

Report of the Committee of Inquiry into
TELECOMMUNICATIONS SERVICES IN AUSTRALIA

Volume 3

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JUNE 1982

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VOLUME 3

SECTION 1

REPORT FOR THE TELECOMMUNICATIONS INQUIRY COMMITTEE

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London

Sydney, N.S.W., Australia
July 1982

INTRODUCTION

- 1.1 In response to the request in April 1982 of the Australian Telecommunications Inquiry Committee, two visits (20--26 May and 18 June to 6 July 1982) totalling some 26 days were made to Australia by Paul L. Skey of Cable & Wireless P.L.C., London.

SCOPE

- 1.2 The purpose of the visit was to assist the Telecommunications Inquiry Committee by providing engineering advice, particularly in relation to comparing productivity, manning levels, techniques etc. of Telecom Australia with those of comparable telecommunications administrations.

METHOD

Briefing visit

- 1.3 During the first visit the task was defined and all of the available written information relevant to the task was collected and taken for reading. One day of preliminary discussions took place at Telecom's Headquarters in Melbourne. During the ensuing two weeks, data, particularly from Telecom Australia's submission (February 1982) to the Inquiry, was compared with the rather limited data available from a number of other administrations. The work was carried out in London by Cable & Wireless assisted by Logica. The principal conclusions are referred to in this report.

Subjects examined

- 1.4 On the second visit the written information, especially the main submissions to the Inquiry and Telecom's answers to specific questions, were studied in detail. Visits were made to L.M.E.'s offices and

factory at Broadmeadows, Melbourne and to Telecom Australia's undermentioned locations in the Melbourne area in connection with the subjects shown:

LOCATION	SUBJECT
Offices of State Manager, Victoria	<ul style="list-style-type: none"> . customer trouble report rates; . Telecom activities in Victoria.
Office of the Chief Planning Engineer, Headquarters	<ul style="list-style-type: none"> . plans and progress in digital telecommunications; . transmission planning; . new telex exchanges; . optical fibre techniques.
Lines Practices and Protection Section, Jolimont	<ul style="list-style-type: none"> . modern methods of monitoring pneumatic integrity of pressurised cables.
Lonsdale Telecom Centre	<ul style="list-style-type: none"> . pressurisation equipment; . observation of cable tunnel system.
Maldstone External Plant Centre	<ul style="list-style-type: none"> . existing and new lines practices; . optical fibre systems; . cable TV system; . solar power system for unattended repeaters.
Footscray District Field Depots:	
Fault Despatch Centre	<ul style="list-style-type: none"> . 'Leopard' system of computerised fault control.
Telephone Installation Centre	<ul style="list-style-type: none"> . present and proposed methods of control of installation of new services.
Line Depot	<ul style="list-style-type: none"> . reporting centre for field staff.

Comparisons

- 1.5 Statistics of productivity and performance in detailed spheres of engineering (e.g. output of cable installers, manhours to install terminal equipment etc.) are not normally publicly available from telecommunications administrations or would take too long to obtain for this study even if administrations were willing to release such normally confidential internal particulars. Moreover, the validity of comparisons would be reduced by the adjustments that would have to be made for different conditions and different extent of use of mechanical aids to save labour etc. The latter is, however, a good indicator of management's concern to reduce costs in countries such as Australia

where labour is not cheap, so particular attention was given during the survey to determining whether modern labour saving methods were in use. Comments are made on this aspect herein. In addition, some costs of installations by contractors of junction cables and of digital crossbar exchanges were compared with Telecom's figures and are referred to in paragraphs 1.58--1.65.

Sampling

- 1.6 It was decided to examine sample segments of each main sphere of activity to determine whether the practices adopted or soon to be adopted by Telecom Australia are up to date by world standards and conducive to further steady or future rapid increase in productivity.

Plant Assets

- 1.7 The activities from which sample techniques were examined were treated as having importance in proportion to the value of Telecom's plant assets in that sphere. Appendix 1 contains a pie diagram showing Telecom's plant assets in June 1982. From this the following is noted:

Table 1.1: Telecom's plant assets

ASSET	PERCENTAGE
	OF TOTAL ASSETS
	%
Line plant (local plus trunk and junction)	46
Exchange equipment	30
Customers' equipment	12
Other	12
TOTAL	100

Source: Telecom data

Productivity -- prospects

- 1.8 Study of the statistical data shows that the number of subscriber services (or 'direct exchange lines') has increased from about 3.5 million to about 5 million between 1975 and 1981 (i.e. by about 43 percent) while the number of staff has increased by about 1.7 percent. Productivity has therefore increased steadily, evidently primarily through economies of scale. However, in the immediate future, new techniques and especially the wide range of new planning options

arising from an integrated digital network provide the opportunity for a sharp rise in productivity and a reduction in the real costs per added subscriber, provided that staff can be retrained and redeployed from declining disciplines to growing ones. At the request of the Committee particular attention was addressed to this area.

FINDINGS -- LINE PLANT (46 PERCENT OF PLANT ASSETS)

Urban practice

- 1.9 Urban subscriber line plant practices in Australia are, in most respects, modern and creditable and they compare favourably with advanced countries having the best telephone line practices (e.g. Sweden, UK, Germany FR) and they are far superior to North American practice where much urban line plant is erected overhead on power poles and is vulnerable to storms, collisions and criticism by environmentalists on grounds of visual pollution. There are over 20 million 'joint user' poles in North America. Many also carry cable TV and other services. The factor which distorts line plant engineering economics in North America is absent in Australia, i.e. it is not economic in Australia to reduce capital costs of line plant by suspending, as in the USA, large distribution cables and festoons of drop wires on power poles while accepting that maintenance costs are high but allowable against taxes. In the words of an ex-Bell engineer:

"If we use large capital sums to install lines properly underground we pay shareholders forever. If we stick the cables on the power company's poles and they all fall down the next day the cost of repair is allowable against tax -- it is at taxpayers' expense. The user expects storms and acts of God to cut his service anyway."

