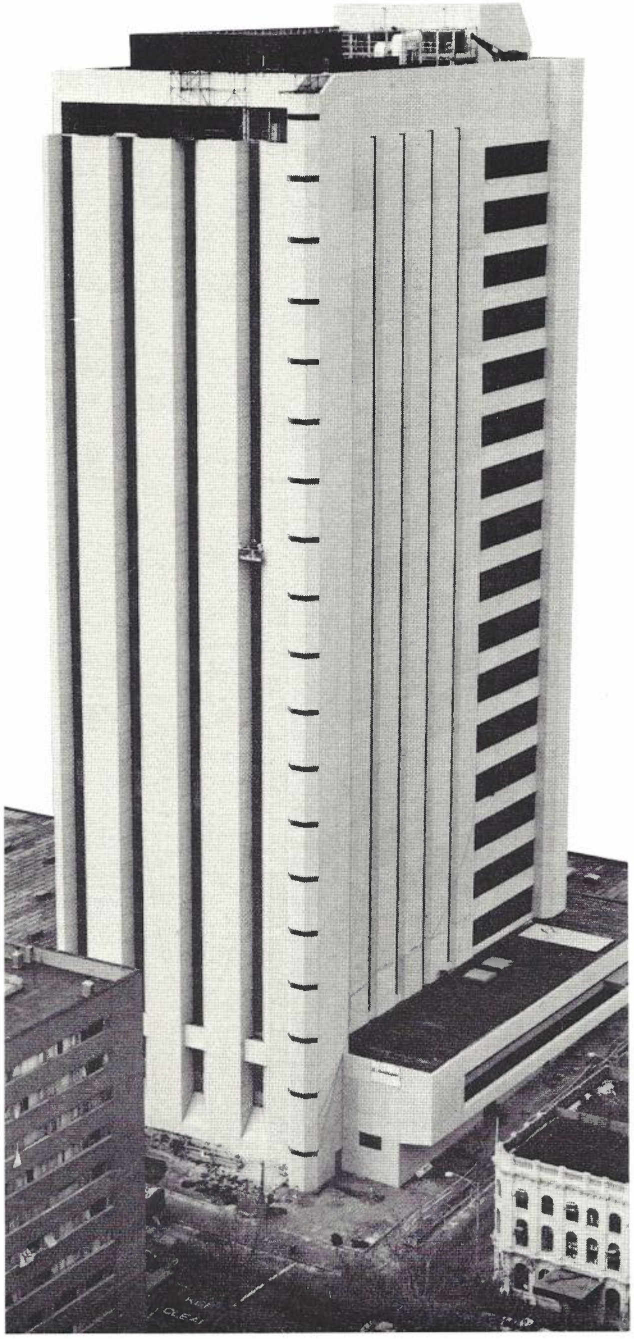
The birth of the Melbourne IDN is in progress. IDN stands for Integrated Digital Network which in turn means combination of transmission and switching in identical digital format. The digital transmission network is already established and is expanding rapidly (see pages 4 and 5). Installation is proceeding on the first AXE digital exchanges at Lyndhurst and Narre Warren and others are programmed at Batman, Toorak and Box Hill. With cutover of the first AXE digital tandem at Windsor in 1983/84 and another at Exhibition soon after, the Melbourne IDN will be firmly established.

A feature of AXE digital exchanges – commonly called NODES – is that the Central Processor (CP) associated with the Group Switching Stage (GSS) can serve not only its co-existing Local Subscriber Stage (LSS) but also Remote Subcriber Stages (RSS). Thus an AXE node at say Box Hill might also serve RSS's at Blackburn, Templestowe and Warrandyte. Above is an illustration of possible development of the Melbourne IDN through year 1990 to 2000.

An aspect to be appreciated is that digital transmission promotes digital switching and vice versa. The existing analogue network will survive for many years however, probably to the extent that some 50% of the total Melbourne network will still be analogue by the year 2000. Efficient interworking between the IDN and the existing network will therefore be one of the major engineering challenges of the coming years.

EXHIBITION EXCHANGE – BUILDING OF THE '80s

The latest major telecommunications building in Melbourne – Exhibition Exchange – is now available for progressive occupation. Seventeen storeys high and recognized as one of the most attractive new buildings in Melbourne, it is programmed to accommodate the following installations in the coming years –



- Digital Terminal Exchange
- Digital Tandem Exchange
- Digital Trunk Tandem Exchange
- Digital Trunk Exchange
- Digital Data Service Equipment
- AUSTPAC – Packet Switching Exchange
- Optical Fibre Cable Terminations
- Digital Transmission Equipment
- Minicomputers for SULTAN
- Automatic Call Distributor (ACD) for Directory and Service Assistance Centres
- SPC Telex Exchange (AXB)
- National Support Centre incorporating model exchanges for 10c, AXB, ARE and AXE.
- International Manual Assistance Centre
- Service Assessment Centre
- Special Services Restoration Centre

Transmission access to Melbourne will be considerably enhanced with the establishment of Exhibition Exchange. Entry via underground cable entry chambers which are an integral part of the recently extended city tunnel system will provide significant diversity to Melbourne's other main exchange complex – Lonsdale. The roof of the building is also designed to accommodate short haul radio antennae.

THE MELBOURNE DIGITAL TRANSMISSION NETWORK

In the 1980s development of the Melbourne transmission network will focus on provision of Pulse Code Modulation (PCM) systems. For analogue traffic such a system samples the sound wave 8000 times per second, converts each sample into a 8 bit digital code for transmission to line, and then reconverts each sample back to analogue format at the distant end. Each channel therefore carries 64Kbits/sec which in turn means that a 32 channel PCM system has a capacity of 2.048 Mbits/sec. This is commonly referred to as 2 Mbit/sec Primary PCM. One of the channels is used for signalling information and another for synchronization control leaving 30 channels for speech circuits.

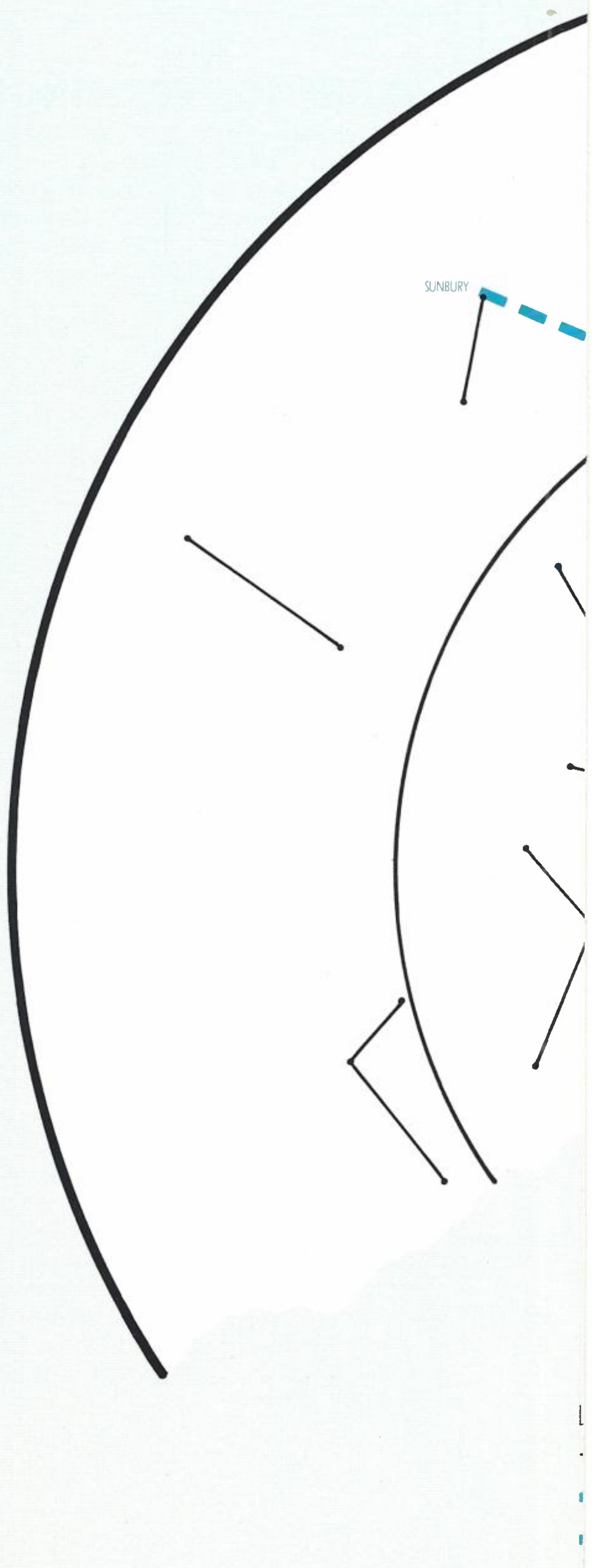
Whilst PCM is a proven economic method of transmission for speech in many instances, particularly as an integral component of the IDN, (see page 2), it is even more economic for transmission of non-telephony traffic originating and terminating in digital data or computer terminals. With PCM transmission, such traffic remains in digital format from origin to destination. Very significant developments are foreseen in this type of traffic during the 1980s and to meet the requirement a special overlay network of PCM systems is proposed called the Digital Data Network (DDN). Other proposed special networks utilizing PCM for both data and telephony purposes are the Packet Switched Network (PSN) and the Special Services Network (SSN).

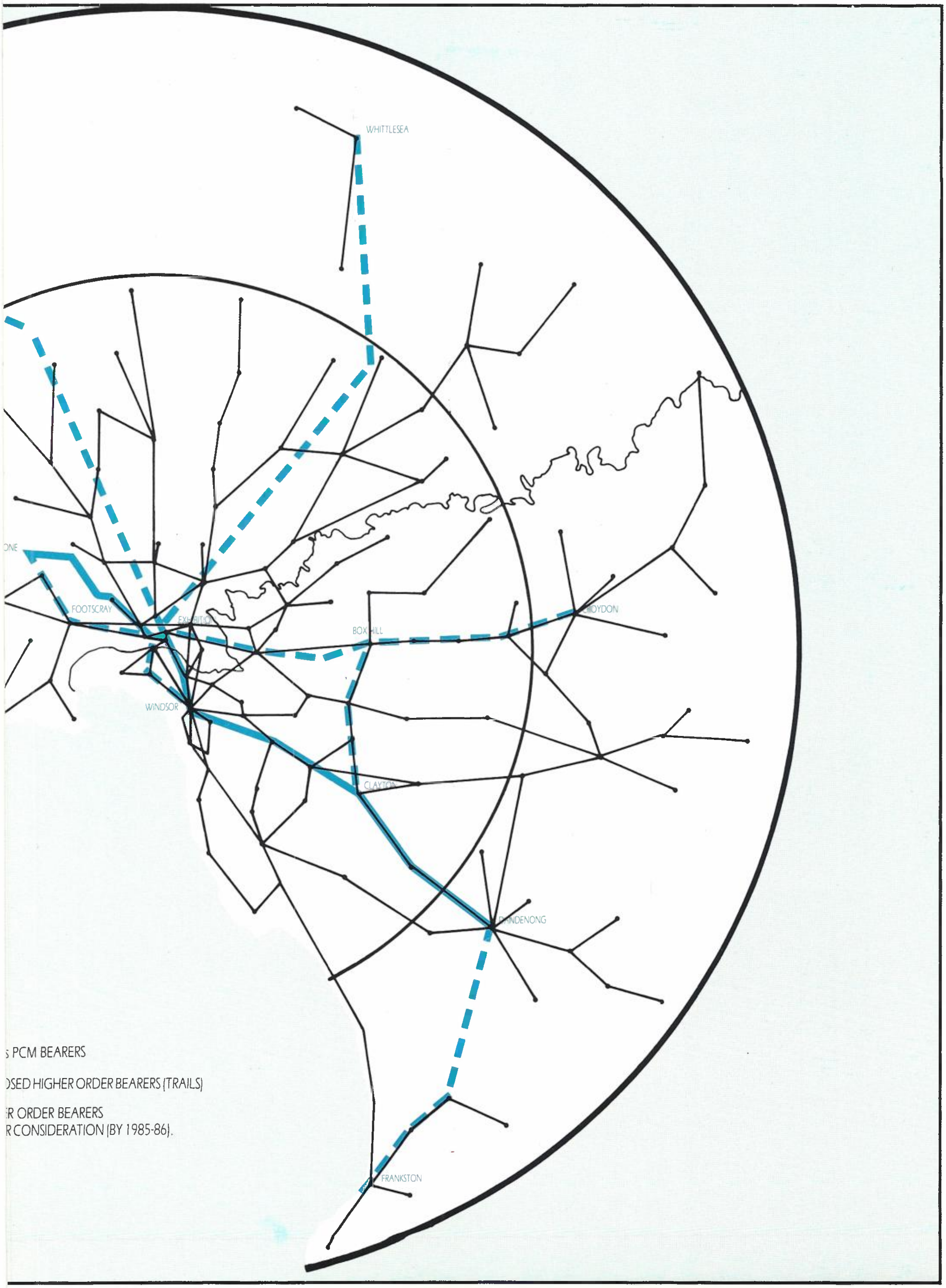
To meet the large demand for digital circuits generated by all these networks, including the IDN, comprehensive development of the Melbourne digital transmission network is programmed on two levels.

1 A grid of primary PCM digital line transmission systems (2 Mbits/sec) on selected pairs in existing junction cables
2 A network of higher order digital systems (34 and 140 Mbits/sec) interconnected to the 2 Mbit/sec network.

The accompanying diagram illustrates the possible development of both networks throughout the 1980s. With each primary PCM system requiring only 2 cable pairs as bearers there is considerable potential for these systems to be installed on Melbourne's comprehensive junction cable grid – 72 systems in a 1200 pair cable utilize only 12% of available pairs yet nearly triple the circuit carrying capacity of the cable. Provision of PCM systems is more economical in most cases than further provision of pair cables and conduits. A significant improvement to overall network transmission performance also results.

It is already evident however, that over longer metropolitan distances, the economics of exploiting the capability of existing junction cables to support primary PCM systems will be overtaken by the economics of multiplexing primary PCM into higher order digital systems (34 and 140 Mbits/sec equivalent to 480 and 1920 channels respectively) to be transmitted over optical fibre cables, coaxial tubes (where they exist) and digital radio systems. A 140 Mbit/sec system is programmed on a 12 fibre optical cable between Exhibition and Dandenong. A 34 Mbit/sec system is programmed on digital radio between Lonsdale and Sunbury.
Subject to satisfactory performance of these trial systems, other systems are under consideration as illustrated.





WHITTLESEA
FOOTSCRAY
BOX HILL
WINDSOR
CLAYTON
FRANKSTON
PCM BEARERS
HIGHER ORDER BEARERS (TRAILS)
ORDER BEARERS
CONSIDERATION (BY 1985-86).

AXB 20 TELEX EXCHANGE

The automatic telex service was introduced in Australia in 1966 with the installation of ARB, ARM crossbar type exchanges. Since then the telex network has grown rapidly, experiencing growth rates of approximately 15% per annum and at March 1981 had approximately 37 000 customers.

To meet the future demands for growth, new customer facilities and a containment of costs, the L.M. Ericsson AXB20 Stored Program Control system was selected as an alternative to crossbar telex exchanges. Benefits with the AXB20 system include lower equipment costs, lower installation costs, reduced operating costs, savings in accommodation and improvement in transmission when compared to crossbar exchanges. In addition, the AXB20 system offers automatic conference and broadcast switching with group listings, automatic insertion of date and time and duration advice of the chargeable time.

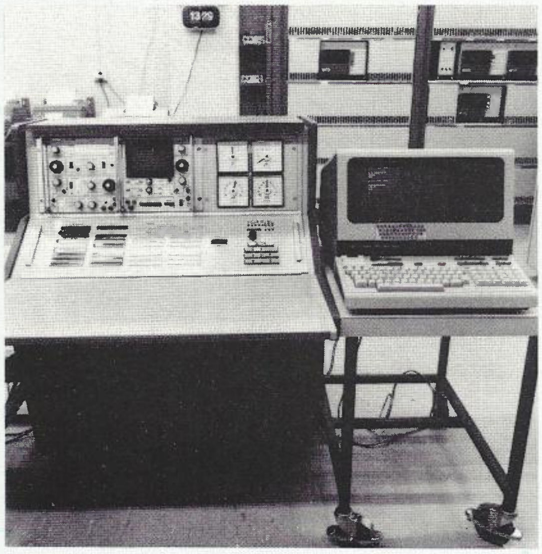
The first Australian AXB20 exchange, which is located in Lonsdale Exchange Building, Melbourne, was placed into service on 5 April 1982. The maintenance centre is co-located with the AXB20 and includes total customer and exchange support facilities. The installation, which comprises 1 270 customers and trunk terminations, was undertaken by the Electronic Exchange Installation Section of the Victorian Engineering Construction Branch.

Initially it offers automatic conference/broadcast facilities to Victorian customers only but these facilities will eventually be extended on a national basis. A maximum of 80 conference/broadcast calls may be simultaneously set up within the exchange.

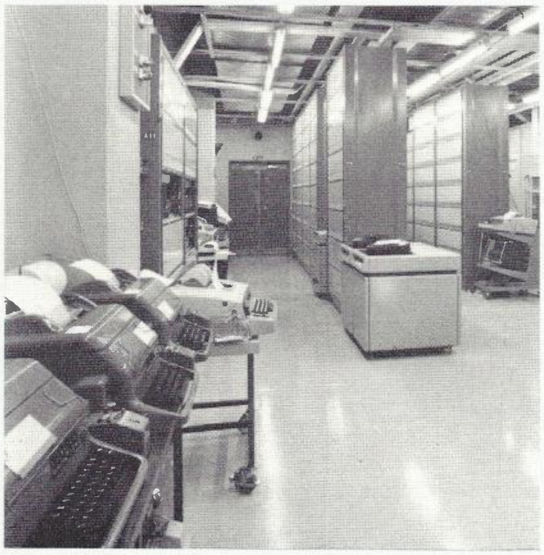
The AXB20 is a fully digital switching system based on an identical APZ processor as used in AXE exchanges. The APT switchblock features time division multiplexing using the bit interleaving technique.

Charging information, comprising an individual record for each call, is stored on a duplicated disc system. Under operational control these call charge records are transferred to magnetic tape for off line processing. In the long term, a data link between the exchange and Data Processing Centre will be established for automatic retrieval of call charge information.

The predominant features of the AXB20 exchange incorporate enhanced customer facilities, high capacity switching and improved transmission and operational techniques, all of which make the system ideal to meet today's exacting demands. These economies mean that costs to the customers are kept as low as possible.



Testing position and associated VDU



General view of installation

PROJECT REMO – PROGRESS TO DATE

"One Millionth Line of ARE Equipment Reached"

The conversion of North Geelong Exchange to ARE in April 1982 marked the 1 millionth line of (a) Conversion of ARF to ARE under Project REMO and (b) Provision of new ARE equipment throughout Australia.

Project REMO is the programme of modernisation of existing ARF and ARM Cross Bar Exchange equipment. In the ARF exchanges it upgrades or replaces the registers, upgrades the subscribers stage and group selection equipment and in the case of the ARM exchanges, the register equipment.

Project REMO provides for facilities in existing ARF exchange equipment for:

i. Calling Line Identification (CLI) – basic to the provision of Call Charge Record for International Subscriber Calls (ISD-CCR) and the later introduction of Call Charge Records for National Subscriber Calls (STD-CCR).

ii. Centralised Interception Service – including services such as Interception and Re-direction, Change Number Advice and Malicious Call Trace.

iii. VF Pushbutton Telephones (Touch Phone 12). (Additional exchange equipment is also necessary.)

iv. Additional subscriber classifications to enable barring of access to certain routes for subscribers.

In the case of ARE it also makes provision for operational advantages.

Strategies for implementation of Project REMO are:

a. Modification of Reg LP registers (limited application)

b. Replacement of Reg LM and Reg LP registers by ANA 30 type processor controlled electronic register equipment (ARE conversion).

In addition 12 first-in ARE installations will be completed during the course of the REMO programme in Victoria, but not as part of it, in all enabling advanced facilities for approximately 1 million lines of customers cross-bar exchange equipment in Victoria.

Project REMO is being undertaken by Construction Branch in conjunction with and the support of the Design and Practices Branch and the Melbourne Workshops.

Modification of Relay Sets for REMO at Melbourne Workshops

Victoria's achievement in the ARE conversion area at June 1981 and expected achievement in 1981/82 and 1982/83 are as follows:

	Reg LP Modification*		ARE Conversion Increment	
	No. of Lines	Exchanges	No. of Lines	Exchanges
Prior to June 1981	26.3K	9	92K	10
1981-2			184K	21
1982-3			202K	25

At the end of 1982-3 approximately 370K lines require conversion in the Metropolitan area.

**Metro area only.*

THE CALL CHARGE ANALYSIS SYSTEM

The need for more efficient and up-to-date subscriber metering supervision equipment was underlined in the Auditor-General's report tabled in Parliament in May 1980. Tenders were subsequently called for the supply of a Call Charge Analysis System, the successful tenderer being STC, agents for Telesciences Incorporated of USA.

The Call Charge Analysis System (CCAS) will be used in the telephone network to obtain customers' call records for checking under and over metering of customers and to monitor the metering performance of the network. It will replace the Call Record Printers (CRP) introduced in the 1960s.

CCAS is being implemented nationally under Headquarters Engineering Department co-ordination. In Victoria, Operations Support Systems Section of Design and Practices Branch is responsible for its implementation.

The central site equipment is being delivered in May 1982. Box Hill District will be the first to cutover in August/September 1982 and it is expected that all districts will be commissioned by late 1983.

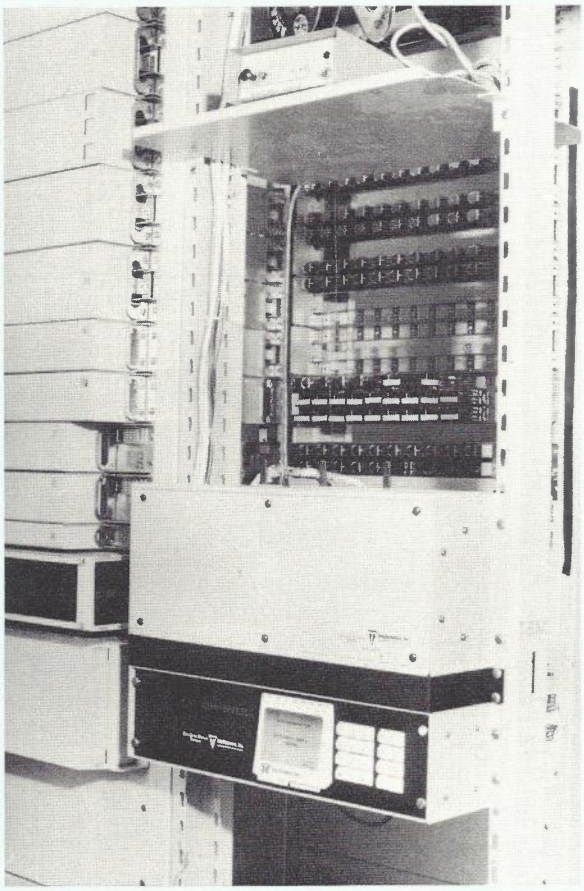
CCAS will automatically provide reports which:
- investigate metered call charge disputes
- investigate 'abnormal' meter reports
- supervise the metering system.

115 exchanges in the 03 Closed Numbering Area will be equipped with a CCAS terminal. Exchanges between 3000-13000 lines will be equipped with a terminal of capacity for monitoring 50 lines whilst larger exchanges will be equipped for a capacity of 100 lines.

All call record information is transmitted to a central minicomputer at Windsor Exchange for processing and long term storage. Every call processed at the central site is verified against internally held charging tables.

District Telecom Branches in the 03 CNA will be equipped with a high speed printer to automatically receive completed customer call record studies. A report on calls that are incorrectly metered will be sent in real time to the Network Performance Analysis Cell. The central site manager oversees all studies in progress and can provide interim reports for users as required.

Exchange staff can access an exchange terminal via a display panel and key pad, but no hard copy information is provided at the exchange.



CCAS equipment installed in an exchange in the Sydney Pilot.

INTRODUCTION OF THE "TECHNICAL PUBLICATIONS SYSTEM"

A new system associated with the production of technical publications will commence in Victoria on 1 July 1982. This "Technical Publications System" will completely revise the procedures for registration, indexing and distribution of all technical information published within the Commission.

The new system will gradually replace existing Engineering Instructions and will also include the considerable amount of information now published outside the Engineering Instructions series.

An important feature of the new system will be the computer based keyword index which will enable all available information on a particular topic to be quickly located. This index will be widely distributed in microfiche format and will be updated at frequent intervals.

During June 1982 a number of information seminars will be held to introduce the new procedures to author areas, after which a detailed publication "Technical Publications System Guidelines" will be distributed within the State.

Two views
of
ENDEAVOUR HILLS VIC
FIRST AXE ANALOGUE EXCHANGE
commissioned
October 1981

SOME HIGHLIGHTS OF ACHIEVEMENT – ENGINEERING DEPARTMENT VICTORIA 1981-82

- First Stored Programme Control Telex Exchange AXB 20 - Melbourne
- The Mobile Automatic Telephone Service for Melbourne 03 area
- The first 18MHZ Broadband System (3600 channel capacity)
- The first 300 Channel Carrier Telephone Systems commissioned
- 80 816 lines of new exchange equipment
  including 3 new ARE and 35 ARK exchanges and
  one Country Minor Switching Centre
- ARF-ARE conversion of 184 000 lines of equipment at 21 exchanges
- Extension of Windsor 10C Trunk Exchange to 8K/8K
- Commencement of work at Maidstone on second Radio Communication Centre for Melbourne
- Introduction of SULTAN in one DTM area
- Commissioning of 62 PCM Carrier Systems including 147 regenerator housings, 616 Carrier Channel Modems, 50-12 Channel Systems and 45 VF Telegraph Systems and 7 Video Cable Systems
- Installation of 129 000 PKM of main end junction cable 180 TKM coaxial cable and 329 DKM of conduits.
- Introduction of LEOPARD into a second DTM area
- Remote recorded information service, designed and implemented

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Western Radio Terminal – Maidstone

Melbourne's second major radio telecommunications terminal is currently under construction on a site adjacent to the Headquarter's Cable Measurement Laboratory in Hampstead Rd Maidstone. The stub legs for the 84 metre high tower have been installed and the building for the terminal equipment is nearing completion as shown in the above photograph. The Maidstone Terminal will complement Melbourne's other major radio telecommunications terminal at Surrey Hills in catering for the extensive intrastate and interstate trunk circuit growth expected in the 1980s and beyond. With two major radio telecommunications terminals, diversity and hence security of trunk access to and egress from Melbourne will be significantly enhanced. An outline of the relationship between the two terminals and Melbourne's trunk exchanges is included in this issue.

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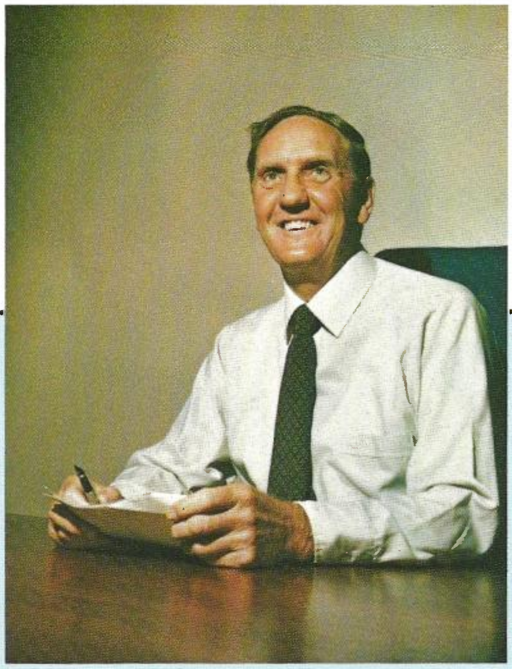


From the Office of the Chief State Engineer

It is programme time. As a matter of fact, it always seems to be programme time, but at this time of the year we start the next round to set up the critical programmes for 1983/84 and following years.

The first is the Engineering Construction Programme. In apportioning the funding of capital works, this puts great emphasis on expanding our networks, improving our services, modernising our plant, and in bringing new facilities on stream. In addition to customer terminal facilities, there is an emerging range of network facilities. New networks, very important to our large customers, are the digital data and packet switched network and the special services network. The IDN, combining AXE digital switching and PCM transmission, is now under construction. To expand the basic grid we need to get on with the business of augmenting the long haul transmission networks. Optic fibre and digital radio projects are appearing on the programme in quantity for the first time.

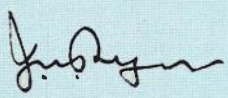
The recent National FYEOP Conference, with its extraction of necessary productivity improvements, concentrated on the distribution of resources to meet the growth pressures and the resource demands of the introduction of the new technology. This constant improvement in productivity is vital to enable us to finance the new services and facilities required to make us strongly commercially competitive.

The third of the trio of programmes is the RDI Programme, also discussed at a recent National Conference, through which innovation and new technology, as well as the development of methods and practices are programmed and introduced. Computerised systems for improving the management of our operations are handled in a complementary programme.

When staff are recruited and trained and material purchased, the inter-related programmes represent a statement of what shall be done.

The programming process means determining priorities. Demonstrated capacity to perceive alternatives and their implications and wisdom in selecting priorities are marks of a proficient manager. Often it requires courage.

Engineering management is a tough discipline.



Western Radio Terminal – Maidstone

The idea of establishing a western suburbs radio telecommunications terminal for Melbourne was originally promulgated in the early 1970s for the following reasons:

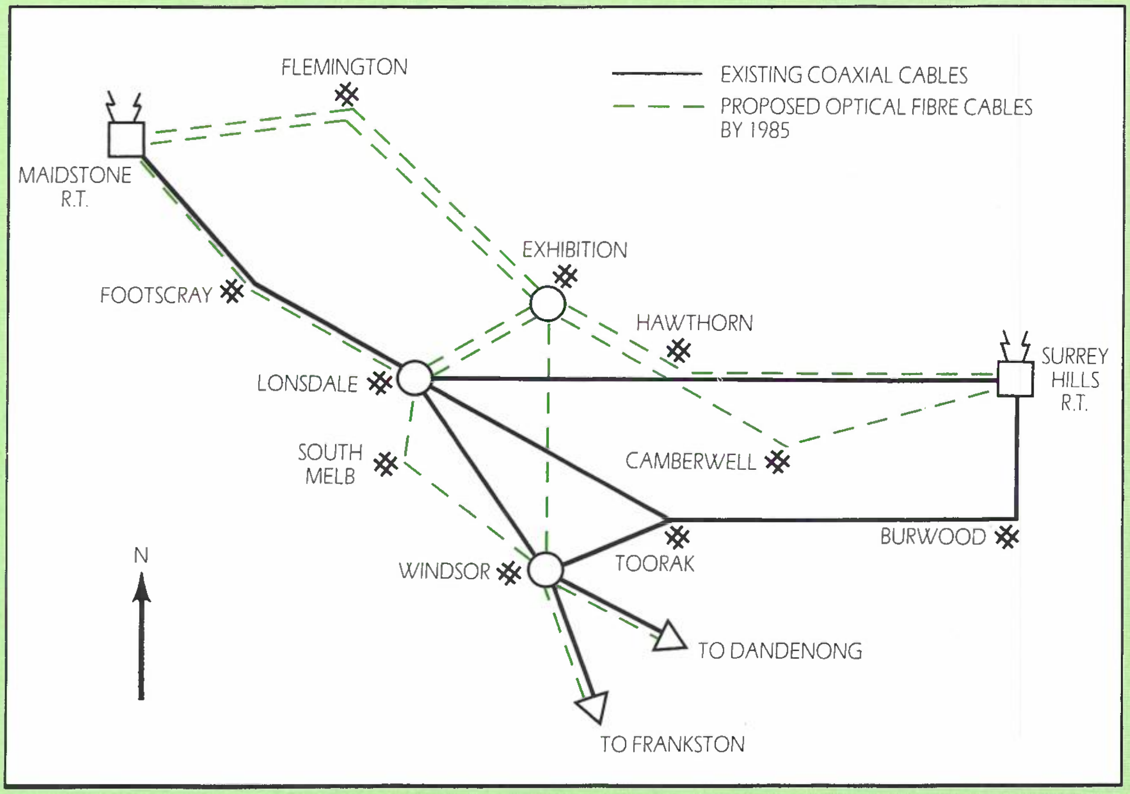
1. To provide relief to the Surrey Hills Radio Terminal in catering for trunk circuit growth.
2. To improve propagation paths to the first repeater stations of radio telecommunication routes heading west from Melbourne.
3. To improve network diversity and hence security – particularly for interstate trunk traffic.

The economic timing for the proposal seemed to be by the mid 1980s, however, higher forecasts of intercapital trunk circuit requirements incorporating anticipated rapid growth of the Digital Data Network advanced the need for the terminal to October 1983 at the latest.

The Maidstone site was selected as the most economic and convenient because the site was already owned by Telecom. Considerable negotiation took place with local authorities and the Department of Environment on design of the tower and the building. Contracts were finally let in 1981 and construction of the building is now nearing completion. Radio Section line staff have installed the stub legs for the tower and expect to complete the steelwork by December this year. The first installation to radiate from Maidstone will be a new 6.1 GHz analogue 1800 channel radio system to Bendigo required by October 1983 to meet Melbourne-Adelaide trunk circuit growth. This will be followed by a 6.7 GHz digital 140 Mbit system to Sydney required by June 1984 to cater for rapid development of the intercapital Digital Data Network. An identical system to Adelaide will follow for the same purpose.

The geographical relationship of the Maidstone Radio Terminal to the Surrey Hills Radio Terminal and to Melbourne's three trunk exchange locations of Lonsdale, Windsor and Exhibition is shown in the diagram below. Initial connection of the terminal to the Melbourne network will be achieved by coaxial cable to Lonsdale where crossconnection can be made to other coaxial cables or to trunk switching equipment. The Bendigo radio system will be extended into Melbourne on this route.

An optical fibre cable is also being installed on an alternative route as shown. This will terminate at the new Exhibition exchange which is to be the initial Digital Data Network main switching centre for Melbourne as well as the initial digital trunk switching centre. The proposed Melbourne-Sydney and Melbourne-Adelaide 140 Mbit systems will be extended into Melbourne on this route. Other optical fibre cables are proposed on both routes and also to link up Melbourne's trunk exchanges as shown. Melbourne's trunk switching is currently carried out by two crossbar ARM exchanges at Lonsdale and two computer controlled 10C exchanges – one at Lonsdale and one at Windsor. These are expected to meet trunk switching requirements up to approximately 1985 when the first digital trunk tandem switching exchange is programmed at Exhibition.



EASTERN SUBURBS COMMUNICATIONS CENTRE

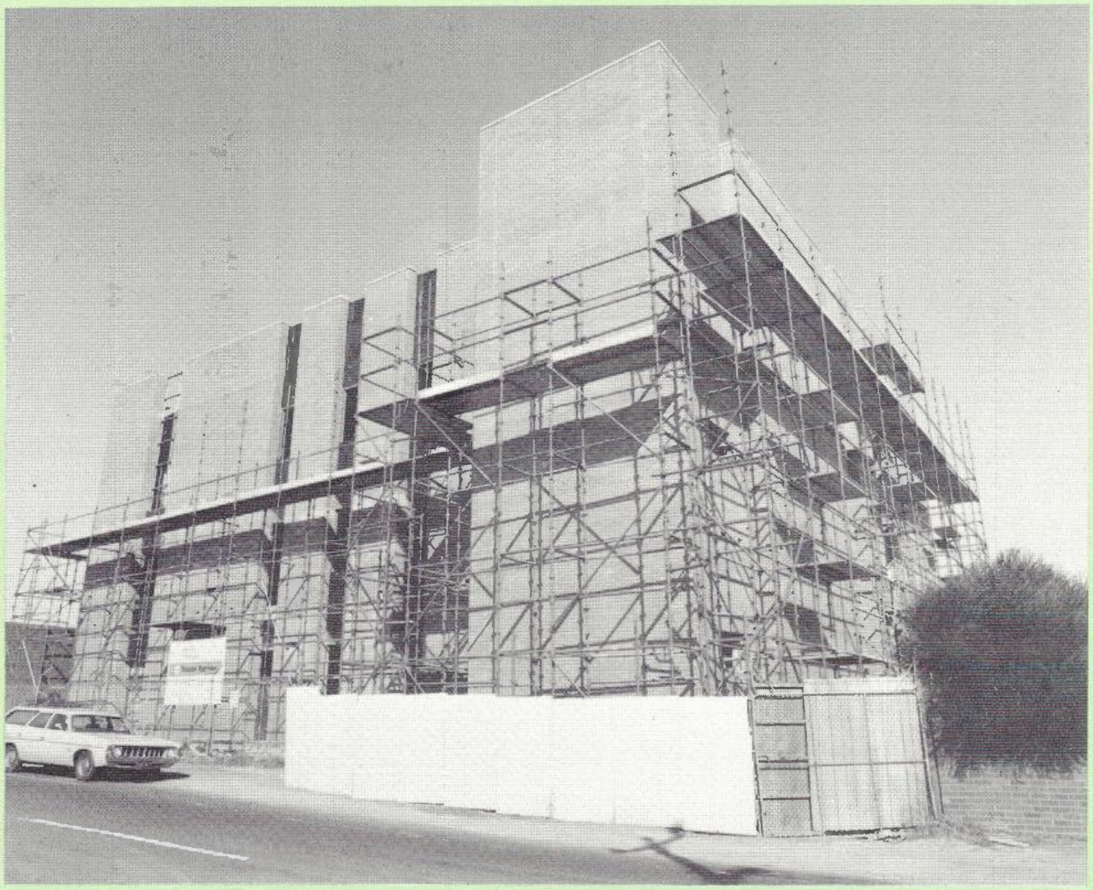
The new Eastern Suburbs Communication Centre building, costing approx. $1.2 million, is nearly completion in Carrington Rd Box Hill. It is a 3 storey structure as illustrated with potential to accommodate –

- Digital local switching equipment
- Digital tandem switching equipment
- Digital trunk switching equipment
- Digital data service equipment
- Digital transmission equipment
- Optical fibre cable terminations
- Conventional cable termination.

The initial equipment installation in the building will be 6K lines (1K = 1024 lines) of digital AXE local switching equipment. This is scheduled for cutover by mid 1984 and is designed to replace 5600 lines of step by step switching equipment in the existing Box Hill exchange thus providing Box Hill customers with access to modern telecommunications facilities such as ISD/CCR and voice frequency push button telephones. Subsequent AXE installations in the new building are planned to allow complete recovery of all equipment from the existing exchange by 1987.

The existing Box Hill exchange is located at the rear of the Post Office – approx. 0.6 Km from the new building as shown on the accompanying diagram. It is an old building established in 1930 and extended in 1956. It contains wholly step by step switching equipment including the last 4000 lines of pre-2000 type equipment remaining in Australia. It will therefore make history in June 1984 when recovery of the equipment will finalize the national pre-2000 type replacement programme commenced in the mid 1960s. Attempts over many years to acquire properties adjacent to the existing exchange were unsuccessful and it eventually became necessary to plan the new building on the old Box Hill line depot site in Carrington Rd despite the disadvantage of its distance from the existing exchange.

A further complication in cutover arrangements between the two buildings is the development of the Box Hill Transport Centre. This proposal is to transform the Box Hill railway station and surrounds into a modern inter-modal transport interchange incorporating retail, office and commercial developments – the first of its type in Victoria. The development is under the control of the Railway Construction & Property Board. The major impact on Telecom arose from the lowering of the existing Box Hill railway line approx. 10 metres resulting in ultimate transformation of the Station St level crossing into a 4 lane bridge over the lowered railway tracks. To facilitate this work it was necessary to clear 19 major cables from the existing junction conduit route along Station St.



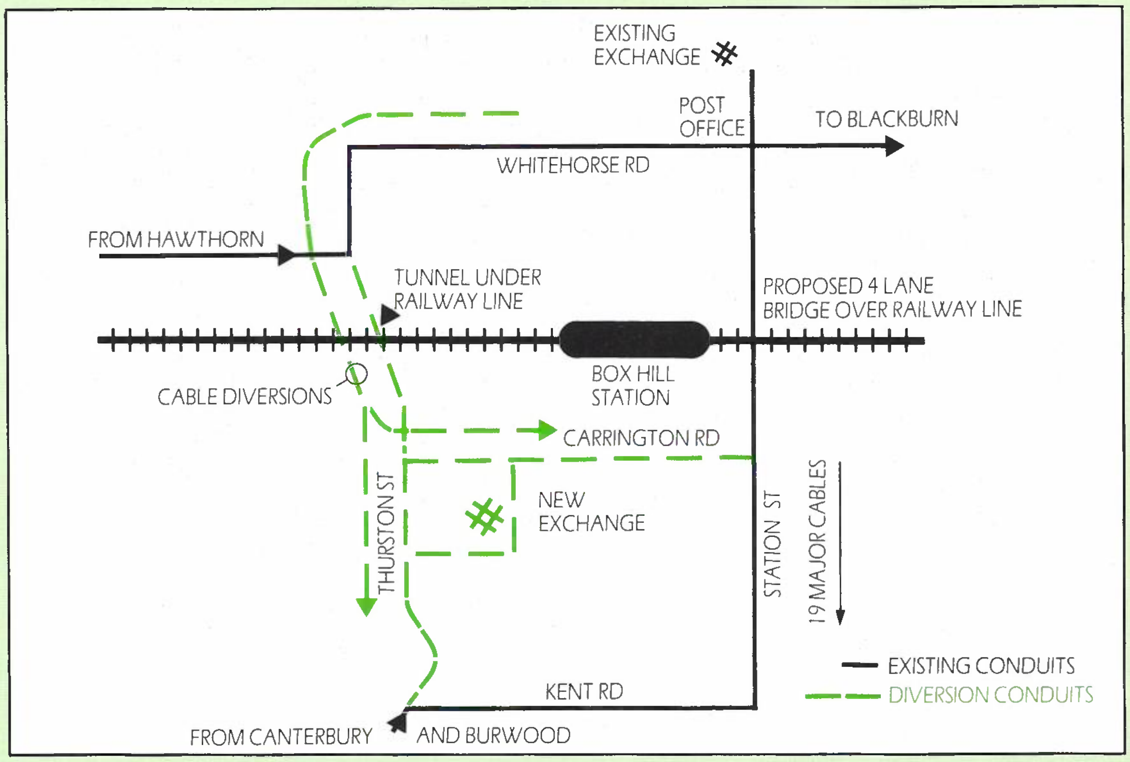
This was achieved by installation of new conduits via the new exchange site as shown, and by diversion of all cables via them, initially bypassing the new exchange but with intention of diverting them into the new building when it becomes available.

A special feature of the new work was the construction of a tunnel approx. 10 metres below ground level beneath the railway line to link the new conduits with another major conduit route as shown. Fifty-two ducts were installed in the tunnel which was subsequently backfilled.

Allowance has also been made to provide continuity of the old conduit route across the new Station St bridge when it is completed thus duplicating access across the railway line from the new exchange.