In the absence of this distortion of good engineering economics Telecom Australia has provided, in urban areas, an excellent permanent infrastructure of ducts, tunnels and jointing chambers with scope for orderly growth over the years. Its unobtrusiveness and permanence of construction are in marked contrast to the overhead distribution lines in most areas.

Primary or main distribution cables

- 1.10 Telecom's modern primary cables are ducted polyethylene aluminium laminate sheathed, air spaced, machine jointed, and pressurised, a combination which is scarcely capable of being bettered (for high staff productivity and low maintenance) in the present state of the art. It was observed that for primary cables, wire jointing machines and crimped connectors are in general use, which is conducive to good jointer productivity. An advantage of manholes in Australia compared with most other countries is that they are installed almost exclusively

in footways and nature strips and they have large entrances that would not be acceptable in more congested territories. This design was seen to reduce the need for lighting sets and forced ventilation. The absence of prime movers, with attendant maintenance, round a manhole in which jointing was taking place, was evident. The poly laminate sheathed cables used by Telecom are immune from electrolytic corrosion which might otherwise be caused by DC powered transport such as tramways and railways. (cf. French P.T.T. which was in 1980 still installing bare lead sheathed trunk cables in ducts). Surprisingly, paper insulation of primary cables is still normal in Telecom, though a phased introduction of cellular polyethylene insulation is envisaged. This should result in a further small improvement in productivity. The sheath closure method (lead collars and sleeves with internal and external heat shrink sleeves) is probably the most reliable method currently available for closing polyethylene sheathed cables. Telecom Australia appears one of the first administrations to have recognised this fact. The cables are pressurised and a modern system of automatic monitoring of pneumatic integrity has been adopted and is to be extended throughout the network (see paragraphs 1.23--1.28). This technique ensures that most incipient faults are discovered by loss of air rather than by ingress of water. Subscribers' service is therefore seldom affected and the need for rushed remedial work, entailing overtime, is greatly reduced compared with unpressurised systems where nearly all faults are discovered through loss of service. The primary cable techniques are therefore excellent and the main question to be asked (paragraphs 1.46--1.57) is whether there is enough determination and availability of capital to exploit the new digital technology to reduce the costs of further expansion of this part of the network.

Secondary cables

- 1.11 These are generally polyethylene sheathed, polyethylene insulated, air spaced but not pressurised. Though a minority of the length of a subscriber's line (e.g. one fifth in the UK) normally comprises secondary cables, it was said by Telecom that the majority of faults occur in these cables. This is normal in most administrations because, inter alia, the secondary network is more frequently accessed by jointers for alterations. The absence of 'protection' (i.e. by pressurisation or by using compound filled cables) in Telecom's secondary network, undoubtedly aggravates the problem of fault liability. Telecom's unpressurised, air spaced secondary cables are prone to ingress of water through faulty joints and (judging by U.K. experience of the 1950's) due to an osmosis like effect of water vapour permeation through polyethylene sheathing. In having this weakness Telecom is perhaps a decade or two behind the trends in a number of other advanced countries though it was noted that use of compound filled cables is now envisaged by Telecom. Part of this delay is however occasioned by the quite justified desire of Telecom to find a compound which is less 'messy' and unsatisfactory to jointers than the petroleum jelly most often used for this purpose in other countries, including tropical territories.

Disadvantages of compound filled cables

- 1.12 Joint closure failures in a ducted system typically comprise over 95 percent of cable faults and are mostly caused by the telecommunications administrations' own staff. Joint failures on jelly filled cables are almost always service affecting whereas on properly monitored pressurised cables they are usually discovered through loss of air and are very seldom service affecting. Expectation of great improvements of reliability in the secondary network with the introduction of compound filled cables are therefore usually doomed to disappointment.
- 1.13 From a fault hazard standpoint the secondary network should therefore be kept as short as possible. The economics also militate in favour of small secondary cable areas because cable pairs in a large air spaced primary cable are normally considerably cheaper per metre than in the relatively smaller jelly filled secondary networks. For example, where modern trends facilitate small secondary distribution cables. Some there are large and important blocks of subscribers (e.g. a high rise complex of offices) it would be best to feed direct by primary pressurised cables to indoor distribution frames which constitute in effect hypothetical cabinets or pillars. The installation of an addressable transducer to monitor air pressure at the end of each such important spur further safeguards security of service. In short, it would be a pity to reduce the reliability of service to these concentrations of important subscribers by unnecessarily introducing jelly filled secondary cables (with their inherent fault liability) between the subscribers and their conventional pillars or cabinets. In paragraphs 1.32--1.45 of this report reference is made to exploitation of new digital technology to keep secondary networks small.

Subscribers' leading-ins -- present policy

- 1.14 Telecom's policy is to employ as far as possible underground leading-in cables, installed in small ducts or conduits to subscribers' premises in urban areas. It is best if such conduits are straight and lead direct into the house but, where such cables have to terminate on external walls, Telecom's policy is to make them as inaccessible as possible to accidental and malicious damage. In this respect, Telecom's practices are far superior to most advanced administrations, especially the USA but also the UK, where underground lead-ins usually terminate on the outside of buildings and close to the ground because British Telecom, despite a high level of staffing, seldom installs a leading-in conduit from the street to the house while the house is under construction. The other underground services (e.g. gas, water, electricity) are installed during construction as a routine matter. If the modern trend is to be followed of exploiting costly and inherently little used subscribers' lines to provide value added services such as security systems (e.g. remote monitoring of burglar alarms), remote reading of gas and water meters etc, it is essential that leading-in cables are reasonably secure at subscribers' premises.

Subscribers' leading-ins -- suggested trend

- 1.15 In new houses, Telecom would like to ensure that the leading-in conduit is as straight as possible and leads direct into the house, i.e. without the need for the costly operation of cutting already laid concrete to chase in the conduit to an external wall. With this in mind, Telecom would like to see a Federal regulation obliging house builders to provide, as a condition of obtaining a building permit, a conduit.
- 1.16 In this respect Telecom's thinking is amongst those in the forefront of modern trends. Telephone penetration in Australia is so high that few such conduits would be wasted but much expenditure would be saved. Usually such conduits would need to be buried somewhat diagonally (in plan view) so that the conduits from adjacent houses would meet in the footway opposite the boundary of the two properties. Costs are thus reduced by ensuring that one jointing chamber serves two premises. The Government of the Bahamas introduced, in 1968, a building regulation of this kind. Each building permit includes wording to the effect that the developer must provide an underground leading-in conduit to the specifications of the Telecommunications Corporation. Cable & Wireless are seeking similar legislation in several territories. The cost to the developer is small if the conduit is installed in the trench with the other underground services, as an unplasticised PVC (uPVC) conduit costs a few cents per foot. It is suggested that Telecom be given every possible support in this aim.

Subscribers' leading-ins -- future fibre cables

- 1.17 Telecom's far sighted policy outlined above could perhaps be further improved. The normal conduit for leading-ins to a dwelling is said to be 30 mm in diameter. Within the very long life of such a conduit there is little doubt that in the next decade or less the bandwidth limitation of a pair of copper wires will be unacceptable for new services such as videophones, cable TV, electronic mail, electronic banking, home security, etc. The most effective and workable arrangement is for Telecom to provide the one or two fibres for these and all other telecommunications services including telephones. There would thus be a common carrier to the subscribers' premises regardless of how many value added services are superimposed on it and by whom. Telecom thought that the penetration of fibre in the distribution network was rather too long term to be taken into account but all-fibre pilot distribution schemes are under trial in Germany, Canada and elsewhere. The prospects are for an accelerated transition as the cost of fibre made from the world's most common mineral element, will certainly fall steeply. The most valuable asset for this impending era will therefore probably be the duct and conduit system. Present metallic communications cables are likely to be scrapped or recycled. It is important that the leading-in conduits are large enough and straight enough for fibre cables to be drawn in over old metallic telephone cables. It is therefore suggested that consideration be given

to employing 50 mm uPVC conduits in preference to 30 mm. The difference would be a few cents per foot. Telecom advise that they would be happy to reduce their installation charge for new premises pre-conducted in this manner.

Overhead drop wires

- 1.18 For overhead leading-in schemes Telecom employs an integral tri-foil cable embodying two copper conductors separated by a steel messenger strand. The drop wire is usually short and the copper conductors can be led direct into the house by simply stripping away the steel strand. This technique is far superior to the steel conductor drop wires hitherto normal in North America and Britain. The very thin copper coating of these steel drop wires has been found to be an inadequate protection against corrosion. Transmission over steel conductors is also poor, especially when, as in the USA, long lengths of drop wires are employed in festoons supported by power poles. There is, in the USA, a linesmen's tester which pricks the drop wire insulation for testing. Rust normally sets in at these points and maintenance is high. A change from steel is being contemplated in several countries including Britain. While it is admirable that Australia has been avoiding this legacy of fault prone drop wires, it would be still better to adopt a universal policy of conduited underground leading-ins.

Junction cables

- 1.19 In having employed twin, rather than quad type junction cables for the old era of loaded audio lines, Telecom is fortunate because twin formation is more suited to the superimposition of PCM systems in the digital era. The near end crosstalk on a twin cable is approximately 6dB better than on a quad type cable.
- 1.20 Telecom Australia, in line with other advanced telecommunications administrations has, however, recently virtually (and rightly) ceased to install more of these large and costly junction cables (e.g. 1200 pairs of 0.64 mm conductors). Telecom has found it more cost effective and conducive to improved transmission to derive additional circuits by using 2 megabits PCM multiplexing on existing cables. This is in accordance with the trend towards the use of high technology artifacts in lieu of labour intensive techniques such as heavy cables. Superimposing PCM on existing cables, however, involves entry to existing joints, unloading of loaded pairs, fitting of regenerator tail cables etc. This can be an expensive operation especially if access to the joints has been obscured by later cables and joints. There is an alternative; Telecom has not yet used a type of small cable specifically designed for PCM systems and now used in the USA, the UK and elsewhere to overcome the above problems. It is also used where new junction cable routes are required. It is a small transverse screened cable, seldom above 100 pairs, in which half of the pairs are screened from the other half by a longitudinal aluminium foil wrapped in, for

example, an 'S' shape. When fully equipped with PCM this small 100 pair cable can provide some 1 440 4-wire speech circuits. Between two AXE digital exchanges having the usual 32 time slot, two megabit junction streams no further multiplexing would be required; only the line systems would be needed. It is recommended that standard PCM systems with their line and regenerator test systems be harmonised to the 'BYB' practice of the AXE exchanges, in the interests of moving to a unified equipment practice in line with the trend towards a single equipment room for the rapidly converging fields of switching and transmission.

Optical fibre junction cables

- 1.21 Telecom has recently permitted planners to include optical fibre cables in their evaluation of alternative junction cable proposals. It is suggested that the use of optical fibres should be more positively encouraged, even where the initial cost is somewhat higher. Besides the well known advantages of smaller size, wide bandwidth and fewer repeaters, an important advantage of fibres in a developing all digital system is a freedom from 'spikes'. These may be caused in metallic conductors, by, for example, electronic traction systems or by longitudinal induced voltages arising from earth fault conditions on adjacent power lines. For full exploitation of high bit rates (e.g. 64 kilobits for data) a low bit error rate is required. There will accordingly be an inclination to 'retire' metallic cables early. A built-in disinclination to install new metallic cables is therefore advisable. Small metallic transverse screen cables may be useful as an interim solution but falling cost of 8, 34 and 140 megabit multiplexing, however, helps to make it reasonable to adopt optical fibre from the outset.

Trunk routes

- 1.22 From the brief discussions on trunk cables it appears that Telecom has envisaged that new analogue terrestrial radio systems and coaxial cable systems will serve a full life. This accords with the slow rate envisaged by Telecom for transition to digital switching as discussed in paragraphs 1.32 and 1.34. It appears that recent decisions have accordingly been taken on costs only. It is suggested that a more positive drive towards an integrated digital network should be made. It is however gratifying to note that Telecom envisages a new 20 fibre Sydney--Melbourne cable in the mid 1980's. It is hoped that at that time monomode fibres will be economical and repeater spacing can be 35 kilometres or more. At 140 megabits such a cable will have a capacity of 19 200 telephone circuits or forty 68 megabit colour TV channels.