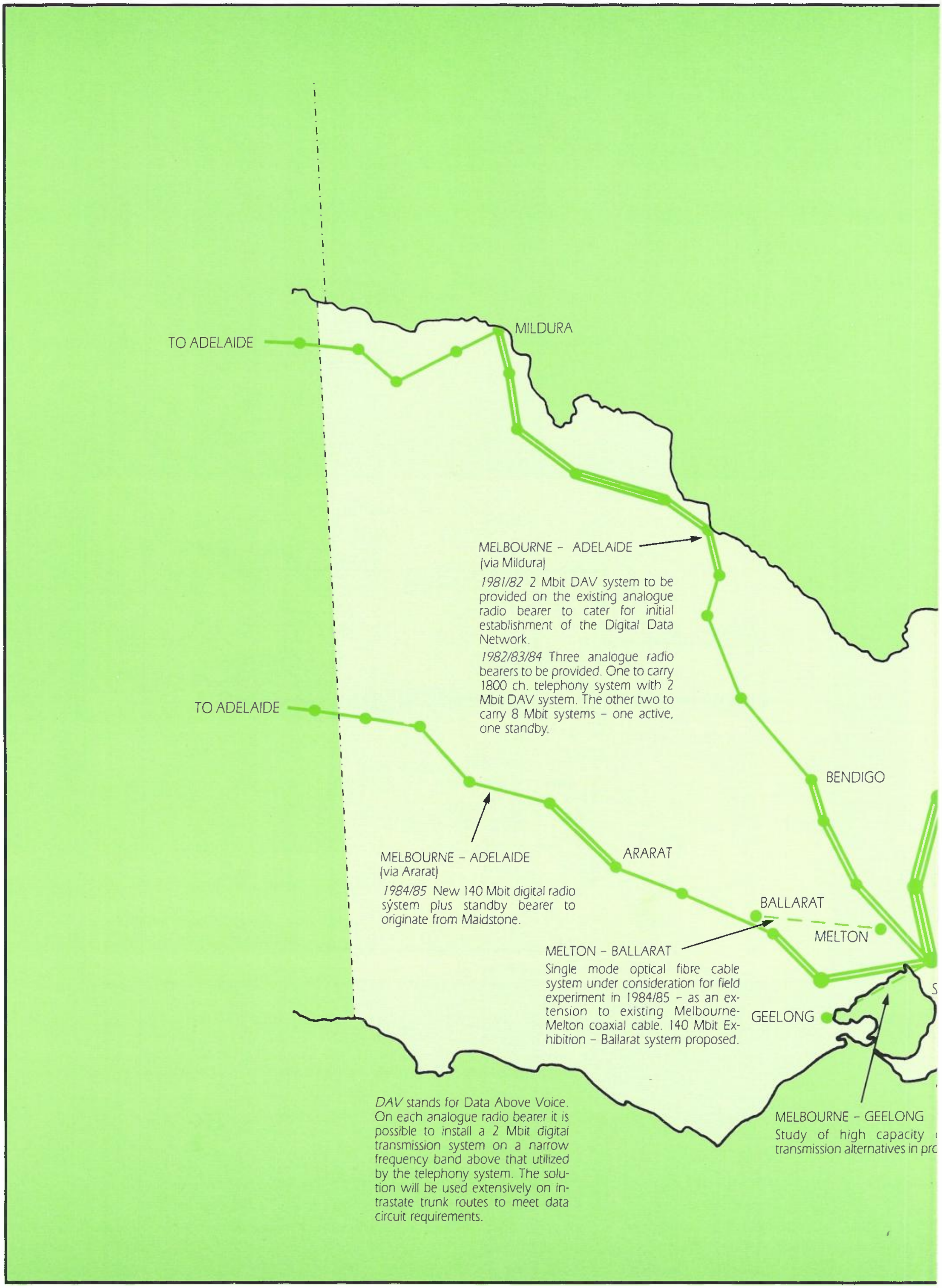
The total cost of external plant diversion work was approx. $1 million of which approx. $0.5 million was assessed as recoverable from the Railway Construction & Property Board.

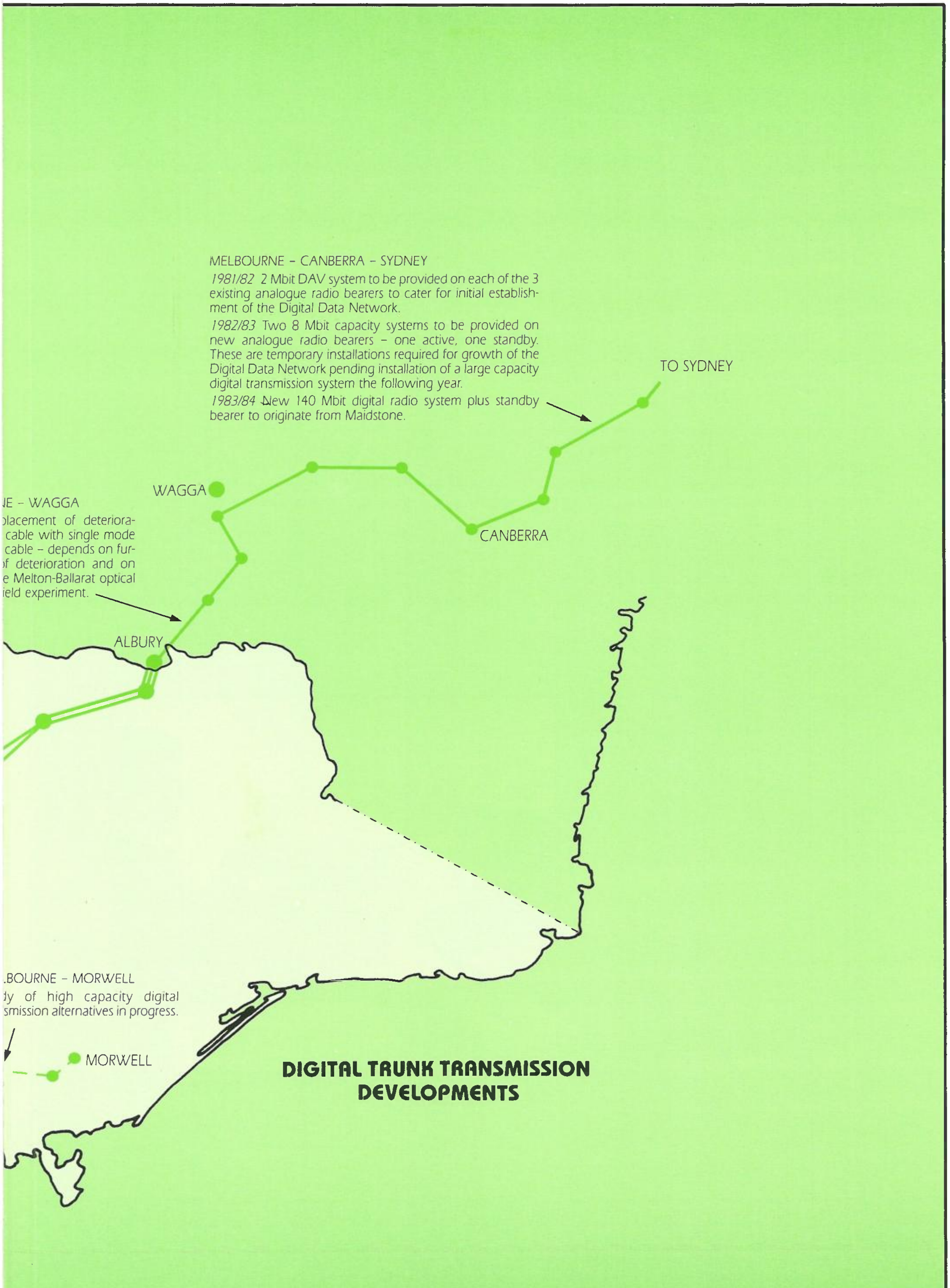
Station St. end of excavation.



The project has involved all Branches of the Engineering Department broadly as follows –

- Planning & Programming Branch – overall project planning including equipment layout in the new building and detailed negotiation with the Railway Construction & Property Board.
- Construction Branch – conduit and cable works and equipment installation.
- Buildings Branch – design of building and tunnels in association with Department of Housing & Construction.
- Design & Practices Branch – provision of cable gas pressure alarm systems.
- Network Service Branch – transmission measurement associated with cable cutovers.
- Services Branch – provisioning of mechanical aids and materials, particularly large size cable.
- Field Engineering Branch – local design work and co-ordination with Operations Department.


TO ADELAIDE
MILDURA
MELBOURNE – ADELAIDE
(via Mildura)
1981/82 2 Mbit DAV system to be provided on the existing analogue radio bearer to cater for initial establishment of the Digital Data Network.
1982/83/84 Three analogue radio bearers to be provided. One to carry 1800 ch. telephony system with 2 Mbit DAV system. The other two to carry 8 Mbit systems – one active, one standby.
TO ADELAIDE
BENDIGO
ARARAT
MELBOURNE – ADELAIDE
(via Ararat)
1984/85 New 140 Mbit digital radio system plus standby bearer to originate from Maidstone.
BALLARAT
MELTON
MELTON – BALLARAT
Single mode optical fibre cable system under consideration for field experiment in 1984/85 – as an extension to existing Melbourne-Melton coaxial cable. 140 Mbit Exhibition – Ballarat system proposed.
GEELONG
DAV stands for Data Above Voice. On each analogue radio bearer it is possible to install a 2 Mbit digital transmission system on a narrow frequency band above that utilized by the telephony system. The solution will be used extensively on intrastate trunk routes to meet data circuit requirements.
MELBOURNE – GEELONG
Study of high capacity
transmission alternatives in pr



DIGITAL TRUNK TRANSMISSION DEVELOPMENTS

NPAC USES MINI COMPUTER FOR FAULT FINDING

The State Network Performance Analysis Centre (NPAC) located in Windsor Exchange, under the control of Network Service Branch, has advanced into the 1980s with establishment of an on-line real time Network Call Failure Supervision (NCFS) System.

The NCFS samples live traffic in the network and details of any calls that fail are directly transmitted to the NCFS system mini-computer. Call failures are classified as follows –

- MFC Signalling Failure
- No Progress to SxS terminating
- No Progress to MFC terminating
- Triple Connection
- Congestion

The sampling is achieved from the register equipment within ARM, ARF, ARE and 10C exchanges. It is intended that most country minor and secondary switching centres and metro exchanges will eventually be connected to the NCFS System.

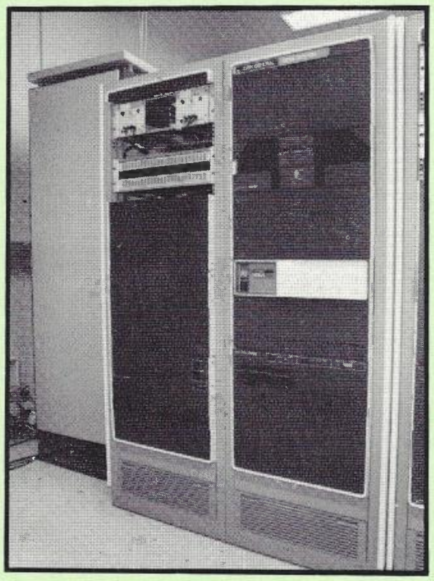
The NCFS computer programme relies on a network model data base. This data base is a comprehensive and detailed fiie containing information on exchanges, tandems and routes between tandems. As fault messages are logged by the NCFS mini-computer, the NCFS programme determines the trunking and the most probable point of failure in the switched network. The parameters required to derive the trunking come from the information content in the message and the information stored in the network model data base.

After a message has been analysed, it is stored with trunking information in the message file. The trunking detail allows rapid correlation with other messages in the message file. When the number of similar messages equals a pre-set action limit a pattern formation will result illustrating a fault in the network. At this point the NCFS system operator will assess the pattern and, where applicable, initiate fault location and repair action to be taken in the field.

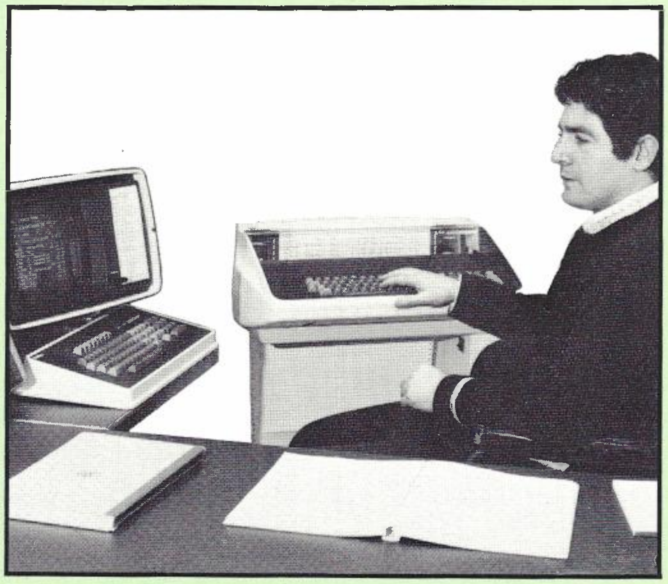
To ensure a responsive NCFS system, the operator is required to maintain the network model and its associated action limits by periodic updates to allow for changing network conditions.

As at September1982 approximately 55 exchanges are connected to the NCFS system. This represents a trebling over the last three months mainly due to the ARE-11 conversion programme and the relative ease of ARE connection to the system.

The NCFS system also provides for centralised monitoring of exchange performance in terms of switching and congestion loss.



NCFS Mini Computer



NPAC Operator at System Console and VDU

PRODUCTIVITY IMPROVEMENT IN MANHOLE CONSTRUCTION

Traditionally, large manholes have been built or cast in situ. Attempts to improve construction methods have produced small to medium manholes of concrete multi-slab construction which have been found to have structural disadvantages.

In a bid for improvement in productivity, quality control and installation methods, Primary Works engineers during 1976-77, in association with a Victorian manufacturer, developed the prototypes for prefabricated manholes in the following range –

PF4 – for routes 1-4 conduits
PF12 – for routes 6-12 conduits
PF20 – for routes 12-20 conduits
PCM – for 1-2 regeneration housings

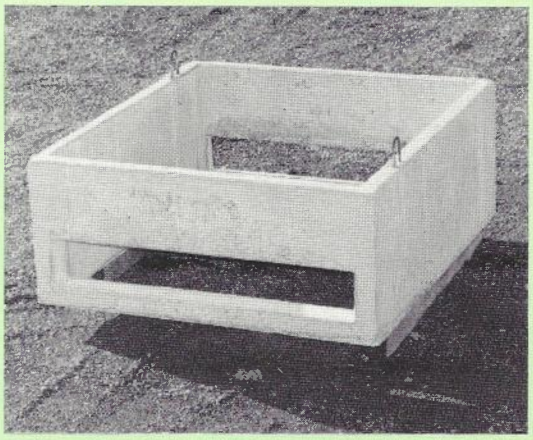
The PF20 consists of 4 wall slabs and a roof slab. Steel channel sections top and bottom locate and lock the walls in position and a recessed roof completes the rigid assembly. The other types are of monolithic construction.

When a prefabricated unit is installed, the void around the exterior walls is back filled with crushed rock, a floor is poured, and the cover and frame necked up and set to existing surface levels.

Chief advantages in the use of prefabricated manholes are –

- High quality structural product.
- Transport direct to the work site.
- Simple to install.
- Low cost future adjustment to changed surface levels.
- Significant labour savings.
- Facilitates installation of PCM regenerators.

Over the past 12 months some 300 of the larger manholes plus 95 PCM units have been installed in Victoria. In this period approximately 50,000 manhours have been saved by this method, achieving a total cost saving of approximately $600,000.



PCM manhole

Installation of PF20 manhole

PF12 manhole

LEOPARD CONVERSIONS GAIN MOMENTUM

LEOPARD (Local Engineering and Operations Processing, Analysing and Recording of Data) is an 'on-line' computer based system which substantially eliminates manual handling of Trouble Reports by Service Assistance Centre (SAC) operators and enables the Fault Despatch Centre (FDC) to operate with VDU's instead of dockets. Under this system, all relevant information on customer services is held in a computer data base which is accessed via Visual Display Units at FDC's, SAC's and District Offices.

In Victoria, by December 1982, approximately 1 million telephone stations will be serviced by the LEOPARD system; this figure will be extended to over 1.6 million stations during 1983, the entire metropolitan area.

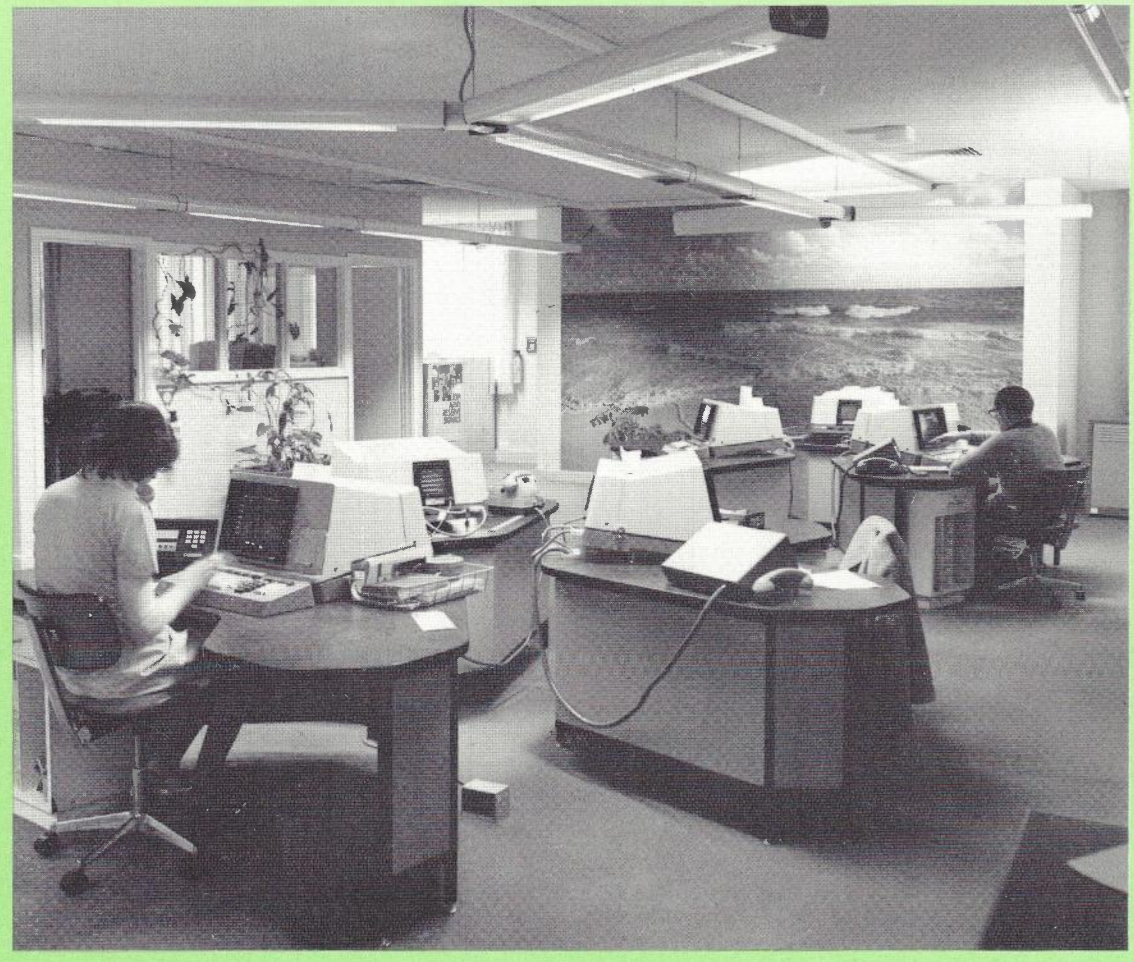
Footscray and Brunswick FDC's have been successfully operating with LEOPARD for some time. Hawthorn was converted in August 1982, whilst Northcote and Lonsdale are scheduled for conversion later this year followed by Cheltenham (presently Brighton), South Yarra and Clayton in 1983. Extension of the system beyond the metropolitan area is scheduled to be commenced in 1984.

At the Russell SAC, 12 operators now have VDU's for direct entry of trouble reports into the LEOPARD system. These operators serve the Footscray and Brunswick districts and have access to the fault status information required to handle customer enquiries. This facility will be extended to all metropolitan SAC operators by 1984.

Many of the benefits of LEOPARD are now being realised; these include direct access to legible and accurate records, (including fault status information), improved speed of attention, better management reports, improved customer service priority, increased identification of special problems, better work satisfaction and improved productivity.

For a LEOPARD implementation and running cost of $1.45/station/year, it is estimated that tangible benefits amounting to $3.82/station/year will be achieved. (Calculated over a 10 year period at 1980 prices.)

The LEOPARD project is being undertaken by the Design and Practices Branch with strong support from many other areas, particularly the Field Engineering, Construction and Buildings Branches.



MANUAL CONVERSION PROGRAM

The 1960 Community Telephone Network Development Plan for Australia, specified as a primary economic objective the need "to have all subscribers dial their own calls both local and trunk".

In pursuit of this objective, programmes of conversion of manual exchanges to automatic in Victoria have been achieved year by year, steadily bringing the balance of manual services down. During the 81/82 financial year alone a total of 20 manual exchanges involving 5,900 new lines of automatic equipment were cutover in Victoria.

The culmination of the Manual Conversion Programme in Victoria is now well in sight with only 13 manual exchanges remaining to be replaced by automatic exchanges. These are programmed over the next 2 years, 82/83 and 83/84.

With the completion of this programme of cutovers, the Victorian network will be fully automatic and all telephone customers will have the benefits of 24 hour service each day and the facility of National STD. It brings the network up to best of standards of any other telephone administration.

This programme has required, over the years, close co-operation between all Departments of Telecom.

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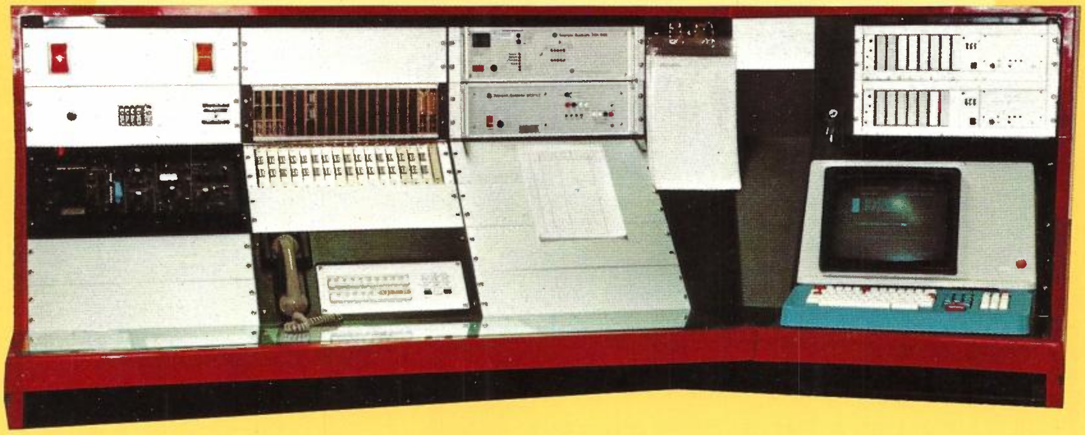
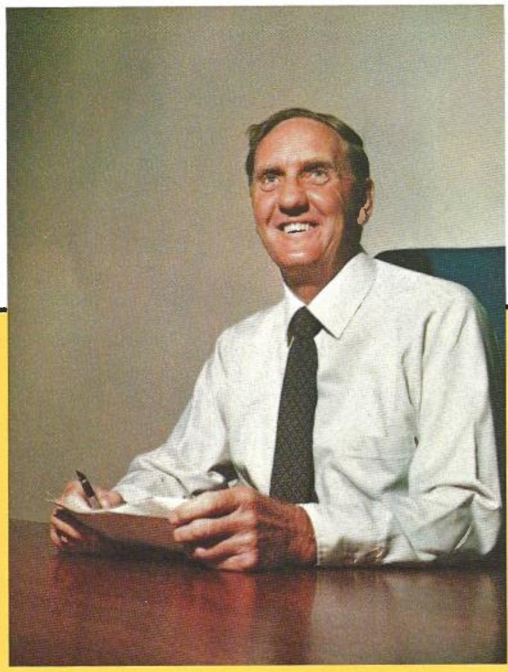


The Digital Data Network (DDN)

December 15, 1982 saw the public launch of the Digital Data Service (DDS); an inter-capital data network specifically designed for point-to-point and multipoint data communications provided by the Digital Data Network (DDN). The basic services offered by the DDS are synchronous leased services operating at 2400, 4800, 9600 and 48000 bit/Sec. The Services will be functionally similar to and plug compatible with the corresponding Datel Services. The service will be extended quickly to other areas in response to customer demand and will ultimately replace the existing Datel Service. Demand for data communications is very high and the growth rate is currently in excess of 30%. The DDN is being established to enable rapid service provision and restoration of dedicated data communication services in a far more effective and efficient manner than is possible via the Datel Service. It also has substantial economic advantages on transmission links as well as more efficient use of frequency spectrum.



From the Office of the Chief State Engineer

There has been a lot of activity recently in discussing the job the Engineering Department has ahead of it. We have received some very good advice from a variety of sources. As the custodians of "the network", it is our job to plan it, build it and develop systems and approaches to maintain it actively.

This issue highlights some of the services such as DDN and PSN which are made available as a result of our common carrier role. In the future we will see other kinds of networks and facilities emerging in response to pressure from customers to provide advanced services.

One of the aspects of a commercial environment is to provide the kind of service that people want, to provide it in terms of quality and reliability and at a competitive cost. But of course, it is also essential that we provide our services in a reasonable time frame although to bring forward some of the technology and facilities takes years. The development of major switching systems can really be undertaken only by large companies having multi-million dollar resources at their disposal. Some of the facilities can be, and should be, provided virtually on demand. We need to be able to differentiate between the two response times.

The implication is that, if we are going to be able to provide facilities quickly, there must be the elements of pre-provisioning of the major components of the network and that the fast response is applied only to equipment provided at the end of the network. This in essence is what the McKinsey recommendations say. However, the concept is no longer just words. Built into future works programs it is the provision of funds, material and resources so that we can quickly provide these kinds of services.

We need now to turn our attention to our Engineering Department organisation to streamline it, to ensure that the appropriate elements are grouped together enabling us to plan and construct the major network elements. More responsibly we have to meet the challenges by introducing the new technology and at the same time providing services with the kind of alacrity which is expected by demanding customers upon whose custom our cash flow depends.

Digital Data Service

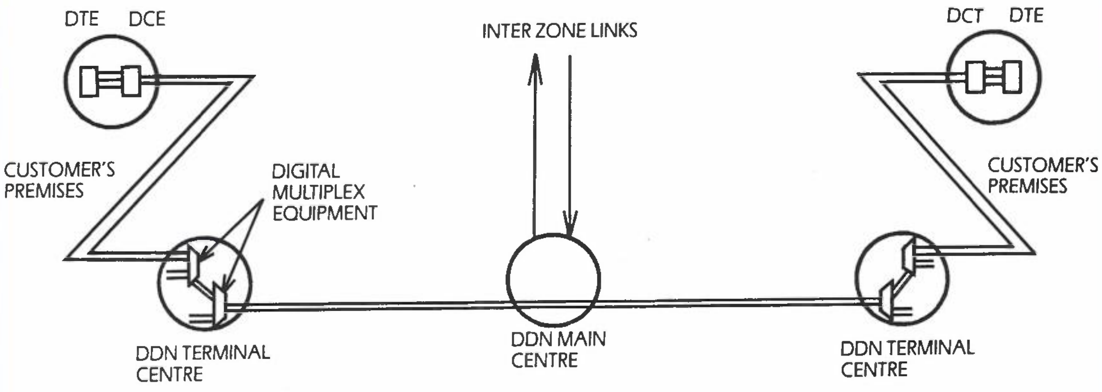


FIGURE 1. DDN BASIC STRUCTURE

The DDS provides new facilities that combine both transmission and multiplexing of synchronous data streams into 2 Mbit/S PCM streams from terminal centres located in strategic telephone exchanges to the Exhibition exchange Main Centre for intra and interstate cross-connection. These facilities will enable customers to make substantial cost savings, and with charges being less distance dependent, overall charges will in many cases be substantially lower than those of DATEL. However, DDS is also more attractive due to such features as:

- better quality transmission
- high reliability
- new network/terminal interfaces which are simpler, cheaper and provide new facilities
- network multiplexing to reduce the need for customer-supplied multiplexing equipment
- faster provision of services
- faster restoration of services
- flexibility, enabling customers to re-configure their networks to accommodate changing operational needs.

The basic structure of the DDN is shown above. It has been developed and established around a two level network hierarchy. These are the basic building blocks:

- Main Centres act as multiplex collection points for the DDN in their zones. They enable the semi-permanent cross-connection of data streams within the zone and between zones. They also contain the network synchronisation and network management systems. The main centres are interconnected by 2.048 Mbit/Sec PCM digital links on coaxial cable and radio bearers. From 1985/86, 140 Mbits/S digital radio systems will form the predominant intermain centre bearer. All of Victoria forms a zone with the Main Centre located at the new Exhibition exchange.
- Terminal Centres are focal points for multiplexing and transmission of customer data streams to the Main Centre. The terminal centres are located in telephone exchanges in accordance with demand requirements in particular areas. As DDS expands, the number of these centres will increase. Within the customers' premises data streams from the various Data Terminal Equipment (DTE) are multiplexed together by the Data Circuit Equipment (DCE) and transmitted to the nearest terminal centre via 4-wire subscriber and junction (if necessary) cable pairs. The data streams from the various DCE's, which could compose a mixture of synchronous data streams at various bit rates up to 48000 bit/S, are multiplexed at the terminal centre into a 2.048 Mbit/Sec stream. This stream is transmitted to the parent Main Centre by duplicated 2.048 Mbit/Sec PCM systems. In this manner, high reliability and good quality transmission will be assured. All data traffic between terminal centres traverses the parent Main Centre.

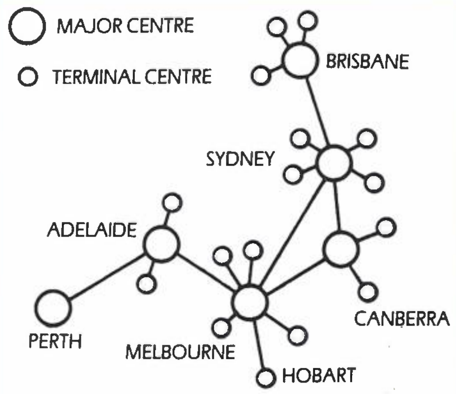


FIGURE 2. INTERCAPITAL DDS

Figure 2 depicts the Intercapital DDS at time of public launch. In the coming years the network will be expanded rapidly to other cities and country towns. By June 1985 the DDS will be available in over 100 cities and towns throughout Australia. The timing and location of this expansion will depend on demand requirements.

As mentioned, other major features of the DDS will be a flexible system, with fast provision and restoration of services. To realise these features, special network management equipment is installed as part of each Main Centre. As depicted in figure 3 the Main Centre consists of an equipment room and a Maintenance Control Room in which is located supervisory and specialised test facilities. The Maintenance Control Room is responsible for all digital links connected to the Main Centre and its Terminal Centres. Also associated with each Main Centre is a Special Services Restoration Centre (SSRC) which co-ordinates restoration and maintenance of services at the customer level. The subscriber test system is very comprehensive enabling the Network operators to:

- monitor the status of any multiplex digital link
- monitor the status of any customer link
- set up loopbacks at various parts of the customer network including the DCE
- inject and monitor test patterns on this looped circuit.

DDN customers can contact the SSRC directly if they experience service difficulties. The provision of these facilities as part of the Main Centre enables fast diagnosis of problems and quick restoration. Also the system can quickly respond to new customer demand as well as to existing customers wishing to reconfigure their networks.

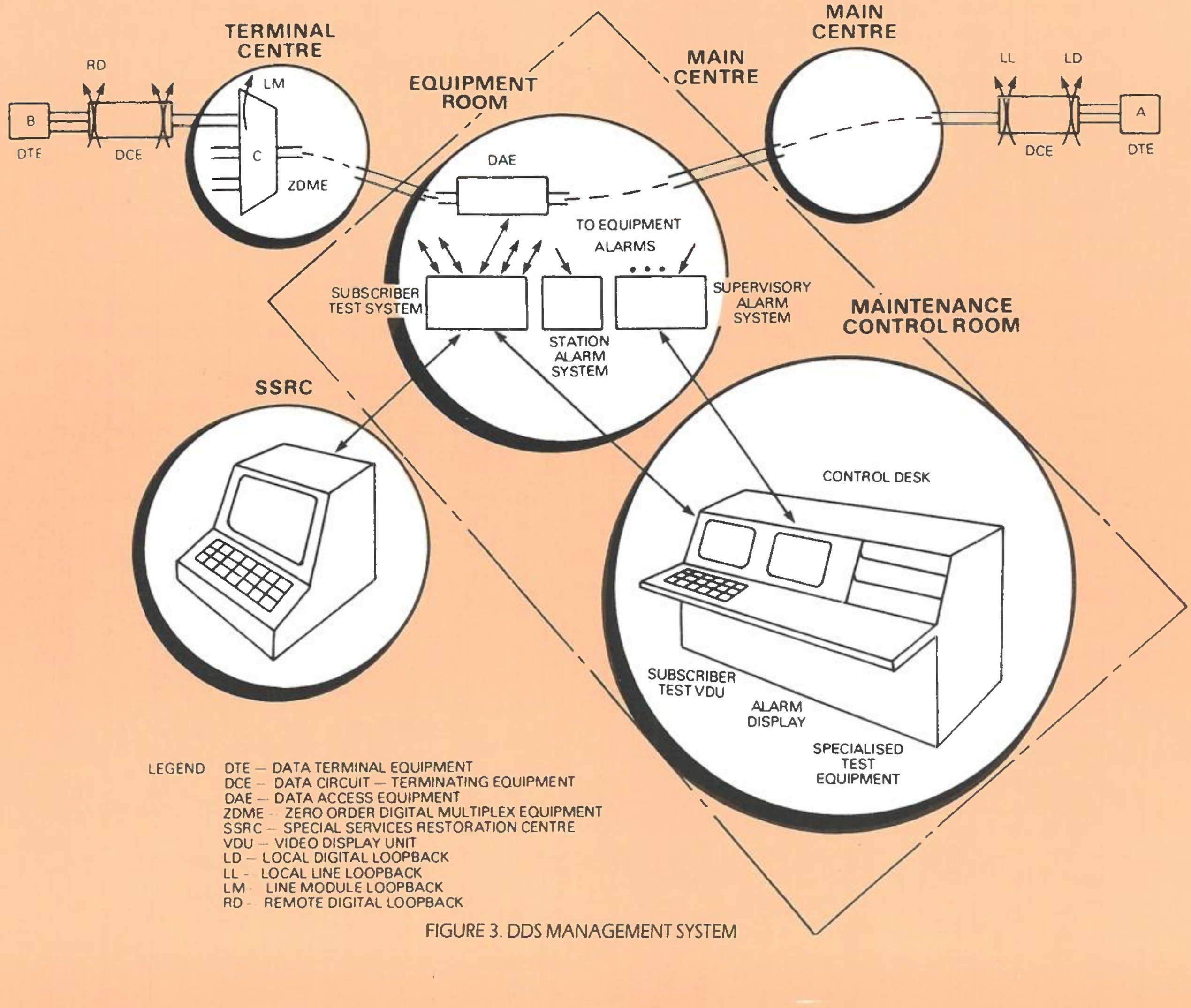


FIGURE 3. DDS MANAGEMENT SYSTEM

AUSTPAC (Packet Switched Data Service)

AUSTPAC, Telecom Australia's new packet switching data service commenced operation in December 1982. The service is distinctive from DDS and DATEL which provide dedicated data circuits for point-to-point and multipoint networks conveying large volumes of data. AUSTPAC, whose charging is distance independent, caters for data users who desire a flexible data network which can handle synchronous and asynchronous data streams of various speeds and protocols with smaller quantities of data. By means of channel sharing, AUSTPAC establishes a 'virtual circuit' between terminals by the packet switching technique. This nationwide service incorporates switching, transmission and network intelligence to solve many existing customer problems as well as providing a network to cater for new teleprocessing applications. It relieves many customers of the burden of designing, installing, maintaining and augmenting their own private networks.

What is Packet Switching? Packet switching is a store and forward technique in which data is split up into small segments of variable length up to a maximum of 128 octets (or 1024 bits of data), called packets, by the customer's computer or data terminal equipment (DTE). Each packet is switched and transmitted through the network independently of other packets belonging to the same transaction. Consequently, packets belonging to different messages can travel via the same data channel as no channel is exclusively reserved for a pair of terminals for the duration of the call. The communicating terminals are connected via a 'virtual circuit'. A virtual circuit is thus a logical association, for the duration of the call, between two communicating terminals. The switching of these packets is done by the Packet Switching Exchange (PSE) which comprises a minicomputer, disc memory, and multiprotocol ports. One PSE will be located in each capital city interconnected by 48 Kbit/Sec Links provided via the DDN. Victoria's PSE is located at the Windsor exchange. Terminals can access the PSE via the DDN or via the Public Switched Telephone Network (PSTN), Data Terminals utilising the PSTN, dial up the PSE via the PAD attachment (Packet Assembly/Disassembly). This enables low speed asynchronous terminals not equipped with packetising interfaces to access AUSTPAC.

Some features of AUSTPAC

Some distinctive features of AUSTPAC are:

- Simplification of communication control procedures and equipment – AUSTPAC reformats data from various terminals and protocols into a form suitable for host computer.
- Error correction – AUSTPAC checks packets for errors and will request retransmission of a packet if found faulty.
- Speed Change – AUSTPAC will enable communication between terminals operating at different bit rates.

Who will use AUSTPAC?

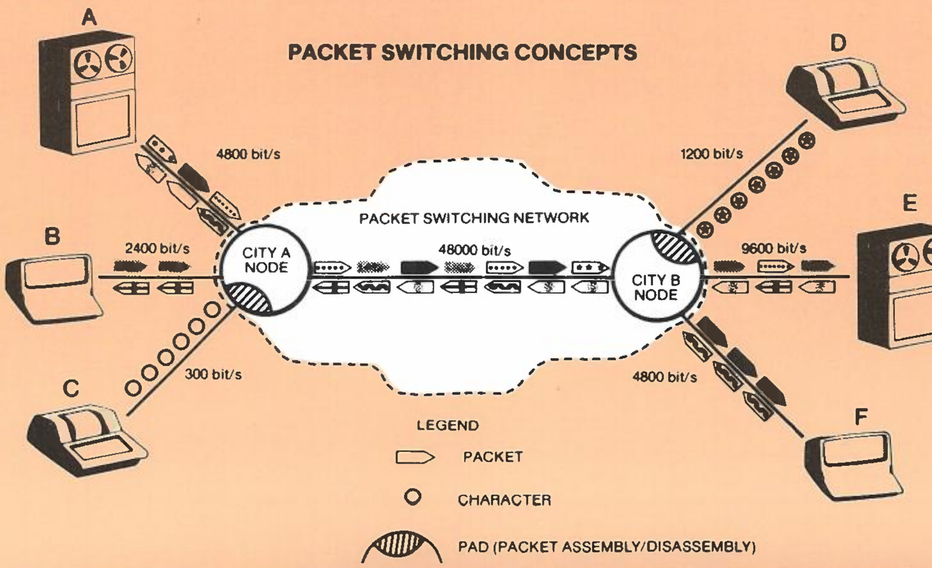
Most teleprocessing applications are suited to packet switched data communications services, in particular, the following application areas:

- where a large number of users transmit small volumes of data over long distances.
- where a large number of widely dispersed terminals access a common host computer in interactive mode with long pauses between accesses.
- where there is a requirement for communication between terminals with incompatible characteristics (speed, code, protocol).
- where terminals need to access more than one host computer.

New Target Areas

Some emerging applications that will require the data switching capabilities of AUSTPAC are:

- corporate data/message systems.
- electronic payment systems/electronic funds transfer systems.
- monitoring systems e.g. road traffic, environment.
- digital facsimile.
- electronic mail/text communication/teletex.



Network Management

The importance of the network to the nation as a whole is being highlighted through such reports as that recently released by the Davidson committee.

As we enter the "Information Era" the demands on the network will become more diverse with customers expecting faster response times and improved reliability to meet their particular requirements. This coupled with a network which is becoming more complex – integrated switching and transmission – greater use of centralised control systems – necessitates improvements in the management of the network from end to end.

Funds are being made available to achieve more reserve trunk capacity, diversity, reliability, along with improved monitoring and control of traffic and network/plant performance.

Material procurement procedures and installation programmes are being reviewed to accelerate executive decisions to enable quicker response to special services demand and additional circuits to adequately dimension the network.

An integral part of network management is the establishment of efficient network monitoring/analysis systems which will provide information for/on:

a. long term planning, design and construction of the network.
b. short term network relief.
c. network/plant breakdowns and restoration activities.
d. real time control of traffic.
e. indication of overall network performance.

NSW and Victoria have established task forces to carry out network management studies and Headquarters commissioned AT&T International to carry out a study of the NSW network and recommend a network management monitoring system which will lead to real time control of traffic.

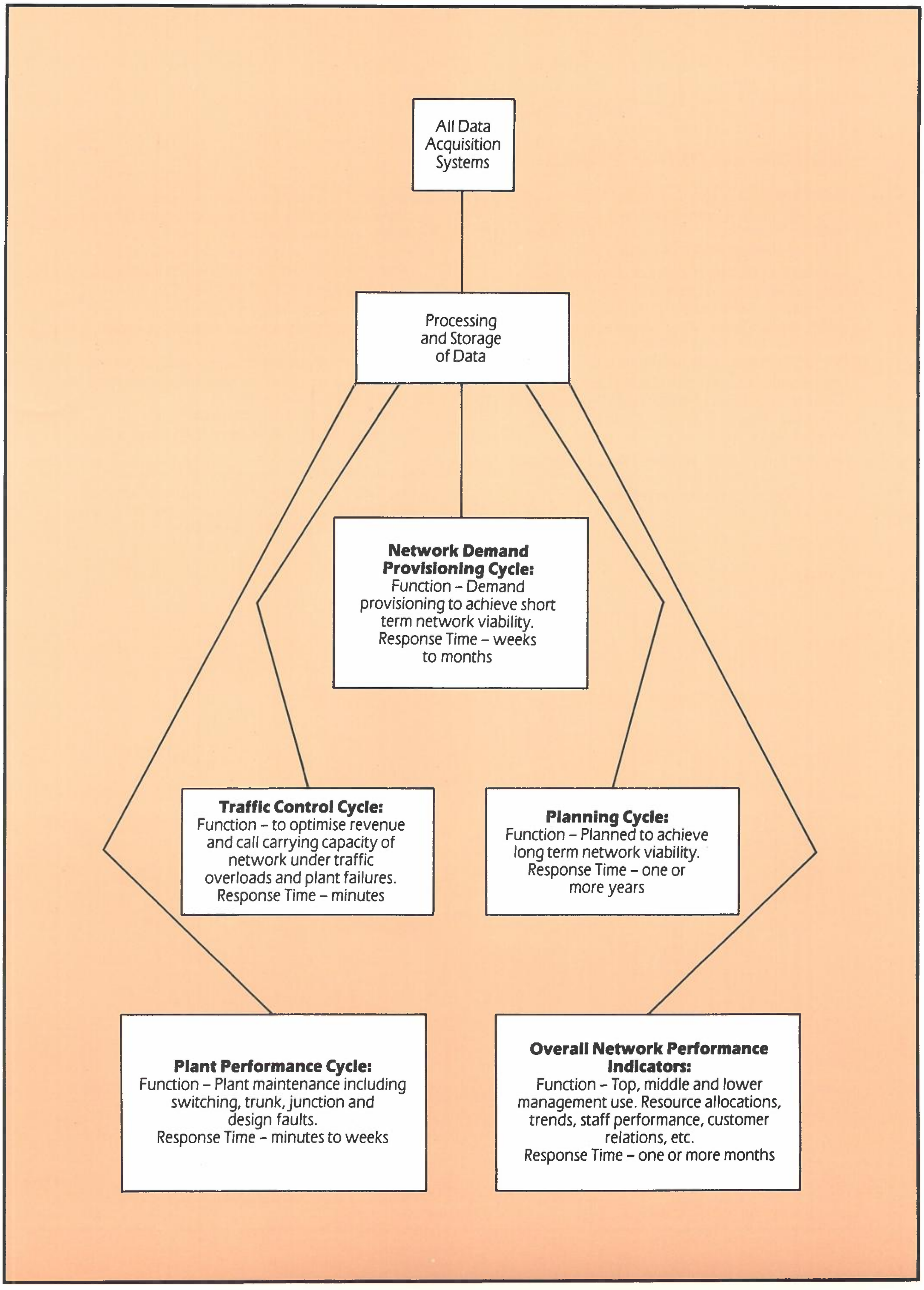
AOM CENTRE CLAYTON

The Victorian team has the task of determining network performance monitoring and traffic measuring requirements so that network defects can be readily identified, accurate data provided to achieve efficient dimensioning and optimisation of the network and actual performance compared against design and service standards.

The team will identify and bring together systems existing and becoming available to measure traffic, congestion, calls and network and plant performance to produce a coherent and accurate picture of the way the network is performing and so allow Telecom to be more responsive to network congestion problems and customer demand for network facilities.

For dynamic traffic control to be effective the network must be efficient and timely dimensioned to ensure that congestion does not exceed the planned target under normal network conditions and that all plant is maintained at the optimum performance level with a minimum of non-availability of plant for service at any time. The Project Team has given first priority to this aspect of network management as trunk network congestion is seen as a major problem in the present situation of insufficient capacity in the Trunk Network and increasing demand by customers for additional network services.

In the face of possible competition in the trunk network area and the fact that a major portion of Telecom revenue is generated from STD calls, it is essential that an efficient and economic network be established and maintained. This can only be achieved by the introduction of modern network management techniques which are being developed by the Network Task Force working in close liaison with other groups in Victoria, NSW and Headquarters.


All Data Acquisition Systems
Processing and Storage of Data
Network Demand Provisioning Cycle: Function – Demand provisioning to achieve short term network viability. Response Time – weeks to months
Traffic Control Cycle: Function – to optimise revenue and call carrying capacity of network under traffic overloads and plant failures. Response Time – minutes
Planning Cycle: Function – Planned to achieve long term network viability. Response Time – one or more years
Plant Performance Cycle: Function – Plant maintenance including switching, trunk, junction and design faults. Response Time – minutes to weeks
Overall Network Performance Indicators: Function – Top, middle and lower management use. Resource allocations, trends, staff performance, customer relations, etc. Response Time – one or more months

SULTAN – Subscriber Line Test Access Network

Footscray pilots Sultan

SULTAN (Subscriber Line Test Access Network) is a computer based system which will improve the reliability, extent and accuracy of customer line testing at Test and Service Assistance Centres (SAC's).

Accessing and testing of customer telephone lines is obtained via a Test Communications Controller (TCC) minicomputer which responds to commands from tester visual display units. Microprocessor Robot Testers (MRT's) located in exchanges greater than 300 lines perform tests under the control of the TCC.

At the SAC's, operators use VDU's to link into both SULTAN and the LEOPARD record system via Operator Communications Controller (OCC) minicomputers.

SAC's and Test Centres in Victoria are planned to be served by 22 minicomputers located at the Windsor and Exhibition communication centres.

The pilot TCC installation is currently being tested by staff at the Footscray Fault Despatch Centre. Shortly the first OCC installation at Windsor will be commissioned for initial use by operators at the Russell SAC. Full implementation of SULTAN throughout Victoria is scheduled to be completed by 1985/86.

Some of the main benefits of SULTAN are:

- The SAC operators will have national test access.
- Tests carried out for the operator are stored and forwarded in more detail to the tester, this provides the tester with a record of the line conditions as tested at the time of initial report.
- Accurate testing of open circuit faults.
- Improved testing at selected small country exchanges.

SULTAN has been designed by Headquarters Engineering and is being implemented by Design and Practices Branch with strong support from Construction Branch and Operations Department.

Prototype Sultan test work station

CENTOC IMPLEMENTATION (Daily Traffic Recording)

CENTOC (Centralized Occupancy) is a minicomputer based system developed by Telecom to provide an economic means of continuously measuring the traffic (number of calls simultaneously in progress) on selected trunk and junction routes. Microprocessor controlled Remote Traffic Monitors (RTMs) installed in exchanges sample the traffic per route at 3 minute intervals and transmit the sample values to a minicomputer installed at a central location. The minicomputer receives the data, checks for errors, then summarizes and stores the data on disk. The stored data is accessible to users via both local and remote terminals.

Large numbers of RTMs can be connected to the minicomputer via a shared telemetry network in which RTMs can branch or chain the telemetry link to other RTMs. At a monitoring rate of 75 or 150 bits per second such a network requires only 8 input ports to the minicomputer itself even though each RTM is capable of monitoring up to 128 individual groups of circuits.

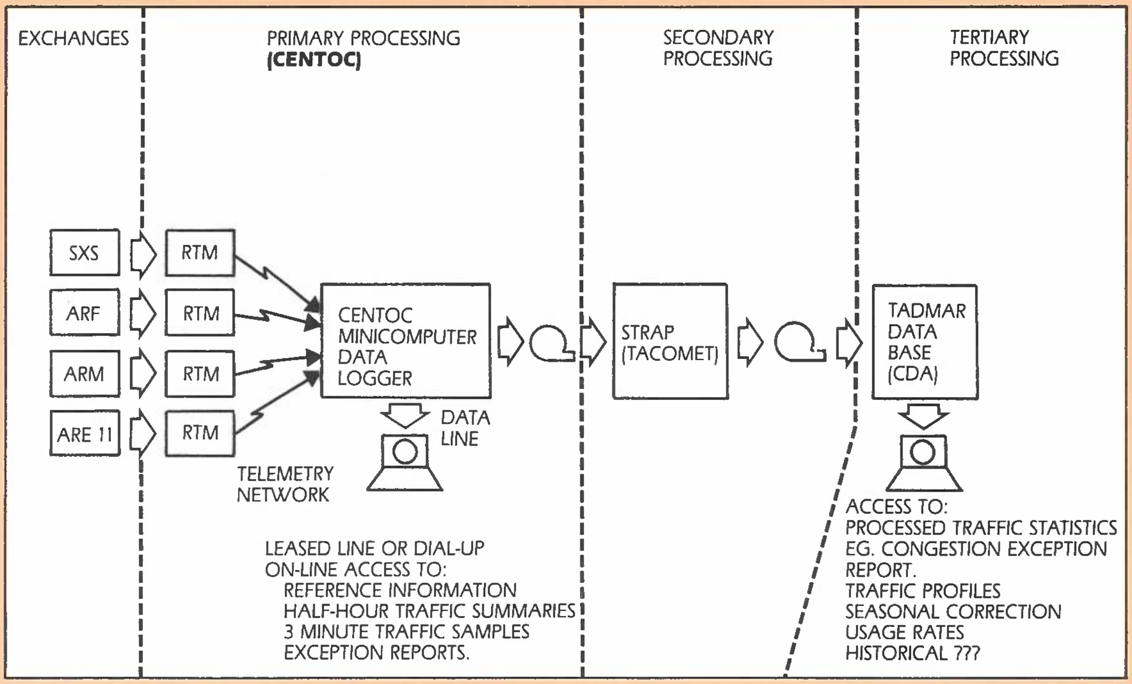
At the end of a weekly cycle the minicomputer offloads the data into magnetic tape for further processing on TACONET by the processing program STRAP (Secondary Traffic Processor) and subsequent transfer to the traffic data base TADMAR (Traffic Data Management Analysis and Reporting). The accompanying diagram shows the data flow through the systems and the points at which data is available to users. For further information interested readers are advised to seek out the CENTOC "black brochure" issued by HQ last year.

Victoria's CENTOC minicomputer is installed at the traffic engineering field office located at 441 Lonsdale Street. Our first 16 RTMs have been installed at ARM exchanges which includes all secondary switching centres except Bendigo, at metro zone crossbar tandems, and at selected minor switching centres. Outer metropolitan crossbar tandems and more minor switching centres are programmed in 1983/84 followed by metropolitan terminal exchanges in 1984/85.

CENTOC is not applicable to 10C exchanges or to AXE exchanges. An alternative technique producing a similar result will be available for 10C exchanges early this year, and a separate minicomputer system called TRAXE is being developed for AXE exchanges.

These significant advances in traffic monitoring, recording and processing will produce substantial benefits not only for the Engineering Department but also for Commercial and Operations Departments. Some of the main ones are as follows:

- Early warning of potential congestion on particular routes.
- Early identification of unforeseen traffic load.
- More accurate traffic forecasts due to better seasonal correction factors possible from more comprehensive data.
- Accurate monitoring of traffic trends resulting from commercial decisions such as tariff reductions.
- Direct access to up-to-date traffic data.



Extension to Melbourne's Tunnel System

Melbourne's original underground cable tunnel system, as shown on the accompanying diagram, was constructed in 1909 to accommodate cables radiating from Central Manual Exchange. Subsequently, Melbourne's first City Automatic Exchange, City West, was connected into the system in 1938. Further development then saw the new Batman and Russell Exchanges linked into the system in the mid 1950's followed by Lonsdale Exchange in 1970.

The original tunnel system was designed to accommodate relatively bulky cables of the day containing up to 540 pairs of wires from 0.72 to 1.47mm in gauge. Subsequent reductions in wire gauge resulting in increases in cable size to up to 4000 pairs, together with the advent of coaxial cables with up to 2700 channels on one pair of tubes, had the effect of extending substantially the expected capacity of the original system.

Nevertheless, by the mid 1970's the Queen Street tunnel between Little Bourke and Little Collins Streets was becoming seriously congested. The need had also arisen to link the tunnel system with the new Exhibition Exchange, to provide relief to the main Eastern outlet tunnel in Little Collins Street and at the same time provide for an alternative cable network strategy via the City Area.

A tunnel requirement plan, which was developed by Engineering – Planning and Programming Branch, included:

a. Duplication of a section of the existing Queen Street tunnel.

b. A new tunnel in Lonsdale Street between Queen and Spring Streets, with connecting tunnels to the existing tunnel in Russell Street and to the new Exhibition Exchange in Exhibition Street.

c. A short section of tunnel on the North side of Exhibition Street to the corner of Victoria and Rathdowne Streets;

together with associated loading coil chambers and interconnecting chambers with the existing or proposed duct system.

The feasibility of such a proposal was investigated and confirmed by the Department of Construction. A Project Team comprising the Department of Construction Branch and Telecom Engineering – Buildings, Planning and Programming Branches was then established to handle the project. Other Branches were co-opted as required.

Extensive survey and design work ensued including numerous consultations with other authorities. Ground conditions, service locations, structure footings and access to existing tunnels were all investigated in detail ultimately resulting in a design contract, drawings and specification.

Tenders closed in early 1979 and the contract was awarded to a consortium known as Codelfa/Cogefar in Joint Venture. Other works such as monitoring ground movement, surveys, relocation of underground services, insurance policies and consultants fees were handled separately to the contract. The total overall cost of the project including the Department of Construction on-cost fees amounted to approximately $6.35m.

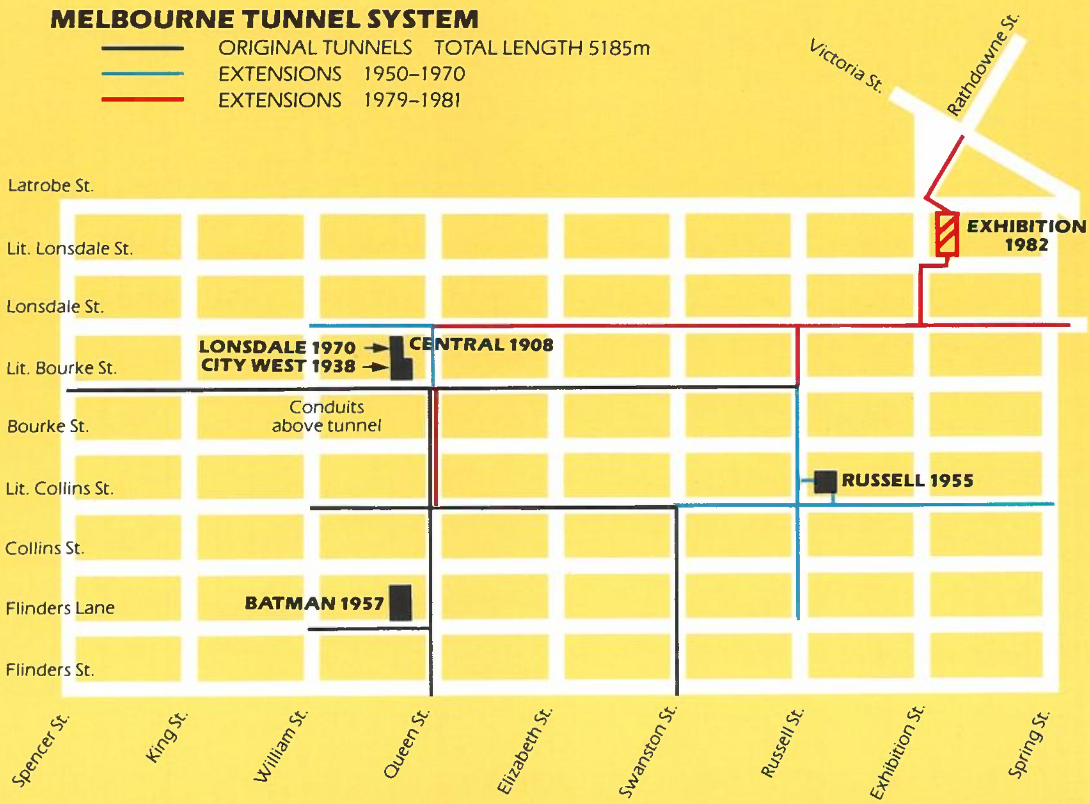
The project included 1850 metres of concrete lined tunnels of either 2.5 or 3.6 metre internal diameter, each having a number of loading coil, jointing and access chambers. In addition, several vent shafts had to be strategically located as part of the ventilation of the tunnel system.

The bulk of the tunnel excavation was carried out using an Alpine mining machine which gave an average face advance of 2.55 metres per 8 hour shift. The best shift advance was 7 metres. Spoil was removed from the tunnel by rail trucks hauled by a diesel hydraulic locomotive and then dumped by a self-propelled pneumatic tippler onto the surface work site opposite Exhibition Exchange.

After each 1 metre excavation, rapid primary support was installed in the form of steel arches supporting longitudinal timbering. Following complete excavation of the tunnels in this manner a mobile pneumatic/hydraulic controlled formwork carrier was introduced which could hold up to 36 metres of steel formwork in place whilst concrete was pumped between the formwork and the excavated tunnel surface. Steel arches and timbering were entombed in the process. Approximately 76 metres of concrete lining was achieved per week resulting in a total of some 9000 cubic metres of concrete for the full installation.

Completion and integration of the Queen Street tunnel with the existing tunnels was completed in August 1980. The Lonsdale Street/Exhibition Street tunnels, including integration with the new Exhibition Exchange cable chamber, were completed in December 1981. All tunnels have since had cable racking installed by Primary Works and installation of initial cables is proceeding.

Steel supports to double width of tunnel, Exhibition St.



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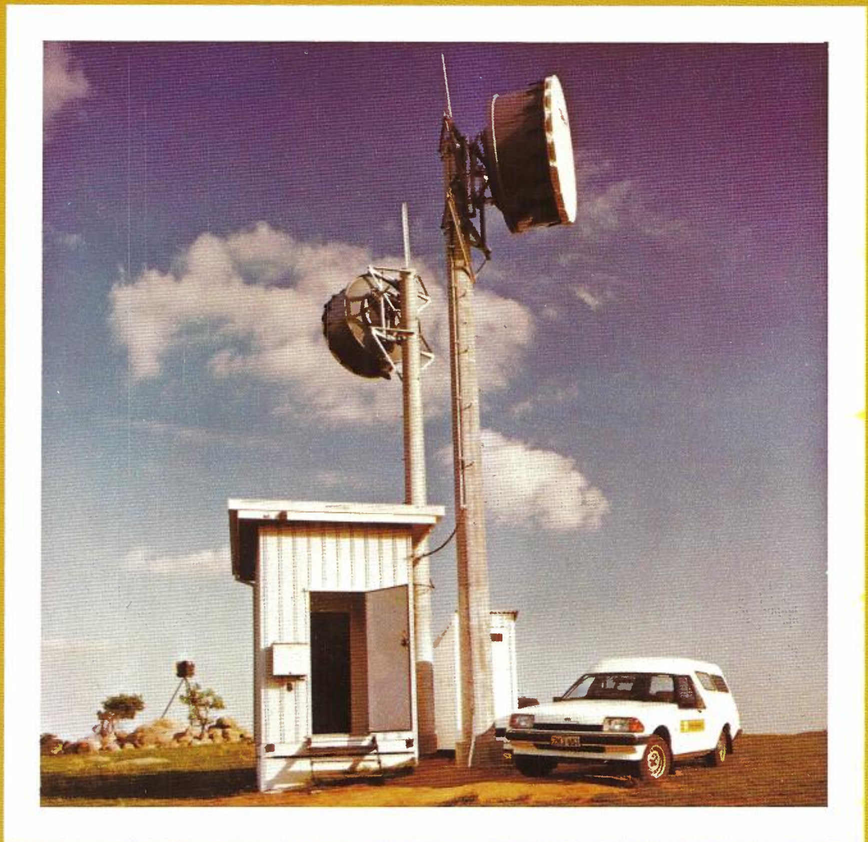
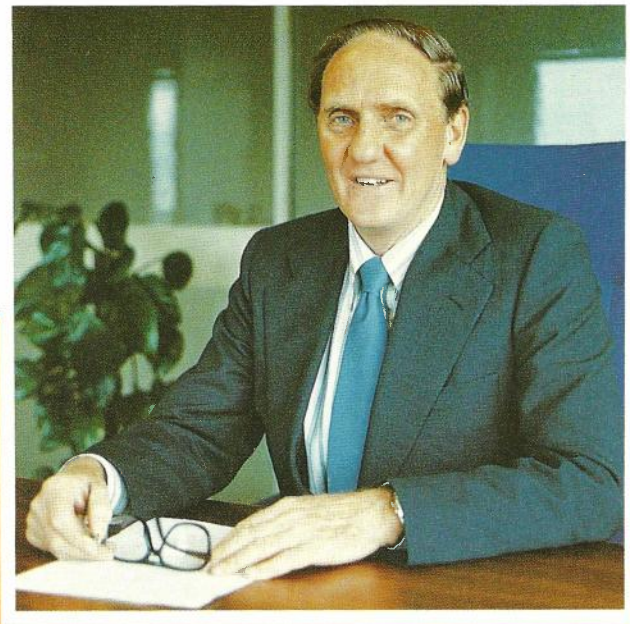


1st Digital Radio System For Melbourne Network

The above photograph shows the radio regenerator at Gellibrand Hill East of the Melbourne Airport for the Lonsdale-Sunbury Digital Radio System. This 34 Mbit/s digital radio system now being installed operates in the 13 GHz band and is the first such system in the Melbourne District. The building accommodates the regenerator equipment which is connected by elliptical waveguides to the two 1.8m dish aerials, mounted on two 10m concrete poles.



From the Office of the Chief State Engineer

Browsing over past issues of this bulletin provides a good insight into what we are achieving. Every Branch contributes; the long term planning framework, the construction of buildings and plant and the management, operation, maintenance and repair of systems, facilities & services.

We cover a lot of ground and it helps if we can appreciate what our colleagues are doing.

The same principle applies on a national scale. Policies don't appear overnight. They develop over time as the need is perceived to decide an approach in conformity with the Commission's charter.

Our General Manager, Engineering, Mr K.J. Simpson, has seen to it that State Engineering Departments are aware of the lines of policy development and the emerging technological and management implications at the formative stage.

We know what to expect.

He sees so clearly the direction in which the Engineering Department as a whole should be heading and has done much to sharpen perceptions and understandings. He has pressed for improvement in organisation to reflect his progressive approach.

He is retiring now at the peak of his distinguished career and we wish him well.

J.M. Ryan
CHIEF STATE ENGINEER

The Lonsdale-Sunbury Digital Radio Link

The microwave radio link being installed between Lonsdale and Sunbury is part of the growing digital network in the Melbourne metropolitan area. Initially it will augment existing channels to Sunbury but will later form part of the Integrated Digital Network (IDN). It is the first of several such installations planned as junction routes in the metropolitan area. A second radio link is scheduled for Lonsdale-Whittlesea with a regenerator on Joyce Hill at Yarrambat.

Since the late 1970's, digital systems on pair cable (PCM 30) have been installed in rising numbers, with optical cable and microwave radio now being planned for higher order systems. On 10 March 1982, approval was granted for the introduction of digital instead of analogue radio systems, where economically justified, for junction routes in urban and rural areas. In general, a radio link is an economic means of junction relief where there are no available ducts, distances exceed 30Km and the terrain is suitable. Such a situation prevails on the Melbourne to Sunbury route, with the cost of the radio installation only about half that of an alternative cable link.

A further application for use of radio on junction routes is where the uncertainty of growth exists thereby enabling permanent works, such as cable and duct relief, to be deferred until a definite trend is established. The use of radio in such circumstances has the advantage of relatively rapid establishment, simple upgrading and, if necessary, subsequent recovery and use elsewhere. Moreover, there will be little impact on staff levels and work performance, and only minor effects on training for a small number of specialist radio construction and maintenance staff.

The Lonsdale-Sunbury radio link comprises two hops, with a regenerator on Gellibrand Hill, just East of the Melbourne Airport at Tullamarine. The Lonsdale-Gellibrand hop is 19.3Km and the Gellibrand-Sunbury hop is 15.1Km. The total system is being provided initially as a fully engineered field trial and as such, will be used to evaluate the installation and operation of a short haul radio system where aesthetic considerations are important and space limitations prevail. These issues are relevant for Gellibrand Hill, which now forms part of the Gellibrand National Park being developed by the State Government. The site on which the regenerator hut, concrete poles and aerials were installed measures only 8m x 8m.

The required elevation of the aerial at Sunbury has been achieved by a single concrete pole, height 20m, located directly behind the exchange building. On Gellibrand Hill, there are twin concrete poles 10m high close to a beacon light operated for the benefit of aircraft. The actual regenerator is within a portable ARK building with elliptical waveguide feeds to the two aerials on the poles. At Lonsdale, the aerial is supported on a small tower situated on the roof of the building itself. At all three locations, the circular dish-like aerials are 1.8m in diameter.

The radio equipment for the link has a transmission frequency of 13GHz and a bearer capacity of 34 Mbit/s (which corresponds to 480 telephony channels when fully equipped). By providing diplexing equipment at the radio front end, additional radio bearers can utilise the same waveguide and aerials, each with a further 34 Mbit/s capacity. Hence, ready augmentation of this new link is possible as circuit demand necessitates.

Currently, there are approximately 500 telephony channels on junction circuits between Lonsdale and Sunbury, of which 380 are via the Melbourne-Bendigo coaxial cable which passes through Sunbury. The remaining 120 are on Z12 systems between Sunbury and Melton, and extended on the Melton-Footscray-Melbourne coaxial cables. Subject to satisfactory field trial performance of the radio system, about one third of the circuits now on the Melbourne-Bendigo coaxial cable will be transferred to the new radio link during 1984/85 with an additional third to be transferred the following year. The Z12 systems via Melton will be maintained as an alternative route between Melbourne and Sunbury while the remaining capacity on the microwave radio system will accommodate junction growth. Some of these circuits are to be extended via 2 Mbit/s systems on existing pair cable from Sunbury to Diggers Rest to meet both circuit growth and transmission standards.

Sunbury Tower

Melbourne Telecommunications Development Plan 1982-1990

Copies of the Melbourne Plan, as illustrated, were recently distributed to all Victorian Departments, Engineering Departments of other States and Headquarters. The plan follows on from the Victorian Telecommunication Plan featured in Issue 1 of Engineering '82 and applies the broad network development strategies expounded in the State Plan specifically to the Melbourne Metropolitan area.

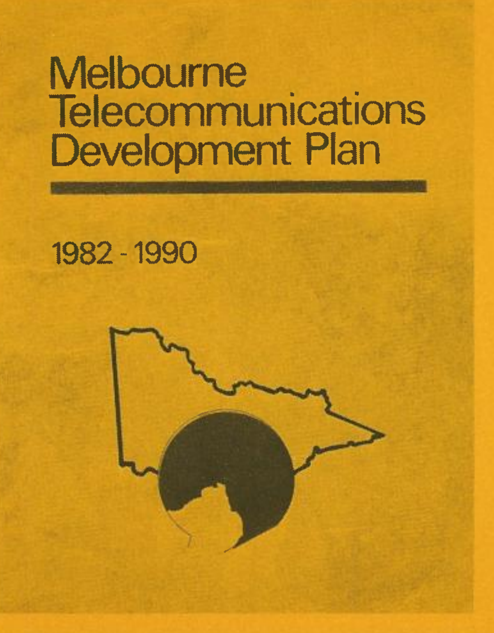
Major thrusts of the Melbourne Plan are:

- Establishment of the Integrated Digital Network (IDN).
- Revision of the Metropolitan transmission plan.
- Establishment of an AXE "presence" at most Metropolitan exchanges by 1990.

A significant feature of the plan is the proposed acceleration of the IDN into the metropolitan network compared with the proposal presented in the State Plant only 12 months ago. Virtually the year 2000 scenario for Melbourne in the State Plan has been advanced to the year 1990.

This does not represent a massive change to the overall exchange equipment installation programme in the metropolitan area but rather a more even spread of AXE equipment installation. It is now clear that the potential for advanced customer facilities is much greater on digital AXE equipment, than on ARE equipment, which being analogue, is now destined to receive only minimal software advancement in the coming years. This does not mean that ARE equipment is obsolete, it merely has limited economic potential for advanced facilities compared to AXE. For general interest a chart of customer facilities available and proposed is shown in Figure 2.

Naturally the advanced volume of the AXE installation necessitates an acceleration in the digital transmission programme resulting in earlier establishment of higher order digital transmission systems as outlined in the State Plan of June 1982. Approximately 5000 2Mbit/s digital paths are planned for the Melbourne metro digital network by year 1990. These are to be provided over pair cables or via 34 Mbit/s and 140 Mbit/s higher order systems on both radio and optical fibre bearers.



FACILITY	SXS	ARK	ARF	ARE	AXE
NETWORK CONFERENCING	*	*	*	*	*
CENTRALISED INTERCEPTION			*	*	*
CALLING LINE IDENTIFICATION			*	*	*
ISD/CCR			*	*	*
STD/CCR			*	*	*
INCREASED SUBS CLASSIFICATIONS			*	*	*
REMOTE CONTROL OF SUBS CLASSIFICATIONS				*	*
VF PUSH BUTTON TELEPHONES				*	*
ABBREVIATED DIALLING				*	*
HOT LINE				*	*
HOT LINE WITH NORMAL DIALLING				*	*
THREE WAY CONFERENCE CALLS					*
CALL DIVERSION					*
CALL WAITING					*
AUTO REDIAL					*
ABSENT SUBSCRIBER					*
DO NOT DISTURB					*
PRIORITY CALLING					*
'64 kbit/s' SERVICES					*

Figure 2

Structure of the Melbourne Network

The establishment of an Integrated Digital Network (IDN) in the metropolitan area will be effected as an overlay to the existing analogue network. The basic building blocks of the digital network are digital transmission paths (for example, 2 Mbit/s PCM path) and the AXE digital exchange equipment using the Group Selector Switch (GSS-D). This combination of digital transmission and digital switching systems forms the Integrated Digital Network. One advantage of this network is that the digital transmission systems can be operated at 0 dB loss irrespective of distance and the Digital Group Selector can be used in a terminal, tandem or trunk switching situation. A further advantage of the digital GSS is that it enables the use of digital Remote Subscribers Stage (RSS) with consequent economies.

The opportunity to utilise digital transmission has led to a revision of the metropolitan transmission plan with overall transmission improvement. Within the IDN the loss will be 6 dB as compared to an upper limit of 12 dB for the analogue network with a range from 6 to 12 dB on the digital – analogue interworking arrangements. Figure 3 depicts some of the link losses that will apply in the analogue and digital networks. A further advantage of using 2 Mbit/s digital paths is that they can be multiplexed into 34 Mbit/s and 140 Mbit/s transmission streams for digital radio and optical fibre systems.

For switching purposes the IDN will be a three level hierarchy with terminal, tandem and trunk exchanges each utilising AXE exchange equipment. At the terminal level the exchanges are referred to as either nodes which incorporate a processor controlled GSS and a local subscriber stage (LSS) or a Remote Subscriber Stage (RSS) which is connected via PCM systems back to a convenient nodal GSS. The tandem and trunk levels consist entirely of processor controlled GSS equipment. Figure 3 depicts the structure of the IDN overlay. The figure also outlines the digital/analogue interconnect routes and trunk network access routes.

The establishment of an IDN as an overlay network not only enables the development of entirely digital exchange-to-exchange circuits but facilitates the future integration of the Special Services Network, the Digital Data Network and the Packet Switched Network as an Integrated Services Digital Network (ISDN) in the 1990's. With the expected close-off of crossbar equipment purchases in the period 1986 to 1988, the progressive recovery of step-by-step equipment and the eventual recovery of crossbar equipment, it is expected that the IDN overlay will ultimately eclipse the analogue telephony network. In the interim, to enable the economic provision of advanced facilities outlined in Figure 2 it is planned to provide an AXE "presence" at most metropolitan exchanges by 1990. This will be achieved by the establishment of 39 nodes (with an associated LSS) and 95 RSS's as well as Tandem T1/T2 switching stages at Exhibition and Windsor. The establishment of these digital switches will in turn require the establishment of digital transmission paths on virtually all metropolitan routes.

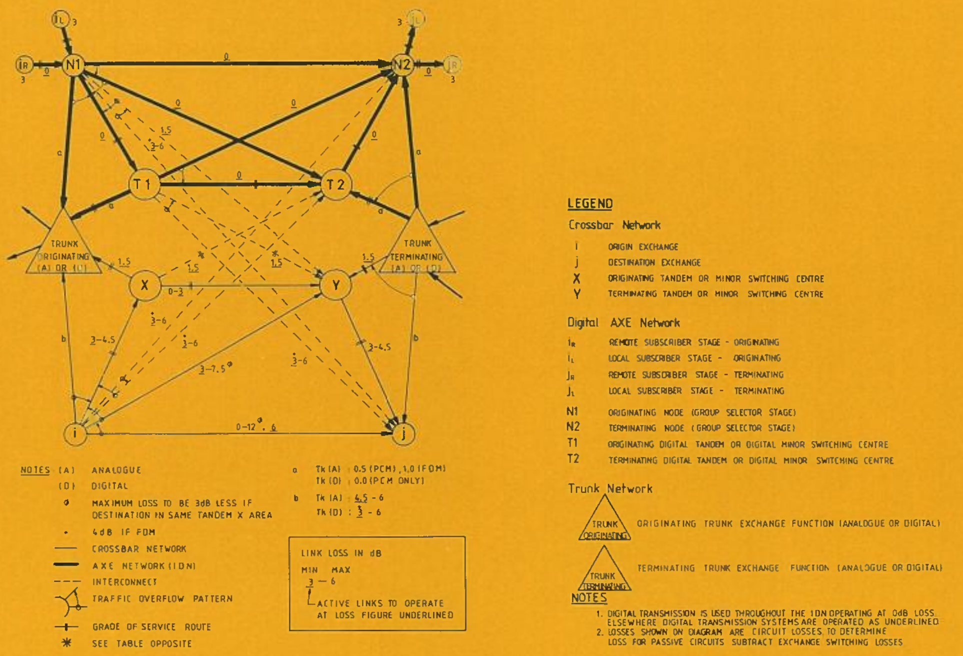


Figure 3

Manual Assistance Plan for Victoria

The Need for Modernisation

In the early days of telephony when all exchanges were manually operated manual assistance was provided by the local telephone operator. Information not readily at hand was obtained by calling other operators. For example, it was not necessary for every operator to have the directory numbers for subscribers in other areas. The call could be set up knowing only the subscriber's name and exchange, the number being known to the operator at the destination exchange. Service difficulties and faults were reported to the local telephone operator, although to the operator who set up the connection and supervised the call, the fault was often apparent first.

When automatic switching was established, a need arose for Manual Assistance Centres to provide trunk call connection, directory numbers, service assistance, a reminder service and interception or redirection of calls to changed numbers.

In this article consideration is restricted to the directory assistance and service assistance aspects of the manual assistance plan. These services were previously provided on a local area basis. In recent years a typical country Manual Assistance Centre provided assistance for about 40 000 subscribers. The various factors which made this an inefficient means of providing service were:

- The small quantity of traffic for each service leads to an inefficient use of operators.
- Records had to be kept and updated – directory information for the whole of Australia is kept at each Manual Assistance Centre.
- Each centre must be staffed on a continuous basis.
- Information not readily at hand must be obtained from distant Manual Assistance Centres, local Fault Dispatch Centres and Operations District Offices.

Because of its size, the Melbourne metro area manual assistance service has for many years been divided into specialised Manual Assistance Centres, e.g. "03" closed numbering area directory assistance (Hawthorn), other directory assistance (Windsor) and service assistance (Russell and Windsor). These services rely heavily on paper records and dockets, as well as the necessity to call other operators and centres for further information.

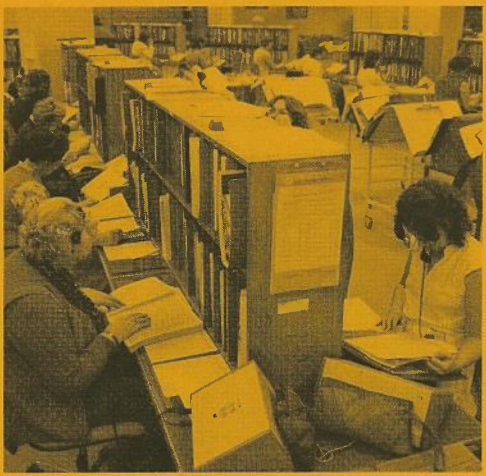
Modernisation Through the MAC Plan

The MAC Plan provides for the pooling of traffic for each service, and the use of modern processor controlled equipment for:

- Complete elimination of paper records and dockets.
- Acceptance of calls in order of arrival (Queuing).
- Through-connection of calls where necessary.
- Information retrieval and input.
- Remote operator working.
- Interworking with other users, e.g. Fault Dispatch Centres, Directories Branch and other Manual Assistance Centres.

The attainment of these objectives calls for the introduction of Automatic Call Distribution facilities (NACD), Directory Assistance Computer System (DACS) and Service Assistance Systems – LEOPARD and SULTAN.

The plan enables opportunities for employment in country centres and at established Manual Assistance Centres in the Melbourne metropolitan area to be maintained. Assistance Centres will be located remotely from their switching machines and data processors, being inter-connected by 4W voice circuits and data links. All switching connections will be made via their parent switching machine, which may be up to several hundred kilometres from the operator's position.



Old Directory Assistance Centre

Modern Directory Assistance Centre

The Directory Assistance Service Computer System (DAS/C)

DAS/C is an interactive system which combines the judgement and decision making abilities of the human operator with the computer's ability to rapidly search large volumes of data. It completely eliminates the need for paper records.

The operator may key-in up to four of the following basic elements, but usually less are required.

1. The Finding Name, which is the name under which the individual, business or government department is listed.
2. The Locality, which is the suburb, town or area in which the customer resides.
3. The Street Name.
4. The type of listing, i.e. residential, business or government.

It is not necessary or desirable to fully spell each element entered. Truncated entries, e.g. BRO for BROWN save on operator keystrokes and the computer searches the listings and determines a "weighted match" value for all entries which are reasonably close to the keyed data. The effect of minor mis-spelling of names or incorrect specification by the enquirer is thereby minimised, and the full power of computer searching is utilised to maximise successful searches. With just a few keystrokes, a trained operator can cause about ten entries to be displayed on the VDU, and then select the most likely entry from the list. In the event that this is not the listing required by the enquirer, other reasonably matched entries are available on the screen as possible alternatives.

The keyboard has been arranged for optimum efficiency. As well as alphabetic keys in a standard typewriter arrangement, there are several additional keys which allow the most frequently used words to be generated by a single keystroke, e.g. HOTEL, BANK, FLORIST, RES (Residential), BUS (Business), GOV (Government), etc.

Network Automatic Call Distributor (NACD)

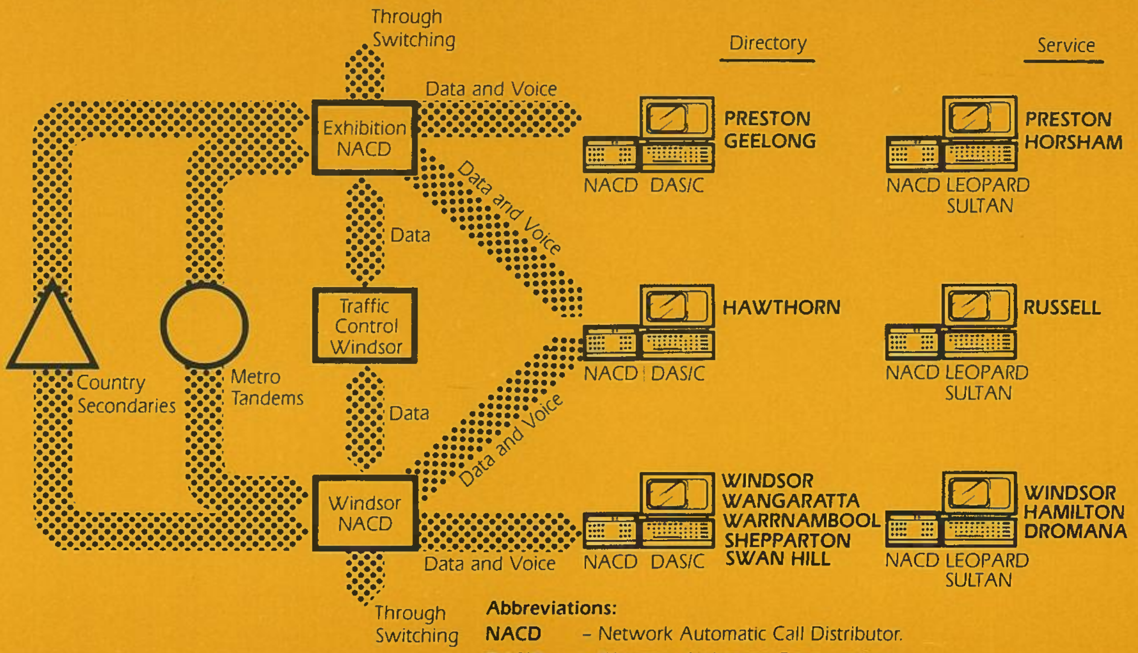
Calls for both Directory Assistance and Service Assistance Centres are switched via Network Automatic Call Distributors located at Windsor and Exhibition. These are stored programme switching and queuing systems with the ability to analyse and distribute large volumes of traffic.

Control of traffic to various groups of operators is carried out at the Traffic Control Centre Windsor. The Traffic Controller can re-allocate codes and incoming routes by keyed commands. Changes in traffic and staffing are monitored so that quick action can be taken to re-distribute traffic as circumstances change.

Management and performance statistics are available for real-time monitoring by the Traffic Controller, or reporting to other management groups.

Figure 1 shows the simplified trunking of the NACD switching network which directs directory assistance and service assistance calls to the appropriate operator.

Directory Assistance and Service Assistance (Simplified)



Abbreviations:
NACD – Network Automatic Call Distributor.
DAS/C – Directory Assistance Computerised.
LEOPARD – Local Engineering and Operations Processing and Recording of Data.
SULTAN – Subscriber Line Test Access Network.

(RATES) Remote Access Test Equipment for Special Services

RATES is a new testing system being introduced by Telecom to enable greater efficiency in the testing of Special Services. This will be achieved by enabling Special Service Restoration Centre (SSRC) testing staff to conduct comprehensive tests on Special Services, connected to the RATES system at distant exchanges, without the necessity to have local staff "shoe" the required circuit on the Main Distributing Frame (MDF).

Any Special Service may be assigned to RATES by jumpering the service on the MDF via a RATES access point appearance. Once connected, the circuit performs no differently to the standard circuit. However, when the circuit requires testing from the SSRC it is extended by a command to a test port through which the required testing can be conducted. When circuits connected to RATES are required to be locally tested, each circuit can be addressed on the local access test port and brought out to a set of jacks where portable test equipment can be connected in either direction of transmission.

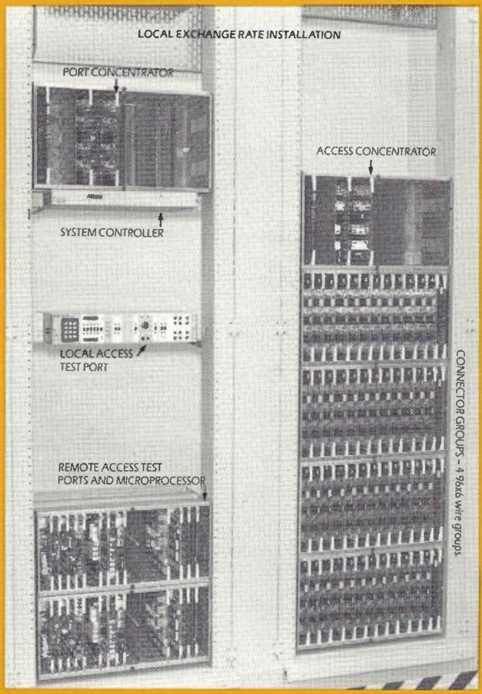
VDU Control Terminal at the SSRC

Where RATES is used for remote testing each circuit addressed is brought by command to the local microprocessor controlled test system, the results of the test being conveyed over a DXL data link to the control terminal at the SSRC which consists of a VDU and associated processor. Each local RATES installation can be addressed from any authorised Control Terminal with each Control Terminal being capable of accessing two local RATES installations simultaneously enabling end to end, or segment testing of the Special Service.

The RATES system is modular in design and each local installation can be expanded in units of 96 six-wire access points up to a maximum of 19 200 six-wire access points. Each access point can be used for either three 2 wire circuits, a 4 and 2 wire circuit or a 6 wire circuit. Test ports for local and remote testing can be added one at a time up to a maximum of 20 per installation.

The initial installation is in 7 Victorian Exchanges, (Lonsdale, Russell, Windsor, Clayton, Tullamarine, Geelong and Morwell) with installation into other States in 1982/83 – 1983/84. The SSRC control section is located at Exhibition Exchange.

A detailed overview of RATES is available in Technical Publication TPV 0073 OSS.



Building Supervisory Systems

In recent years there has been an increasing quantity of computer based equipment introduced into the communications network. This new equipment, while having the advantage of being able to do more in a smaller space, does carry with it some penalties. The environmental conditions required for operation are now more stringent which, coupled with greater heat dissipation, results in larger and more complex building environmental systems so that computer based supervisory equipment has, in turn, been introduced.

In key buildings, a Local Monitoring and Control System (LMCS) is being utilised to provide building supervision. The heart of the LMCS is a minicomputer (CPU) located within the building which runs a multifunction programme dedicated to the monitoring and control of the building. This controls the acquisition and processing of data that describes the status of the building services and environment. The data is acquired through a number of Data Acquisition Panels (DAP) that are strategically located throughout the building. Connected to the DAP's are sensors measuring various conditions such as temperature, pressure, flow rate, current and power consumption. Also connected are signals directly from the building services plant which indicate the status of the plant control systems. All of this information is digitally encoded and sent to the CPU via a cable data link.

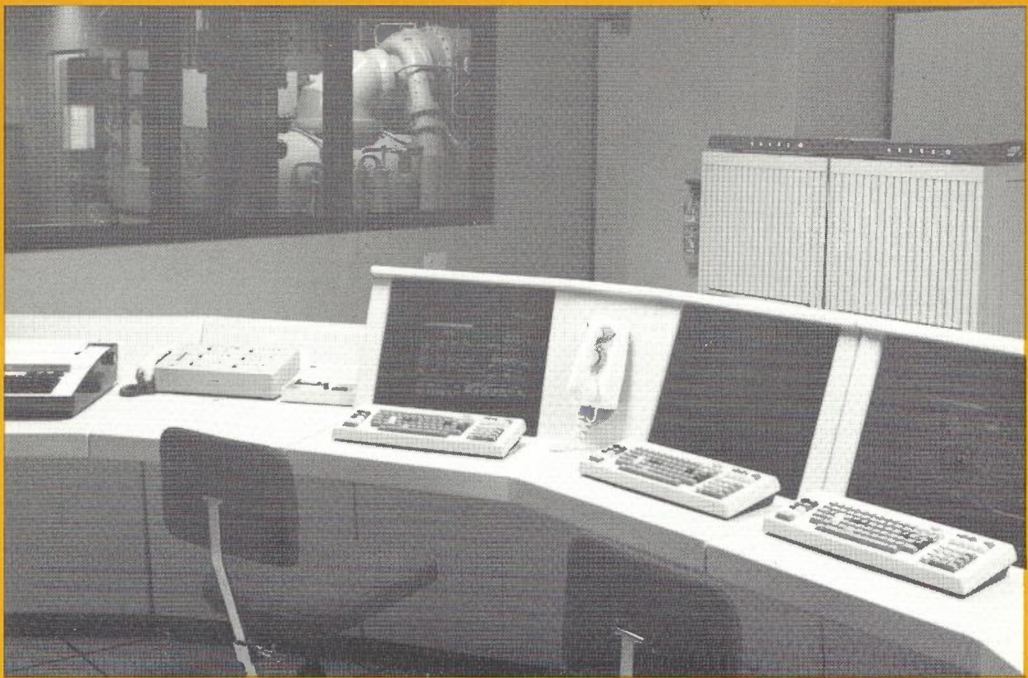
The CPU processes all of the incoming data and, depending on its nature, performs one of several actions. The data can be presented on the operator's VDU terminal for his information or action, it can be stored in order to produce a later report on the long term conditions or the CPU can initiate a predetermined sequence of commands to the building services.

By the same methods which data is communicated to the CPU, control commands can also be sent to the services plant via the DAP's. Consequently the operator, from his terminal, not only is aware of the conditions in the entire building but also has the ability to control the plant.

Therefore it is possible to extend this control facility into sequences that can be initiated by either the operator or the LMCS.

Utilising these high technology LMCS's it is possible to achieve high reliability environmental services for those critical areas that demand it. Currently there is a Johnson JC80 LMCS installed at Windsor TE and a Wormalds LMCS is being provided as part of the new Exhibition TE. A project to retrofit a LMCS to Lonsdale TE is now proceeding and planning has commenced for the provision of a LMCS at Clayton Computer Centre.