Pneumatic protection

- 1.23 Telecom has adopted air spaced main distribution, junction and trunk cables and has a policy of pressurising all air spaced underground cables (except secondary distribution cables). While hitherto the

pressure monitoring has been achieved by relatively labour intensive methods used in the past by most administrations, new and highly sophisticated methods of monitoring the air pressure in cables by means of microprocessor controlled pressure transducers have been tried by Telecom and are to be extended through the underground cable network. This technique is already used to great advantage in parts of the US, in Japan, Bahrain and Qatar.

- 1.24 This monitoring system should enable nearly all failing joint sheath closures (i.e. about 98 percent of cable faults in the average ducted system) to be detected and remedied before they affect service and before entry of water entails costly repairs. Since many of the small leaks can be tolerated provided some pressure remains, the system can be used to reduce overtime, the repair being left until staff is available in normal working hours. As any leak is continually desiccated until repaired, the crosstalk on a pressurised system tends to be low in contrast with unpressurised (e.g. jelly filled) cables and joints where each incipient fault can give crosstalk for long periods until the service fails completely and repairs are carried out. There is a noticeable transmission advantage in an adequately pressurised cable system.

Reduction of entry to manholes

- 1.25 The rapid spread of the addressable transducer system in place of go/no go contactors should be encouraged so that total pressure gradients can be read out at the maintenance centre to reduce the need to send staff to manholes to take manometer tests. If small diameter PCM cables are employed for trunk, junction and primary distribution (see paragraphs 1.29--1.30), in continuous lengths of 1 000 metres or more, it becomes feasible to have a transducer at every joint so that a graph of pressure gradients will pinpoint leaks by read out at the maintenance centre.

Pneumatic resistance of optical fibre cables

- 1.26 When deciding between tightly jacketed optical fibre cables or the loose tube construction which is said to be more tolerant of bending, Telecom should bear in mind the low pneumatic resistance of the loose tube construction. In optical fibre cables, as in most other cables, the prime advantage of pressurisation is provision of early warning of incipient faults, before they become service affecting.

Access by staff

- 1.27 Telecom is using acoustically coupled devices to enable maintenance staff when at home to access the pressure monitoring computer and obtain particulars of urgent and non urgent faults. In this respect Telecom shows itself to be among the few most advanced administrations in using sophisticated technology to reduce staff requirements.

Further exploitation of facilities

- 1.28 The computer and addressable system is capable (with suitable terminals) of monitoring smoke, temperature, door closure etc in unattended buildings of Telecom and private customers. Telecom could thus offer a value added service to customers direct or perhaps, more practically, to security firms who would deal with the more specialist and labour intensive work at the customer's premises.

Effect of digital technology on line plant

- 1.29 It is a feature of AXE digital exchanges that the subscriber stages can be located remote from the processor so that, typically, and depending on traffic, 2 048 subscribers require only about 18--36 pairs of wires to the exchange. This 'pair gain' of about 100:1 can have a major impact on costs of primary line plant, permitting a ring main of 100 pair transverse screen cable to serve about 20 000 subscribers. As the small cable can be installed in long lengths between joints, its installation cost is low and reliability high. Ring mains varying in length from 4--40 kilometres have been in use for several years in the Arabian Gulf area to reduce line plant costs per added line by nearly half. This technique also extends the 4-wire service close to subscribers, improving transmission and stimulating traffic.
- 1.30 Telecom should ensure that the potential to effect savings in this manner is carefully considered when growth is required. Several administrations now adopting this facility are requiring building developers to provide a communications room for the remote subscriber stage, in the manner in which electricity supply authorities require developers to provide a room for the transformer sub-station. The proliferation of sites is a disadvantage which is, however, considerably reduced by the ability of the AXE to provide, at a remote point, a read out of sophisticated tests on each subscriber's line. A more detailed description of the ring main facility is contained in Appendix 2 which is a copy of an article entitled 'Digital Techniques - How do they affect telephone network development?' from the American journal 'Telephony' dated 30 July 1979.

Summary of findings on line plant

- 1.31 In the line plant field which absorbs most funds (46 percent) Telecom has produced a very creditable infrastructure, at least in the urban areas; there being no time to observe rural practices. This is a sound investment in that part of a telecommunications system where reliability is most difficult to achieve because the plant penetrates, typically, both sides of every street in the land.

FINDINGS -- TELEPHONE SWITCHING AND TRANSMISSION

Crossbar

- 1.32 Telecom Australia has a mainly crossbar switching system which is a technique which was up to date in the 1950's. A programme is underway to update crossbar exchanges by conversion from common control to stored programme control. Orders for relatively small quantities of digital switching have been placed. One AXE exchange has been installed but it employs space division switching. Appendix 3 shows the proportions of electromechanical and digital (AXE) switching envisaged by Telecom for the rest of this century. It may be noted that the amount of crossbar in use continues to increase until 1990 and crossbar will not be phased out before end of the century.

Grounds for accelerated change

- 1.33 Several years ago it was common for telecommunications administrations to visualise a slow change of this kind but these attitudes have been changing for the following reasons which should also justify a rapid change by Telecom:
- the fall of digital switching costs below the cost of space division switching has been rapid;
 - the labour savings and service improvements to be achieved by a largely self diagnostic digital system can justify early retirement of non time expired space division switching;
 - building construction can frequently be avoided by change to the compact digital switching and transmission technique;
 - the transmission advantages of the inherently 4-wire feature of digital switching facilitates achievement of the long term Traffic Weighted Mean Reference Equivalent (TWMRE). This new and more rigorous standard for transmission performance cannot readily be met by an administration if an international call can involve two stages of 2-wire switching (e.g. with crossbar) within its territory. Fig. 7 of Appendix 2 shows the manner in which overall transmission can be rapidly improved by adoption of digital transit switching and PCM junctions;
 - digital switching permits rapid extension of service to new areas served by a remote subscriber stage connected to the group selector stage by small cables or by radio mini-links;
 - achievement of an all digital network greatly facilitates a much more rapid introduction of new services which are being demanded with increasing frequency. A digital network gives the telecommunications administration a considerable advantage over competitors who do not have a 'transparent' network with a single mode of transmission (i.e. pulses) which may easily be adapted to many uses.

Proven technology

- 1.34 The impression was received during discussion at Telecom Headquarters that Telecom was keen to proceed slowly towards digital switching because of concern with training, labour relations (involved in changing duties and numbers of men), the need for field trials, the inability of the manufacturer to supply sufficient switching for a more rapid change and concern about unemployment in factories making old technology equipment. Some of these fears do not seem justified. At the end of 1981, 3 997 064 lines of L.M. Ericsson's AXE digital switching were on order or in use. Of these, 1 150 068 lines were in service in 133 exchanges in 30 countries, many of them tropical and backward. The other major supplier of CCITT compatible (i.e. of A-law) digital switching systems, C.I.T. Alcatel of France, had at that time 8 000 000 digital lines on order or in service. Of these 2 362 000 were in service in 208 exchanges in 25 countries, many of which are tropical. There seems no grounds for doubt that further digital exchanges supplied by these two firms, whether from Australia or elsewhere, will also operate satisfactorily.

Training

- 1.35 Training has not been a difficult problem. Four months of training at the manufacturers have been sufficient for existing technicians. The self diagnostic feature has made it possible to operate the digital exchanges in backward countries with very few trained men, whereas maintenance of electromechanical space division systems requires many trained craftsmen. In the case of the few faults which are not diagnosed by the equipment itself, and therefore require expertise, the operation of a data circuit to the manufacturers' works has enabled experts to diagnose faults from a distance of thousands of kilometres and to advise what cards to change. Normally, however, it is possible to rely on a relatively small number of experts within the territory to carry out this diagnosis.

Manufacturing capacity

- 1.36 It was clear from a visit to L.M.E.'s factory at Broadmeadows, Melbourne, that digital switching could be produced at three or more times the present rate and capacity could readily be increased further. From a discussion with the principals in Stockholm it was clear that the latest version of AXE, with digital switching at the subscriber stage and a codec per subscriber whether remote or co-located with the group selector stage, could be produced in Australia only a few months later than in Sweden if required. This version would also have a stand alone remote subscriber stage which would continue to operate (though at reduced traffic handling capacity) if cut off from the group selector stage.

- 1.37 Telecom should ensure that as rapid a change as possible to the latest version is achieved so that advantage can be taken of the further extension, over the next few years, of the 4-wire circuit towards the subscriber by extension of the 64 kilobit time slots, at first to cabinetised roadside remote subscriber stages and/or through 30 circuit and 10 circuit subscribers' multiplexers to clusters of subscribers and finally by burst mode transmission to the subscribers' premises. The latter facility has already been developed by British Telecom and will doubtless be available in AXE in the next few years.
- 1.38 If a large amount of AXE is produced with only the analogue subscriber stage, it will not be possible without costly changes to extend the 4-wire facility to subscribers on that equipment. In short, further development is taking place rapidly and it would be regrettable if Telecom were precluded from availing itself of the progressive extension of 4-wire telephone service to the subscriber.

Pair gain

- 1.39 Telecom appears to consider that there will not be much need in city areas for the 100:1 pair gain provided by remote subscriber stages, nor the 15 or 5:1 pair gains available from 30 circuit and 10 circuit digital multiplexers. Telecom considers that these facilities might be useful in rural areas. Doubtless they will, but the growth normally demanded by businesses can result in demands for costly line plant extensions in city areas where congestion of ducts is most likely to be met. Subscribers multiplexing as the means of meeting rapidly the growth demands of business subscribers has proved increasingly useful in other countries and should be available by digital means to Telecom. The added cost of local line plant in 1980--81 divided by the number of subscribers added to the network was \$1 077. Since switching is primarily a line plant saving technique the further opportunities for line plant saving provided by digital switching should be fully exploited.

Mini radio links

- 1.40 It was clear from a discussion at Telecom Headquarters that some of the new options for exploiting digital switching and transmission to economise in distribution type cabling (reticulation) were not widely realised. For example a further means of exploiting digital switching to respond rapidly to increasing demand in compact areas is by use of 8 megabit mini radio links at frequencies of, for example, 13 GHz and above, over distances of up to 5 kilometres between the group selector stage and remote subscriber stage of switching (RSS) to serve 500 to 1 000 subscribers. The Swedish and British versions of the mini links are very compact, with small (e.g. 300 mm x 600 mm x 800 mm) weatherproof equipment cabinet and 600 mm diameter dish attached to a 4 mm alloy tube easily erected inside or on top of an office building. Such a link would normally allow a standard grade of service to up to 1 000 subscribers (numbers depending on traffic) to be given rapidly

and at low cost compared with a 1 000 pair cable in an urban area. It would also provide better transmission, as the 4-wire termination would be close to the subscriber. The 1 000 lines could perhaps be block wired from the RSS to subscribers. The only multiplexing required would be the 2--8 megabit conversions at each end. Consideration should be given to exploiting this new option for inexpensive links between group selector and remote subscriber stages, for saving of line plant, improving transmission and increasing speed of response to demand. If a transverse screen ring main or optical fibre cable is later used as the means of linking the group selector stage to the remote subscriber stage, the mini link can be recovered and re-used for rapid response to demand elsewhere. Telecom Australia, like most telecoms administrations has for historical reasons divided its engineering disciplines into distinct subjects (e.g. switching, transmission, lines etc). If the new planning options resulting from an integrated digital system are to be exploited the system planning will need exposure to this type of new option, perhaps by demonstrations and seminars.