As each of the new LMCS's comes into operation further advantage will be taken of the LMCS digital data transmission capabilities. The introduction of modems between the CPU and the operator's terminal enables the terminal to be located in another building. Thus, by utilising the Telecom network, the control of all the key buildings will be concentrated to a single control centre.



L.M.C.S. Installation Exhibition Exchange Building

PCM SYSTEMS – Installation in the Network

Since the initial introduction of PCM into the Melbourne junction network in 1978, its applications have been extended to include the following networks:

1. ANALOGUE
   - 30 channel voice frequency systems for junction relief.
2. DIGITAL
   - Interconnecting of AXE Exchanges at 2 Mbit/s.
3. DDN
   - Main and patch bearers linking terminals to main centres and main centre to main centre, in the Digital Data Network.
4. SSN
   - Bearers to interconnect the nodes in the Special Services Network.

The original equipment supplied on early contracts was NEC CC29B. This equipment consisted of eight dedicated PCM systems on one NEC style rack with no flexibility. The multiplex equipment had an eight wire (4W + 2E & M) VF interface employing initially T3 and later T5 signalling.

Later equipment was designed to fit on standard transmission racks (Type 72) in sub-rack form, NEC Type CC67A. Separate sub-racks are used to house the line terminal equipment (DLTE) and the multiplex equipment (PCMME). This new design gave flexibility with patching and re-arrangement facility available on the intermediate frames – DDF, digital distribution frame.

The contracts for 1983 have made available a wider range of suppliers. Multiplex equipment will be provided by three manufacturers (NEC, STC and SIL), with a choice of three different VF interfaces.

1. 4 wire – 2 E & M signalling (T5)
2. 2 wire – loop disconnect signalling (L1)
3. 4 wire – 1 E & M signalling (T & T3)

Line terminal and regenerator equipment will be supplied by two manufacturers (NEC and STC). This equipment although electrically compatible will not be mechanically compatible except for UG regenerators. This will necessitate separate sub-racks for each style of equipment.

A standard cabling and interconnecting scheme has been designed to connect the appropriate equipment to the PCM system and the junction network. A typical arrangement is shown in Figure 1.

Regenerators (DLR) can be located at either an exchange or in an underground housing. Installation of underground regenerators is a time consuming exercise involving both technical and lines staff.

- Lines staff are required to open manholes, override air-pressure alarms, depressurize the housing and open the housing. After the installation of the repeaters by Technical Staff the housing and manhole is returned to its original state.

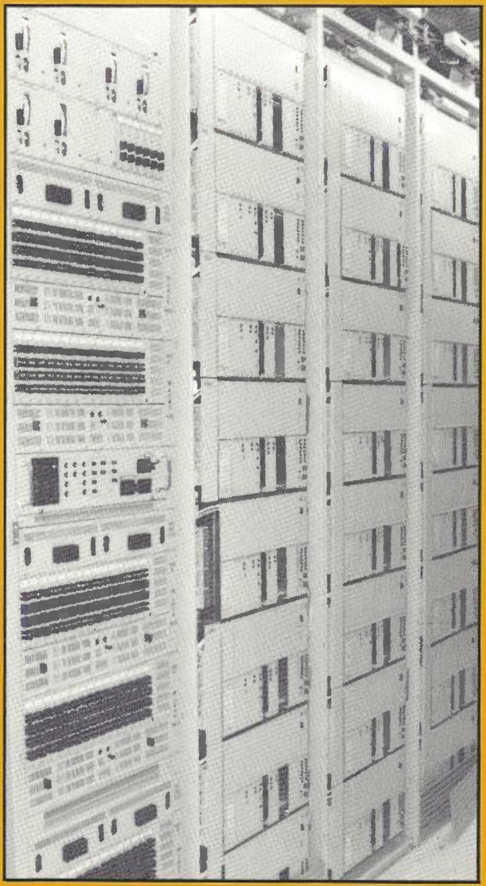
Testing of PCM systems involves:

1. VF TESTS
   a. Checking channel equivalent.
   b. Measuring signal distortion.
   c. Measuring noise.
2. 2 Mbit/sec. error rate testing.
3. Characterisation of regenerator performance by "TRIOS" testing each regenerator in the system.

   TRIOS testing involves sending pulse trains down the bearer with a consecutive +ve –ve +ve, or –ve +ve –ve pulses that give a resultant VF tone. At each housing supervisory filters allow the correct tone to enter the regenerator and an output is obtained on the test instrument.

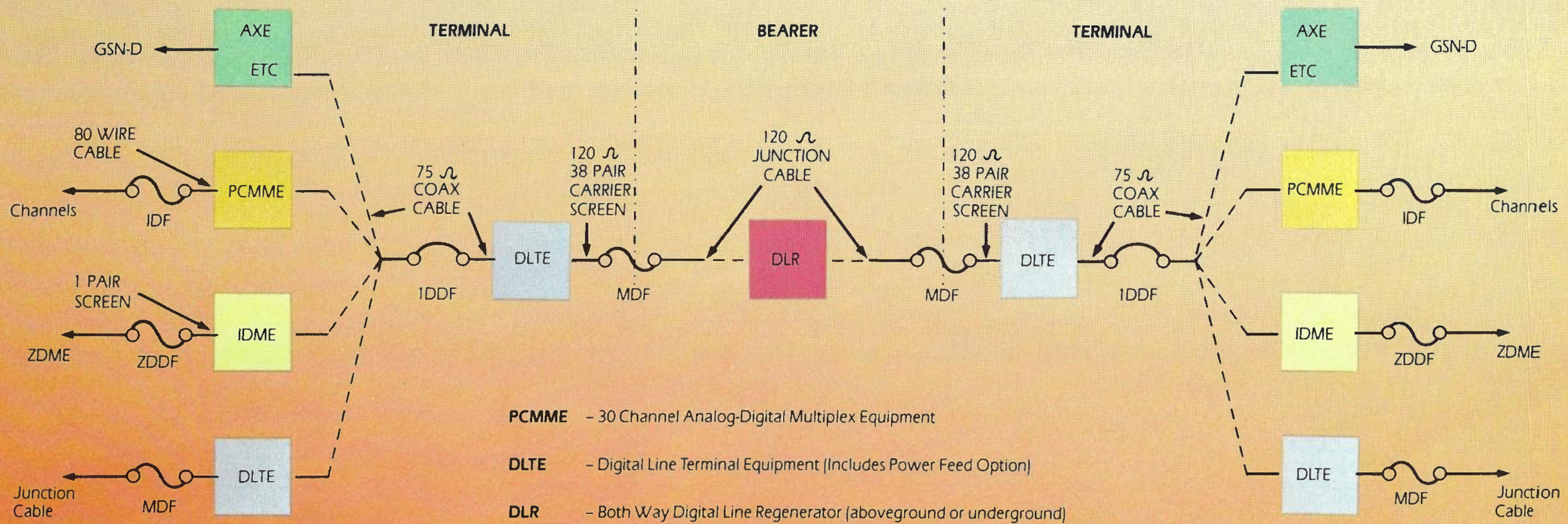
An ANDO Test Set being used for TRIOS testing on regenerators is illustrated.

The use of digital technology is rapidly expanding and PCM equipment will become more common place than FDM equipment . At major exchanges such of Windsor and Exhibition many tens of rack positions together with appropriate IDF potential have been reserved for PCM growth.



NEC Type Rack (Left)
Type 72 Racks with PCMME Equip't.

TYPICAL CABLING AND IDF/MDF ARRANGEMENTS
For Two M/B's Digital Transmission System



PCMME – 30 Channel Analog-Digital Multiplex Equipment

DLTE – Digital Line Terminal Equipment (Includes Power Feed Option)

DLR – Both Way Digital Line Regenerator (aboveground or underground)

1DDF – 2MBIT/SEC Digital Distribution Frame

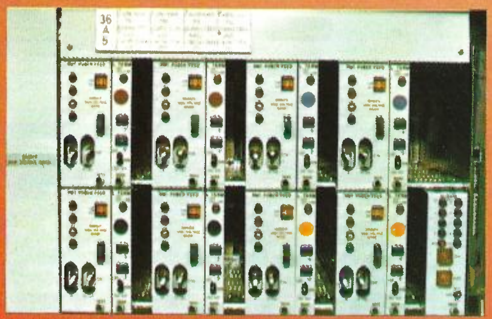
ZDDF – 64 K BIT/SEC Digital Distribution Frame

IDME – First Order Digital Multiplex Equipment (DDN)

ZDME – Zero Order Digital Multiplex Equipment (DDN)

ETC – Exchange Terminating Circuit (AXE)

GSN-D – Group Switching Network – Digital



Digital Line Terminating Equipment (DLTE) on Sub-Rack

"ANDO" Test Set being used for Trio's Testing on Regenerators

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The new Mobile & Paging Exchange – MOPAX

Established in the Mobile Control Centre at Windsor Exchange, the operational functions of the Mobile Telephone System (MTS) and the new High Capacity Paging system are integrated and controlled by MOPAX. A member of the MCC staff is shown testing the Central Processor. An article on the MOPAX appears in this edition.

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Establishment of the Integrated Digital Network (IDN) in the Melbourne Network

The commissioning of AXE Digital Subscribers equipment at Batman Node and the AXE digital group selector stage (GSS-D) at Windsor Tandem represents the initial establishment of the Integrated Digital Network (IDN) for the Melbourne network.

The IDN is a completely new overlay network using 2 M/bit digital streams (effectively 30 speech channels) and is separate from, but with access to, the SxS and crossbar (MFC) networks. It operates only in a digital mode and provides the equivalent of 4-wire transmission. It only converts to the analogue mode on calls to SxS and crossbar destinations as the network trunking conditions dictate. At the point of conversion, a multiplex (MUX) is associated with the 2 M/bit stream. At the AXE exchange, beyond the Local Subscriber Stage (LSS), information is converted from the analogue mode to digital mode and conveyed via the digital group selector to the appropriate time slots under the control of the exchange's central processor unit. See earlier issues of Engineering 82/3 for background information on IDN and digital transmission.

The introduction of the Batman Node and the Windsor Digital Tandem takes place in two stages as a measure of prudence because of the high traffic of the subscribers and the complexity of the installation and cutover. Stage 1 transfers 1000 existing Batman crossbar subscribers to the AXE equipment, with their originating tandem functions being transferred from North Melbourne Tandem "X" stage to the Windsor AXE Tandem. Also included are, 107 high calling rate outward (Z) lines from 7 PABX's.

In the second stage, a 2nd 1000 crossbar subscribers are transferred to Batman AXE also with their originating functions carried by Windsor AXE Tandem. At this stage, the terminating traffic to both thousands, previously passing through the BY stages at Hawthorn, Windsor and Northcote as well as the Central Tandem Y at Lonsdale, now enters Batman AXE from Windsor AXE Tandem. Also in the 2nd stage is a transfer to AXE equipment of indialling groups serving 55 PABX's with 1456 lines as well as providing 1000 lines to meet growth.

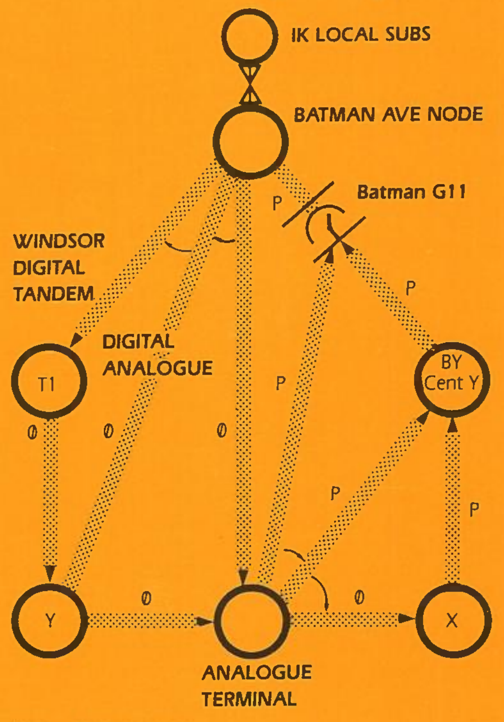
In early 1984, further nodes will be added to the IDN at Box Hill (6K) and Toorak (6K). These will be followed by nodes at Dandenong, Ringwood and Exhibition and a second tandem also at Exhibition.

The first digital Remote Subscriber Stage (RSS) will be introduced in 1984 at Port Melbourne parented off Batman Node.

Consequently, Lyndhurst and Narre Warren AXE digital exchanges, which are currently operating externally in the analogue mode, will be transferred to the IDN in digital mode.

Eventually the IDN will be expanded to a National Network with the introduction of Exhibition and Windsor Digital Trunk Tandems.

Network Trunking Stage 1 C/O

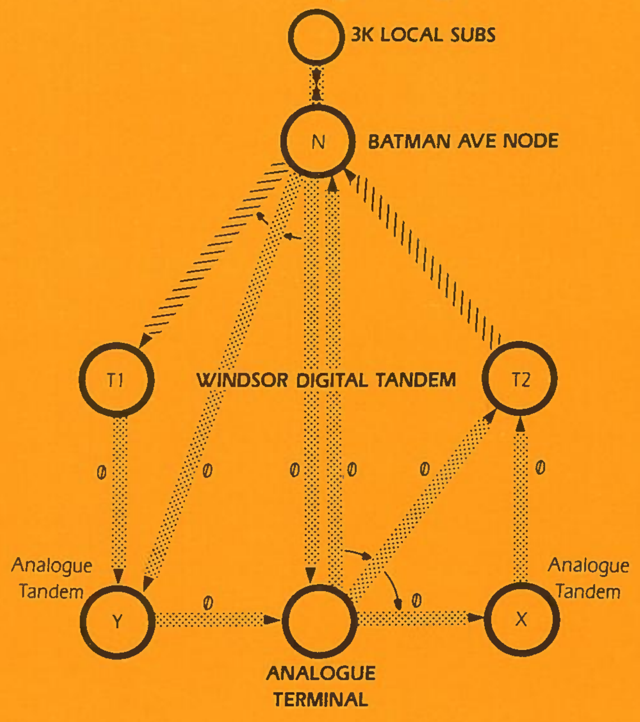


2M/bits stream.

Ø Either physical, FDM or digital stream with analogue conversion (MUX) where required.

P Physical.

Network Trunking Stage 2 C/O



2M/bits digital streams.

Ø Routes are either physical or digital streams with analogue conversion (MUX) where required.

Automatic Pressurised Cable Alarm and Monitoring System – APCAMS

The pressurisation of underground cables with dry air is now a well established practice. In pre-pressurisation days it was not unusual to sustain massive loss of service to customers following heavy rainfall. The introduction of CPAS (Cable Pressure Alarm Systems) reduced service loss dramatically.

The pressurisation system protects cables against failure due to moisture ingress because:

i. the air pressure in the cable will generally prevent the entry of moisture in the event of minor sheath failure.
ii. when a sheath failure occurs, the drop in pressure raises an alarm in the exchange.
iii. the pressure variation in cable enables the position of the sheath fault to be located.

APCAMS Is a monitoring system that automatically supervises the CPA system to allow efficient and timely fault finding and easily accessed management reports.

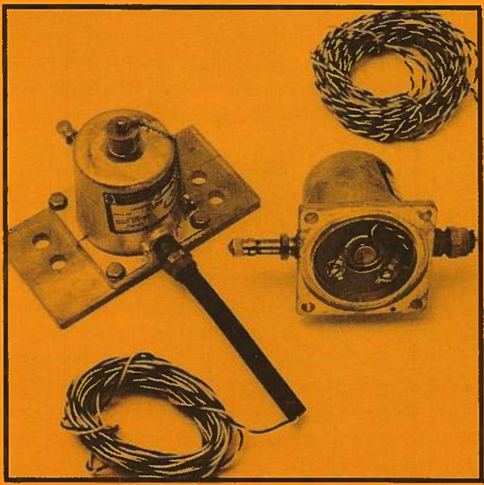
The existing CPAS network uses field hardware and exchange equipment that has been largely unchanged since cable pressurisation began in the 1960's. The network is monitored on an exchange by exchange basis with full monitoring usually only available during working hours. At present there is a low and variable level of monitoring of contactor alarm circuits over the 24 hour period.

APCAMS will monitor the whole CPA network in an area at a constant high level for the full 24 hours and will reduce the risk of service affecting faults in cables due to water entry. It will also provide the local supervisor with up to date information on the condition of the network under his control and will enable him to better plan maintenance and repair activities.

In mid 1978 APCAMS was installed, under the control of Lines Practices and Protection Section, as a trial system on City junction cables and is now also monitoring coaxial and optical fibre cables. The trial system, a Sparton 5300 manufactured in USA by Sparton Southwest Inc. uses a microprocessor controlled minicomputer. The microprocessor stores alarm levels for each cable or device and steps automatically from one input to the next. When alarm levels are detected, a telephone call is initiated automatically to a pre-established data terminal and alarm information is printed out. Staff can interrogate the system and ask for up to date reports on the condition of any input. Routine reports can be programmed for set times each day.

The full power of the APCAM System will be realised when existing contactors are replaced with pressure transducers. The CPAS supervisor will then receive full information on cable pressure status from the depot terminal without the need for physical inspection which can include travelling, manhole lid lifting, water pumping, identification of cable etc.

The primary alarm sent to the designated supervisory terminal is called a Trend alarm. This indicates that the pressure at a transducer point has decreased to a level set by user, say 10 kpa (kilo-Pascals) from the normal working pressure of 65-70 kpa. If the pressure then



drops below a preset low level, say 35 kpa, a 'Low' alarm is sent. The time between Trend and Low alarms gives an indication of the time CPAS staff have in which to attend the fault before the air pressure in the cable becomes too low to protect the cable from possible water damage.

The features provided by APCAMS include:

1. Automatic 24 hour monitoring of the pressurised cable network.
2. Ability to report to locations remote from the local telephone exchange eg. to central District monitoring units.
3. Ability to easily divert reports to another location after hours eg. after-hours centre.
4. Regular reports of network conditions to CPAS supervisors, local management etc.
5. Ability to monitor the existing (contactor based) network and perform loop resistance readings.
6. Detection of open circuit, short circuit or other alarm pair fault conditions.
7. Automatic recognition and reporting of sheath fault conditions.
8. Ability to remotely measure the pressure in the cable at different pressure points using addressable pressure transducers and transducers on dedicated pairs.
9. Ability to monitor compressor/dehydrator and air cylinder bank alarms.
10. Possible independence of physical pairs for communication (ie can use the "dial-up" network).
11. Provision of hard copy printout of alarms, system status etc.
12. Simplicity of operation.

The system can monitor and recognise contactor alarm pair circuits, contact closure/opening alarms, pressure transducers, flow transducers, air volume counters, open or short circuit on the input pairs.

Multiplexers (normally installed in remote exchanges) contain addressing electronics to effectively convert dedicated transducers to addressable. The microprocessor is programmed with data such as: Exchange identity, cable identification, type of device(s) on each input pair, upper and lower alarm limits for each device, reporting times and telephone numbers for remote data terminals.

The system scans each input in turn, comparing the measured value with that in memory. If an alarm condition is detected, contact is established with the output terminal (at normal maintenance Depot) and an alarm message is printed out.

If no alarms are detected, the system continues to scan through the inputs. At predetermined times, a report of the status of all inputs can be sent to the output terminal so that supervisory staff have a printed record that can be analysed over a period of time to monitor the performance of the pressurised cable network.

At the end of the normal work day, the system automatically redirects alarm and reports to a continuously staffed centre for attention. Normal after hours recall procedures apply.

The full scale implementation of APCAMS into the Metropolitan network is planned over the next five years commencing with the Coburg and Ivanhoe Districts in 1983/84.

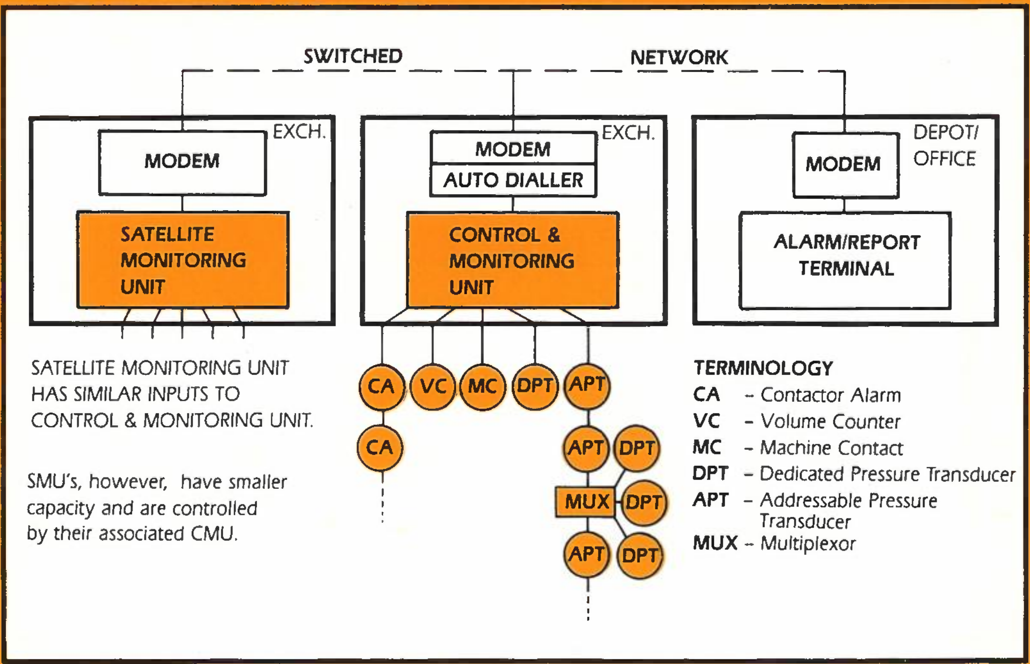
This will involve the replacement of existing contactors with pressure transducers, installation of exchange based monitoring units and office terminal equipment and the training of local staff in efficient use of the APCAMS system.

It is envisaged that CPAS Depots, after hours centres and the District Offices will be equipped with terminals to allow easy access to the detailed information APCAMS can provide.

The use of addressable pressure transducers which can be connected to one pair of wires and addressed separately by the monitoring unit will minimise cable pair requirements.

The (03) Melbourne APCAMS network when fully operational should require little routine maintenance. A specialised maintenance team with APCAMS expertise is available to provide monitoring unit programming and maintenance. District CPAS staff will be responsible for all field maintenance.

The implementation of APCAMS will allow efficient management of the CPAS network and minimise service loss resuling from cable sheath failure.



COMPONENTS OF A.P.C.A.M.S.
(Automatic Pressurised Cable Alarm & Monitoring System.)

Establishment of Special Services Network – SSN

Leased lines provided by Telecom to customers are better known as Special Services. Whilst there is a big variety in types of services over these lines, about one half of them have a common characteristic: they require a nominal 4 kHz bandwidth. About half of the circuits requiring speech bandwidth are between premises in different exchange areas and are the most difficult, complex and costly to provide and maintain. Individual attention is necessary to meet their transmission and signalling limits; line conditioning and signalling repeaters are often required.

To facilitate provision of long Special Services over the junction network it is proposed to establish a Special Services Network (SSN) using dedicated digital transmission systems (PCM) with cross-connections being provided at a number of strategic points called nodes. As with the public switched telephone network, a hierarchy is required to discipline the connections between terminals. There will be two levels of SSN nodes where cross-connection can occur. The higher level is a transit node which will be linked to all other transit nodes. The lower level is the collector node which is linked to at least one transit node. Not more than two cross-connections will be allowed on a circuit in SSN. Connections between the SSN terminals and customer premises will be in VF cable pairs requiring VF-to-PCM interface units appropriate to that type of special service. Such a network would enable more rapid and efficient provision of VF leased lines between different exchange areas, improve transmission and provide greater security of service and simplified maintenance through the use of standardised designs and equipment.

Initially the cross-connection at the nodes will be carried out at VF between PCM channels. By December 1985 AXE telephone exchanges will be equipped to provide semi-permanent through connections of SSN circuits by program commands. This is not switching in the true sense as the connection can only be changed by another command over a data link from a control centre and not by signalling over the circuit. This will eliminate the undesirable digital – analogue – digital conversions at the SSN nodes.

Initial stage of SSN is currently being established in Melbourne, where six dedicated PCM systems are provided from Melbourne Airport to North Melbourne and one to Lonsdale. During 1983/84 a further 24 systems will be installed thus forming a simple network with cross-connections at three centres: Windsor and Exhibition as transit nodes and North Melbourne as a collector. In 1984/85 SSN will be doubled in size and the Melbourne SSN will be linked with the Sydney SSN using digital radio transmission systems. Links to Brisbane and Adelaide will follow soon after.

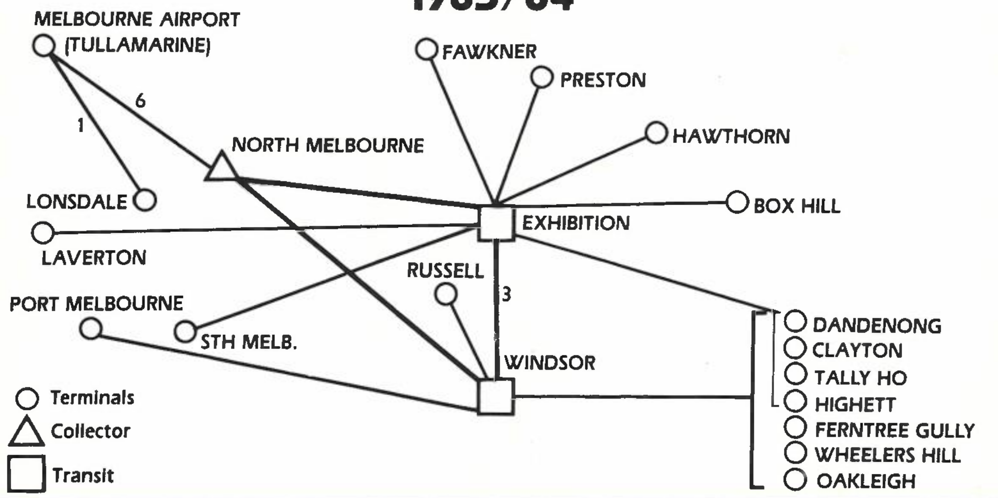
Connections of Special Services to the new network at present are limited by the available types of interface units (IU) to the following services:

- Outdoor extensions, unidirectional tie lines and distant exchange lines.
- Bothway tie lines.
- 4-wire VF circuits.

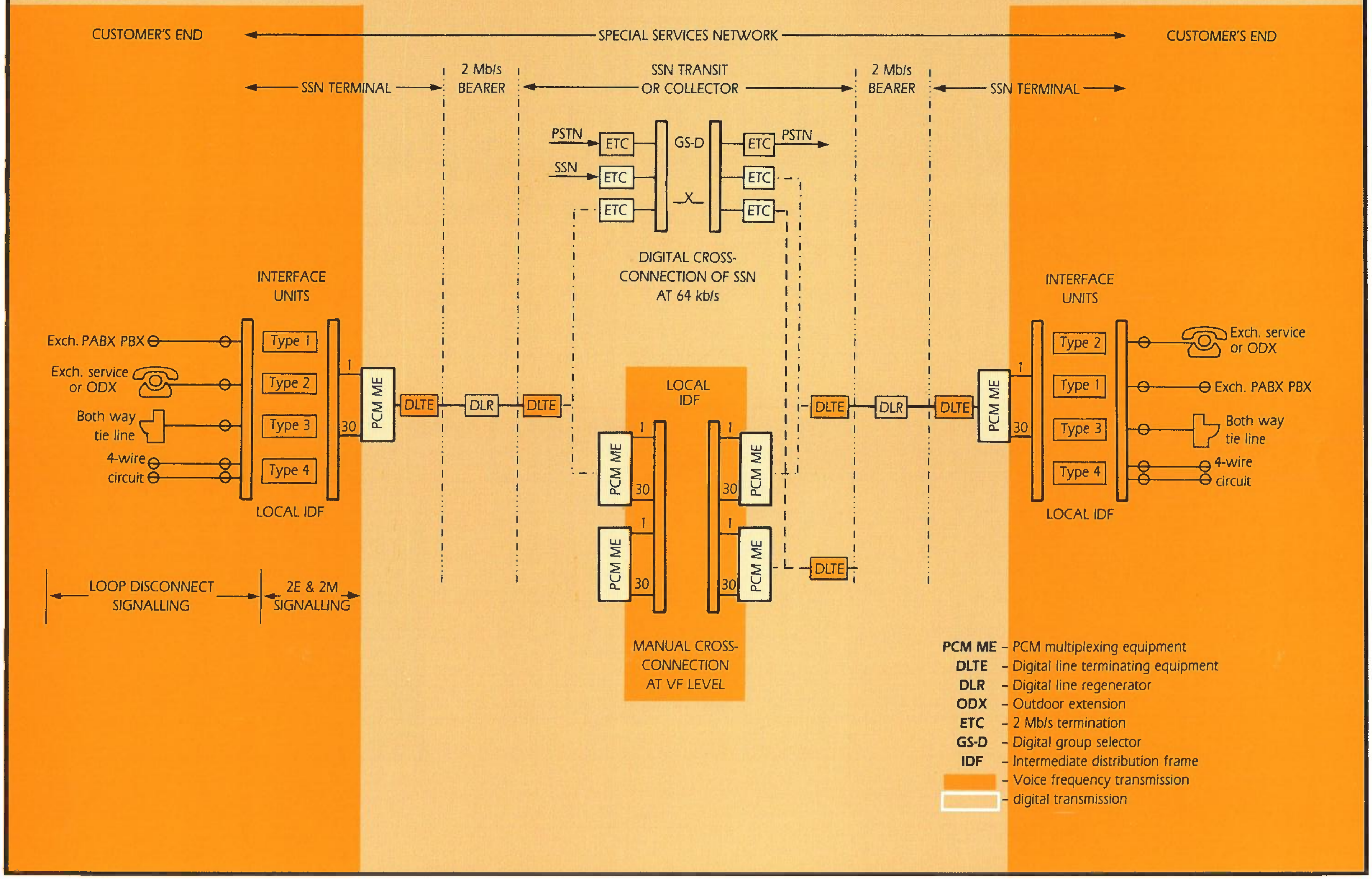
Double E & M lead signalling is used over the SSN PCM systems.

It is not intended to transfer existing Special Services to the spare capacity in SSN, unless they are unsatisfactory and require transmission improvement. However, in some cases junction relief requirement may dictate the transfer of existing Special Services to SSN on some junction routes.

Proposed Special Services Network, Melbourne 1983/84



TYPICAL CONNECTION OF SPECIAL SERVICES TO SSN



PCM ME – PCM multiplexing equipment
DLTE – Digital line terminating equipment
DLR – Digital line regenerator
ODX – Outdoor extension
ETC – 2 Mb/s termination
GS-D – Digital group selector
IDF – Intermediate distribution frame
– Voice frequency transmission
– digital transmission

Records Automation for Special Services – RASS

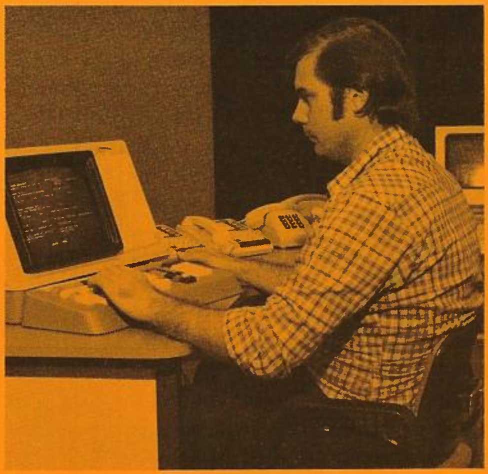
The telephone switched network is designed around the requirements of telephone services. Characteristics, such as relatively short subscriber lines, common equipment for switching and inter-exchange circuits as well as the establishment of a connection by switching together of a series of links, have all shaped both the network and the practices associated with its management. Special Services have different characteristics. They need individual design to ensure that the particular transmission requirements are met and their installation and maintenance need individual co-ordination.

The range of Special Services consists of DATEL, DDS and AUSTPAC services, alarm lines, telegraph and telex services, voice private lines, tie lines, outdoor extensions and wideband services. Many of these are interstate connections.

Special Services are for the most part used by the larger business customers. Each tends to be assigned to a particular purpose and its loss is of more significance than, for example, a few exchange lines from a PABX group. For these reasons the provision and maintenance of Special Services is given a higher priority than telephone service.

Some years ago, HQ embarked on the development of the RASS system in order to reduce the difficult and complex job of keeping of records and other administrative processes for Special Services. Introduction of the RASS system will consist of several stages, comprising a data base, the handling of applications for new or altered service, issuing of service orders, co-ordination of installation work, control of maintenance, preparation of billing information, provision of statistics and control of material.

Stage 1 (data base) commenced operation in Victoria and NSW early this year and is planned to commence in some of the other States during 1984. To expedite the provision of the additional facilities, the work on Stages 2, 3, 4 & 5 is being done concurrently, with Victoria being responsible for Stage 3 (installation), NSW for Stage 4 (maintenance). HQ is handling the pre-order and billing stage (Stages 2 & 5) and is also co-ordinating the overall work, since no stage can be developed in isolation. Stage 4 is expected to commence operation in NSW in July 1984 with Victoria to follow about a month later. Stages 2, 3 & 5 will commence in both States some months after that. Some additional facilities will still remain to be automated, in particular control of material and much of the preparation of statistical information.



The Special Service Restoration central accessing RASS data base.

The present intention is to continue with SPAN for the distribution of service orders, even after the commencement of DCRIS. This is because Special Services require centralised processes and DCRIS is decentralised. The ultimate replacement of SPAN at the end of its service life has yet to be decided but this is a matter that can be considered after the further development of RASS.

Synchronisation of the Digital Network

The digital network will use both digital transmission and digital switching systems in the connection of a telephone call. Digital transmission and switching system use time-divided techniques in their operation. Time consistency (or synchronisation) throughout the digital network is therefore essential to ensure satisfactory performance of the network.

Network synchronisation is also necessary in order to meet CCITT recommendations for international connections. In addition, network synchronisation is an essential part of preparing for an Integrated Services Digital Network.

In March 1983 the Chief Manager Engineering approved a policy to implement synchronisation of the digital network as a consequence of the policy decision to proceed with the development of a National Integrated Digital Network.

Network synchronisation will be implemented by synchronising the clocks at digital exchanges to a single National Reference Clock (NRC) provided at the Telecom Research Laboratories. A hierarchy system of clocks operating in a master-slave arrangement is proposed.

Highly stable and accurate clocks will be provided at selected digital trunk exchanges enhancing the reliability and survivability of the network. Dedicated links will be provided between the NRC and the highly stable clocks in the highest level of hierarchy.

Implementation of network synchronisation co-ordinated by Transmission Network Design Branch, Headquarters, has a high priority at AXE trunk exchanges and will be extended progressively to other digital exchanges as the Integrated Digital Network develops.

Radio Australia – Transmitter Replacement

The international high frequency transmitting station at Shepparton, Victoria, was established following agreement between the British and Australian Governments in 1941, to set up in Australia a high power station capable of broadcasting to any area of the world. The service was known at that time as Australia Calling and the station was initially equipped with 2 transmitters of 100 kW output power and 1 transmitter of 50 kW output. The 50 kW transmitter, operating as VLC, commenced service in May 1944. The 100 kW transmitters, operating as VLA and VLB started service in August 1945 and July 1946, respectively.

Today the service is known as Radio Australia and programmes of information, education and entertainment, originating from the ABC Radio Australia studios in Melbourne, are transmitted from Shepparton on a round the clock schedule. Programmes are broadcast in 7 languages to principal service areas in the Asian and Pacific regions. Services are also beamed to other target areas which include North America, Europe, southern Africa and the Antarctic. To cater for the progressive increase in the number of transmissions over the years, the transmitter complement has been expanded so that Shepparton now has 4 transmitters of 100 kW output, 3 transmitters of 50 kW and 2 transmitters of 10 kW in service. A matrix switch enables any of the transmitters to be switched to any of the 31 horizontal dipole arrays and 3 rhombic antennas which occupy the 250 hectare site.

A major program of transmitter replacement is currently proceeding at Shepparton. The four 100 kW transmitters are being replaced in two phases to avoid program interruption and this will be completed by December 1983.

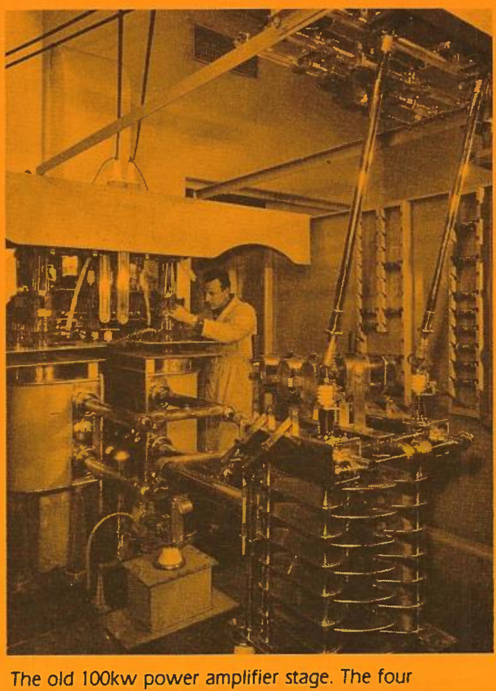
The four transmitters being replaced have an interesting history. They started off in the 40's as two 100 kW transmitters, the design including duplication of the 100 kW power amplifiers, mainly to facilitate frequency changing. Between 1959 and 1962 reprovision of the modulation stages and separation of the 100 kW power amplifiers into separate enclosures resulted in four transmitters each capable of being operated separately.

The new transmitters are Harris Type SW 100A transmitters having an operating frequency range of 3.2 to 22 MHz. A unique pulse duration modulator provides for low operating costs and the design includes such features as servo controlled tuning, solid state power supplies, automatic supervisory systems and remotely controlled frequency synthesizers.

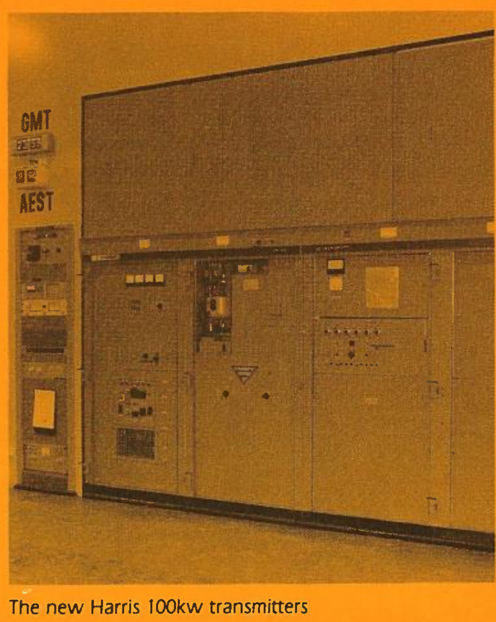
The introduction of the new Harris transmitters will result in the following improvements:

- Reduction in power usage from 370 kW down to 250 kW per transmitter. This arises from the use of pulse duration modulation and maximum use of solid state techniques.
- More rapid change of frequency from 15 minutes down to 20 seconds.
- Wider audio bandwidth and reduced spurious radiation.
- Contains only 5 valves compared with 45 in the older transmitter and is thus more reliable.
- A smaller, less complicated and more efficient cooling system adds to the reliability and lower maintenance costs.

The installation work is being carried out by staff of the Radio Section, Network Service Branch, with participation from Buildings Branch in building and power supply aspects and Telecom Workshops in transmission line connecting equipment and special fabrications associated with water and air cooling.



The old 100kw power amplifier stage. The four F124 A valves are at the rear. In the foreground is the output coupling unit.



The new Harris 100kw transmitters

Mobile and Paging Exchange – MOPAX

MOPAX consists of 2 parts, the Mobile Telephone Service (MTS) commissioned in Melbourne September 1981 and a High Capacity Paging Service to be introduced later this year.

The heart of MOPAX is the Mobile Control Centre (MCC) located at Windsor Exchange. The MCC is based on a Nippon Electric Company standard local switching exchange and is a stored program controlled system, built around a dual 3-stage trunk line network switchblock.

The switchblock provides:

i. the connection between the network, incoming and outgoing trunks and the radio channels;
ii. the connection of signalling, tone and voice announcement devices, to the trunks at appropriate times of a call or page.

On the radio side, the MTS service area will closely match the Extended Local Service Area for Melbourne. One hundred and twenty channel frequencies in the 500 MHz band have been allocated for the MTS, and based on assumed traffic conditions, these enable 4000 mobile subscribers to be connected to the system – initial installation in 1981 catered for 1000 mobile subscribers. Each radio channel uses separate mobile to base station and base station to mobile frequencies with 10 MHz separation, enabling simultaneous conversation in each direction. MTS subscribers have the same network access classifications as normal subscribers.

The 3 radio base stations (transmitter/receiver sites) for the Melbourne MTS are sited at Lonsdale Exchange, Dunn's Hill and Mt St Leonards. Operating experience has shown poor performance in some areas (due to varying terrain) necessitating the establishment of a 4th base station at Surrey Hills later this year.

To perform the switching functions, the MCC interfaces the Telecom network at a 2-wire, ARE-11 terminal exchange at Windsor for mobile originating calls. Terminating calls to a mobile are connected via the Melbourne No 3 (10C) trunk machine situated at Lonsdale Exchange.

The first extension of the MTS system was commissioned in July 1983 and caters for an additional 1900 subscribers. This involved extension to the existing equipment and radio base stations – further extensions will depend on traffic and customer demands.

The integration of High Capacity Paging with the MTS necessitated the expansion of existing trunking and the addition of a Paging Terminal and District Controller. The Paging Terminal is capable of serving up to 100 000 subscribers over a single voice frequency bandwidth radio channel. Two District Controllers installed at Windsor, serve transmitters in Tasmania and Victoria. The Victorian transmitters are located at Lonsdale Exchange, Mt Dandenong, Arthurs Seat, Pretty Sally and Morwell. An additional transmitter will be installed at Geelong shortly to improve the marginal reception in that area.

MOPAX – Simplified Trunking Scheme

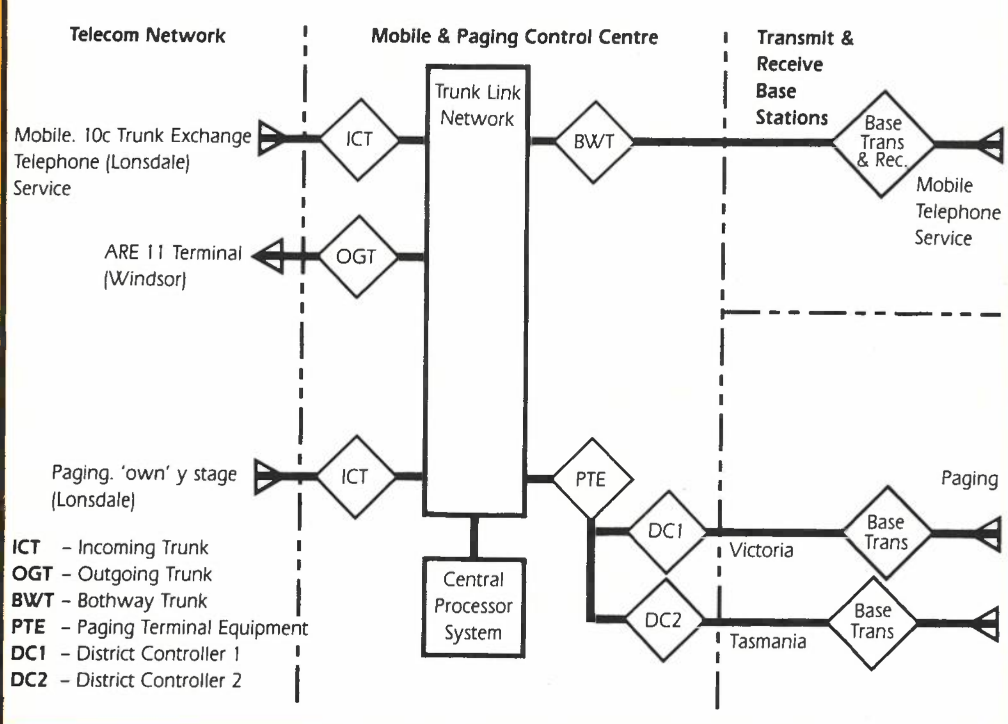


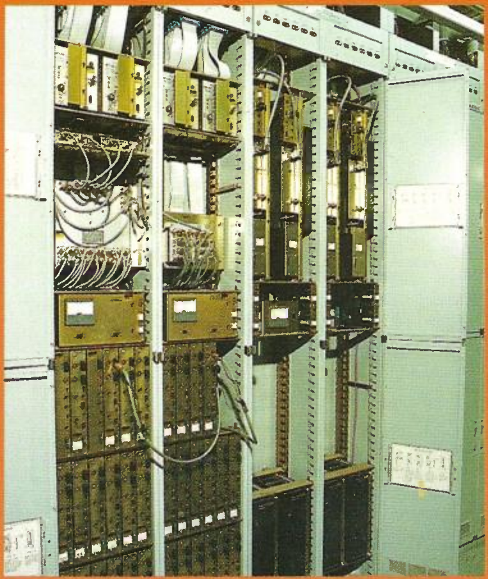
Figure 1 shows the simplified trunking of the MOPAX system.