Standardisation

- 1.41 Telecom considers that there should be a standardised digital exchange but with the scope for two competing sources of manufacture in Australia. Telecom has selected AXE and negotiated a contract of this sort. The ATEA submission to the Inquiry, on the other hand, urges that Telecom should develop its own digital system and produce it, evidently in factories owned by Telecom. There seems no ground for support of the ATEA recommendation. Their contention that high technology is not being transferred to Australians was seen to be groundless. It is known that L.M.E. in Australia has made and continues to make major contributions to the ongoing development of AXE. The contention that an entirely new Australian design of digital switching would favour exports is insupportable. Foreign importers seek proven systems and AXE has the considerable advantage of being well proven. L.M.E. has also exported much switching from Australia, e.g. for Oman in the 1970's. It has the option to do so to a substantial area of the developing world. If a new system were invented by Telecom it may take an estimated 1 500 man years of development and, like some systems now nearing completion of development, would be available so late that there would be few uncommitted markets left for penetration. In selecting AXE Telecom appears to have come to the same conclusions as Cable & Wireless. These are embodied in the extract at Appendix 4 of a submission dated January 1982 which is part of a paper presented by engineers to management concerning a territory requiring digital switching by mid 1983. AXE was the system that could meet the technical requirements combined with an acceptable proven record.
- 1.42 Telecom is also exploiting the advantages of standardisation of processors between AXE telephone and AXB telex and data exchanges which are close counterparts. This appears an enlightened policy which should facilitate training, standardisation of spare parts, interchangeability of staff and progress towards an integrated services digital network. The further development of skills in high technology

by Australians could perhaps be prompted by, for example, collaboration between Telecom and L.M.E. Australia for further exploitation of the switch to save line plant, i.e. accelerate provision of roadside cabinetised remote subscriber stages etc. Collaboration in such a field between Telecom research and development staff and the manufacturers' staff could well result in a popular exportable feature of AXE exchanges. Australia would prove a good testing ground for high temperature conditions encountered in many developing countries. Telecom considers that Australia is not a large enough market to have more than one type of digital public exchange switching but that there should be more than one source of the equipment. Standardisation coupled with multiple sources appears an entirely appropriate philosophy and is beneficially adopted by other and large telecoms administrations such as the British and Japanese.

- 1.43 In summary, Telecom's policy decision on a proven and available system appears entirely sound. The point of doubt seems to be the slow rate of change to all-digital switching and transmission envisaged by Telecom. The impression was gained that some of the grounds for this apparent conservatism were not solely technical. This matter is addressed in the next section.

Extension of new facilities

- 1.44 It should be axiomatic that Telecom would exploit and perhaps earn revenue from all of the facilities on an AXE exchange even though such facilities are not available to subscribers on remaining electromechanical exchanges. Such facilities might include: call diversion, conference calls, automatic wake up calls, subscriber applied trunk access barring, hot line facilities etc, etc. This would lead to further differences between the quality of service and facilities available to different subscribers, but Telecom's policy should be to rectify this by the earliest possible replacement of electromechanical exchanges by digital exchanges. It is questionable whether much further effort should be devoted to partial upgrading of electromechanical exchanges. Acceleration of the spread of digital exchanges appears the better option. The plans shown by Telecom for extension of the digital overlay system in the Melbourne area in two stages (diagram entitled 'The Melbourne Integrated Digital Network -- Switching' from Telecom's publication, 'Engineering 82', Issue No. 1, June 1982, Engineering Department (Victoria)), firstly to 1990 then to the year 2000 appear much too slow, resembling British Telecom's slow pace of change rather than the 'great leap forward' of the French PTT. Some developing countries already have digital overlay networks and others will be completed by 1983. It is suggested that Telecom's target for the year 2000 should be set forward to 1990's and that all the remaining electromechanical switching and frequency divided trunk systems should be phased out in the early 1990's. It is recognised that this would entail, as in France, a conscious government policy to invest in accelerating advent of the new 'information society'.

Cable TV

- 1.45 A pilot installation of cable television under trial by Telecom was examined at Telecom's Maidstone External Plant Centre, Melbourne. It employed American materials based on metallic cables. Some of it was overhead and other parts underground. In the USA most such plant would be overhead on poles shared with power supply lines, street lighting, telephones and sometimes other services. It is to be hoped that no such practice would be tolerated in Australia. It is suggested that any thoughts of allowing a separate cable television company to use Telecom's ducts should be discarded. As already mentioned herein, it is the experience of many administrations that some 98 percent of line plant faults in a ducted system occur through disturbance of existing cable joints caused by the telecom authority's own staff working in the manholes. A second authority using the same ducts would not only probably double this number of faults but would create problems of 'Who did it?' leading to friction. It would not be reasonable to expect an efficient telephone service under these conditions. Moreover the number of ducts provided by telecommunications administrations is carefully based on 20--year demand forecasts. The intrusion of another operator, probably requiring a whole 100 mm duct, even for his less than 30 mm cable, would necessitate a revision of all plans. Where Cable & Wireless has recently been under pressure by governments to provide cable TV, it has proposed the provision of a few extra fibres in its junction cables. The use of these (two colour TV channels per fibre) makes no measurable difference to the diameter of the cable and to duct use. It will also provide a system which is not prone to electrical interference. It is expected that a separate private organisation will deal with programmes and subscriber terminals. This pattern of development involves least total investment by society for cable television.

OBJECTIVES AND CONSTRAINTS

Use related tariffs

- 1.46 There appears no area in which telecommunications administrations generate more ill will than by bulk metering and the feeling of subscribers that telephones (alone amongst the services) locate the subscribers' meters away from the subscribers' premises and where the subscriber cannot keep check on them. It is the 'take it or leave it' image towards queried bills which generates the ill will. It is noticeable that those telephone administrations (e.g. Hong Kong and Barbados telephone companies) which make no charge for calls within their territories (being cross subsidised by overseas calls) are popular with users. The solution lies not in flat rates which are inequitable and tend to cross subsidise business subscribers by residential subscribers, but in widely available subscribers' private metering, subscriber applied barring facilities and itemised accounts. The tariff should be increasingly use related, for equitability,

revenue growth and as a cushion against inflation. At present a local call over distances of more than 20 kilometres can be made for 12 cents untimed. Those who habitually make long local calls may be seen as subsidised by those who do not. The system lends itself to abuse enabling, in effect, the equivalent of a private leased circuit to be set up between busy users for unlimited periods for 12 cents. Since the telephone tends to be used increasingly with the passage of each decade, a use related tariff which reflects the duration, frequency and distance of calling will tend to produce increasing revenue which helps to reduce the number of tariff increases which have to be made for reasons of inflation. The new technology facilitates adoption of tariffs which are time and distance related even in the local area. Consideration should perhaps be given to reducing the value of a metering pulse when making it time and distance related for all calls.

Transmission and traffic

- 1.47 It is noticeable that transmission losses between subscribers in Sydney and Melbourne metropolitan areas tend to be high. Rather high Reference Equivalents are accepted by Telecom. An accelerated change to integrated digital switching and transmission, with its inherent 4-wire working, could be used as the means of making a dramatic improvement in transmission which, as found by Canadian Bell, gives a lucrative stimulus to traffic. Appendix 2 Fig. 7 indicates the major improvements in transmission resulting from the inherently 4-wire nature of the digital system.

Constraints -- revenue and capital

- 1.48 Telecom's submission to the Inquiry seeks to show that Telecom's tariffs are low compared with other specified countries but this is based on the supposition that an Australian traffic pattern can be applied to, for example, French tariffs. Appendix 5 demonstrates that this reasoning is not supportable. Nevertheless, Telecom's tariff should be not only more use related but sufficient to support the more rapid depreciation caused by accelerating technical change and increased capital expenditure while producing an acceptable return on capital. This recommended trend towards a more commercial and rather less social service type bias should be accompanied by a considerable easing by Government of constraints on raising of capital by Telecom. In the rapidly developing era of the information society, telecommunications should be profitable and able to support its capital requirements provided it is permitted to take part in all profitable activities, even if in competition with specialised value added providers of its services.

Constraints -- staff

- 1.49 From the Telecom and ATEA submissions to the Inquiry and from discussions with Telecom, it is clear that the problems of changes in manning levels created by new technology are acute for Telecom. The highly fragmented unionisation of crafts (with 28 unions in Telecom) apparently makes change of duties very difficult. Moreover, whereas the media in the UK make frequent references to the explosive growth of the information society and cause British Telecom staff to feel that expansion rather than retrenchment will occur, no such ethos appears to have been created in Australia as yet. There is a need to create confidence and optimism in telecommunications and to allow whatever type of advertising is required to promote this. For example, the North American telephone system, despite the weaknesses referred to in paragraph 1.9, is usually regarded by its users as the best in the world, even if they have experienced no other system. Much of this is attributable to regular promotional advertising, through 'coast to coast hook-ups' on television, through sponsored popular programmes, e.g. films on wildlife, and promotion of corporate image. The statement that the American system is the best in the world is repeated to the public so often that the public believes it. Subscribers in Australia and elsewhere commonly think that if there is a cable passing their premises there is no excuse for delay in 'hooking up to it'. There could be benefits in TV advertisements explaining that telephones, unlike all the other services, require a separate facility all the way (from the exchange) to each subscriber. To avoid a heavy burden of unused plant these pairs are normally provided in a phased way based on forecasts. New technology can reduce but not yet eliminate the reliance on dedicated subscribers' lines.

Staff for capital works

- 1.50 Telecom Australia appears unusual, if not unique, in employing its own staff for virtually all exchange installation work, ductwork, and cable installation. Agreements with unions apparently formalised such arrangements. Normally, it is an axiom that if an administration has sufficient staff for capital works it is over staffed for normal operations. The alternative is to spread the capital works so that there are continuous but piecemeal extensions. The unions' agreements and capital limitations imposed on Telecom management would tend to promote this trend and it was understood that this piecemeal expansion is the tradition. If so, it is a bad one. It may explain the high fault rate. (Tables 13 & 14, Appendix 6 refer). Continuous expansion of electromechanical exchanges and of ducted cable systems tends to cause a high rate of faults which were not otherwise explained. Telecom's urban line plant is, as stated previously, of high quality, as are its urban exchanges (within the limitations of old technology), yet the fault rate is over three times as high as Sweden's. A large part of this is at the subscriber's premises and some is attributable to dial type telephone instruments, a problem which might be eased by a more vigorous pursuit of the policy of change to push button multi-frequency telephones. These will also improve Telecom's image of modernity and, through the 12--button key pad, facilitate use of the new facilities offered on digital stored programme exchanges.

- 1.51 Other steps to reduce piecemeal extensions are matters more of government policy and industrial relations as referred to below.

The need for change

- 1.52 Telecom has too many handicaps. They need attention with the help of Government. There is a need for inducement to reduce the number of craft unions, to encourage flexibility of staffing, to reduce concern with demarcation, to alleviate an apparent sense of insecurity and to allow contractors' staff to install, inter alia, digital exchange equipment and ducts. Without the confidence and co-operation of staff, Australian telecommunications and hence the economy will suffer. As a trade off for some move away from one seemingly unique feature (all capital works by Telecom staff) it is suggested that another very unusual feature be removed: prohibition of provision by Telecom of various equipment (e.g. certain PABX's) and services (e.g. videotex). While competition in these fields is feared by the unions, 'predatory pricing' is feared by the would-be competitors. Both fears appear exaggerated.
- 1.53 The emerging experience of organisations overseas is that it is virtually impossible for the telecommunications administrations to provide all of the specialist value added services that can now make use of the telecommunications common carrier. Private firms providing such services, based largely on work at the subscribers' end, come to be regarded by telecommunications administrations as welcome, creating as they do the increased use of a costly technical infrastructure provided by the common carrier. Freedom of Telecom to compete in any field is not at all inconsistent with competition for value added services. In Britain it appears that competition (whether real or imaginary) has produced a new and stimulating atmosphere of commercial responsiveness in British telecommunications services which has enhanced job satisfaction rather than created uncertainty amongst telecommunications workers. This has been a comment recently made by a number of those attending interviews for overseas postings when explaining the reduced number of applicants for overseas postings.