The District Controller is installed between the radio paging terminal and transmitter for encoding of both the 5 tone code and digital code format, and to control and supervise the transmitters.

The transmitters operate in the 150 MHz band and employ direct frequency modulation and frequency shift keying to transmit the 5 tone and digital signals respectively.

The High Capacity Paging system will replace the existing paging system now operating in some country areas and extension into all provincial centres of Victoria is envisaged during 1984.

Other plans include the provision for transmitting a numerical message to a pager, where it would be displayed.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1
The MTS radio transmission equipment at Lonsdale Exchange.

2
The High Capacity Paging Service radio transmission equipment at Lonsdale Exchange.

3
The District Controller equipment at Windsor Exchange.

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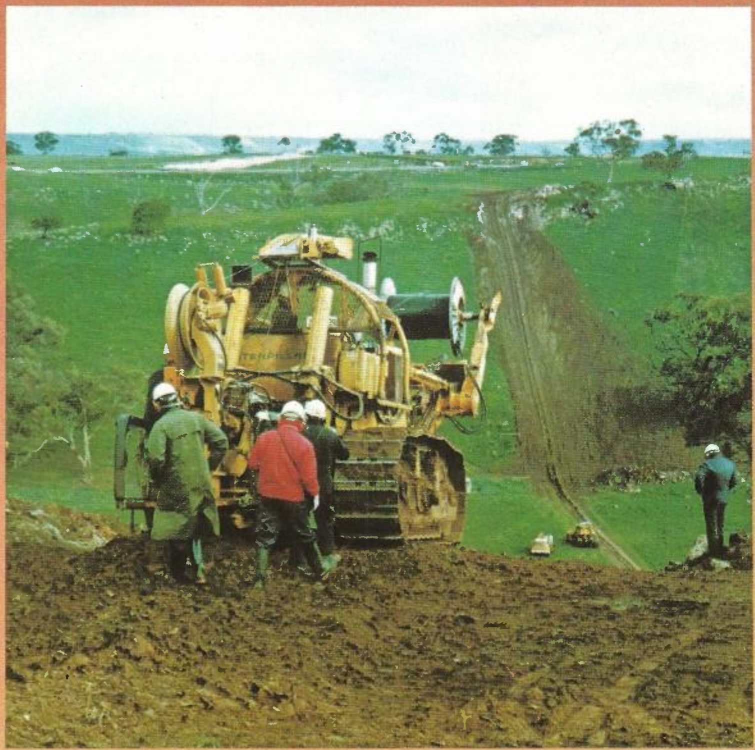

Trial of Direct Burial Techniques for Optical Cable – Bacchus Marsh.
See article in this edition.

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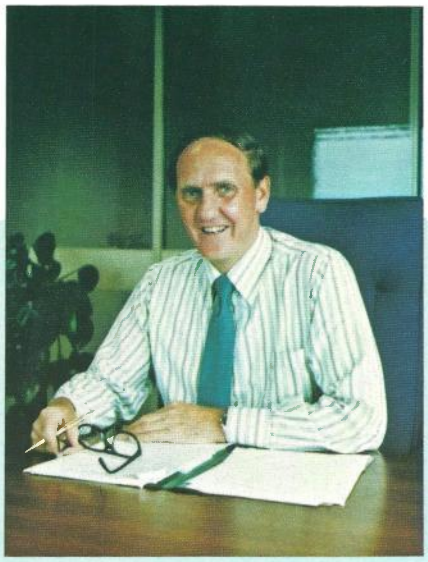


From The Office of the Chief State Engineer

"Anticipation" said the Chief General Manager A/g Managing Director on the occasion of a retirement function "that's the characteristic that marked him as an exceptional manager. He was able to sense when something was going off-line and take corrective action before the matter became serious".

The idea was put another way by the late E.D. Curtis, one of my eminent predecessors. "Sitting up here watching the play", he said "it is easy to distinguish those who run to where the ball will land from those who run to where it was kicked."

Within the last few months there have been a number of noteworthy conferences concerning future directions. Some have explored Government policy, some international trends in technology and there was our own SPICE Conference, outcomes of which have been distributed.

Later in this publication we have featured the opening address of Gordon Martin at one such seminar. He sets out his views on the forward looking and dynamic approach that is necessary for us to stand up in International company.

For our part there are many options for the future. At least we should be prepared to cope with any reasonable combination. It is our privilege and responsibility to foreshadow developments and to engineer flexibility into our networks and facilities. It will be a mark of our perception that we do this in such a way that we can later exploit those options which will provide better service at lower cost or higher profit.

J.M. Ryan
CHIEF STATE ENGINEER

Direct Burial of Optical Cable

The introduction into the Telecom network of optical cable and the development of techniques involved in its utilisation cover a wide range of disciplines and organisational groups. This article discusses some of the problems and solutions associated with the mole plough installation of optical cable in non-urban areas.

Automotive Plant Section Victoria, in conjunction with Automotive Plant and Transport Headquarters, are currently involved in the development of mole ploughing techniques and equipment suitable for laying this type of cable.

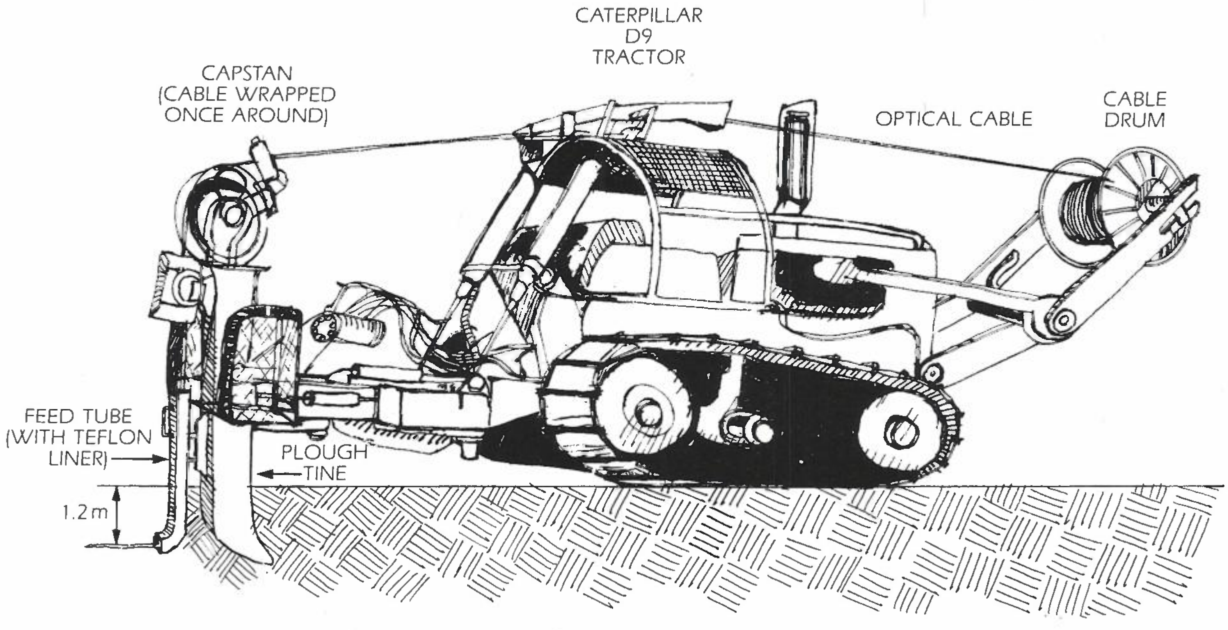
A field trial has been carried out by Country Primary Works Section for Lines Construction Branch HQ to test these techniques and to determine the ploughability of 4 different types of optical cable. The trial cables, each 1 km in length, were supplied by two manufacturers and, in their construction, employed various combinations of sheath and core material, jelly-filled or unfilled, as well as loose, semi-loose or tight stranding of the optical fibres.

A test site at Bacchus Marsh was selected for its particularly arduous conditions. Pre-ripping of the plough line was done by two Caterpillar D9 tractors, with one doubling as the plough. A third tractor, a D7, fitted with a 20 tonne winch, provided added support on the steep inclines encountered. A vibrating sheep's foot roller was used to reinstate the rip.

Optical fibre cable is particularly prone to failure from excessive residual strain. It is therefore imperative that the laying tension on the cable be carefully controlled. The feed tube behind the plough tine was fitted with a Teflon liner to reduce friction and the cable fed into the feed tube by a hydraulically powered capstan which drew the cable from the drum and regulated the cable tension into the tube. This technique has not been used in Australia previously and the necessary equipment was imported from the USA for the trial.

Transmission tests, carried out by Research Transmission Branch while the cable was being laid, showed that the residual strain was within the prescribed limits. The tests also indicated some degree of transient strain during the laying process which has been attributed to irregular rotation of the cable drum. Automotive Plant have developed a drum rotation system which will effectively regulate the tension between the capstan and the cable drum. Other performance characteristics will be determined as further tests are carried out on the installed cables over an extended period.

The techniques developed in the trials will be of direct application in the installation of an optical trunk link between Ballarat and Melton in 1985, followed by the upgrading of the Melbourne-Sydney route the following year.



Fire Safety in Buildings

Telecom is committed in its Corporate Thrusts to ensuring that the working environment for its staff is a safe and healthy one while at the same time maintaining a highly reliable and secure telephone network. Safety and security go hand in hand but fire is the enemy of both.

Modern telephone exchange buildings and communication centres need to be designed in such a way that the utmost flexibility is obtained for the installation of equipment and staff work activity. Maximum security is ensured by fire isolating particular areas of the installation. The Fire Safety Group in Buildings Branch continually monitors aspects of fire protection in buildings and is frequently confronted by day to day problems involving a need to compromise between accessibility, security, emergency egress and the preservation of fire ratings. Consequently it is essential for Fire Safety Officers to keep abreast of developments both within Telecom and in the fire protection industry.

Recent interesting developments in the area of fire safety in buildings are as follows:

Fire Partitions – Recent research and development has resulted in the development of special partitions between work areas which meet fire codes and which provide appropriate fire isolation as well as visual supervision from a supervisor's point of view.

The partition comprises standard steel framed fire rated construction with sealing to the clear wired glass panels specially drilled and fixed in steel frames to achieve the 1 hour fire rating requirements.

The installation of this type of fire rated window in the Information Systems Branch building at Clayton is the first of such installations.

Fire Rated "Stable" Door for TIC's – In TIC's and Supply Department Sub-stores, it is necessary to provide a satisfactory serving counter with door in an area surrounded by a fire rated wall. Conflict arises between the need for accessibility and for fire safety. A special door has been developed comprising a modified standard fire rated door with a metal inner frame with non-asbestos sub cladding and finished with fire resistant and treated ply cladding. This door can be installed in the wall and, fitted with a shelf for stores handling facilities, overcomes the problem of degradation of fire rating and allows access.

Modular Halon Fire Suppression Systems – A system which was recently developed by Headquarters for the Perth-Dampier gas pipeline project in Western Australia has been adapted for installation in key R/T Stations. There is a prototype installation at Pretty Sally R/T Station being evaluated for use as a standard system for other strategically important installations.

The system automatically discharges extinguishing agent after a delay following smoke being detected by detectors on a dual circuit system. The system incorporates visual and audible alarms as well as a manual override to prevent discharge in the event of a false alarm.

Discharge tests of the automatic sprinkler system especially designed for the high rise warehouse racking – Supply Branch, Springvale.

It is envisaged that the system will provide an economic means of providing automatic fire suppression facilities at remote establishments.

Sealing of Cable Penetrations Between Floors – Amongst the critical aspects in the fire protection of any multi-storey building is the maintenance of fire rating between floors, particularly where cables and ducts penetrate the floor slab. Flexibility in cabling telephone exchanges demands that frequent penetrations of floor slabs occur. The Fire Safety Group has initiated the development and fire testing of a light weight (non-asbestos) panel system which can be used for fire sealing around cables passing through floors. The system consists of modular panels of compressed vermiculite approximately 300 x 150 x 75 mm fitted into a steel frame which facilitates installation around existing cable runs.

Fire resistant pillows manufactured from a moisture resistant fabric material and filled with granulated mineral fibre, which were introduced in 1981 for sealing horizontal penetrations, are used as a temporary means of sealing openings in floor slabs until such time as all cables are in situ. Modular panels can be installed later.

Individual Circuit Monitoring – ICM

Individual Circuit Monitoring (ICM) equipment is a powerful maintenance aid for identifying individual items of switching equipment which are malfunctioning in live traffic.

ICM provides automatic supervision of selected circuits or devices and at preselected intervals provides accurate data on call seizures, circuit occupancy and average holding times. Reports automatically generated by the ICM equipment indicate which circuits or devices are faulty.

The basic principle of ICM as applied to telephone equipment maintenance is that similar circuits/devices should, over a sufficiently large time period, exhibit similar call holding times. Circuits/devices which are never seized, permanently seized or have holding times significantly at variance with the normal are indicated to be worthy of investigation as being possibly faulty.

The equipment to be installed in Victoria, New South Wales and Queensland is the AUTRAX system manufactured in the USA by Telesciences Inc. It is planned to install AUTRAX into 37 Victorian exchanges by the end of the 1985/86 financial year. The installation will commence with the 10C's and progress to the ARM's and selected Minor Switching Centres with an installed capacity of 500 or more transit circuits.

Portable ICM equipment is available which can be used to monitor up to 500 selected circuits.

The fundamental building blocks of the system are the automatic data collection and storage terminals model TE500 and a Central Data Control (CDC) unit comprising a Hewlett Packard minicomputer together with its peripheral equipment and communications unit.

The model TE500 terminals which will be used by Telecom vary in capacity from 1 024 inlets to 10 240 inlets. Each inlet is wired to a precabled IDF containing the circuit/device to be monitored. The equipment, in sequentially scanning the inlets at a predetermined rate, counts the number of seizures of each inlet (pegcount) and records the total holding time of each inlet.

Typically the points to be monitored will be:

10C – Busy Free Test Points
ARMs-MSCs – FIR, FUR, FDR and some common control equipment.

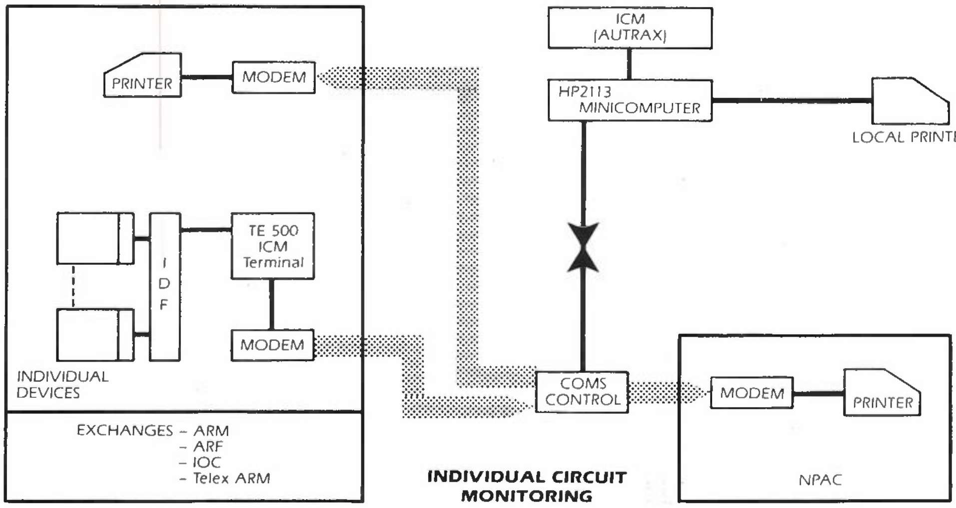
Each inlet on the terminal has two active memories for circuit pegcount and usage, and two passive memories which store and transfer data when the CDC requests it.

The terminals can be interrogated at 15 minute intervals. However the interval can be varied depending on the volume of data to be transmitted, the number and size of the reports to be sent to the exchanges being monitored and the speed (typically 1 200 bps) at which the information is collected and distributed by the CDC.

Software packages in the CDC process the raw data from the terminals into readily interpreted real time reports on the status of the transit circuits. The reports identify the following types of faults.

'Killer'	A circuit/device which is seized many times and is held for very short periods of time.
'Busy'	A circuit/device which has been occupied throughout the entire monitoring interval.
'Idle'	A circuit/device which has not been used over the entire monitoring interval.
'Crossed Trunks'	Different circuits with the same numbers of seizures and identical holding times over a polling interval.

This information used in a maintenance program will ensure the optimum availability of equipment for switching transit traffic.



INDIVIDUAL CIRCUIT MONITORING

Remote Telecommunications Satellite Service – RTSS

The commencement of operation of the Australian Communications Satellite will initiate the extension of the Telecom network into areas which have previously been too remote to enable the provision of service by existing means.

Apart from the earth stations operated by AUSSAT Pty Ltd, the company operating the Satellite, Telecom will establish an earth station, located at Bendigo, which will provide the link between these locations and the rest of the National Network.

The RTSS will also enable the early provision of temporary service in some areas prior to the provision of permanent facilities as well as allowing rapid restoration of service under emergency conditions.

NEC are to install the Main Earth Station at Bendigo and to initially supply 65 Remote Earth Stations for installation by Telecom.

Figure 1 which presents an overview of the system illustrates some of the possible Remote Earth Station configurations:

i. Homestead Telecommunications Earth Station. This provides service for an individual customer.
ii. Community Telecommunications Earth Station. This can cater for a number of individual customers plus a small group of customers connected to an ARK-M exchange.
iii. Emergency Telecommunication Earth Station. This station is similar to the community service but has additional facilities to provide the flexibility needed to cope with the variety of conditions which may be expected under emergency working.

The Main Earth Station, to be located at Bendigo, will be responsible for overall control of the RTSS system. It assigns the frequencies (channels) to be used by the remote stations as required and arranges the connection of these channels at the satellite. As the access point to and from the existing telecommunication network, it is responsible for the setting up and supervision of all calls to and from the remote stations including, when necessary, the direct connection of two remote locations via the satellite.
The equipment at the Bendigo Main Earth Station consists of a radio transmitter and receiver for communication to the satellite, a small but complex exchange to switch calls to and from the network and multiplexing equipment to arrange the connection of the voice signals from the radio channels to the switching equipment. This equipment will be installed within the Communication Building in Short Street. The radio signals to and from the satellite are in the 12-14 GHz range and will be sent and received by a large (6.4 metre diameter) antenna which will be mounted on the roof of the Short Street building.

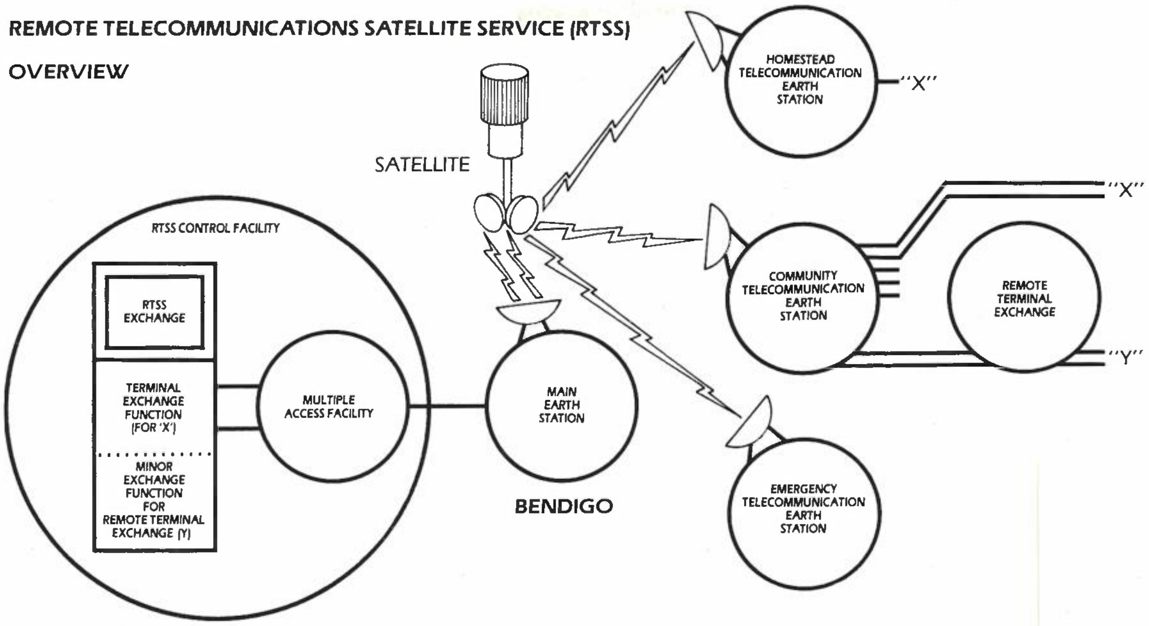
A brief description of a typical call is as follows. A Homestead station customer lifts his receiver to make a call. His station equipment signals to the Main Earth Station via a channel common to all customers that this particular customer wishes to make a call. The Main Earth Station on receiving the request assigns the frequencies to be used for the call and signals these to the remote station. A connection is then made on these frequencies from the customer to the Main Earth Station. This connection (channel) is now exclusive to the call, and the call proceeds on this channel. Figure 2 illustrates the connection of a typical call.

For incoming calls from the network, the call is received at Bendigo Trunk Exchange and a connection is then made to the Exchange in the Main Earth Station. From there, the call is switched to the appropriate customer, via the satellite, on frequencies assigned by the control equipment.
In addition to providing the access to and from the network and the supervision of calls, the Main Earth Station also monitors the state of the entire system, detects faults and raises the appropriate alarms. The NEC exchange at Bendigo will provide advanced customer facilities and will function as both a Minor and Terminal exchange.

It is expected that NEC will commence the construction of the Main Earth Station in August 1984 and construction and testing will proceed until the satellite is launched in July 1985. Further "live" testing will proceed from the remote stations to the Main Earth Station and service is expected to commence early in 1986.

FIGURE 1

REMOTE TELECOMMUNICATIONS SATELLITE SERVICE (RTSS) OVERVIEW



TYPICAL CALL PATH - REMOTE SATELLITE SERVICE CUSTOMER TO MT. ISA.

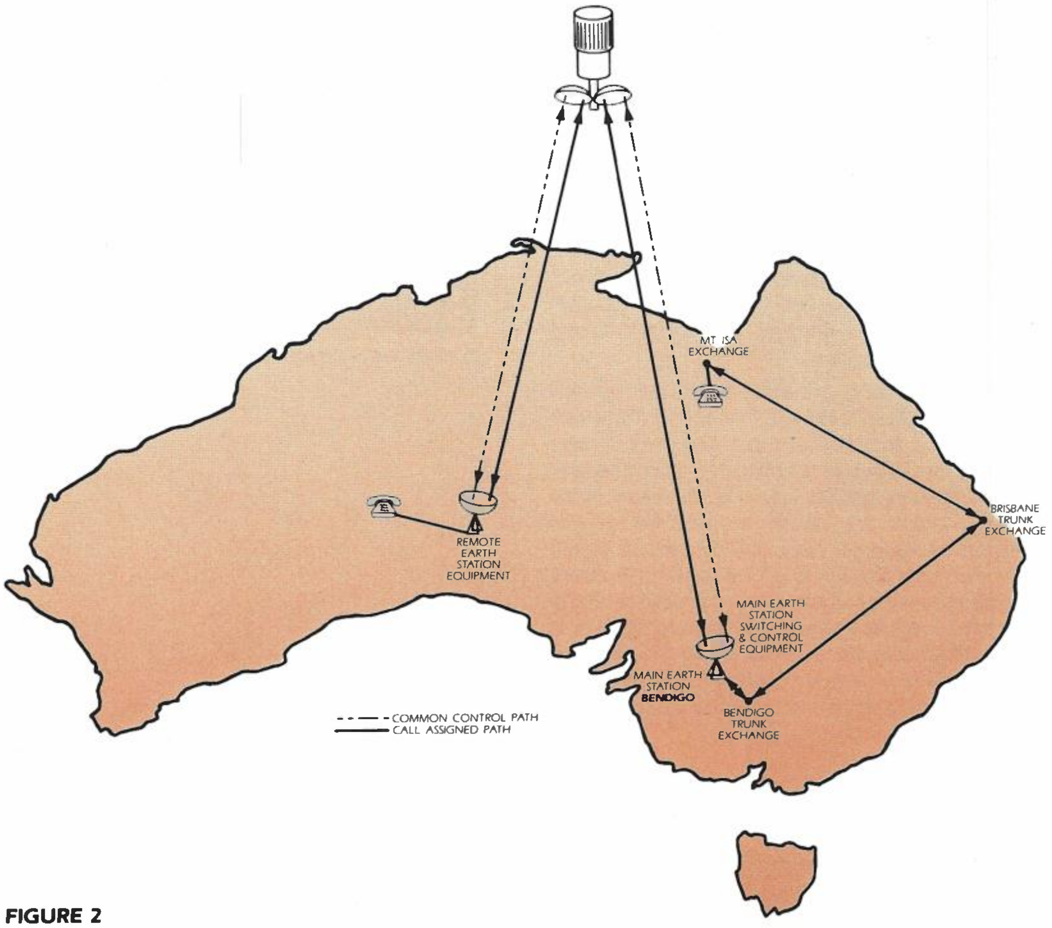


FIGURE 2

Customer Lightning Protection

A significant increase in the number of reported incidents of customers injured by lightning while using telephone services has been evident since around 1980. The increase is believed to be the combined result of an improved incident reporting system, greater customer awareness and an actual increase in the number of injuries.

The possibility of injury exists when a high potential difference develops between the telephone line and the surrounds of the customer using the telephone. This may be produced by a strike to Telecom line plant, raising its potential with respect to the customer's surrounds. It may also arise from a strike to, or in the near vicinity of, the customer's house or a strike to the power wires supplying electricity to the customer's house. This will raise any earthed objects surrounding the customer to a high potential with respect to the telephone line.

Most reported incidents of injury have occurred where the customer has provided a link in the discharge path between the telephone and some locally earthed object. The most common being the metal cabinets of electrical appliances and concrete slab floors.

The principle of protection is to limit any potential difference between the telephone line and locally earthed objects to a safe level. High voltages on the telephone line are discharged by means of a three element gas protector to a Telecom protective earth system installed at the customer's premises. To avoid the possibility of dangerous potential differences occurring between the Telecom protective earth and other earthed appliances in the house, a bonding conductor is installed between the Telecom protective earth and the low voltage power system protective earth. Approval to make this protective bond in Victoria has been given by the Chief Electrical Inspector.

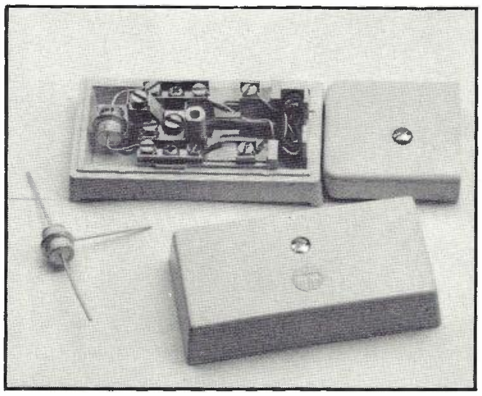
A policy change, greatly increasing the number of new services to be fitted with protection and providing for the restrospective fitting of protection to some existing services, was implemented in July 1983. Although the actual number of injuries in Victoria is numerically small the policy change reflects both Telecom concern for this type of injury and current community expectations.

Details of the policy are contained in the technical publications TPH0265NO and TPV0104LPP. Protection will now be provided for those new services more likely to be affected by lightning and those emergency and operator services where by the nature of the service, people are unable to heed the general Telecom warning to "keep clear of earthed objects and limit phone usage to brief essential calls during lightning storms". Programs are being implemented to retrospectively fit protection to existing services in areas of greatest risk and commercial provision has been made to provide for the fitting of protection to new or existing services of individual customers who express particular concern.

Implementation of the new protection policy in Victoria will necessitate protection of approximately 14,000 additional new services annually and the retrospective protection of at least 22,000 existing services over a five year program.

Determining the services at greatest risk has been done from a knowledge of the characteristics of lightning strikes, information on actual injury incidents, areas commonly incurring plant damage and consideration of lightning strike activity across the State.

A lightning strike location system operated by Research Department is of considerable assistance in locating areas of high lightning activity and identifying areas of lower than normal risk. The system electromagnetically detects cloud to ground lightning strikes using a system of direction finding antennae. This information is fed to a position analyser to determine the location of the strike. The location data is then further analysed by the Lines Practices and Protection Section, Victoria, to produce detailed lightning strike location and strike density maps.



The new gas protector and terminal block.

Lightning Strikes Over 28 Days in February 1983

International Seminar on the Application of New Telecommunication Technologies

Sponsored by Telecom Australia and K.E.C. Japan, a subsidiary of Japan's sole international telecommunications enterprise, KDD.

Held in Melbourne on 26/27 October 1983 and attended by approximately 400 representatives of overseas and local delegates representing Telecom, Industry, Statutory Authorities and Academics. The representatives of Victorian Telecom included Engineers involved in all aspects of Engineering.

The Seminar was opened jointly by Mr R.W. Brack, Chairman of Telecom Australia and Dr Oshima, President of K.E.C. Japan and the keynote address was presented by Mr R.G. Martin, speaking as the Managing Director, Telecom.

In his keynote address Mr R.G. Martin presented an overview of Telecom's current network, the wide uses to which the network is put, the technology situation and his perceptions of the various initiatives being pursued. He stressed the magnitude of the tasks ahead, the risks, the compelling need for Telecom to strive for an advanced telecommunications network and the need for stronger co-operation between Telecom and the telecommunications industry.

Mr Martin drew attention to the particular problems which are imposed on Telecom by geography, population and climate. The network currently represents an asset around $9.7 billion and requires ongoing expansion and modernisation. Touching on the recent steps to develop the network, he stressed the significance of the decision to introduce the AXE system with its capacity for end-to-end digital telephony and its association with IDN and, in due course ISDN with its ability to meet all demands for digital transmission of voice and data, including such facilities as:

- telephony services
- telemetry
- teletex
- circuit switched data services
- facsimile services
- security services
- videotex
- alarms
- electronic mail

The application of optical fibre transmission systems will complement these thrusts which will take us not only into the next decade but also the next century.

Referring to the continuing high percentage growth of the Datel Service and the expansion of the Analogue Data Service he mentioned the current developments in the introduction of two new data services, the Digital Data Service (DDS) and the Packet Switched Service (AUSTPAC).

Telecom has also contracted for the provision of 65 earth stations for its proposed Remote Telecommunications Satellite Service, with terrestrial access to the satellite service via a main earth station at Bendigo in Victoria. Elements of this system should be operational in late 1985.

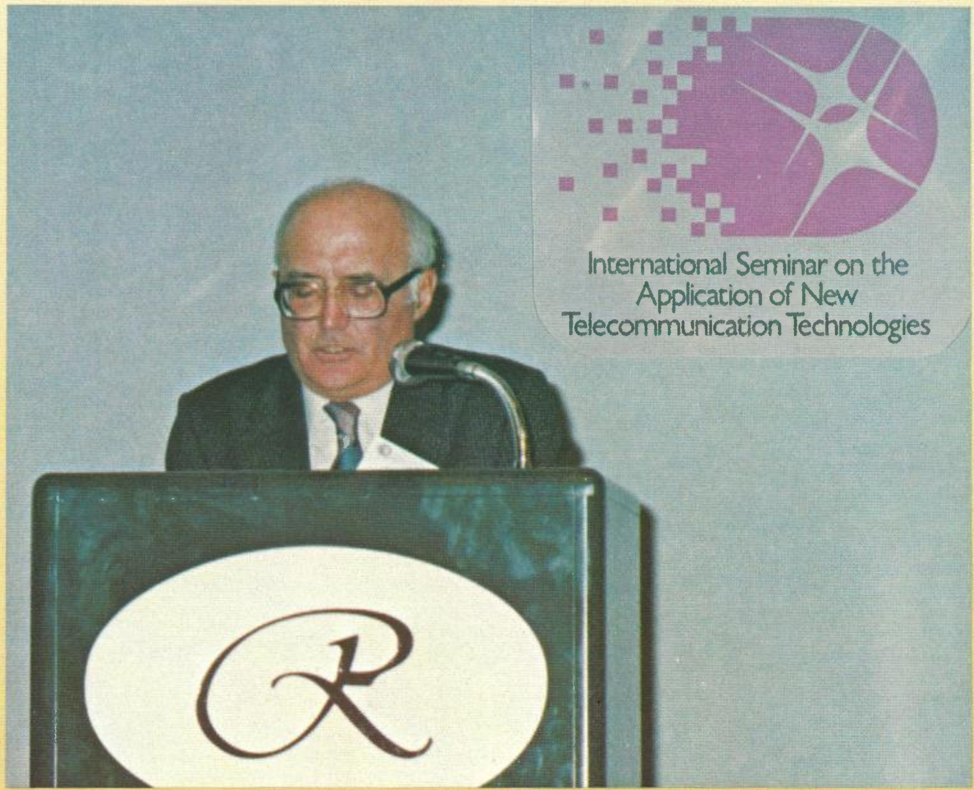
Telecommunication Engineers in both Telecom and Japan are contributing significantly to the CCITT activities associated with the development of internationally accepted standards in the application to IDN and ISDN and Telecom regards this development as high priority.

Telecom attaches considerable importance to publicising its plans to both users and the industry. Telecom and the industry have opportunities, through seminars such as this, to learn of developments and to consider these in the dynamic situation of their planning. Telecom's hope, said Mr Martin, was that Telecom and the industry could become increasingly dynamic to meet these changes and could increase the level of necessary co-operation.

Papers on the following subjects were presented:

- Trends of Optical Communication Technology in Japan – Professor Y. Fujii, Tokyo University
- Present and Future Needs in Optical Communication in Australia – Professor A. Karbowiak, University of NSW
- Optical Devices/Components and Electronic Circuits for Future Communication Systems – Mr T. Iwakami, NEC
- The Present State of Optical Fibre Cable Technologies – Mr S. Inao, Furukawa Electric
- Application of Optical Fibres for Telecommunication Services in Australia – Mr J. Burton, Telecom
- Measuring and Other Technologies of Optical Fibre Cable – Mr M. Hoshikawa, Sumitomo Electric
- Dimensioning of Internatonal Optical Fibre Submarine Cables – Mr M. O'Connor, OTC
- Local Area Network for Office Automation – Mr Y. Suzuki, Fujitsu Ltd
- Local Area Networks – Mr R. Wyss, Telecom
- Japanese Telecommunication Status and Future Evolution Plan Toward Network Digitalization – Mr S. Tomita, NTT
- Present Status and Future Possibilities of Telecommunications Services in Australia – Mr D. Brooke, Mr D. Gannon, Telecom; Mr T. Barker, OTC
- An Approach to International Digital Communication Services – Dr S. Watanabe, KDD
- Current Issues on the use of International Public Data Networks – VENUS – P – Mr H. Ohmura, KDD
- International Packet Switched Data Service MIDAS – Mr P. Thomas, OTC
- DDX Operational Experience and The Network in 1985 – Mr S. Tomita, NTT
- AUSTPAC and Digital Data Service – Mr N. Crane, Telecom

The role of Telecom Australia in assisting in the promotion of this most important international seminar represents a milestone in the future development of communications for Australia.



In his conclusion Mr Martin stated:

"Together, the challenge for us is a massive one. It will involve risks on both our parts from time-to-time, because the very nature of forecasting the demand for advanced telecommunication services is becoming increasingly complex and difficult. Nevertheless, if Telecom Australia is to maintain an international reputation for its technically advanced, well-developed telecommunications network, while at the same time the telecommunications industry in Australia is to become stronger and more self-sufficient, then an increased level of co-operation is necessary."

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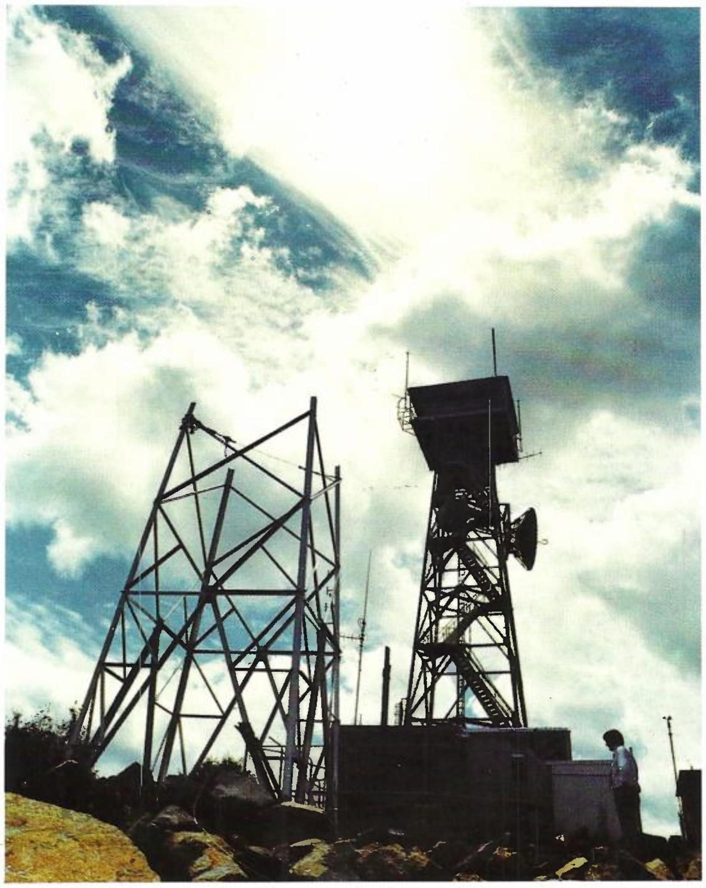

Olympic Games Television A New Link For OTC(A)

A radio relay system has been built linking Healesville and Melbourne to allow OTC (Australia) to provide TV coverage of the Los Angeles Olympic Games. The entire project was conceived, designed and installed in just 6 months.

The picture above shows the partially completed Mt St Leonard temporary tower, a vital component of the system.

In the background is an MMBW lookout tower.

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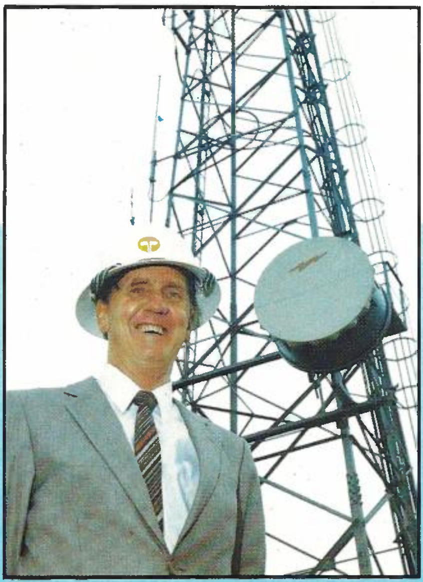


A Message from the Chief State Engineer

This issue focuses attention on the new OTC earth station at Healesville and the interconnection with our Telecom network – a job undertaken with some urgency since the facility will be used for broadcasting from the Olympic Games in Los Angeles later this year.

AUSSAT will also establish an earth station at East Burwood soon and there will be our own Iterra station at Bendigo.

It was pretty cold on the roof of Lonsdale Exchange where the above picture was taken but I suppose it would be a lot colder working on the towers where our radio linemen make their contribution to international communications.

In any event it does mean that we shall need to learn a new language to bring in this new technology. The Space Age comes to Victoria! I recall Charles Prosser, a very knowledgeable Superintending Engineer, Planning relating a conversation he had had with a young graduate Engineer concerned that his employment in the (then) PMG's Department would cause him to lose touch with advanced technology. "Don't worry" said Charles, "most of the advanced technology will find application in our communications system in due course".

Maintenance aspects of course are of equal importance and there is some very good inter-branch and Inter-departmental work being done to establish standards and procedures particularly for digital transmission systems and in support of the IDN and private networks.

J.M. Ryan
CHIEF STATE ENGINEER

Olympic Games Television – A New Link For OTC (A)

In October 1983 Telecom was informed that Overseas Telecommunications Commission (Australia) – OTC (A) was constructing an INTELSAT Satellite Earth Station at Healesville, requiring two TV links to Melbourne. The links were to be made available by May 1984 to allow for TV coverage of the Los Angeles Olympic Games in July-August 1984.

The short time available did not allow consideration of a cable link, leaving radio as the only means available. The time scale, however, was considerably less than desirable for the design and construction of an entirely new temporary radio relay system.

The closer and more desirable Surrey Hills Radio Station had to be excluded as no coaxial tubes could be made available between there and Lonsdale, where the Television Operating Centre (TOC) is located.

Following path evaluation studies it was decided to use a two-hop radio relay:

- OTC (A) – Healesville to Mt St Leonard.
- Mt St Leonard to Lonsdale Exchange building.

The equipment available was sufficient to provide two television bearers, without protection.

The second hop, from Mt St Leonard to Lonsdale, is unusually long (57 km) requiring large dish antennae (3.7m diam) at Lonsdale and Mt St Leonard.

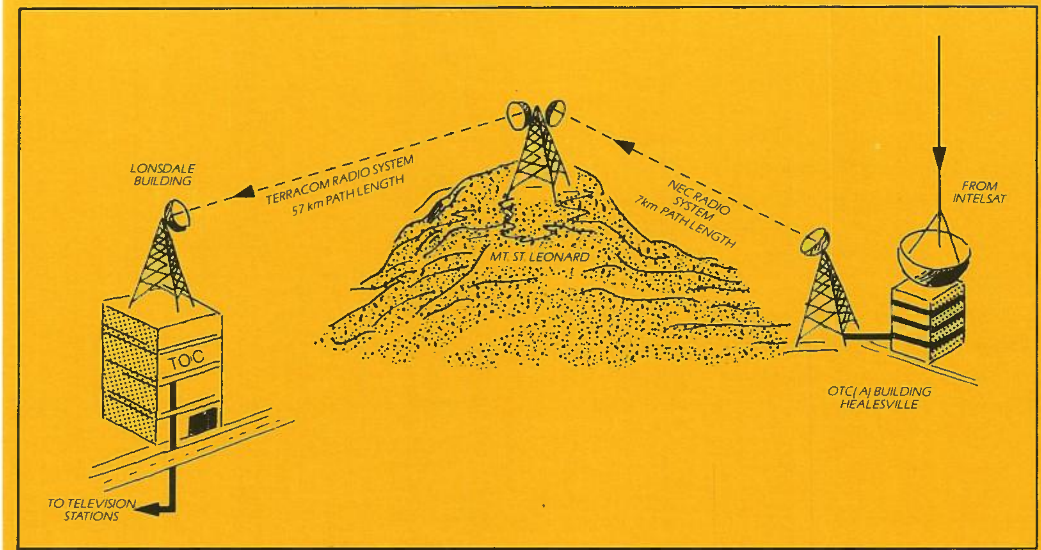
Engineering of the project required the co-ordination of five major activities –

- Erection of a 30m tower at OTC (A) – Healesville under contract to OTC (A).
- Erection of a 15m tower at Mt St Leonard. This tower was transferred from Queensland and required special footings to suit the rubble site conditions. Approval for the tower as a temporary structure was given by both the MMBW and the Upper Yarra Valley and Dandenong Ranges Authority.
- Strengthening of the existing Lonsdale tower to accommodate the large antenna.
- Diversion from NSW of an NEC radio system for the hop OTC (A) – Healesville to Mt St Leonard, and installation of radio and antenna equipment.
- Gathering together of Terracom emergency radio units from NSW, Queensland, Victoria and Headquarters, to assemble and install a system for the long hop Mt St Leonard to Lonsdale.

Before installation the radio systems were assembled and proved in a Depot.

The successful completion of the project required intensive engineering effort and close co-operation within the Victorian and Headquarters Engineering Departments.

The temporary radio links will ultimately be replaced by permanent facilities, probably using optical fibre cable.



RADIO LINK – HEALESVILLE TO LONSDALE

The ARE/AXE/AOM State Support Centre

The introduction of SPC local telephone exchanges into the metropolitan network led to a need for new exchange maintenance and support arrangements. To meet this need a four tier structure, known as MEMO (Metropolitan Exchange Maintenance Organisation) was established. The State Support Centre (SSC) forms the second level of this organisation. (See diagram).

The SSC incorporates a centralised group of Engineers and Technical Officers who have a high level of ARE, AXE and AOM system expertise. It provides an interface between the State organisation and Headquarters, and within the State provides technical support for ARE local exchanges, AXE local, tandem and trunk exchanges and the AOM message switching system. This support is provided in conjunction with the District Support Centres (DSC) and Exchange Maintenance Groups (EMG), and hence demands a close working relationship between the Engineering and Operations Departments.

An important feature of the SSC is that it be capable of providing day to day high level technical support for operational exchanges, as well as ensuring that system enhancements and new facilities are introduced to meet targets defined by network growth requirements and marketing plans.,

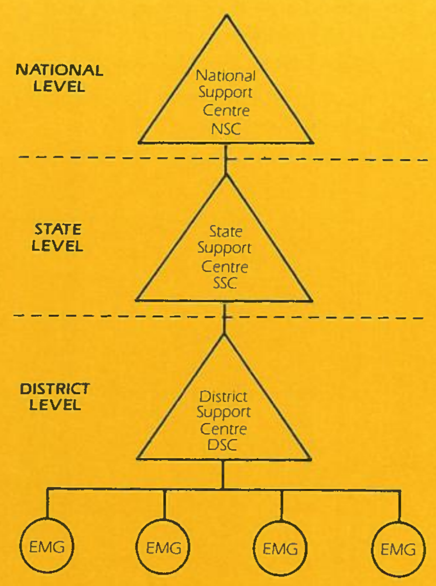
The main functions performed by the SSC are:

- To liaise with Headquarters and relevant areas within the State on maintenance arrangements, practices and procedures.
- To provide high level technical assistance to Operations Department District staff involved in the location of complex faults.
- To provide system support for longer term maintenance and operations, by investigating the causes of system failures and the effectiveness of maintenance aids and procedures.
- To control the implementation of software and documentation releases received from Headquarters.
- To control the operation of a central parts store, to assess State requirements for system spares and to co-ordinate the implementation of relevant works specifications.
- To ensure that secondary training courses are adequate, timely and reflect the needs of users.
- To participate in development work by assisting HQ in the specification and evaluation of field trials, or by working on particular projects.

Data communications with the ARE and AXE exchanges are used for inputting commands and receiving information from the central processors. The SSC has a data link to each of the DSC's for communicating with ARE exchanges and to the AOM to access all AXE exchanges.

At the completion of the REMO project in 85/86 there will be 100 ARE exchanges with approximately one million lines installed. Also at this time the AXE Programme is expected to have provided 24 nodes and 15 Remote Subscribers Stage (RSS) locations with an installed capacity of approximately 100 000 lines. This programme incorporates local terminal, tandem, and originating and terminating trunk tandem facilities in both the metropolitan and country networks.

The establishment of the SSC has provided a focal point within the State for all operations and maintenance aspects associated with the ARE, AXE and AOM systems. The close working relationship that the SSC has with Construction Branch, as well as Operations and Commercial Departments, will facilitate awareness and efficient achievement of targets identified in the Engineering Construction Programme.



METROPOLITAN EXCHANGE MAINTENANCE ORGANISATION
MEMO

MJR – Metropolitan Junction Records

The need for an on-line computer record system for use by Junction Control in Commercial Department to maintain details of the 03 cable network has become more urgent with increasing demands for greater accuracy and quicker response for cable details.

A system, developed by South Australia, and now being implemented by Engineering in Melbourne, is appropriate for metro junction cable records as it gives:

- high record accuracy
- improved access to records
- network statistics
- management reports

MJR includes all PCM systems and junction cables within the 03 Closed Numbering Area and is scheduled to be in service in May/June 1984.

On-line up-date and retrieval capabilities enable MJR to operate efficiently and maintain up-to-date records in the data base. Record updating is the responsibility of the Junction Control group.

Output reports available from the system are:

• Cable Reports (showing utilisation of pairs)

• PCM System Reports (showing utilisation of channels)

• Circuit Reports (showing cross connection of pairs or channels)

• Cross Connect Reports

• Field Work Reports (machine generated Junction Schedules)

• Outstanding Authorities Reports (showing circuits pending connection)

• Intact Services Reports

• Statistical Reports

Routine microfiche records of cable and circuit reports are also provided; these replace the duplicate manual records in user areas.

The major benefits of MJR are:

• high record accuracy resulting from a common record for all users

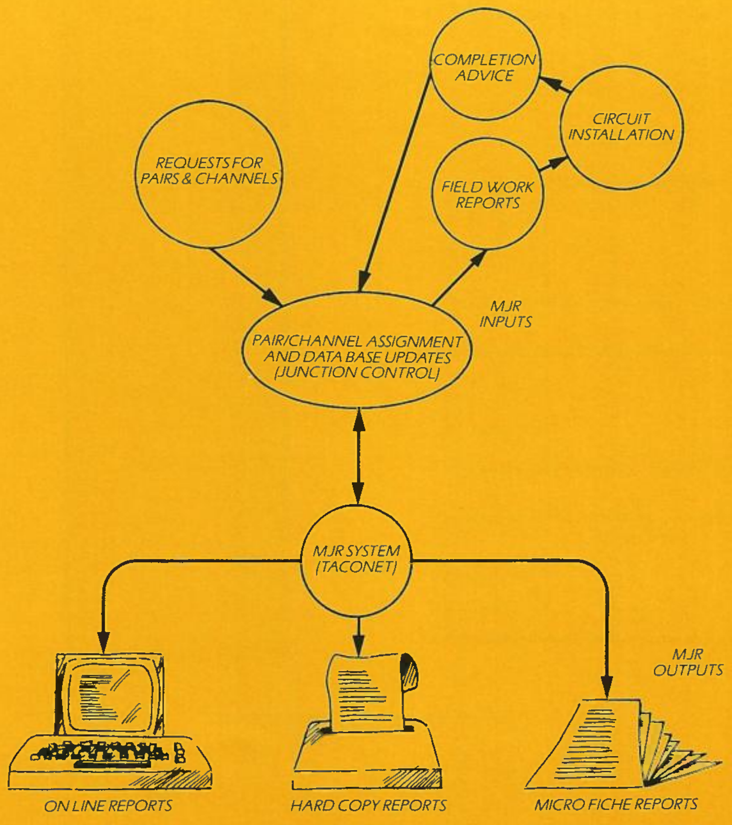
• access to latest up-to-date records via VDU if required

• improved cable occupancy resulting from improved accuracy

• better management information.

The initial loading of the MJR system into a Honeywell DPS6 mini computer commenced in October 1983. During data capture, codes are automatically converted to the National Coding Structure and are checked to ensure that all cross connections are listed for each circuit.

The MJR Special Service information can be validated against the RASS (Records Automation for Special Services) system, ensuring that both systems have a high level of accuracy.



MJR SYSTEM WORKFLOW

AXE Remote Switching Stages (RSS) – A Further Step in the Integrated Digital Network

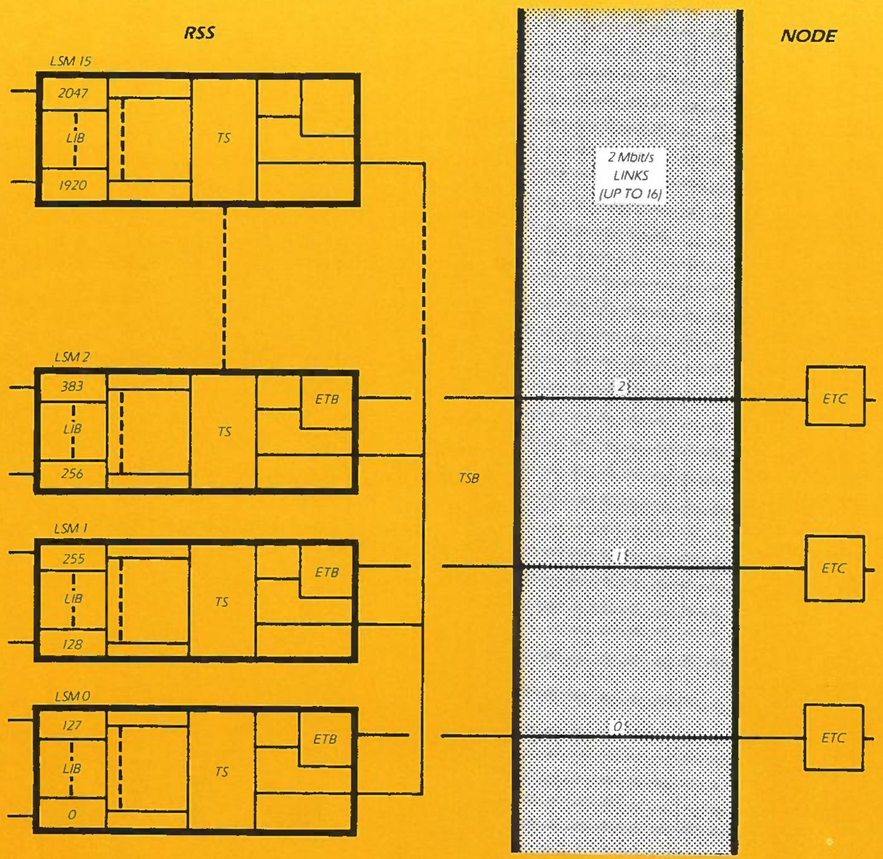
The first AXE Remote Switching Stage (RSS) in Australia is due to be commissioned late in 1983/84. This RSS is located at Port Melbourne Exchange, in a semi-industrial area on the fringe of the Melbourne Central Business District.

The policy was adopted in 1982 to use the AXE remote switching stage to provide for telephone service development and to make advanced facilities available on a wide-spread basis. Deployment of RSS units in the telephone network will make use of the full potential of AXE switching stages set up as nodes to control both local and remote switching stages. Installation of RSS is a more economical method of providing for network growth than providing autonomous nodes or continuing with crossbar equipment.

RSS has no system intelligence, relying on its parent node for processing of all calls, including those internal to the RSS. It is therefore possible to offer standard AXE customer facilities relatively cheaply through the RSS.

Interconnection between the RSS and its parent node is by 2 Mbit/s links which provide traffic circuits and control channels. For security a minimum of 2 digital systems are provided, and as far as possible the routing of the links is completely diversified.

Each RSS unit is self-contained, with a maximum size of 2K (2048) lines, and up to 16 2 Mbit/s systems can be provided to enable connection of up to 494 traffic channels. The simplified block diagram shows that the RSS consists of up to 16 Line Switch Modules (LSM) which contain 128 Line Interface Boards (LIB), a time switch (TS) and capacity for an Exchange Terminal Board (ETB). The TS are interconnected by a Time Switch Bus (TSB) which allows any LIB to be connected to any ETB. Connection to the parent node is through Exchange Terminal Circuits (ETC), using 2 Mbit/s links between ETB and ETC. In the 2 Mbit/s link, time slot 0 is used for synchronisation and 1-31 are used for traffic circuits; except that in two links time slot 16 is reserved as the control channel between RSS and node.



RSS – SIMPLIFIED BLOCK DIAGRAM

LSM	Line Switch Module
LIB	Line Interface Board
TS	Time Switch
TSB	Time Switch Bus
ETB	Exchange Terminal Board
ETC	Exchange Terminal Circuit

Port Melbourne

Port Melbourne was chosen as the first RSS site for a number of strategic reasons:

- Close to an established node.
- Close to Headquarters Engineering, National AXE Model Exchange and L.M. Ericsson.
- High-traffic location, requiring AXE facilities.
- Integral to relief strategy for a site-limited exchange building.

Testing of Port Melbourne RSS, as the first RSS to go into service, has been very extensive, involving:

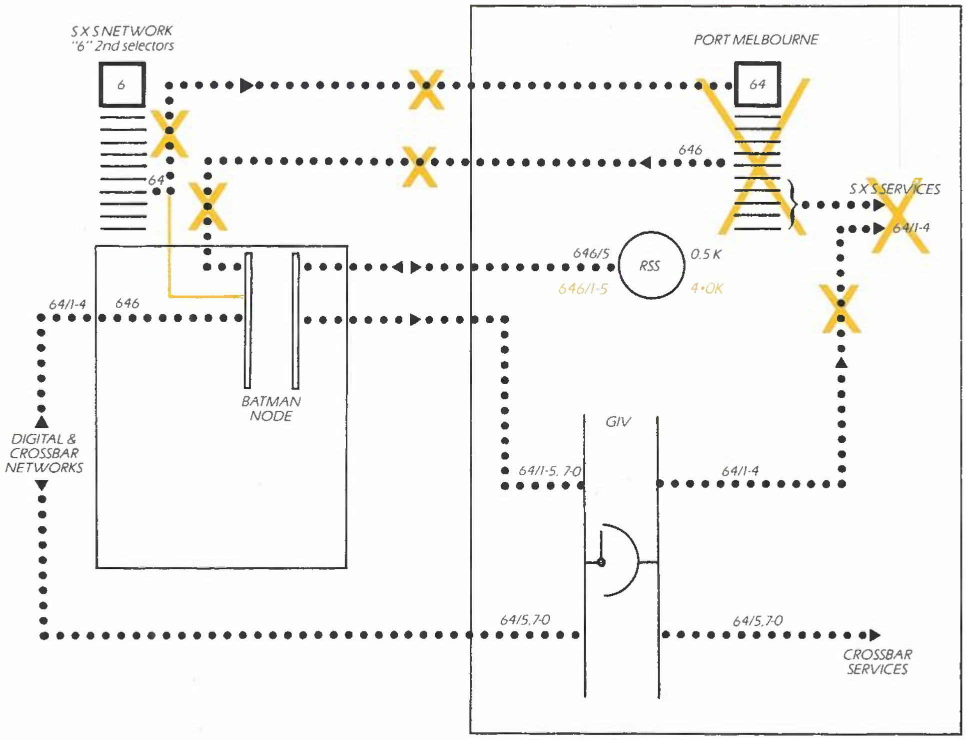
- Interworking with the National AXE model node, testing hardware and software, particularly for multiple RSS control.
- Interworking with Dandenong node (not yet in service) in a network configuration.
- Testing with Batman, the parent node, followed by commissioning.

The simplified trunking sketch shows that network access to Port Melbourne RSS (Code 646) is via Batman node, which receives traffic from the digital, crossbar and SXS networks.

The next stage of development will be to extend the RSS from the initial 0.5K (512 lines) to two individual units each of 2K and recover the SXS equipment. This is indicated on the trunking sketch.

Future Development

Plans for the Victorian network include a rapid expansion in the development of RSS. The present version of RSS does not allow for any internal call switching. An enhanced RSS is expected to be available in the late 1980's which will allow limited internal switching, and also provide for digital (64 Kbit/s) customer connections.



SIMPLIFIED NETWORK TRUNKING FOR PORT MELBOURNE RSS

FIRST CUTOVER: 0.5 K, CODE 646/5

SECOND CUTOVER: 4•0K, CODE 646/1-5 REPLACING 64/1-4 SxS SERVICES, WITH CONVERSION FROM 6-DIGIT (64) to 7-DIGIT (646) NUMBERING

AXE Easycall Services

Easycall Services is the generic name given to a range of Customer Services to be marketed as standard facilities with the introduction of AXE equipment. These facilities are provided within the AXE exchanges at installation and were field trialled by Engineering at Batman exchange before being released for customer use. The field trial was followed by market research on selected Toorak AXE exchange customers. The launch date for Easycall Services is early 1984/85.

The services to be offered in the initial launch of Easycall are Speed Calling, Call Control, Call Waiting, Third Party Enquiry, Three Way Conference, Call Diversion and Hot Line. The services have been grouped into 3 distinct packages for marketing purposes. (See diagram). An additional service, Last Number Re-Dial, may also be introduced in Package 1.

THE BASIC FEATURES OF THESE SERVICES ARE:

Speed Calling enables a customer to store a group of commonly called local, national or international numbers, and later dial those numbers by the use of a 1 or 2 digit code.

Call Control gives the customer the ability to bar service to particular types of outgoing calls (ie STD, ISD or Trunk Operator) and later restore normal access.

Call Waiting. A customer engaged on a call is given a tone indication that another call is attempting to access his number. He may choose to accept or ignore the waiting call.

Third Party Enquiry allows a customer engaged on a call to set up an enquiry call to a third party.

Three Way Conference allows a customer who has established a third party enquiry call to connect all 3 parties in conference mode.

Call Diversion allows incoming calls to the customer's number to be redirected to another previously specified number. Initially, call diversion is to be restricted to numbers within the same exchange. However, the AXE has the facility to extend the service to include numbers in distant exchanges. This may be made available in the future dependent on tariffs, signalling and transmission being satisfactory.

Hot Line service allows a customer, on lifting the handset, to be automatically connected to a predetermined telephone number without dialling. An alternative option allows the Hot Line service to be combined with a normal call facility. In this case, establishment of the Hot Line call is delayed for a period of 4 seconds to allow the customer to initiate a normal call by dialling. With this option the customer may change the Hot Line number from his own service.

Last Number Re-Dial. Should a call be made to a busy number, this facility enables the customer to re-dial that number by operation of a button on his touchfone.

Additional services available in AXE are being considered for possible future release. These include Do Not Disturb (Incoming call diverted to a recorded message); Automatic Alarm Call (Automatic Appointment/Reminder Service); Call Forward on Busy and Call Forward on No Answer (Incoming call diverted to another service).

At the launch of Easycall, about 26 000 AXE lines will be available in Victoria. This will be doubled by the end of 1984/85 and doubled again in 1985/86 to an expected total of 100 000 lines.

All Easycall facilities are exchange-based and are implemented entirely in the central software of the local exchange. Hence an AXE customer is provided with access to these facilities by allocation of a classification in the AXE software. The allocation of a classification is carried out by command from an authorised terminal. No modifications are required either to the exchange equipment or to the customer's telephone.

EASYCALL SERVICES

Maintenance of Melbourne-Wagga Coaxial Cable Systems

Considerable work is being done on the line transmission systems on the Melbourne-Wagga section of the Melbourne-Sydney coaxial cable to counteract deterioration of the cable because of chemical changes in the coaxial tube insulating spacers.

When installed in 1962 the route was equipped with 6 MHz valve equipment, with repeaters every 9km in above-ground buildings. Between 1972 and 1975, it was upgraded to carry 2 x 12 MHz transistorized systems, with repeaters every 4.5km. The additional repeaters were housed in underground containers. In 1983, an 18 MHz system was commissioned, with repeaters every 4.5km.

The present gross channel capacity is:

2 x 12 MHz systems	=	5400 channels
1 x 18 MHz system	=	<u>3600 channels</u>
		9000 channels

Besides providing the majority of circuits on the busiest inter-capital route in Australia, the coaxial cable provides transmission facilities to centres along its route, including Seymour, Euroa, Benalla and Wangaratta, where little or no traffic diversity is available.

In addition, 32 interstitial pairs are used for a variety of purposes, such as order wires, alarms, junctions, carrier system bearers and private lines, all adding to the overall importance of this cable.

Regulating amplifiers in each regulating repeater sense the change in level of a pilot frequency due to changes in cable temperature over the year, and adjust gains over the whole band width to match a standard cable.

In the late 1970's, it was found that to maintain the route to Telecom standards, re-equalisation was necessary. The carrier equipment was within limits, but it appeared that the cable itself was deteriorating and would soon be outside system design limits.

In 1981, Telecom Research Laboratories advised that the changes in system performance were consistent with increased dielectric loss in the coaxial tubes, and the investigation concentrated on the poly-ethylene spacers used to position the centre conductor within each coaxial tube. Eventually, it was proved that the problem was due to oxidation of the spacers in the Melbourne-Wagga section of the cable, and unless a way was found to stop the degradation, by about 1988 the cable would be unworkable.

It was then found in the laboratory that by using nitrogen gas instead of dry air in the cable, the deterioration due to the oxidation of the spacers could be substantially arrested.

Nitrogen was inserted into the section between Wangaratta and Albury in late 1982, and into the remainder of the cable between Melbourne and Wagga during early 1984, and measurements in March 1984 showed that as predicted, the deterioration had been arrested.

However, the use of nitrogen in the cable instead of dry air is a safety hazard. Staff have been trained in the safety precautions to be taken, especially in underground repeaters, and warning notices are prominently displayed near equipment, and on the cables.

The cable now is non-standard, and errors in gain adjustment at each regulating repeater become additive along the route.

Therefore if the route is not regularly measured and re-equalised, a large number of the 9 000 derived circuits will go high level, which will overload the amplifiers, and cause all circuits to become noisy and eventually fail.

Also, many of the links from this coaxial cable are cross-connected to other radio and cable links, and high levels generated in the coaxial cable could result in degraded performance or failures elsewhere in the network.

The objective of the Victorian Trunk Network Service staff is to maintain the coaxial cable route between Melbourne and Wagga at the fullest capacity for as long as possible with the least interruption to traffic.

Great care is needed, as much of the work has to be done on working equipment, and a mistake could cause the failure of up to 3 600 channels, severe network congestion, community isolation and loss of revenue.

Coaxial cable joint showing warning signs.

Coaxial cable make up showing inner conductor, spacers and outer tube.

New Network Developments

Call Charge Recording for STD Calls

The Call Charge Recording (CCR) system enables customers to be provided with individual records of their non unit-fee calls. This service will be available to customers for an additional fee.

The CCR facility is limited to customers connected to exchanges which provide Calling Line Identification (CLI). A call to be charged by CCR is routed to a CCR charging point where the customer's CLI (sent from the originating exchange) and the call details are associated, and recorded for off-line processing.

Commencing in July 1984, STD/CCR will be offered to metropolitan customers connected to AXE, ARE and some modified REG-LP exchanges using the 10C exchanges at Lonsdale and Windsor as CCR charging points. These exchanges are:

> Batman (AXE), Russell (ARE), Lonsdale (ARE), Exhibition (ARE), Collingwood (ARE), South Yarra (ARE), South Melbourne (ARE), Windsor (ARE), Port Melbourne (AXE), Highett (ARE), Lyndhurst (AXE), Narre Warren (AXE), Wheelers Hill (ARE), Camberwell (Reg-LP), Hartwell (Reg-LP), Oakleigh (ARE), Boronia (ARE), Mooroolbark (ARE).

From July 1986 it is planned to increase the number of STD/CCR charging points in the metropolitan area by using the AXE trunk exchanges at Exhibition and Windsor. In the period up to 1987 the STD/CCR capability will progressively be extended to all CLI-capable metropolitan exchanges and to selected exchanges in the Geelong and Mornington Peninsula areas. It will be further extended into country areas by providing AXE facilities at selected centres as part of the modernisation of the country network.

008 Service – Switching Developments

The 008 service, previously known as INWATS, is an automatic reverse charging system. It allows telephone customers to call 008 customers for the cost of a unit fee call regardless of distance. The 008 customer is bulk-billed based on the usage of his 008 lines.

Switching for 008 customers is handled by centralized crossbar group selector (GV) stages located at Lonsdale exchange. Three separate switching stages handle the various service options –

- AUST WIDE
- STATEWIDE
- METRO ACCESS.

However the crossbar GV stage has route address constraints which limit the number of 008 customers which can be connected per stage to 80. This limitation has severely restricted our ability to meet the volatile demand for the 008 service.

To improve our responsiveness, an ARE-controlled 008 exchange has been planned for commissioning by June 1984. The majority of the equipment (initially 2 000 lines of m = 10B SL equipment) is being recovered from Central Business District (CBD) exchanges as part of a CBD modernisation strategy. This involves the progressive transfer of Lonsdale customers from ARE equipment to AXE equipment, releasing 7 000 lines of ARE equipment for 008 customers.

The 7 000 line 008 ARE exchange should cater for demand until late 1987/88. After that it is proposed to use AXE equipment for the 008 service.

Quizphone

For a number of years, some radio and television stations have been conducting quizzes and give-away sessions inviting listeners or viewers to telephone the studio. These events can result in severe disruption to the public switched telephone network.

The station conducting the quiz normally has only a small number of lines to terminate the calls and initially, disruption to the network appears as congestion in the terminating switching stage.

In severe cases the large number of calls generated, combined with repeated call attempts, reflect the congestion back to the originating exchange resulting in a 'No Dial Tone' condition.

A proposal, called Quizphone, has been intitiated to alleviate the network congestion.

The fundamental objective is to terminate as many calls as possible, as terminating the calls reduces the likelihood of congestion and reduces repeated call attempts. This will be achieved by –

- directing the traffic to a large capacity switching stage.
- providing a short duration recorded announcement for calls which are switched to the Quizphone number but **not** able to be accepted by the radio/TV station as responses to the quiz.

Network congestion will be further avoided by selectively routing Quizphone calls so that they do not overflow to backbone routes.

The crossbar level 11 (L11) tandem at Lonsdale will be used to provide the Quizphone service.

A small number of private lines will be provided between the Lonsdale L11 tandem and radio and televisions stations. These lines will be used by the staions to answer the successful quiz calls. The station will provide an appropriate message for those calls which overflow to the recorded announcement. A call count facility can be provided at the stations for marketing and popularity statistics.

MANUAL CONVERSION
NATIONAL STD ACCESS
STROWGER LINE EQUIPMENT REPLACEMENT

VICTORIA COMPLETED

Three historic milestones were reached in the Victorian telephone Network during 1983/84. It is fitting that these should have occurred in the same year that the digital era began, as they mark the passing of the oldest technology in the Victorian Network.

MANUAL CONVERSION

From 1961 to 1974, more than 1 000 manual exchanges were closed, as 70 000 customers were connected to RAX or ARK exchanges. These cutovers from manual to automatic service were accompanied by a vigorous programme of upgrading part-privately-erected telephone lines and network upgrading.

In the last 10 years, from 1974 to 1984 the remaining 34 000 customers on 233 manual exchanges were cutover to automatic. The honour of the last cutover went to Murtoa, with the final "Number Please" on Friday, 25 May 1984.

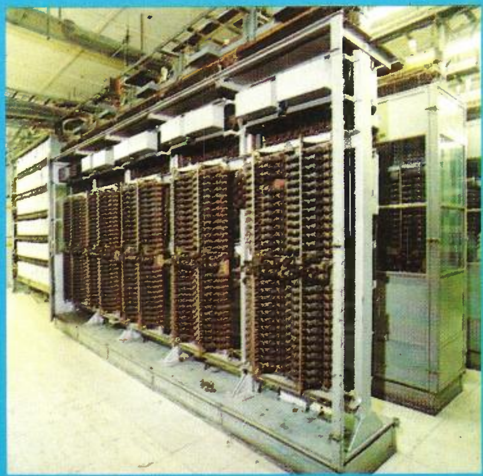
Murtoa Exchange ▶

NATIONAL STD ACCESS

Through the installation of 60 minor switching centres from 1969 to 1984, all customers were given national numbers and access to the national STD network. The commissioning of Foster minor switching centre, replacing a step-by-step tandem, on 2 Oct 1983 marked the completion of this programme.

STROWGER LINE EQUIPMENT REPLACEMENT

The last two groups of Strowger primary line equipment in Australia were phased out during 1984, with 4 000 lines at Box Hill being cutover to AXE equipment, and 2 000 lines at Canterbury being cutover to ARE11 equipment. Only a single stage of Strowger group selectors remains at Box Hill, to be replaced at a further stage of the complete replacement of Box Hill SxS exchange with AXE.



Strowger Line Equipment ▶

ENGINEERING 82, 83 & 84 CONTENTS

ISSUE NO 8 OCTOBER 1984 ENGINEERING DEPARTMENT TEL (03) 657 2706

ENGINEERING 84

To meet today's business needs a new generation of PABXs has been developed which integrate voice and data information in a digital format.

This integrated office switching system uses Third Generation PABX equipment which is shown in the above picture.

TPV0010 CSE PREPARED AND AUTHORISED BY CHIEF STATE ENGINEER VICTORIA. DISTRIBUTION CODING: SELECTIVE

A Message From The Chief State Engineer

Here's a picture of Ern Angel, Superintending Engineer - Construction and me browsing through the first seven issues of Engineering 82-84.

Looking back, we were concerned that the changes in telecommunications engineering were becoming increasingly hard to keep up with. How to keep everyone informed of the latest, or even the existence of it, demanded urgent attention.

It was Ern who accepted the job as first chairman of the Editorial Board and with the presentation skills of John McHutchison - Drafting Publicity - and some fine contributions by others, set the standard. We've covered a lot of ground since. Ern has now retired after a noteworthy career. Thanks Ern.

The time has also come for me to leave Telecom and I do so with a tremendous respect for the quality of the people I leave behind. I have enjoyed working with you.

J.M. Ryan
CHIEF STATE ENGINEER

Extension of Radio Paging in Victoria

Introduction

Whilst the original public paging service using equipment installed at Lonsdale Exchange met the basic paging ("Beep-Beep") needs of our customers, and MOPAX (Mobile and Paging Exchange) caters for growth and some types of numeric pager, recent overseas developments have led to more sophisticated systems becoming available.

Continuing high level of demand, competition from the private sector in both Metropolitan and Regional centres along with the introduction of a new policy whereby privately operated paging systems are allowed to interconnect directly with the Telecom network has placed pressure on Telecom to match facilities provided by private enterprise.

A new paging system – BBL is being introduced at Windsor Exchange which will cater for all the various types of pagers.

BBL System 111/R

Designed and manufactured in the USA and supplied through Motorola, BBL can accommodate up to 160 000 customer codes. The initial installation at Windsor will cater for 10 000 codes.

The BBL system consists of a number of modules providing an interface with the telephone network and external control/information devices, eg. VDU, along with storage of customer records and output of analogue and digital information to activate customer pagers via strategically placed radio transmitters.

The system can accommodate various paging formats including 2, 5 and 6 tone, tone and voice, POCSAG (Post Office Code Standardisation Advisory Group in UK – tone and/or digital), digital tone and/or numeric display and alpha-numeric display.

Paging of customers having numeric pagers can be achieved using either a tone dialling touchfone, acoustic coupler or via a Telecom operator. In the case of alpha-numeric pagers consideration is being given to accessing the BBL system via either the telex network or using the dial up Datel Service.

Voice Retrieval System

The paging system can be used in conjunction with a voice retrieval system which can serve as an unattended message centre capable of accepting voice messages and providing access for retrieval via the telephone network.

A recorder module can be provided which will temporarily store voice messages. The message, which can be up to 24 seconds duration, is transmitted following the tone paging signals which alert the paged customer.

It is proposed to trial a BBL voice retrieval unit.

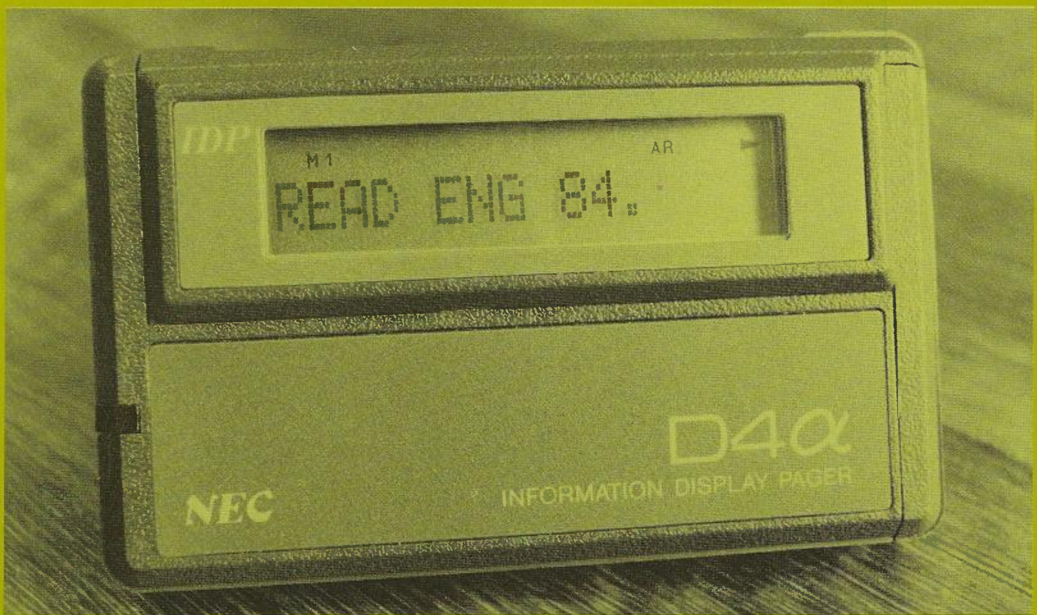
Coverage

Apart from the Metro area and Mornington Peninsula, with fringe coverage of Geelong and the Bellarine Peninsula, the paging service now operates in the Latrobe Valley, Ballarat, Bendigo and Shepparton with additional country centres – Warrnambool, Mildura, Sale and Wangaratta being introduced later this year.

These centres along with Hobart and Launceston utilise the Melbourne paging equipment.

Summary

The demand for a paging service is becoming more widespread whilst customer requirements become more sophisticated. Engineering is responding to this and the challenge of competition from privately operated services by extending the paging service to country districts and providing a new system which will cater for the various types of pagers now available.



Typical Alpha-numeric Pager

Radiocommunications Network – The First 25 Years

1959 saw the first Broadband Microwave system commissioned in Australia linking City West and Bendigo trunk centres. During the past 25 years Engineering has put in place an extensive radiocommunications network linking capital cities and major centres within each State.

The Victorian radiocommunications network (See Map) covers the greater area of the State. At present Telecom has 164 radiocommunications sites with a further 18 planned for establishment by 1987. It is anticipated that there will be a 50% increase in radiocommunications circuits within the next 4 years.

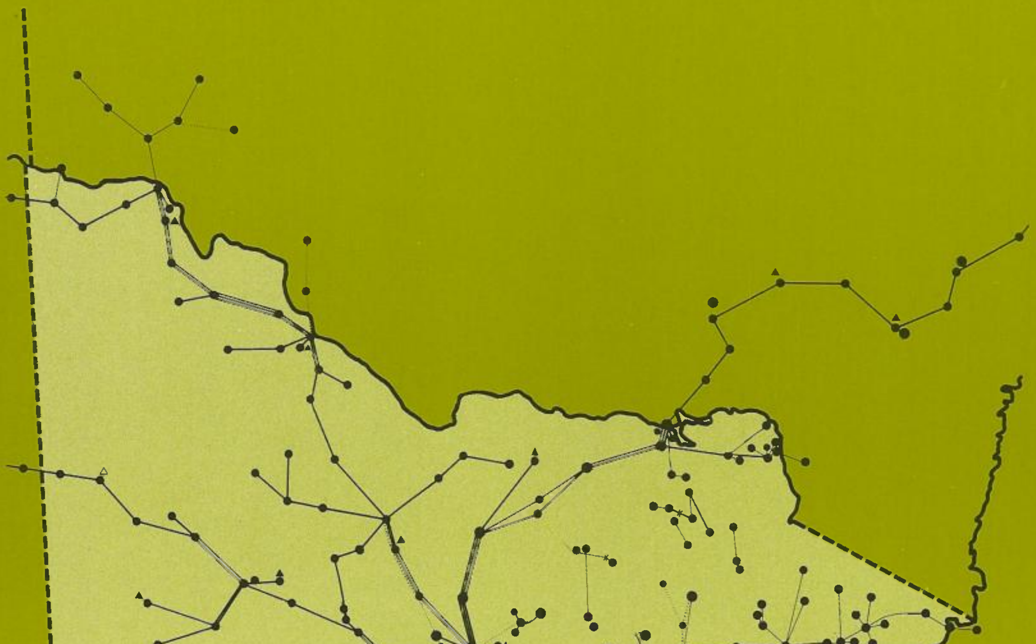
Radiocommunication in conjunction with cable transmission systems plays a vital role in the trunk/junction network. This can best be illustrated by the number of circuits provided on the Melbourne-Sydney route:

- Three analogue systems of 1800 voice channel capacity for telephony, telegraph and private lines
- Three digital links of 2 Mbit/s capacity
- Two digital links of 8 Mbit/s capacity
- One 140 Mbit/s capacity link
- Six television bearers
- Protection bearers for fault and maintenance patching and itinerant services.

Other services provided by Radio include:

- Small capacity telephony from 6 to 120 channels
- Single channel customer services
- Mobile Telephone Service (MTS)
- Paging (Telefinder)
- Telecom Mobile Communications Network (MCN-T)
- Customer 2 Mbit/s and 8 Mbit/s Digital Links.

On a commercial basis, other services such as the Gas and Fuel network and the links to the Esso off-shore oil platforms are maintained by Telecom.



A large part of the capital investment in radio systems is in the external plant. Repeaters must be located within line-of-sight of one another and, to achieve system performance, design of each leg of a route must include consideration of tower size, antennae height, gain and type, length of waveguide and transmit power.

Efficient supervision and control of the radio network is vital in safeguarding the continuity of traffic and regulating maintenance activity. This function is performed in Victoria at the Surrey Hills Radio Terminal on a 24 hour basis for all systems.

Alarm information from each repeater is multiplexed on location and inserted on the sub-baseband of a broadband route. Individual alarms are then concentrated and displayed at the Surrey Hills terminal. (See Photo). Because of the specialised nature of the radiocommunications network, it is necessary to employ specialist and experienced staff who are able to interpret and accurately classify faults so that the most effective and efficient recall procedures are practiced.

Maintenance of the radio broadband and small capacity network involves Country Districts who perform first-in maintenance on radio systems installed within their boundaries. The Radiocommunications Service Centre (RCSC), Box Hill performs first-in maintenance on City based systems and second-in maintenance on the entire network. Included in the RCSC complex is a Panel Repair Centre which repairs, stores and despatches spare panels as required.

A major maintenance problem is the rapid changes in technology resulting in the continual introduction of new types of equipment and systems. This necessitates considerable updating of knowledge and the storage of a vast range of spare parts and sub-assemblies.

The broadband radiocommunications network is a major carrier of trunk communications on a national basis. The importance of the radiocommunications network is vital to both Telecom and national economic stability and growth. The planning, establishment, maintenance and security of this vital network is dependent upon the continuity of specialised staff whose experience and expertise remains invaluable in maximising and maintaining high system performance.

Control Suite at Surrey Hills Radio Terminal

New Generation PABX's

As we enter the Information Era customers are demanding communication systems which can efficiently handle all their voice and data requirements. This has led to the development of PABXs and associated networks which switch and transport voice and data information in an integrated digital format.

We have progressed from the electro-mechanical PABX – First Generation – through the SPC analogue PABX – Second Generation – to the integrated voice/data digital system – Third Generation. The general features of Third Generation PABXs are discussed in this article.

The first SPC PABXs provided a quantum leap in facilities and also reduced accommodation requirements compared with their elecromechanical predecessors. They also had several shortcomings, namely:

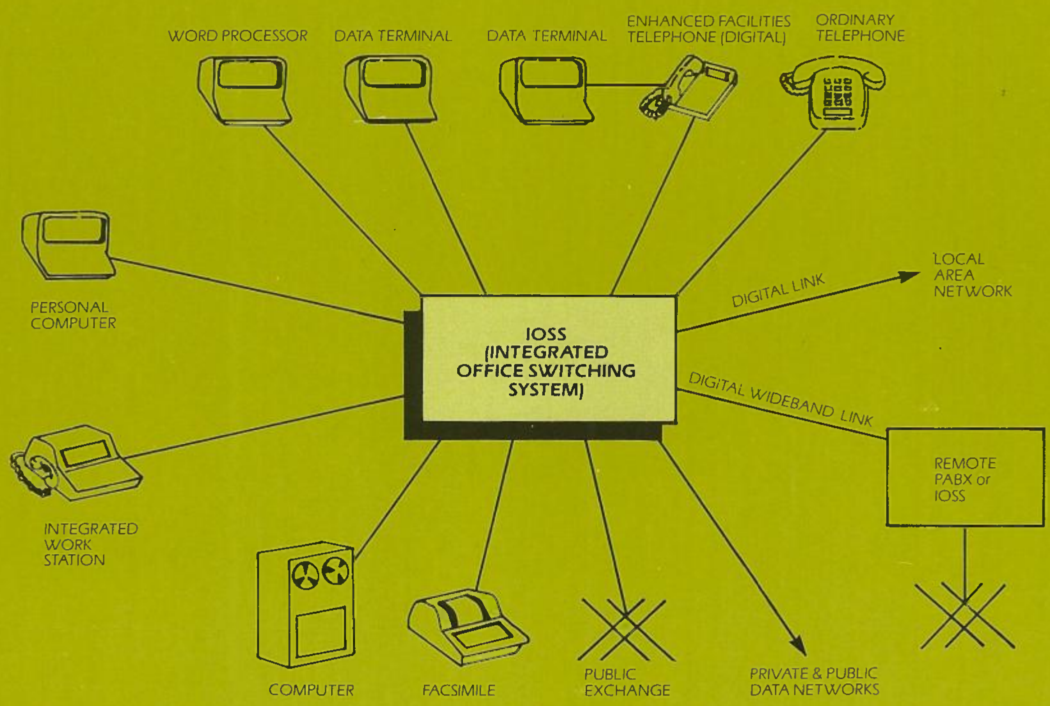
- general lack of technical standardization
- limited intelligence and control in networking applications
- low to medium traffic capacities for large systems
- limited ability to switch data
- large requirements for power supplies and air treatment
- high cost of maintenance (staff training, amount of attention required and spare parts).

In the late 1970's and early 1980's a number of manufacturers in the USA announced plans for futuristic systems which would be developed to meet the demands of the "office of the future".

There was considerable conjecture on the requirements of office automation with a number of different approaches being proposed. It is generally recognised now that office automation will involve:

- exclusive use of personal computers or 'dumb terminals' by executives and managers
- inhouse switching of telex, teletex and word processing
- access to corporate data bases via workstation equipment
- use of electronic mail and word processing for inhouse document preparation, delivery and storage
- management control of communications costs and flexibility to configure systems and networks.

Although not designed specifically with these facilities in mind, many second generation SPC PABXs have been adapted to provide some of them. Most second generation PABXs however are analogue switching machines.



INTEGRATED OFFICE SWITCHING SYSTEM (3RD GENERATION PABX)

PABX systems designed to have the capability of meeting the above criteria are known generically as Third Generation PABXs. They are also referred to as Integrated Office Switching Systems (IOSS). Although the specification and demands have been the outcome of the need to meet the office automation requirements, the results have been made possible by the availability of high-speed 16 and 32 bit microprocessors and cheap digital memory. The Third Generation PABXs have more than ten times the memory capacity of earlier SPC PABXs. They all have digital switchblocks.

The principal technical features of Third Generation PABXs are:

- the back plane switching stage operates in integer multiples of 64 Kbit/s thus allowing direct connection to other media and connection to 2 Mbit/s 32 channel streams
- non-blocking capacity of the switch modules (e.g. 400 extensions, and virtual non-blocking up to very large system sizes i.e. greater than 2500 extensions). The larger capacity will be essential in supporting simultaneous voice and data communication. The equipment technologies now available allow full availability within reasonable cost limits
- a very large range of data speeds can be switched without the use of modems. Typical data rates of 110-9600 bps synchronous and 600-48000 bps synchronous can be switched
- integration of voice and data within the switch and extended to the terminal instruments will provide enhanced facilities and data transmission at the user's desk. The use of 1, 2 or 3 pair telephone cabling for data switching will significantly reduce costs in evolving data applications
- interfacing to telex, word processing, facsimile, personal computers, 'dumb' terminals, local area networks, mobile radio, packet switching networks and the proposed ISDN (Integrated Services Digital Network)
- the system architecture is based upon a central (duplicated) processor system with distributed microprocessor control in both terminal and port interface hardware, resulting in higher switching speeds, larger memory and greater flexibility
- the ability to interconnect to local area networks (LANs) via protocol converters. This will significantly reduce costs in expansions to existing proprietary LANs through the use of telephone cabling (which is cheaper than LAN co-axial cabling) and cheaper terminal equipment
- common channel signalling (CCS) to CCITT No. 7 standards allows facility and service information to be transmitted from PABX to PABX within a network
- centralized maintenance and administration terminals allow remote monitoring and collection of traffic information, remote alteration of extension classification, remote fault diagnostics and remote collection and analysis of billing information
- voice mail system – these provide a practical vehicle for the rapid exchange of voice information. Digitized voice is stored on hard disk until retrieved by the called party
- text mail systems, which provide a storage and retrieval for text information (including telex, teletex etc) requiring hard copy output locally or remotely
- use of digital phones which are connected directly to the switchblock via 4 wires and employ digital transmission catering for signalling, voice and data.

These features are comparable with those available from AXE exchanges, and indeed the architectures and technologies are similar.

Third Generation systems are already available in Australia from several manufacturers, but their features are not yet fully developed. They are (expectedly) more expensive than equivalent earlier SPC systems. During 1984 it is expected that IOSS installations will represent 1% of the total PABX installation programme, however by 1990 all new PABXs will have most of the essential features of Third Generation systems.

Modernisation in the public and private telecommunications networks must proceed in step. With IOSS, they continue to do so, because IOSS will carry the customer end of the ISDN.

Digital Telephone
(Digitised Voice and Data)

Melbourne – Sydney Digital All The Way

A vital step has been taken in establishing the nationwide digital network, with the linking of Melbourne and Sydney by a totally integrated digital path.

The path consists of a new radio system for 140 Megabits/second (Mbit/s) digital radio bearers which are connected at each end to digital transmission systems on optical fibre bearers to the main digital trunk exchange centre in each city.

In early July 1984 the intercapital link was placed in service, carrying traffic for the Digital Data Network (DDN), providing for expansion in the DDN service, and allowing for the release of analogue radio bearers at present being used for DDN purposes.

The advantages of digital radio bearers, particularly over long routes, are:

- regeneration of signals results in circuit performance being essentially independent of length.
- high immunity to noise and interference.
- interconnection directly with digital line systems without conversion.

Optical Fibre Links

The Melbourne end consists of a 12 fibre cable from Exhibition to Maidstone Radio Terminal, with regenerators at Flemington. Each fibre pair is capable of carrying a 140 Mbit/s digital stream which could consist of a mixture of data and telephone circuits. Used solely for telephony, 140 Mbit/s capacity could provide 1920 circuits.

This cable is presently equipped with 2 digital systems of 140 Mbit/s capacity. The line transmission equipment for each 140 Mbit/s system includes a stage for multiplexing together 4 streams of 34 Mbit/s. This arrangement provides for main and standby systems over the optical fibre route to ensure high reliability in the DDN. The Sydney end is similarly equipped between Waverley Radio Terminal and Haymarket trunk exchange building.

Digital Radio Route

The radio system follows the same route as the existing analogue systems bearers, via the major terminals at Eastern Hill (Albury) and Black Mountain (Canberra) and the 16 intermediate repeater sites. Following this route enabled the radio system to be established rapidly and at minimum cost by using existing buildings and towers.

Digital Radio System

The radio equipment is NEC 500 series, operating in the 6.7 Ghz microwave band, and using phase and amplitude (16 QAM) modulation.

This radio system has capacity for eight bearers, the initial configuration being:

1 digital, 140 Mbit/s
1 digital, 140 Mbit/s, protection

Development during the next 12 months will rearrange and extend the establishment to consist of:

4 digital, 140 Mbit/s
1 digital, 140 Mbit/s, protection
2 analogue TV, unprotected
1 analogue TV, protected on another system

Digital radio bearer equipment is designed to accept either a full 140 Mbit/s digital stream or 4 independent 34 Mbit/s digital streams which can be multiplexed together on the 140 Mbit/s bearer.

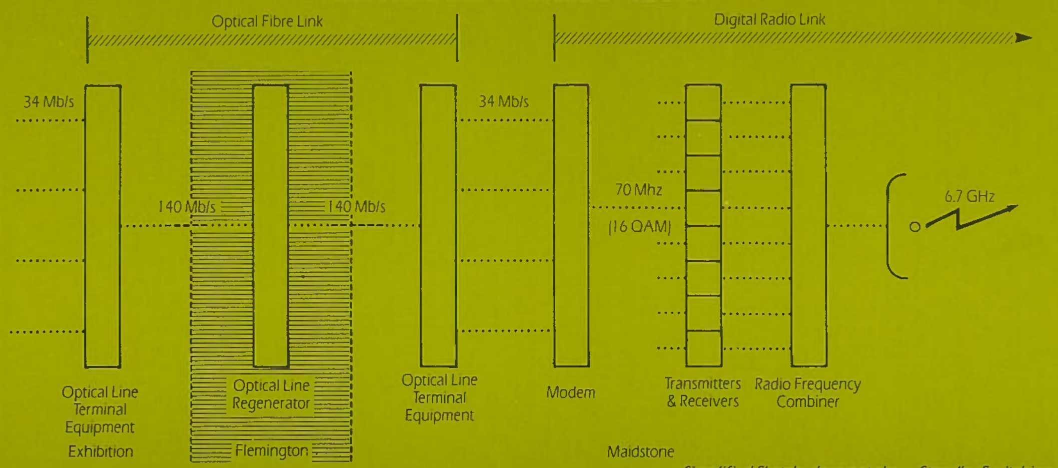
Although the intercapital link is presently carrying DDN circuits only, telephony circuits will be added during the next 18 months to coincide with establishment of digital (AXE) trunk exchanges in each city.

Future Development

Previously, high capacity radio systems have been designed for analogue bearers but by signal conversion have been able to carry digital traffic. These systems are referred to as 'analogue'. The system described in this article is designed to carry digital bearers, and is therefore referred to as 'digital'. The system does however have analogue capability.

There will be no further installation of analogue radio systems. All analogue transmission needs will be met by connection to digital systems.

MELBOURNE END OF INTERCAPITAL LINK



Simplified Sketch, does not show Standby Switching

The Decline and Fall of Step-by-step

Following the cutover of the first Australian public automatic exchange in July 1912 at Geelong, Step-by-Step (SXS) equipment played the major role in automation of the network until the introduction of the Crossbar system in the 1960s. Since then, the network growth has been catered for mainly by crossbar equipment.

The stage has now been reached where AXE equipment will take over to meet growth and SXS will be phased out by the end of this century.

The SXS equipment in the Melbourne Telephone Network consists of over 320,000 primary lines and an extensive network of group selector stages inter-connected by cable pairs. This SXS equipment ranges in age from about 20 to 50 years, and must be considered to have paid for itself in earned revenue.

By comparison with computer controlled AXE, or even the relatively sophisticated crossbar, SXS equipment:

- lacks modern customer facilities, such as tone dialling.
- inhibits the improvement of transmission losses in the network.
- has an increasing labour-intensive maintenance liability.

Clearly, there are service and performance incentives to replace all the remaining SXS equipment with AXE equipment as quickly as possible. The cost of such a programme would be well in excess of $100 million, and would place a high demand on technical skill and manufacturing resources.

Whilst present intentions are to replace all the SXS equipment by the year 2000, the possibilities of complete replacement by 1995 are being considered.

Are we then faced with the burden of SXS on the network and impoverished service to many customers for another 10 to 15 years? A number of initiatives have already been taken and others are in train, which will, for a modest outlay, reduce the liabilities of the SXS **network** while retaining the **primary equipment** in a viable revenue-earning capacity.

Recovery and Re-use

Throughout the Crossbar Era, the aim was to recover large quantities of SXS, even entire exchanges, by progressive crossbar installations with the recovered equipment being used to develop a few exchanges as whole SXS locations. This policy ensured that relatively young SXS equipment continued to give service and earn revenue, minimised the number of hybrid (mixed) exchanges and conserved the outlay on crossbar equipment. Future re-installation of SXS will be minimal with the rapid spread of remote AXE stages.

ISD/Multimetering

Where it was economically justified, multi-metering equipment at SXS locations has been extensively modified to allow access to the ISD services. This has prevented an excessive demand for crossbar lines and a consequent underutilization of SXS lines.

Customer Identification (ABID)

At exchanges where SXS primary lines make use of a crossbar group selector stage for outgoing calls, and where that group selector is under ANA-30 (ARE) processor control, ABID equipment is being installed. This inexpensive addition to the ANA-30 processor allows customers connected to SXS equipment to enjoy the same originating facilties as customers connected to the crossbar equipment, such as tone dialling and access to call charge recording for ISD calls.

The first ABID equipment was recently commissioned at St Kilda and Thornbury exchanges.

Selective Replacement with AXE

There is a strong case for early replacement of SXS equipment with AXE in exchanges which exhibit some or all of:

- high demand for modern facilities.
- high maintenance costs.
- traffic restrictions.

The Central Business District exchanges are high on the list, because of continued strong demand for very large PABX groups, tone dialling, and other facilities not available on SXS.

Civic is due for replacement in May 1985, and replacements are planned to begin at City West and Russell in the 1985/86 programme – to be completed by the end of 1987/88.

Co-Sited Remote AXE Stages

At those exchanges not scheduled for early replacement, it is planned to install small AXE Remote Subscriber Stages (RSS). These will provide for growth and enable modern facilities to be given to existing customers, with a change of number.

Spare Parts

Although the final order of SXS spare parts has been placed, recovered SXS equipment is now becoming plentiful enough to justify a degree of scavenging for replacement parts.

AXE Access

Plans are being formulated to progressively eliminate the SXS group selector network by routing calls from SXS exchanges directly into the digital network through nearby selected AXE nodal exchanges.

Progression of this plan will rapidly remove the high-maintenance group selector stages, leaving SXS equipment to exist only in terminal exchanges. An important product of this plan will be the large release of valuable cable pairs which are now being consumed at an increasing rate for private circuits, alarm and monitor wires and the like.

Conclusion

The application of some minor enhancement in conjunction with a judicious and progressive replacement programme will ensure that SXS equipment continues to provide adequate and profitable service during its declining years.

Optical Fibres Link Melbourne

Melbourne's inter-exchange digital transmission requirements are expanding rapidly to provide for:

- the Integrated Digital Network (IDN)
- the Digital Data Network (DDN)
- the Special Services Network (SSN)
- transmission improvement, to meet new transmission standards
- junction traffic growth, without new metallic pair cables.
- PABX services including remote indialling from AXE nodes.
- customer wideband services

Up until now these requirements have been met by the provision of 2 Mbit/s digital line systems, each system (of 30 voice channel capacity) using 2 cable pairs in existing junction cables.

The high growth rate, exceeding 3000 2 Mbit/s new digital paths from 1984/85 to 1986/87, has resulted in large digital requirements along many junction cable routes. In such circumstances the establishment of a network of higher capacity optical fibre cable systems, operating at 140 Mbit/s (1920 channels) is advantageous and economic.

In the digital hierarchy a 140 Mbit/s digital stream is derived from 64 primary (2 Mbit/s) streams via secondary (8 Mbit/s), tertiary (34 Mbit/s), and quaternary (140 Mbit/s) multiplexers (See diagram). At optical line terminals appropriately equipped with multiplexers, interconnections to other higher order systems can be made at the 8 Mbit/s (120 channels) and 34 Mbit/s (480 channels) levels.

Some factors favouring higher order optical cable systems over primary 2 Mbit/s systems on metallic junction cable pairs are:

- with longer regenerator spacings, the optical regenerators can be located in telecommunications buildings, eliminating the need for underground equipment and simplifying maintenance.
- cable congestion in manholes along major digital routes is minimised, and duct space conserved.
- optical fibres are immune to electrical interference.

Hence in Melbourne, primary 2 Mbit/s digital line systems will increasingly be confined to the shorter digital junction links, while 140 Mbit/s systems on optical fibres and coaxial cables will form a network of high capacity and longer distance routes. These will link the AXE nodes, trunk and local tandems at Exhibition and Lonsdale, and appropriate high traffic exchanges. Other important roles of optical cables and systems are:

- transmission tails for major radio terminals
- reticulation of future wideband services for customers in commercial areas.
- future leased services involving video, data and voice.

The 'multimode' optical cable systems already installed operate at a wavelength of approximately 850 nanometres (850 x 10^{-9}m), and require regenerators every 8-9km. Systems on new multimode cables will operate at 1300 nanometre wavelengths, permitting repeater spacings of up to 13 km. The smaller diameter 'monomode' fibres now becoming commercially viable have potential advantages over multimode fibres:

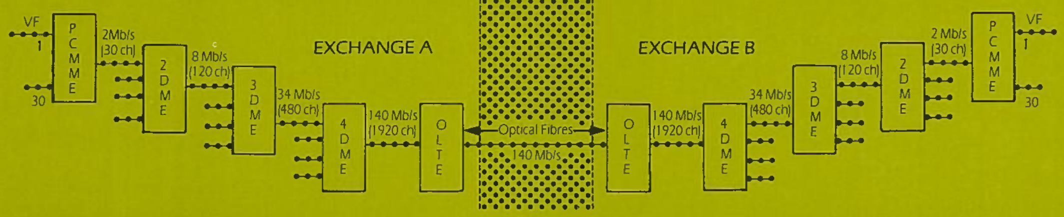
- systems can operate with repeater spacings in excess of 30 km, obviating considerable regenerator equipment on longer hauls.
- monomode cables can support fifth order transmission (565 Mbit/s, 7680 channels) – an option for future expansion.

It is likely that monomode fibres will begin to supplement multimode fibres for inter-exchange use from 1986/87 onwards.

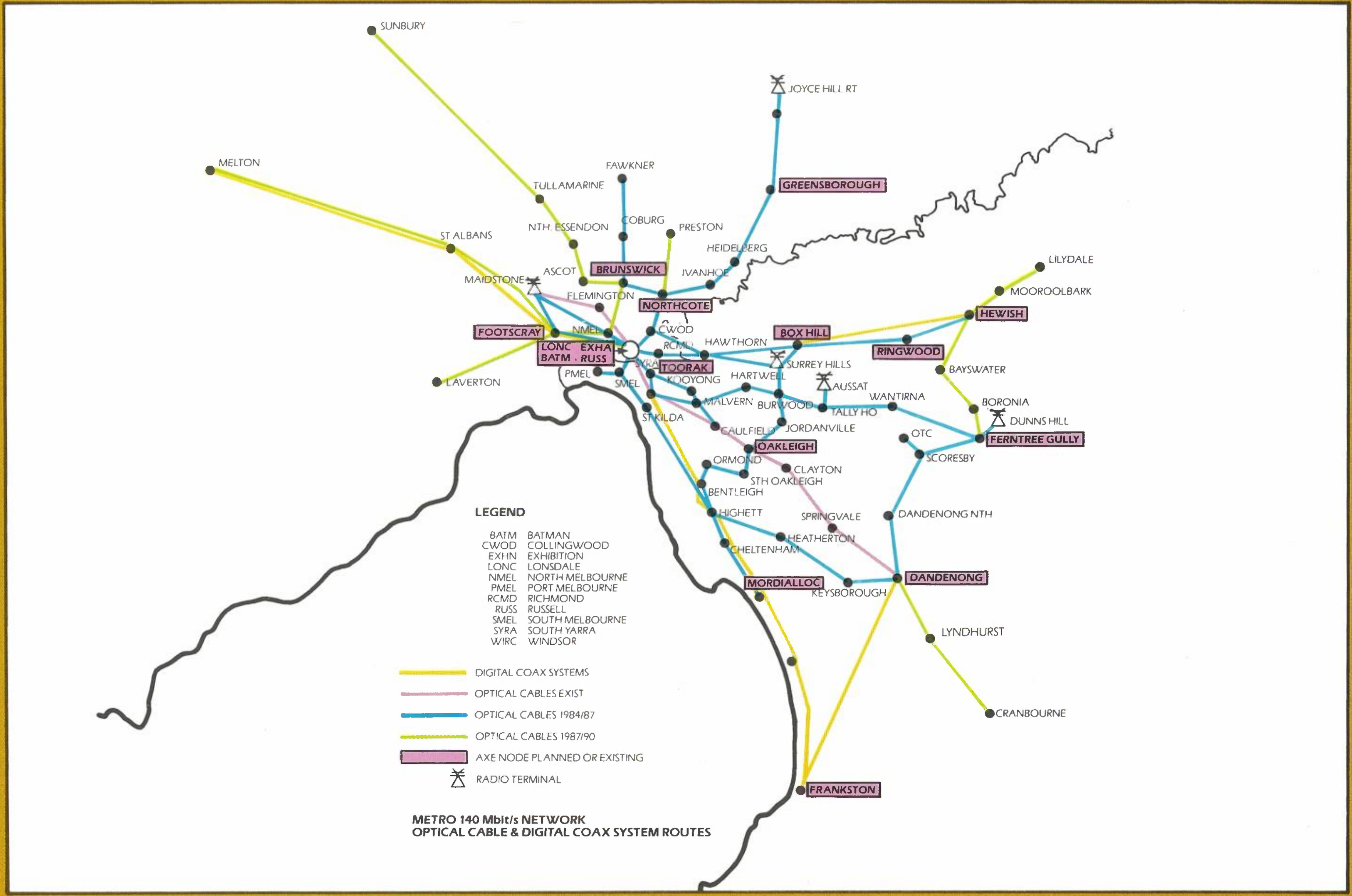
The planned growth of Melbourne's optical fibre inter-exchange network is indicated on the map. This also shows the complementary 140 Mbit/s systems to be provided on existing coaxial cables. By the end of 1986/87, 140 Mbit/s transmission paths will have been established to 21 of the 23 planned AXE nodes, to radio terminals at Maidstone, Surrey Hills, Dunns Hill (near Ferntree Gully), and Joyce Hill (near Yarrambat), to the new OTC Gateway Exchange at Scoresby, and to the Aussat Ground Station at Tally Ho. The network has also been designed to facilitate a high degree of serviceability in the event of cable damage by progressively establishing geographically diverse 140 Mbit/s paths with growth.

Telecom's optical fibre transmission programme represents a challenge to all involved in its implementation. The cables and digital systems comprise a critical component in the development of the Metropolitan network affecting our marketing viability in an increasingly competitive telecommunications industry.

MULTIPLEX ARRANGEMENT – 140 Mb/s TRANSMISSION



PCMME — Pulse Code Modulation Multiplex Equipment (Primary)
2 DME — 2nd Order Digital Multiplex Equipment (Secondary)
3 DME — 3rd Order Digital Multiplex Equipment (Tertiary)
4 DME — 4th Order Digital Multiplex Equipment (Quarternary)
OLTE — Optical Line Terminal Equipment

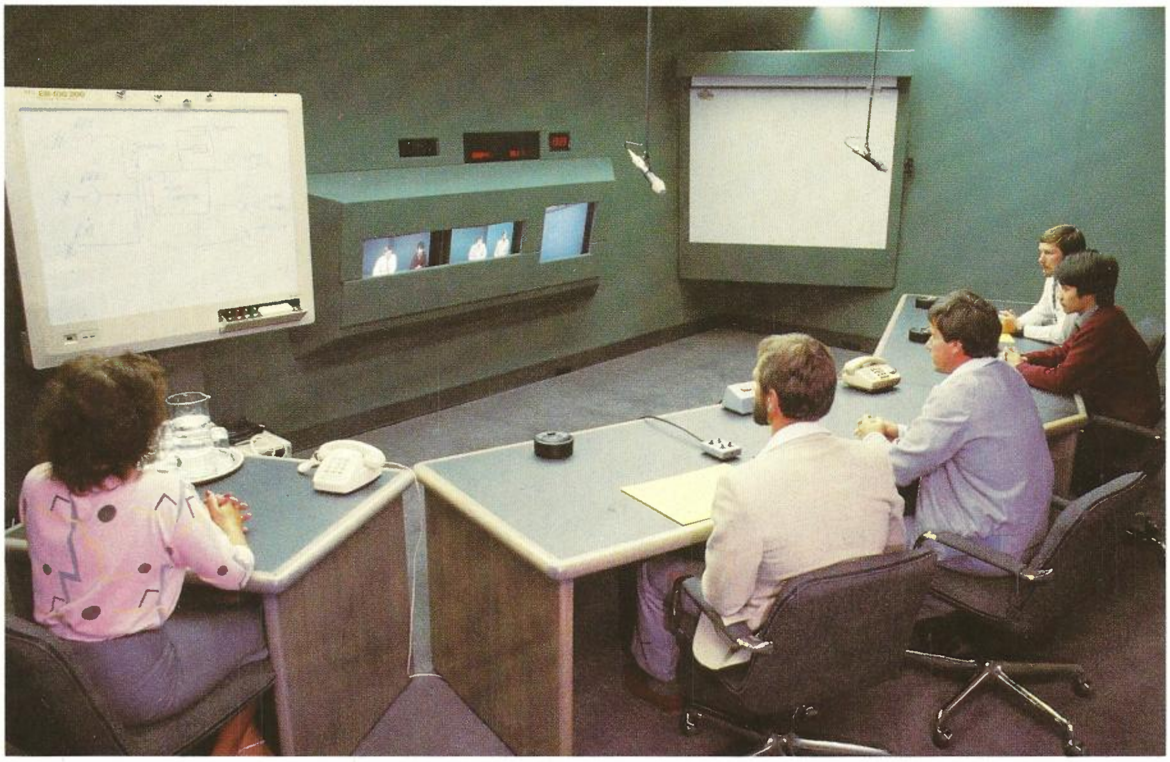


METRO 140 Mbit/s NETWORK
OPTICAL CABLE & DIGITAL COAX SYSTEM ROUTES

ENGINEERING 82, 83 & 84 CONTENTS

ISSUE NO 9 FEBRUARY 1985 ENGINEERING DEPARTMENT TEL (03) 657 2706

ENGINEERING 85



A new Teleconferencing Centre has been established at 172 William Street, Melbourne. This Centre has a Main Studio for TV Conferencing and a second studio catering for Audio Conferences plus limited TV facilities.

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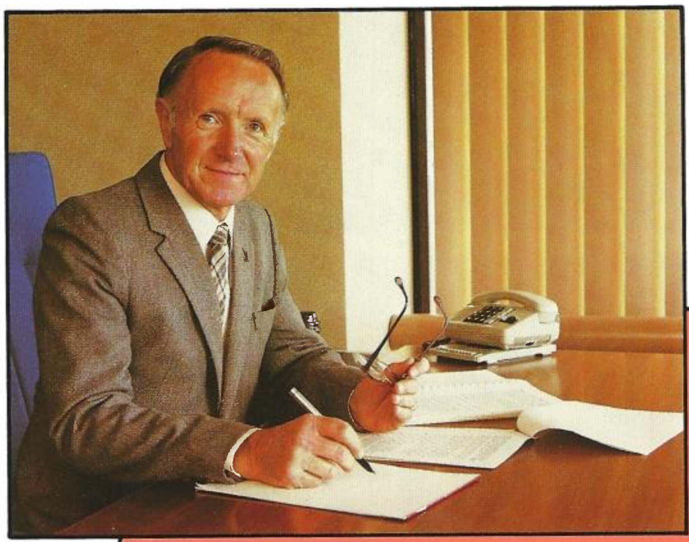


A message from the Chief State Engineer

My predecessor, Jack Ryan, established Engineering 1982 to make us all more aware of the scope of the Engineering Department, its critical importance in satisfying customer needs and to keep us abreast of the rapidly changing technology we must handle. The decision was typical of Jack's perception and foresight. The continuing quality of subsequent issues, both in content and presentation, reflect great credit on all who have been involved.

This issue continues the tradition, covering some outstanding Engineering achievements and outlining some of the new initiatives Telecom is taking.

In Victoria, as well as the challenge of new technology, the Engineering Department faces two additional challenges. Firstly, we must make the best possible use of the limited resources available and respond to the high levels of customer demand. Also we must develop and introduce our new Engineering Department organisation, so that we will be able to meet the demands placed on us in the future. To meet these challenges simultaneously will strain all our resources. I believe we can do it.

F.A. Campbell
CHIEF STATE ENGINEER

Redesign of the 000 Emergency Service

Whenever an emergency situation arises, where police, fire brigade or ambulance must be summoned, the telephone network becomes a lifeline. At times like these it is vital that telephone facilities be available, secure and effective. Telecom has established the "000" service as a unique emergency communications network, engineered to provide fast and efficient contact with all those organisations whose job it is to react quickly to emergency situations.

The "000" facility allows callers in the Melbourne metropolitan area and Geelong to be connected by an operator to the service they require. The routing of calls through the network to "000" operators receives special attention which ensures that they succeed. Access to the Police, Fire Brigade and Ambulance services is provided by direct lines. Operators use the switched telephone network if all direct lines are busy or if the caller requires an emergency service, such as Lifeline or the Poisons Information Centre, which is not accessible by direct lines.

Because "000" now covers a large geographical area, the call origin needs to be identifiable to enable the operator to connect the caller to the appropriate emergency service for that district. For example, most outer Melbourne metropolitan "fire" calls must be directed to the Country Fire Authority rather than to the Melbourne Metropolitan Fire Brigade.

In the past, Telecom has operated its emergency service from the old Melbourne Trunk Exchange (MTX) in the City West Exchange building. The proposed closure of the MTX required that a number of operator facilities, including the emergency service, be relocated. The "000" switching equipment located at City West was over 40 years old and its ongoing maintenance was becoming a problem. For this reason it was considered impractical to move it to a new location.

Possible alternative switching systems were evaluated against the following requirements:

• Acceptance of calls in order of arrival (queueing).

• Identification to the operator of the call origin.

• Through connection of incoming calls to outgoing exchange lines.

• System security in case of equipment failure.

• Redirection of incoming calls in the event of building evacuation.

Because of the critical nature of the emergency calls handled by "000", security of operation under fault conditions is considered to be of primary importance. After evaluation of a number of systems, it was decided that this need for security in addition to queueing, inlet identification and outgoing exchange line facilities could best be satisfied by a combination of standard PABXs and an external microprocessor controlled queueing system.

Hence two Ericsson ARD571 crossbar PABXs were chosen for installation at Lonsdale and Windsor Manual Assistance Centres. Changeover facilities allow the incoming and outgoing circuits to be connected to either PABX under the control of a single switch. Provision is made to delay the changeover of circuits carrying calls in progress until the call is completed.

A microprocessor based queueing system, incorporating interfaces to the existing PABX switching system was designed. The queueing system advises operators of all waiting calls and identifies the longest waiting call. Self-checking hardware and software is included so that if any malfunction occurs, the microprocessor queue is automatically bypassed and the PABX reverts to non-queued operation without loss of call indication. An indication of queue failure is provided to each operator and an inbuilt display provides diagnostic information to assist technical staff.

The advantages of the new system are:

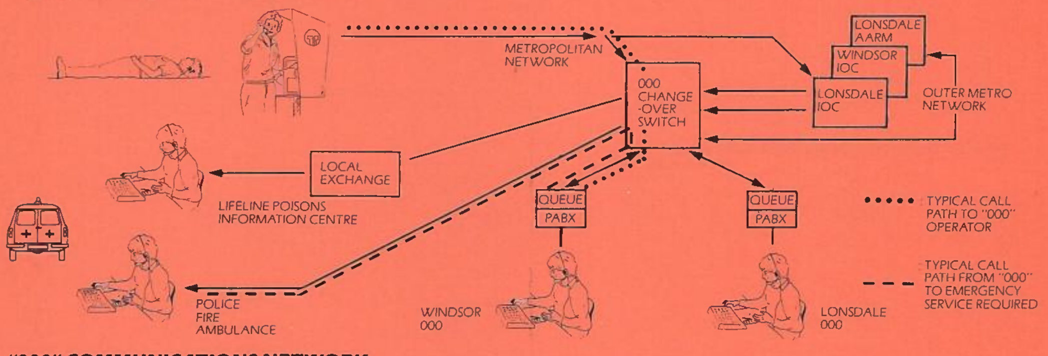
• '000' facilities can be provided from either of two locations;

• the operators can changeover without technical assistance in emergency conditions;

• the system can be fully bypassed if faults develop;

• inbuilt fault diagnostics are provided for technical staff.

Installation of this equipment has enabled Telecom to continue to provide this vital service efficiently and reliably, and provides the basis for its future expansion throughout Victoria.



"000" COMMUNICATIONS NETWORK

Transportable Containers for Axe

We have had 20 years' experience of installing and operating ARK crossbar equipment in transportable containers and in relocating these containers to meet development requirements of exchanges around Victoria. With the adoption of AXE as the new switching system, it is clear that we must develop techniques for installing and operating AXE equipment in transportable containers.

Applications are foreseen for transportable AXE equipment to:

• Replace existing ARK or RAX equipment;

• Supplement existing ARK equipment for growth and to provide advanced facilities;

• Provide temporary equipment to enable replacement of SxS equipment during redevelopment within a permanent building.

Early requirements are for transportable containers to house Remote Subscriber Stage — Digital (RSS-D) AXE equipment, but a future application could be for the rural AXE exchange currently under joint development by L. M. Ericsson and Telecom.

Three possible alternatives are to be evaluated:

• **Standard L. M. Ericsson Container.** This type of container has already been used successfully in the hot conditions of Saudi Arabia.

• **Development model from Telecom HQ Buildings,** to be capable of service in any Australian climatic conditions.

• **Victorian container** as currently used for ARK exchanges up to 1000 lines.

L. M. Ericsson Container

The container has been developed from the standard shipping container, but is slightly over normal height. AXE equipment is accommodated on 2280mm "low-height" structural mechanics, allowing for 6 shelves of equipment magazines. Two sizes are manufactured, to house 0.5K (512) or 2.0K (2048) lines of RSS-D. The container is fully insulated, and uses refrigeration cooling as the method of extracting heat.

A limited quantity of L. M. Ericsson containers has been ordered for 1984/85 and 1985/86 to cater for immediate needs. None of these are destined for Victoria. The first is now on site at One Tree Hill, South Australia.

HQ Buildings Development Model

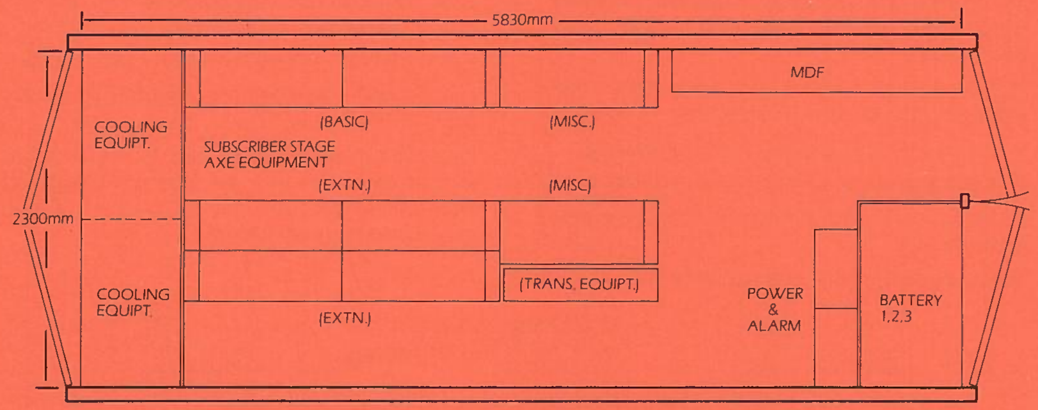
The prototype has been designed to be transported under the same road conditions as a shipping container. As per the L. M. Ericsson container the "low-height" structure is used for AXE equipment.

Twin air-conditioning units provide for convection cooling for equipment, with some radiation of heat through the floor. The walls are foam insulated.

The prototype may be extended in length during production to allow for more equipment space to mount radio, multiplexing, and additional miscellaneous equipment.

Victorian Ark Container

This familiar container is over-dimensioned for road transport, but well established transport procedures exist to cover road movements. Several of these



L. M. ERICSSON CONTAINER LAYOUT

containers will become available as a result of recovery projects.

Space in the container is more than adequate for 2.0K lines of RSS-D, plus additional transmission and miscellaneous equipment. The structural mechanics are identical to those used in a permanent exchange, allowing for 8 magazine shelves, and providing structural compatibility with other equipment racks.

Separation of the switching and ancillary equipment areas is maintained for security and hygiene of the switching equipment and to reduce the load on the twin air-conditioners.

The container walls need foam batt insulation, which requires existing buildings to be de-skinned to have insulation inserted.

Evaluation Trials

The L. M. Ericsson container will be trialled in service. These trials will be carried out in various States.

The HQ and Victorian containers are to be trialled side-by-side at the Fishermens Bend Pre-Installation Centre. Both will have a full 2.0K RSS-D installed, with test traffic being directed to and from an AXE node performing a parent function.

Evaluation of the trials will be in 2 areas:

• Installation techniques in small equipment areas for transportable conditions.

• Effectiveness and characteristics of air-conditioning during the Melbourne summer temperature peak.

Power Considerations

Although power arrangements are not part of the evaluation, the trial installations will use different DC power techniques.

• In the HQ model, an integrated power suite design, using recombination battery cells in a stack structure.

• In the Victorian model, a boost converter system, with a conventional 500AH battery.

The full load operation of a 2.0K RSS-D, plus transmission equipment is around 100 amp at 48 volt, requiring at least 5kW cooling capacity. Battery capacity to support both equipment and air conditioning or fan-draught cooling under mains failure is therefore very large, leading to the need for either on-site or readily available standby generation plant.

Outcome of the Trials

The trials will provide essential data to:

• develop installation practices.

• compare refrigeration and air-conditioning cooling techniques.

• finalise development of the HQ model building for a production design.

• evaluate the suitability of the Victorian container, and the extent of modifications required to recovered units.

The outcome has early relevance to Victoria, as 3 transportable RSS-D units are programmed for 1985/86, with the first due to be commissioned at Creswick, near Ballarat, early in 1986.

L. M. ERICSSON CONTAINER BEING SITED AT ONE TREE HILL S.A.

The Telecom Teleconferencing Centre

Video conferencing is a Telecom service that has been available to the business community for about 10 years. The concept of video conferencing was first tested at the Telecom Research Laboratories, leading to a prototype Video Conference Room being established at the Confravision Centre at Telecom Headquarters, 199 William St, Melbourne, with complementary facilities in the Sydney GPO.

With the technical success and firm base of customer acceptance achieved with Confravision, Telecom foresaw the need to upgrade the service to improve its technical quality and offer a greater range of facilities. These improvements were designed to enhance the attractiveness of the service as a competitive alternative to interstate travel for business meetings.

The new Teleconferencing Centre located at 172 William St replaces the original Confravision Centre. Design and Installation of the Teleconferencing Centre was undertaken within the Victorian Engineering Department.

The Teleconferencing Centre improves upon the Confravision Centre in three respects:

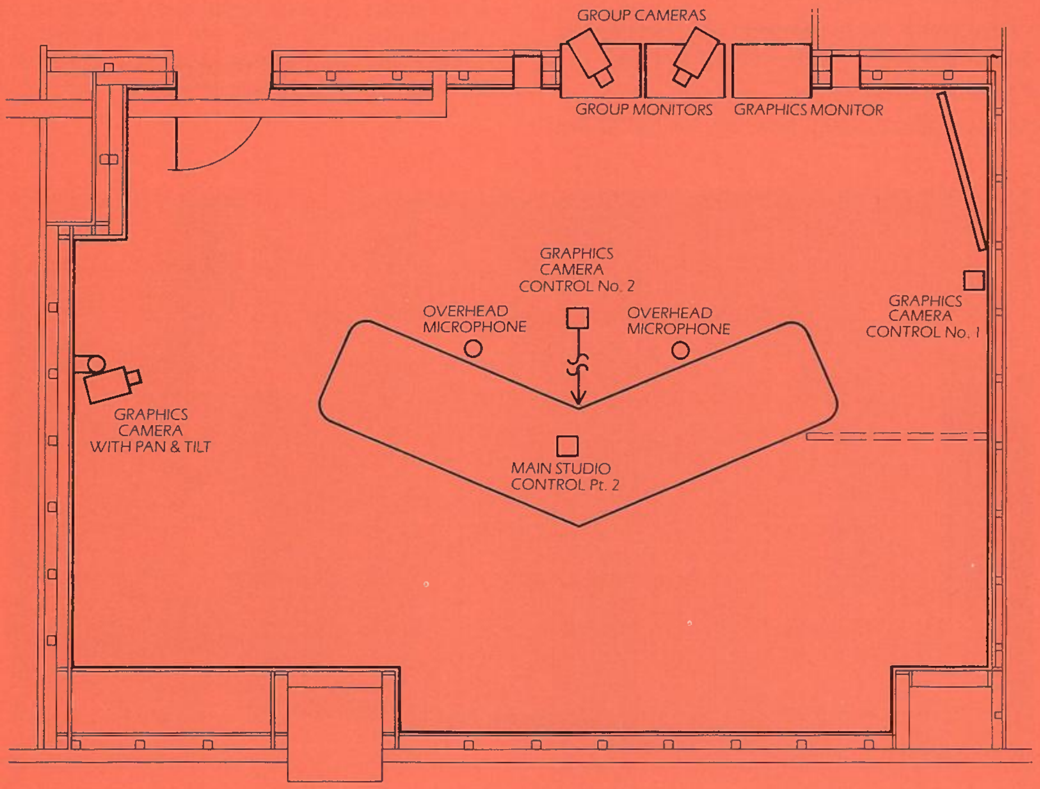
- The Teleconferencing Centre comprises a main studio, a multifunction room, a pre or post conference room and a reception waiting area. The Confravision Centre consisted of a single studio.
- The Teleconferencing Centre is a permanent installation, engineered to allow maximum flexibility and ease of maintenance. The Confravision Centre existed in prototype form, and was difficult to re-arrange and maintain.
- The Teleconferencing Centre has been engineered for complete customer control of all facilities without the need for technical assistance.

Main Studio

The Main Studio allows for full conferencing facilities. These facilities consist of Group Monitors A and B, Graphics Monitor and audio circuits.

The Group Monitors are "half screen 660mm colour monitors" which produce a panoramic head and shoulder image of the conferees in the remote or the local studio.

The Graphics Monitor displays visual information such as projection slides, drawings or charts. The



local conferees can view either their own or the remote graphics information.

Two video cameras are used, each covering half of the studio desk. To transmit the "head and shoulders image" from both cameras over one video channel, the outputs of the two group cameras are buffered and vertically stacked to provide a split field video signal. On reception, the vertically stacked video signal is buffered and split into two video signals which are displayed on two standard monitors, side by side.

The conferees have control of transmission to the remote location through the control unit mounted on the studio desk.

Either graphics or split-field head and shoulders can be transmitted, but not simultaneously.

The switching and video processing for the main studio is handled by the custom-built Video Switching Unit.

Multifunction Room

The second studio, commonly called the Multifunction Room, is primarily intended as an audio conferencing studio but is equipped with a single group camera and an overhead document camera and video monitor.

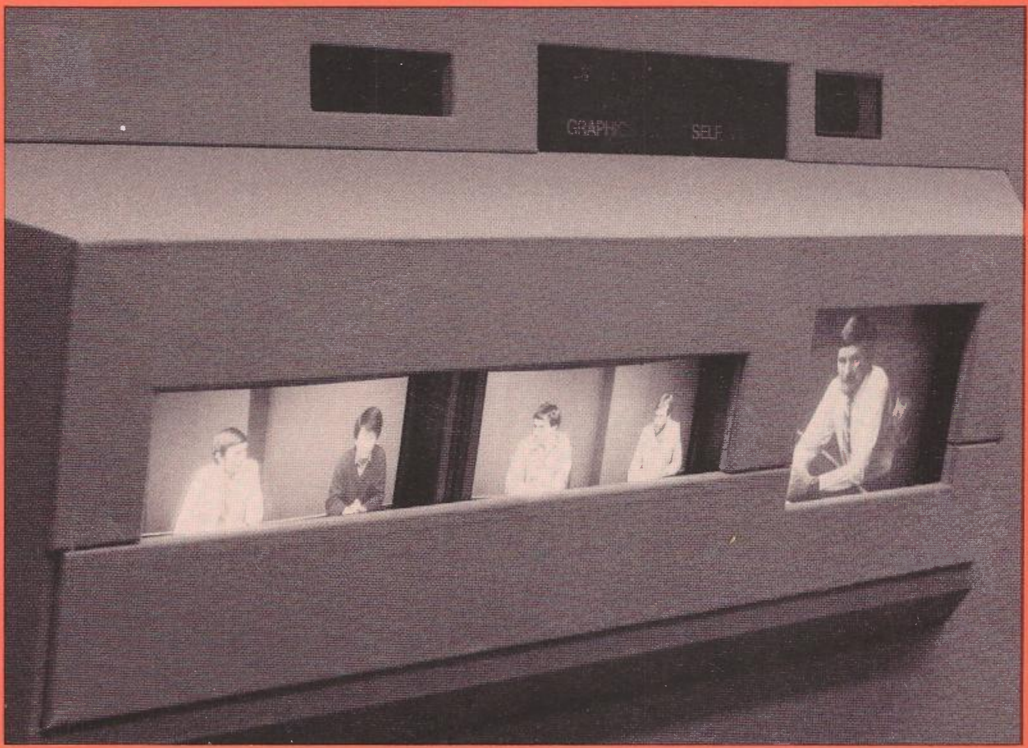
The video output signal of the Multifunction Room can be transmitted as a full colour live video signal or as a black and white slow scan (Freeze Frame) signal. The slow scan TV system transmits two video picture signals per minute over a normal voice-bandwidth telephone channel using frequency shift keying modulation.

It is envisaged that the Multifunction Room will also be used for evaluation of experimental conferencing equipment such as:

- Electronic Blackboards.
- 2 MBit/s TV transmission, providing frame update rather than full-frame picture information.
- Commercial audio conferencing products.

Conclusion

It is anticipated that the enhanced facilities, versatility, and ease of operation of the new Teleconferencing Centre will result in increased demand for this service.



GRAPHICS AND GROUP MONITORS IN MAIN STUDIO.

Viatel — Australia's National Videotex System

February 1985 marks the launch of a new Telecom Value Added Network. This network called Viatel provides an economical Videotex service to Australia.

Videotex is a database-type service which caters for a wide variety of information. This information includes Travel, Finance, Agriculture and Retail Trading. This type of information, provided at comparatively low cost, is such as to make Videotex, or in particular Viatel, of interest to both the general public and the business community. One example of the wide use of Viatel is in the area of home banking. At least one major bank in Australia has a service whereby a customer using Videotex can query his accounts, order a new cheque book, transfer money between accounts, pay bills etc, all from a low-cost terminal in the home, possibly connected to a TV set and telephone.

Other facilities available include a simple mailbox service (where messages can be stored and retrieved by users), an interface to Telex, and provision to give access to information on other Videotex type data bases via a gateway function.

The Videotex system chosen by Telecom for Viatel is of the UK Prestel type. (Prestel is a Trade Mark of British Telecom.) Several other standards are in use world-wide, however Prestel provides a number of advantages over these such as the ready availability of hardware. Prior to the introduction of Viatel, the Prestel standard was already in use on a number of private Videotex services in Australia. This gave ready market acceptance, a reasonably large (approx. 1000) base of compatible terminals, and a number of terminal suppliers available from day one.

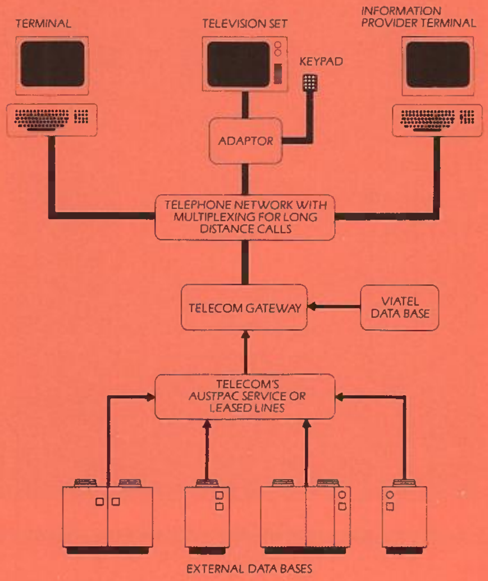
The Prestel system also has a number of limitations relative to other systems, such as the current availability of only simple graphics. Continuous enhancements are however being made to Prestel and the system as purchased can be upgraded to provide new facilities as they become available.

A number of different customer terminals may be connected, varying in both complexity and cost. At one end of the range there is a keypad adaptor for connection to a TV set; at the other end, sophisticated personal computers. Included in this range is Telecom's ComputerPhone, which amongst its facilities provides Viatel access. All customer terminals operate at a speed unique to Videotex type services. These terminals, with integral modems, use 1200 Bits per second (Bps) with 75 Bps so called "backward channel" signalling. What this means is that transmission from the Viatel computer is at 1200 Bps, while transmission in the opposite direction is at the slower 75 Bps rate. This speed difference is intended to reflect the relatively smaller amount of data generated by the customer.

Information providers are treated differently as they can have quite large volumes travelling in both directions. Their terminals, which are often computers in their own right, operate using 1200 Bps full duplex signalling.

Customers' access to the Viatel computer is via the Public Switched Telephone Network (PSTN) with the number 01955 for normal customers and 01956 for Information Providers. The diagram represents the National Viatel Network. As can be seen there is only one computer centre for Australia; this is located in the Windsor Exchange building in Victoria. Customers in Victoria obtain direct access to this centre from the PSTN via a number of ports presently connected to the Lonsdale Central Y Tandem Exchange. In other States, intelligent statistical multiplexers concentrate the traffic from individual State PSTNs and forward it via a high speed data service to the Viatel Centre in Victoria. These Multiplexers provide more efficient utilization of interstate bearers, and can when necessary overflow or re-route traffic around outages. To facilitate this there are at least two paths from each Multiplexer, using the Digital Data Service, and Datel. In States where local connection to Austpac is available this network can be used, further increasing system flexibility.

The diagram also shows how external data bases or Videotex networks can be physically connected to the Viatel computer centre using a direct line on DDS, Datel or via Austpac. This external physical connection can operate in a number of different modes dependent on whether the external computer has Videotex application software or not. There are currently a number of external systems that are, or intend to, utilize this facility.



VIATEL NETWORK.

Freeway Telephones

The expanding freeway system in Victoria has generated a demand for off freeway assistance for motorists stranded on the freeway due to breakdown, accident or petrol deficiency. Road Construction Authority (RCA) statistics for the past 12 months show that 37,000 telephone calls were generated from the metropolitan freeways, 28,000 of which were requests for assistance.

Telecom Victoria has tendered against private enterprise and was selected to develop, construct and install a custom designed system to fulfil the operational requirements of the RCA Control Room. The system as described commenced operation in Dec. 1984.

Specially designed vandal-resistant pillars and telephones are placed along the metropolitan freeways. Each pillar has a unique identification number to pinpoint its location. Instructions are provided at the pillar for motorists, directing them to lift the handset, wait for dial tone and then press a button. An automatic dialler then originates a call to one of a number of indial lines at the control centre at Kew.

The RCA Control Room equipment is designed around several units which, when combined, provide in excess of 60 facilities, the most important of which are:

- Automatic display of the calling pillar number.
- Recorded messages if calls are not answered immediately.
- Display of the longest waiting line.
- Automatic call-back from an overflow system.
- System status indicators and management information.
- System fail back-up.

The units which interface to make up the system are:

- A Custom Designed Indial Digit Analyser —
This unit analyses the last 3 digits dialled which identifies the pillar originating the call.

- Display Systems —
These provide an identification of

(i) The line/s awaiting answer

(ii) The longest waiting line

(iii) The calling pillar number to which an operator is connected

(iv) Calling pillar numbers which require to be called back by the operator.

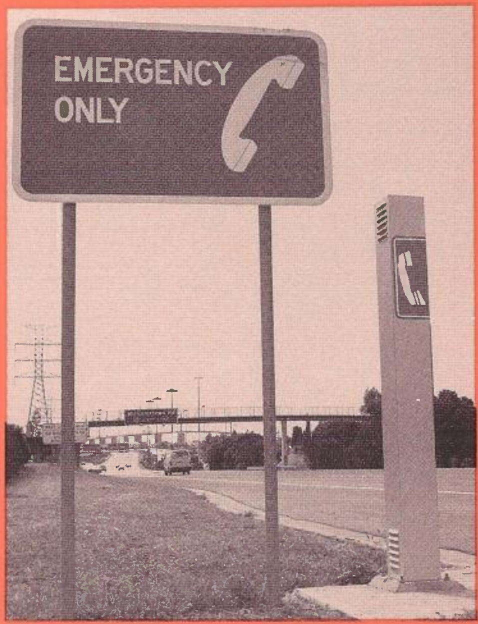
- A Commander Type N2260 Small Business System —
Operators answer the incoming lines on keystations of this system.

- A Custom Designed Overflow System —
This system operates when a predetermined number of calls are waiting for attention — the setting being under the control of the operator/s in the control room. Under these conditions the overflow system automatically identifies the calling pillar and answers the call with a recorded message advising the caller to hang up and wait for a call back. The system stacks all overflow call information and, when the operator accepts the call, automatically sets up the call-back to the pillar.

- A Voca TS160 Automatic Call Sequencer —
This unit determines the line which has been waiting longest for attention. In the event of an operator not answering a queued call immediately, the sequencer may be used to automatically answer the call and deliver a recorded message advising the caller that the call will be attended to shortly. A printer is associated with this unit to provide management information regarding the calls.

- A Custom Designed Rotating Concentrator —
This unit prevents follow-on calls on any line from jumping the queue.

Telecom is confident that the new system will enhance the overall operations of the breakdown service provided by the RCA and will be of significant value to motorists using the Metropolitan Freeway System.



FREEWAY TELEPHONE.

Upgrading Clayton Computer Centre for the 80s

In the early 70s Telecom established a Computer Centre at Clayton. This provided facilities for the introduction of computer systems to cater for engineering, operations and management processes. Since then the demand for computer-based processes has increased rapidly. Annual computer usage has grown by 40-50% in recent years and is expected to continue growing at a high rate.

This dramatic growth has outstripped the capabilities of the early computers at the Clayton site. To meet increasing demand and replacement of obsolescent computers, current models having greater capacity and utilising advanced techniques are continuing to be purchased. Providing the necessary electrical and air conditioning services for the new computers is a considerable engineering challenge.

Whereas the Computer Centre was designed for computers requiring 30-100kW of power to operate, modern computers require up to 300kW but no more floor space. The large increase in power load has necessitated the provision of air conditioning systems capable of removing the considerable heat generated and maintaining the temperature range within close tolerances.

To support the new computers the following upgrading has been carried out:

- Three new 500kW refrigeration machines were installed to provide additional cooling capacity for the air conditioning system.
- The associated chilled water pipework has been totally replaced.
- Eighteen additional 60kW cooling units have been installed within the computer rooms.
- The fire protection system has been upgraded.
- Gas flooding systems have been installed in the computer rooms.
- Major extensions have been made to the main electrical switchboard.

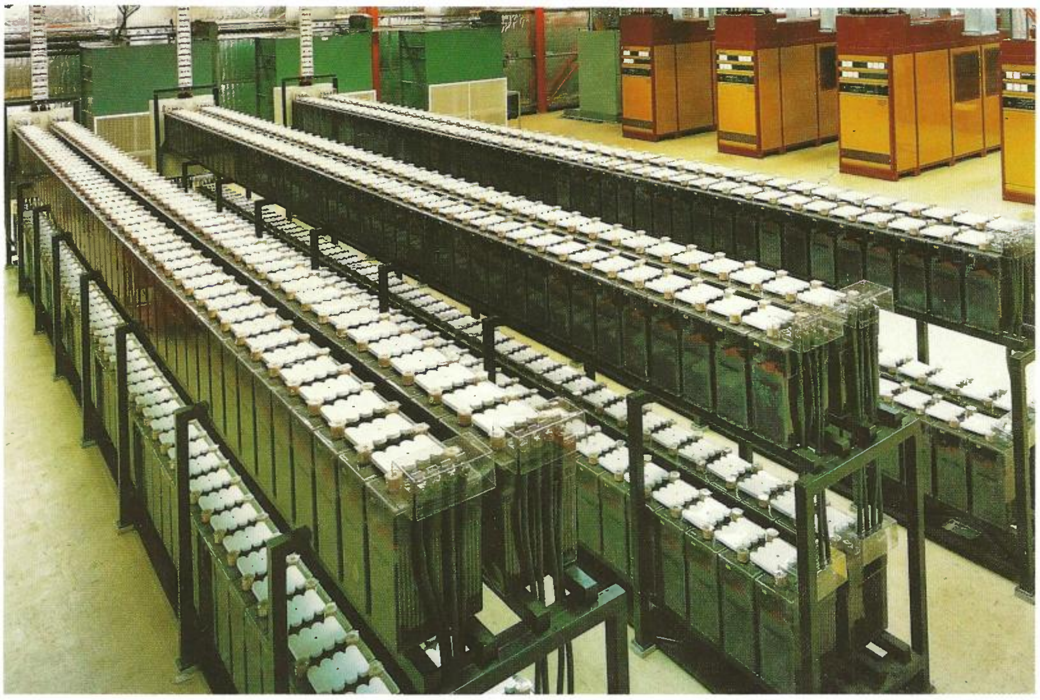
The challenge, however, was not simply to upgrade the services but to do so without interfering with the operation of the Computer Centre. Through careful design and timing of each phase of the upgrade, little disruption was experienced by the users of the centre. There have been only a few occasions when the entire centre was shut down to permit upgrade works to proceed.

The upgrading completed to date only allows for the operation of the computers currently being installed. For the additional computers required in the next few years, further works are required. The existing SEC power supply will be upgraded to 10 MVA capacity and will be distributed around the site at 22kV. A new 3.3 MVA emergency power plant will be provided with facilities for an additional 2 such plants in the future.

A further 2 refrigeration machines will be required to ensure that there is sufficient cooling capacity available. To assist with the management of the increasing magnitude and complexity of the services, a Building Supervisory System is being installed.

Hand in hand with the increase in services capacity is a requirement for greater reliability. In order that the performance criteria for the Computer Centre as a whole can be met, the services are being designed for a target of 99.9% reliability. To achieve this, other projects on the site are necessary. All of the important electrical distribution systems are being duplicated and uninterruptible power supplies are being provided for the computer equipment. Two units of 600kVa capacity will be provided for the new computer equipment which requires 415 Volt 50 hertz power (Australian) to operate. Three units of 550kVa capacity will be provided for other computer equipment which requires 208 Volt 60 hertz power (US) to operate.

Current work being carried out at Clayton will only cater for demand until the late 80s. Site limitations at the centre have necessitated the search for additional accommodation and the planning of a further centre to meet the requirements beyond 1990.



UNINTERRUPTIBLE POWER SUPPLY AND BATTERY INSTALLATION 500V — CLAYTON.

GENERAL VIEW OF A COMPUTER ROOM AT CLAYTON.

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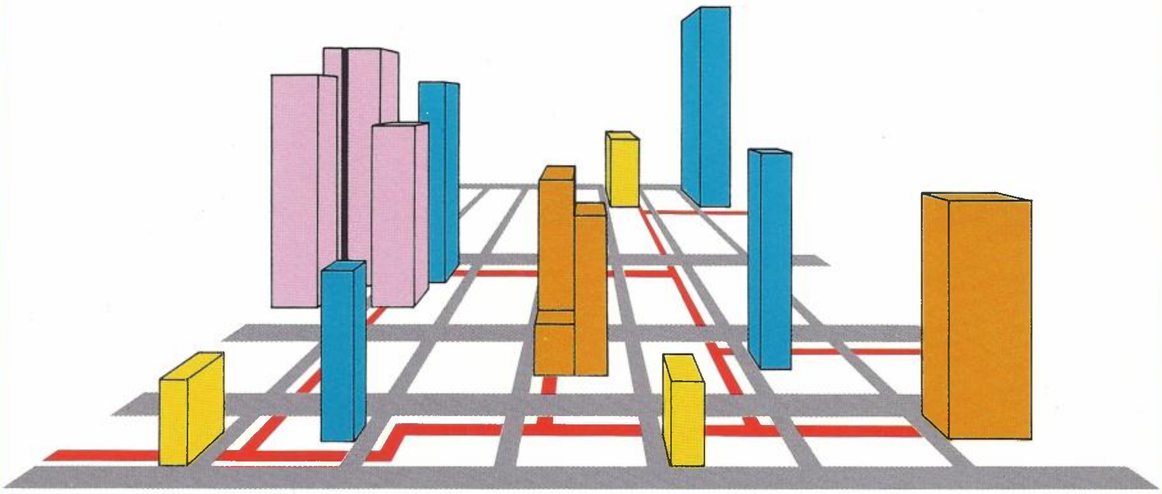

Wideband Optical Fibre Network

Melbourne - Conceptual

- Telecom National H.Q.
- Telecom Victorian H.Q.
- Customer Bldgs as & where req'd.
- Telecom Exchange
- Optical Fibre

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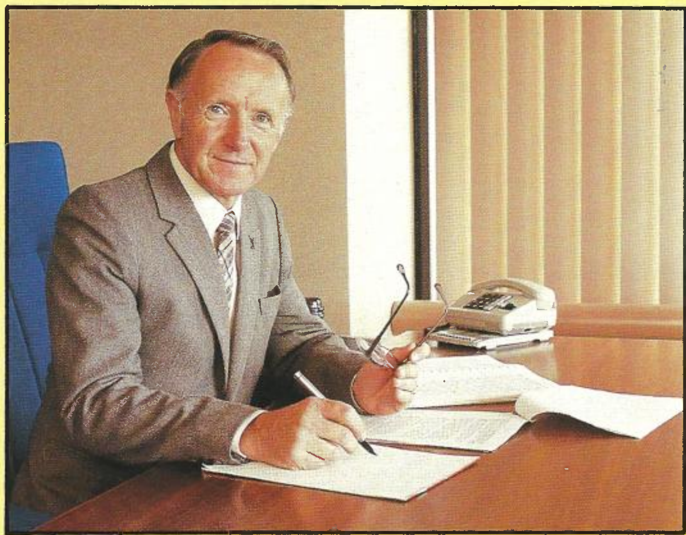


A message from the Chief State Engineer

The Chief General Manager organised a National Forum recently, attended by high level managers from Headquarters and all States. The Forum devoted two days of intense study to Telecom, its current position and the environment in which it will operate in the future.

The clear consensus reached was that the environment in the late 1980s and beyond which Telecom must face will be characterised by –

- an enormous growth in information requirements
- competition

The other unanimous conclusion was that Telecom could retain its dominant position in the information industry. However, we will only be able to do this if we provide quality products and high levels of performance at prices which caused customers to make Telecom their first choice.

No matter how well we have done in the past, our very survival will depend on doing better in the future. Our new organisation provides the opportunity to improve our performance in the Engineering Department.

F.A. Campbell
CHIEF STATE ENGINEER

ComputerPhone: A Step Towards the Electronic Office

Today we are on the threshold of a new era in technology which will allow a major improvement in office efficiency and effectiveness. The office environment increasingly requires access to an advanced telephone, word processor, personal computer, electronic messaging system and a decision making support system. That's what Telecom's new ComputerPhone is: ONE TERMINAL WITH MANY FUNCTIONS.

The ComputerPhone Hardware consists of two units:

- The monitor
- The keyboard

The monitor is a high-resolution display unit which also incorporates a power supply designed for continuous operation.

The keyboard consists of the main unit, the telephone module, and the applications firmware module. Integral to the keyboard are two tape microdrives to provide mass storage facilities, and an RS423 printer port. The telephone module can handle two telephone lines and incorporates a Frequency Shift Key (FSK) modem.

The Base Functional Software allows the user to run several applications at the same time, without interfering with either voice or data calls which may be in progress. All the system's facilities and supplied programs are presented through a series of menus. The top level menu consists of the following options:

- Telephone Directory – capable of storing over 500 entries
- Telephone Control – a synthesized voice answering facility
- Messaging – text transfer between Computer-Phones
- Applications – Exchange business programs
- Computer Access – for connection to Viatel, Taconet etc.
- Calculator – five functions with memory
- Basic – a programming language
- Housekeeping – various system utilities

Each option takes the user through a series of lower menus with user-friendly instructions. For example the Exchange suite of programs comprises the four most needed executive tools.

- Spreadsheet
- Business graphics
- Word processor
- Database

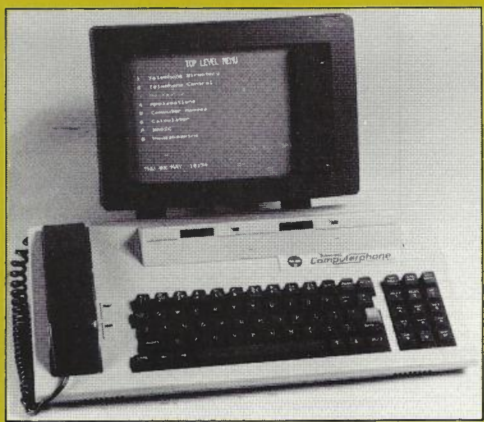
All these facilities are closely integrated for easy data transfer from one task into another. ComputerPhone users can gain access to electronic mail and videotex facilities such as Telememo and Viatel.

Victoria's engineering commitment to the Computer-Phone is the responsibility of the Commercial Department. This State has undertaken extensive functional tests on a wide range of parent equipment. This will ensure network interworking and identify potential problem areas requiring corrective action before launch. Our Victorian role is part of a co-ordinated national approach. As well as the network compatibility involvement, engineering advice on applications will be provided at the ComputerPhone showroom, 180 Queen Street, Melbourne.

In general, the ComputerPhone is an excellent concept that takes care of personal data processing and telephone needs, yet it occupies only the corner of a desk. Telecom is leading the way with integrated voice/data communications products.

Brief Technical Specifications

Processor	68008 at 7.5 MHz
ROM	128K integral, 160K ROMpack
RAM	128K dynamic, 2K battery supported
Mass storage	Two microdrives (100K each)
Monitor	9in monochrome or 14in colour
I/O	RS423 printer port
Keyboard	73 keys (QWERTY), including telephone pad



NERVE – Network Reporting of Vital Exceptions

A new system which is being introduced in 1985 will assist Network Performance Analysis Centre (NPAC) staff to quickly determine details of problems in the Network. The system which is known as NERVE utilises a micro computer. It will be installed at the new Network Analysis Centre in Exhibition Exchange. Customer network and exchange call failure reports are analysed by the micro computer and then presented to NPAC staff who determine the likely location of a network problem.

It is expected that the success rate of faults found in the network to fault patterns issued, currently 75%, will be exceeded with the use of the NERVE system.

The input to NERVE is from a variety of sources.

Customer reports, indicating technical problems in the network are forwarded through the Service Assistance Centres "1100". The Network Call Failure System (NCFS) receives indications of failed calls from ARF, ARM and ARE exchanges. The 10C Trunk Exchanges also contribute the same sort of information. This complex data requires processing by means of micro computer facilities.

The output from NERVE will provide the following:

• Fast Response Reporting

When the number of call failures from any source reaches the pre-set limits established for an Exchange, an alarm is given to the NPAC staff who will interrogate NERVE to obtain details of the network condition. This can happen within seconds of a problem occurring and is most valuable in alerting NPAC staff to a fault condition affecting incoming calls to an exchange. Urgent corrective action is then initiated.

• 10C Trunk Exchange Junctor Analysis

If the number of signalling failures on an individual trunk exchange Junctor is excessive, this is immediately brought to notice and the report given to the Trunk Exchange OIC.

• Broadband Bearer Failures

The failure of bearers associated with 10C Trunk Exchanges will give rise to an alarm. Failure information will be advised to Service Restoration and Traffic Control Centre (SRTCC) staff to assist in determining location and seriousness of the fault.

• Oversight of Network Emergencies

At the time of network emergencies or natural disasters (such as the Ash Wednesday Bushfires) it is necessary to know the effect on traffic in and out of critical areas. NERVE can be interrogated to assist in this purpose.

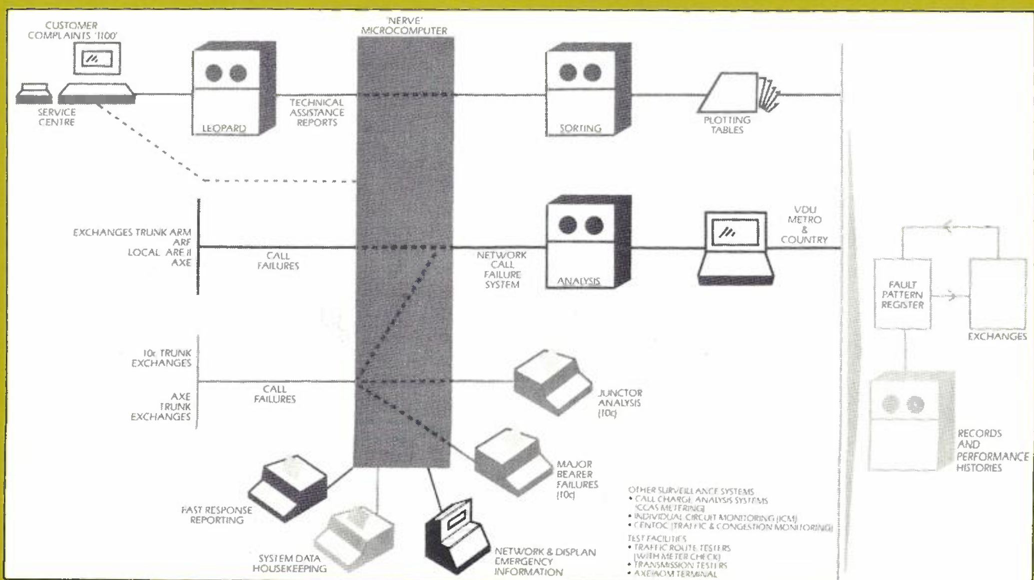
• System Data Housekeeping

NERVE counts the messages arriving from the various sources so that checks can be made of the rate of flow of data and the cause of data losses.

• Further Processing

Technical Assistance reports and network call failure data is further processed as shown in the diagram. NPAC staff plot TA reports to build up a fault pattern and analyse results from a scan of the network call failure supervisory system to determine network problems.

The diagram shows the relationship between the various independent surveillance systems used by NPAC staff to help in the day to day maintenance of the network and in longer term maintenance strategies.



NETWORK PERFORMANCE ANALYSIS - OVERVIEW

Electronic Funds Transfer (EFT)

Telecom is responding to the demands of the banking and retail industries to provide a rapidly expanding Electronic Funds Transfer (EFT) network. EFT represents a significant development in cashless consumer transactions.

This new approach to payment for goods and services was launched by the financial institutions in 1984 using a new application of the Telecom network and a unique agreement with respect to installation/maintenance of equipment involved in the provision of the network.

Basically individual Customer networks consist of a series of low speed data lines which connect the Suppliers/Retailers premises to a Statistical Multiplexer in a nearby telephone exchange.

From the concentrator up to 16 x 300bps Customer lines are connected to a single 2400bps data service using statistical multiplexing techniques. This 2400bps service is carried either by a DDS or Datel link directly to the individual financial institutions central processing unit. In some cases, services from the concentrator are provided via Austpac.

At present each institution buys its own equipment which is then handed over to Telecom to install and maintain. This is a unique approach as the multiplexer equipment and associated 300bps modems are installed in Telecom provided racks.

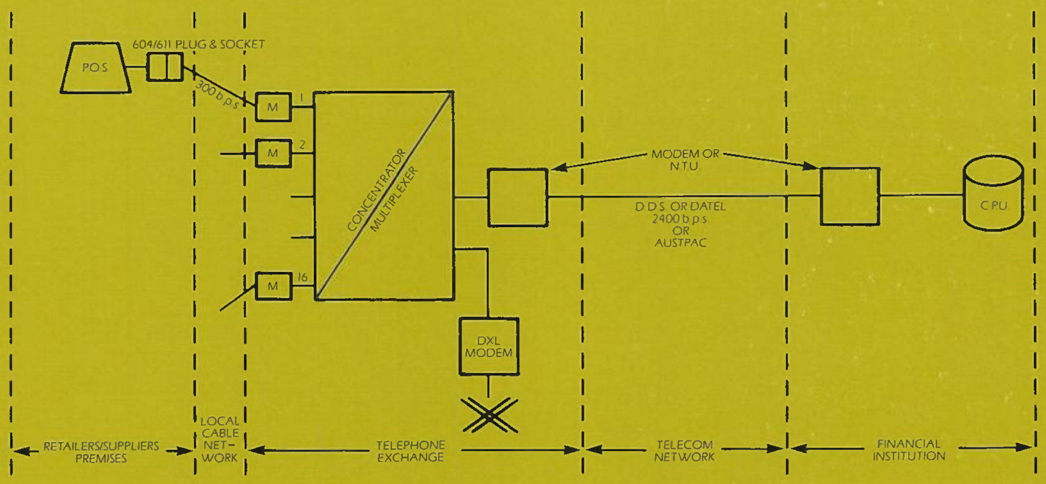
This approach requires special maintenance agreements with each customer. The equipment supplied to date by each customer is from the same manufacturer, thus making installation and mounting common to all installations. Maintenance is performed by Telecom on all plant with the exception of the Point of Sale (POS) terminal and the CPU. To assist with the diagnosis of faults in the Concentrator to POS line, each Concentrator is equipped with a port connected to a Datel Exchange Line (DXL) auto answer modem. This enables remote accessing and interrogation of conditions within the concentrator.

Telecom is presently part of an industry group which is attempting to set Australian standards to ensure that all future EFT services conform to the same standards. This approach will also enable any POS Customer's card to be used at any participating retailer, with the processing intelligence in the Concentrator enabling correct debiting to occur.

To date the demand for EFT services has been healthy and as such a number of provisioning problems are being experienced. These problems mainly relate to lack of network capacity of both junction and distribution cable pairs. These problems are progressively being overcome and the financial institutions have been encouraged to provide early information relating to future requirements and their timing to assist Telecom in network planning activities.

As many POS terminals are being installed in small businesses, such as Service Stations, which usually contain only a single 2 pair lead-in, Districts have been requested to provide larger lead-ins for all new installations.

In order to effectively manage these EFT networks and minimize installation and maintenance problems, a Management team has been established within Commercial Department. The team also maintains a close liaison within Victoria, Headquarters and other States so that Telecom can deliver EFT service as quickly and efficiently as is possible.



A TYPICAL E.F.T. CONFIGURATION

Melbourne Business to go Optical

Optical fibre has been chosen as a principal transmission medium for Melbourne's future major business communications.

As Melbourne is one of the major business and financial centres in Australia, many large business organisations operate their Headquarters here and demand the highest level of business automation and communication technology.

In order to meet this demand, Telecom has established Headquarters/State Committees to investigate the most appropriate business communication technologies for Melbourne, other capital cities and major centres.

The significant outcome of these investigations is the proposal to install a wideband pilot network based principally on optical fibre technology in the Melbourne Central Business District during 1985/86. This will comprise:

- a ring of 30-fibre multimode cables, installed in the city tunnels to link the 4 city exchanges – Exhibition, Lonsdale, Batman and Russell
- optical fibre distribution cables emanating from each exchange, generally installed in sub-ducted street conduits and in looped configurations to provide diversity paths to Customer locations
- lead-in cables of 6 or 12 fibres, taken into the buildings where services are required, terminating in the building MDF room or an area negotiated for optical terminal equipment. Fibres to be used to service the building will be jointed to the distribution fibres on an 'as required' basis.

The network will support a wide range of advanced business services such as:

- Colour video – Teleconferencing (two-way or one-way video with two-way sound)
  – Videophone (two-way)
  – Corporate Video (point to multipoint, one-way)
- Digital services – 384 kbit/s
  – 2, 8, 34 and 140 Mbit/s

Initially, circuits would be provided on a fixed point-to-point basis. As the network develops, wideband circuit switching could be provided for some services.

The project is planned in two phases. In Phase 1 it is proposed to provide the inter-exchange fibre ring and to equip 6 Telecom buildings and a Telecom Business Office with internal cabling and terminals to support a range of video, high speed data and voice services.

Phase 2 will naturally follow in the exploitation of this more advanced transmission capability by customers with requirements for advanced systems, such as optical fibre Local Area Networks (LANs) with integrated voice capability. The opportunity exists for Australian industry to develop or adapt systems to meet customer needs by making use of this advanced transmission capability.

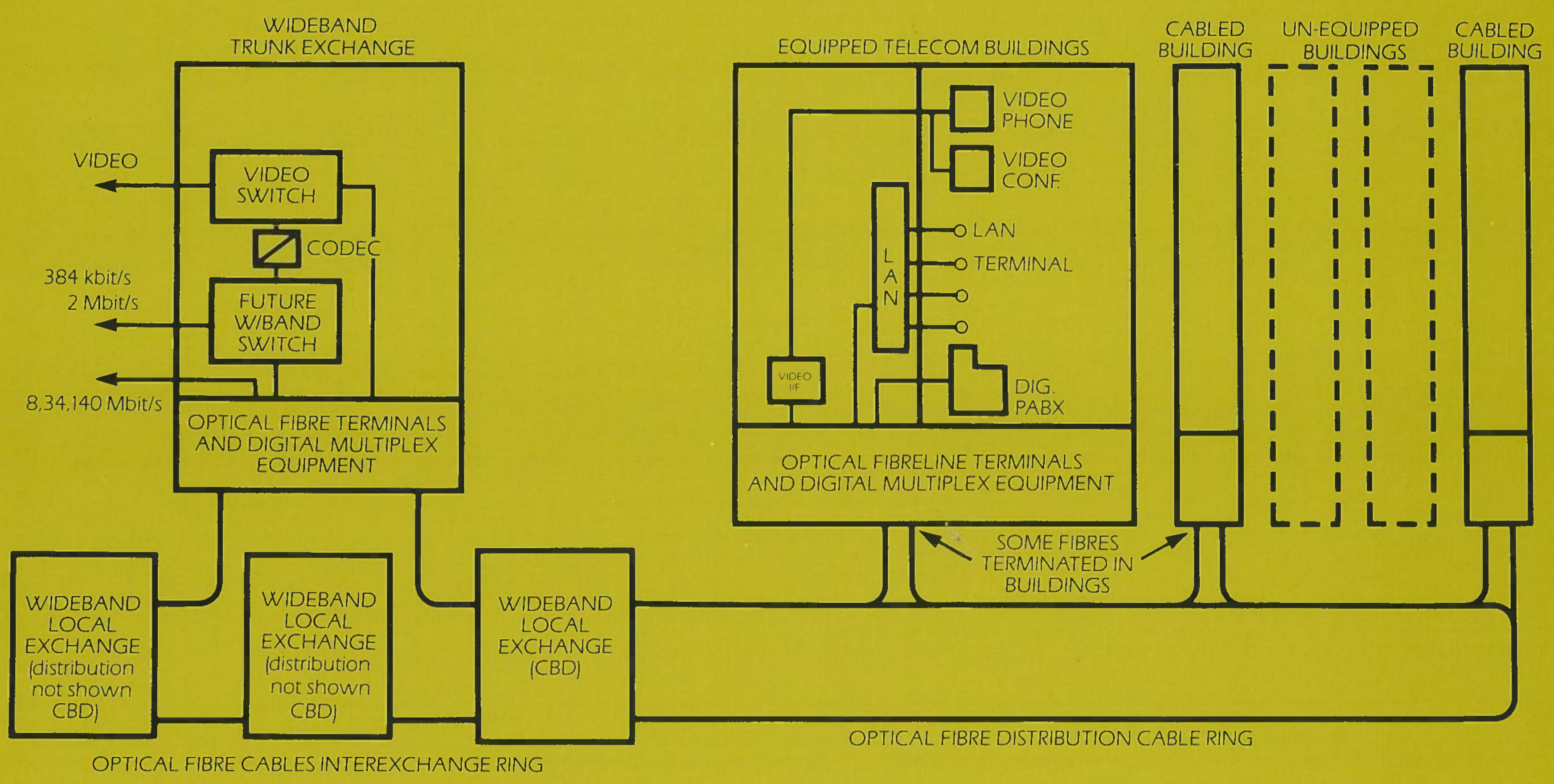
The Melbourne optical fibre pilot installation, demonstrates Telecom's commitment to greatly increased flexibility in communications for major business customers. It will also serve to develop engineering knowledge and practices in optical fibre cable distribution, wideband office networks and wideband switching systems, in close co-operation with the Australian communications industry. Other technologies such as radio and cable TV coaxial systems have been considered for wideband networks in business districts, but optical technology is seen as having the best potential for longer term aspects of service provision, network cost minimisation and availability of network design and development resources.

	PHASE 1 CURRENT EQUIPMENT	**PHASE 2** FUTURE DEVELOPMENT
CABLE	EXISTING MULTIMODE FIBRE	SPECIFICALLY DESIGNED CABLE
LINE TERMINAL EQUIPMENT	ANALOGUE/DIGITAL	DIGITAL
INTERNAL DISTRIBUTION	O.F./COAX/TWISTED PAIR	O. F. DISTRIBUTION VOICE INTEGRATED LAN
TERMINALS	TRIAL TERMINALS	INTEGRATED TERMINALS
EXCHANGE EQUIPMENT	MANUAL PATCHING	AUTOMATIC SWITCHING

WIDEBAND NETWORK PILOT
MELBOURNE CENTRAL BUSINESS DISTRICT

WIDEBAND OPTICAL FIBRE NETWORK

MELBOURNE CENTRAL BUSINESS DISTRICT (CBD) – CONCEPTUAL



Customer Wideband Services

Currently Telecom offers a range of products under the name MEGABAND. These services are defined as: "a service that requires speed in excess of 64 kbit/s or a bandwidth in excess of 48 kHz", or a Wideband service.

The current range of Customer Wideband products now includes:

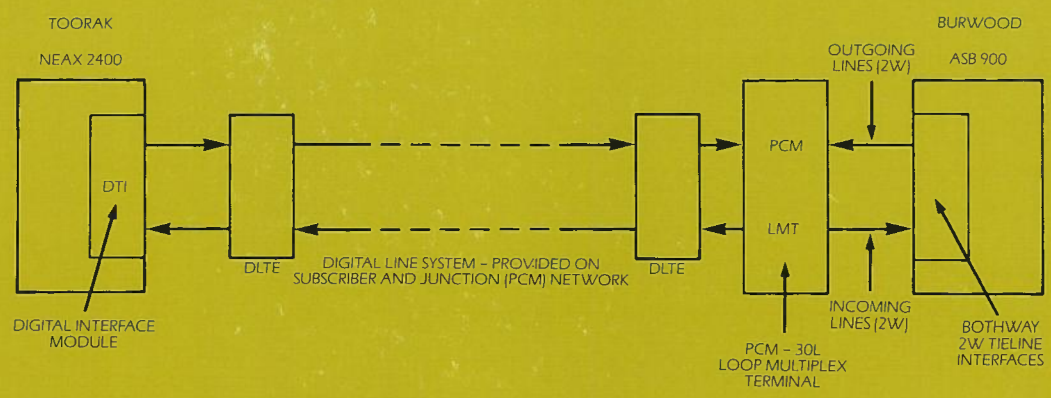
Digital transmission systems consisting of 2 Mbit/s cable systems as well as a range of digital radio systems (including 2, 8 and 34 Mbit/s systems), digital multiplexer enhancements, special data communication links, various analogue video services, sound broadcast links, audio conferencing and FM/FDM carrier links. The engineering and technical aspects of the customer's requirements are examined by specialist groups in the Engineering and Commercial Departments, and equipment required to provide the service is specified.

The most commonly installed Customer Wideband service in Victoria is the 2 Mbit/s cable link. These cable links are typically used to provide computer mainframe (CPU) to mainframe (CPU) transmission, PABX to PABX tie lines, as well as bearers for multiplexed slower speed data channels. Increasing sophistication of office switching systems and data processing equipment requiring high speed digital transmission facilities has led to a rapidly increasing demand for digital Wideband services.

Customer Wideband 2 Mbit/s links utilise the existing distribution pair cable and junction PCM networks. Underground regenerator housings are jointed into the distribution cable when the transmission loss between the terminal exchange and the customer's premises exceeds limits. A small modem cabinet is installed in the customer's premises to house the Digital Line Terminal Equipment (DLTE). The DLTE interfaces between the customer's equipment and the Telecom 2 Mbit/s stream. Wideband 2 Mbit/s links are provided on an interface to interface basis, where the interfaces meet the CCITT standard. A range of multiplexing equipment is also available to suitably interface with the customer's equipment. All customer equipment connecting to the interfaces must have a Telecom "Permit to Connect".

An illustration of the application of the 2 Mbit/s product is the recently installed link for Victoria College to interconnect two PABXs. This service provides bothway tie lines from a NEC NEAX 2400 PABX at Toorak, which is a 3rd generation machine, consisting of solid state switching using sophisticated software control and permitting digital transmission interfaces. The distant end at Burwood is an Ericsson ASB 900 PABX which is a 2nd generation machine with limited software control and analogue voice frequency interfaces. To provide the input to the Ericsson PABX a PCM-30 Loop Multiplexer was installed. The Loop Multiplexer provides the interface between the 2 Mbit/s stream and the analogue voice frequency input to the PABX. The NEC PABX accepts direct digital inputs and particular channels in the 2 Mbit/s stream are programmed as either outgoing or incoming lines.

With the expansion of the Integrated Digital Network, provisioning of digital Customer Wideband links is expected to become quicker, more economic and efficient. Combining the flexibility of the Customer Wideband product with the consultancy provided by Telecom staff, the Customer Wideband product provides customers with a rapid solution to their future high speed digital transmission requirements. Other Customer Wideband services have been provided in a similar manner, as well as more complex networks utilising digital radio links and alternate routing.



VICTORIA COLLEGE 2 MBIT/S CUSTOMER WIDEBAND SERVICE DIGITAL LINK

Exchange Data Gateway

The Exchange Data Gateway (EDG) facility has been developed to provide a national network for the direct transport of each customer's electronic call-meter data to Telecom's computerised billing system. It forms part of a total system aimed at fully automating customer billing processes for metered calls for the increasing number of customers connected to Stored Program Controlled exchanges.

EDG is made possible because AXE exchanges are capable of transferring, under command control, charging data via the AOM to various Network Operation Centres (NOCs). It is proposed that some ARE 11 exchanges, when equipped with Electronic Call Charge (ECC) will also be connected to AOM. AOM is an Operation and Maintenance System used by Telecom to serve various Network Operation Centres by switching of messages between them and SPC exchanges.

EDG is a Data General based computer system designed to receive two data streams from AXE exchanges, namely Call Charge Data (meter readings) and Charging Assessment Data. The latter is a statistical function that samples a specified percentage of local and multimetered calls. The following data is output for each sample.

A party national number
B party number
Date and time of B party answer
Chargeable time in seconds
Number of charging pulses registered
Charged party (A party, B party or No Charging)
Destination Code
Information on link-failure or restarts in AXE

Initiation of data transfers is by Network Operation Centres connected to the AOM. Call Charge Data will be initiated from District Telecom Offices (DTO) while Charging Assessment Data will be initiated from the Centralised Service Assessment Centre (CSAC).

The main services offered by the EDG are:

• The collection of the above data via X25 communication links.

• Production of daily magnetic tapes for the transfer of collected data to TACONET facilities.

• Storage of collected data for the remainder of the operational day or until the next magnetic tape is produced.

• Production of a daily control listing (one per data stream) detailing which transmissions were received that day. The control listing also shows which transmissions failed after commencement of the transmission and includes details of the magnetic tape dumping operation. The daily control listing is sent to the respective user areas concerned as a record of the results of all outputs ordered from remote terminals.

• A log recording the activities of each operational day is maintained at the EDG site. Details of transmission already received or in progress is available at all times either via the log or the EDG console.

A field trial was set up in November 1983 to evaluate the system. Prior to implementation, further enhancements were made to the EDG. This involved the design of an interface for EDG data tapes to the Telecom's Telephone Accounting System (TEL/DRS) processing input. The interface named Call Charge Interface (CCI) is a TACONET based system whose primary purpose is to provide, as an interim measure, a mechanism whereby the meter readings from AXE exchanges, collected by EDG from the AOM/AXE network, can be automatically input to the TEL/DRS for customer billing, prior to the introduction of the new telephone billing system.

The functions of the CCI are:

• Process the EDG output tape.

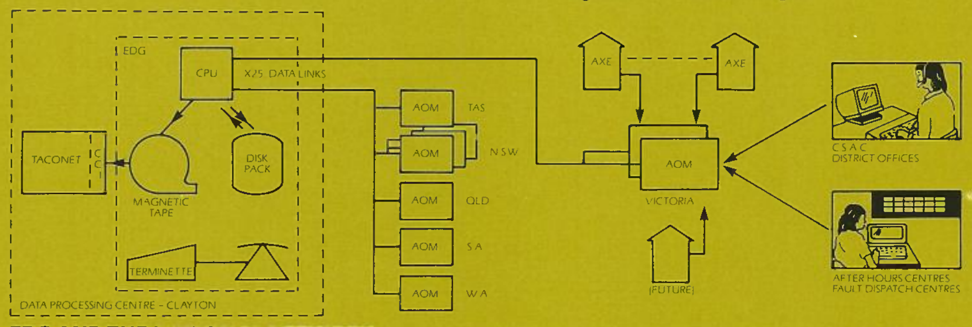
• Perform a format check of the Call Charge Data.

• Restructure the data into a suitable format for TEL/DRS.

• Direct the restructured data for processing by TEL/DRS system.

With the network set up for EDG and the development of the CCI, a full end to end field evaluation took place in April 1984. The test was needed to evaluate the interworking of the entire data transfer chain and the interfaces covering the EDG link between Network Operating Centres, AOM and AXE exchanges and the transmission through EDG, CCI into TEL/DRS.

The EDG system became operational towards the end of 1984. It provides an efficient, reliable support network for the transfer of electronic meter records, with a capacity to match the rapid expansion of digital electronic exchanges.



EDG AND THE NATIONAL NETWORK FOR COLLECTING SUBSCRIBER METER READINGS

Treatment of Asbestos in Telecom Buildings

The uses of asbestos materials have been widespread throughout the manufacturing industry and the building industry for over 100 years.

It was recognised some 50 years ago that workers directly involved in asbestos mining were being exposed to health risks and regulations began to evolve to control the amount of airborne fibres and the exposure to dust for asbestos workers.

In the last 10 years the actual health risk has been actively debated and more clearly defined with the adoption of very stringent standards for any work with asbestos materials.

The National Health and Medical Research Council has set maximum permissible exposure levels and Telecom has adopted permissible levels 10 times as stringent as these.

Asbestos is a term describing fibrous silicate materials with a crystalline structure. It has the ability to break down into fibres of breathable size and may cause lung disease. The 3 potential diseases are:

i. Asbestosis – a thickening and scarring of the lungs caused by breathing excessive amounts of asbestos dust over many years. This disease may shorten the life of an affected person and cause some disability.

ii. Lung cancer – more prevalent in people who have worked in an asbestos industry.

iii. Mesothelioma – more rare cancer of the lining of the chest or abdomen and is fatal.

The method of prevention of these diseases is to avoid breathing asbestos dust; the lower the quantity of asbestos dust inhaled, the less danger there is to life and health.

Buildings Branch in Engineering Department is responsible for arranging surveys of all occupied Telecom buildings to register the locations where asbestos materials have been used.

In each case the condition of the material is recorded and warning signs to identify the material are placed on view.

Potential Sources of Asbestos Within Telecom Buildings

i. Cable slots between cable tunnel and MDF.

ii. Cable slots between MDF and 1st Floor equipment room.

iii. Busbar risers/floor and wall penetrations.

iv. Emergency Power Plant exhaust pipe lagging.

v. Boiler/Hot water pipe lagging.

vi. Sprayed material on slab beams on underside of concrete slabs.

vii. Fibrocement sheet in wet areas or lining material on walls, ceilings or roofs.

The list is not meant to be exhaustive but it gives a good indication of general use areas.

Where there is a danger of fibres becoming airborne then a choice of treatment, to make the situation safe, is made either to seal in situ or alternatively to remove the asbestos.

Methods of Treatment

The best way to treat asbestos, provided it is in good condition with no obvious damage, is to leave it alone and isolate it until the ultimate demolition of the building or plant. This method is applicable in only a few cases. The more usual methods of treatment are:

i. Seal the material.

ii. Encapsulate the material.

iii. Remove the material.

Sealing is used in areas not subject to mechanical damage, suitable sealants may range between a coat of plastic paint to specialist sealing coatings developed for British Admiralty use.

Encapsulation in the form of metal, PVC or fibreglass sheeting is used in areas subject to minor mechanical damage eg: ladders leaning against vertical or horizontal pipes. Encapsulation can only be carried out where the bare asbestos material is in sound condition and already sealed.

Removal is, of course, the removal and replacement of the asbestos bound material by an acceptable non asbestos material, of which, depending upon the application, a range exists.

In all cases, where sealing and encapsulation is carried out, signs are attached concerning the danger of penetrating or cutting the asbestos based materials underneath.

The procedures for treating or removing asbestos include preventing the spread of asbestos dust by laying plastic sheets over the work area and finally vacuuming with special cleaners.

Special attention, in accordance with State Laws, is given to the disposal of recovered material and the protective clothing worn during the operation. A mobile decontamination unit is provided for use of staff involved in the asbestos removal/treatment process.

When the work is completed air samples are collected and tested. The cleaning process is repeated until the samples indicate the asbestos dust levels are below Telecom's standard of less than .01 fibres per millilitre of sampled air usually measured over at least a 4 hour period.

At the present stage of the asbestos investigation program, surveys have been completed with buildings being identified for special treatment or removal of the asbestos materials.

The program is estimated to cost $6M over the next 5 years with the added need for close surveillance and controls on building activities that can disturb asbestos materials being with us for many years to come.

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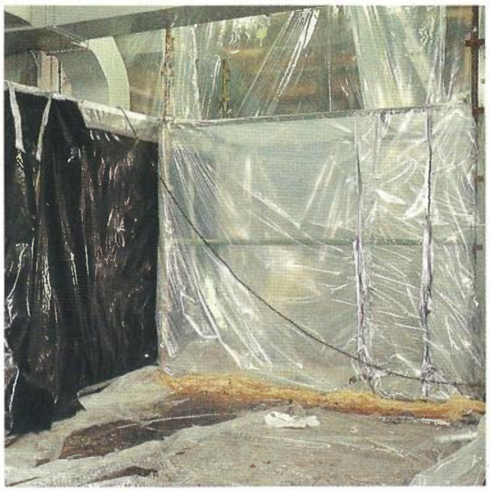

5.

1. PLASTIC SHEET TUNNEL WITH NEGATIVE PRESSURE UNIT IN FOREGROUND
2. REMOVAL OF BOILER INSULATION
3. PIPEWORK LEFT STRIPPED, PIPEWORK RIGHT, RE-INSULATED AND PROTECTED
4. DECONTAMINATION UNIT, SHOWER SECTION
5. TENTING FOR REMOVAL OF CONTAMINANTS

ENGINEERING 82, 83, 84 & 85 CONTENTS