Competition and staff morale

- 1.54 British telecommunications staff disliked (and were bored by) over-manning and narrow demarcation. With some competition and confidence in the future of communications they are showing increased flexibility which enhances their job satisfaction. It can reasonably be expected that in Australia liberalisation for both Telecom and private sector providers of specialist value added services to the subscriber would improve morale. It is credible that, as stated in the ATEA submission, the prohibition of videotex as a Telecom provided service has sapped morale. It does not follow that competition should be prohibited; both are compatible and potentially beneficial and the spectres on both sides appear more imaginary than real.

Installation of digital exchanges

- 1.55 Digital exchange installation work highlights the need for change. The total installed cost of a digital exchange is now lower than for a crossbar exchange. Cable & Wireless finds that the installation costs of a new crossbar local exchange are 50--60 percent of the cost of materials. For a similar sized digital local exchange, installation costs are typically only 15--18 percent of the cost of materials. These latter installations are carried out by the manufacturer's staff. Crossbar exchanges involved a year or more of installation work requiring a rather large team to erect ironwork, install racks, run cables etc. Tests could only be carried out on site when this work was done. In contrast, an AXE digital exchange which makes extensive use of factory made plug in wiring, has simple racks and adjustable shelving suitable for future developments. For Cable & Wireless and other customers it is normal for the manufacturer to set up the digital exchange at the factory and fully test it under artificial traffic conditions to reduce the chance of remedial work in the field, which is inherently more expensive than work at the factory. It is then lowered into crates lying alongside and shipped to site where it is installed by manufacturer's staff in a few weeks. Thereafter there are several months of proving its software under local conditions before commissioning is completed. There were indications that Telecom would not adopt this efficient philosophy. If so, this appears regrettable.
- 1.56 If the constraint is Telecom's large capital works staff and/or agreements with unions, it highlights once again the need to create the conditions in which any such staff could be given training in the staff intensive area of value added services to the subscriber where, if the suggestions of this report are implemented, there would be the stimulating competition of private firms using Telecom as the common carrier.
- 1.57 Numerous digital exchanges can be controlled and monitored from a single operation centre and this should also involve redeploying staff to new fields of work. The growth of the electronic office, communicating word processors, point of sale terminals, electronic banking, credit card verification, etc, etc should lead to a demand for the services of all trained technicians.

PRODUCTIVITY COMPARABILITY

Line plant

- 1.58 At the request of the Committee some sample comparisons were made to determine the approximate relationship between Telecom's costs and those of other administrations:

. MACRO VIEW

Telecom's cost of local line plant (i.e. excluding trunks and junctions) per net added subscriber in 1980--81 averaged \$1 077. This compares with Cable & Wireless' average cost in 15 territories per working subscriber for old technology (i.e. conventional) line plant of between pounds sterling 600 (\$1 020) and pounds sterling 900 (\$1 530) per line. (Cable & Wireless operates overseas and is often faced with abnormal costs for freight and expatriate staff which are not usually fully offset by lower local labour costs.)

. SAMPLE VIEW

British cable contractors' quotation for supplying and installing 10 kilometres of 1 000 pair/0.6 mm subscriber twin type cable in an empty duct in Britain, including the cost of installation materials (average of two competitive quotes):

Cable cost	pounds sterling ⁽¹⁾	136 000	=	\$231 200
Installation	pounds sterling	78 000	=	<u>\$132 600</u>
Total				<u>\$363 800</u>

Telecom Australia's estimate for purchase and installation of 10 kilometres of 1000 pair/0.64 mm junction type (non loaded) twin cable in an empty duct:

Cable cost	\$335 000
Installation	<u>\$103 000</u>
(Labour based on 6 480 manhours)	
Materials	
Total	<u>\$438 000</u>

(1) One pound sterling taken as \$1.70.

Sources: Telecom Australia data and Annual Report 1980--81.
Cable & Wireless PLC.

1.59 Telecom's installation costs are lower than those quoted by the British contractors. This is probably because Telecom anticipated fewer joints than British firms would normally encounter. Telecom uses uPVC ducts which have a lower coefficient of friction than British Telecom's mainly earthenware ducts. Australian streets are also usually straighter. Telecom also uses larger cable drums enabling longer continuous to be installed without joints.

- 1.60 Telecom's cable cost is higher but this is probably because Telecom has quoted a larger conductor (0.64 mm rather than 0.60 mm) and a lower mutual capacitance (0.072 uF per mile appropriate to junction cables) while the British firms have quoted for a subscriber type cable, normally having a mutual capacitance of 0.085 uF per mile. An approximate correction for these differences would make the cable cost figures comparable. This would be in accordance with the usual experience as cable costs vary very little throughout the world, being mainly dependent on the world prices for copper, polyethylene etc.

(Note: The exceptions are sometimes cable prices from oriental suppliers. These prices are occasionally considerably lower and are widely thought to be based on concealed subsidies such as tax relief on exports etc.)

- 1.61 Telecom Australia's practices (e.g. uPVC ducts and longer lengths of unbroken cabling, use of twin rather than quad formation) are conducive to higher staff productivity than the comparable British practices.

Exchanges

- 1.62 Table showing the 1980--81 Break-up of Additions to Assets shows that labour costs for installation of exchange equipment is approximately 66 percent of the cost of the equipment. (This figure excludes from labour costs the administrative and overhead costs.)
- 1.63 This is comparable with Cable & Wireless experience that for a 10 000 line new crossbar exchange the directly ascribable labour costs equal to 50 to 60 percent of the cost of materials.
- 1.64 In both these cases the labour costs are high because of the labour intensiveness of the installation work for an electromechanical exchange.
- 1.65 The scope for labour productivity improvement lies in a change to digital exchanges, the installation costs of which are typically 15 to 18 percent of the cost of materials, in the experience of Cable & Wireless PLC.

Packet switching

- 1.66 The Committee requested a view on whether the date for provision by Telecom of packet switching, planned for December 1982, was reasonable in comparison with the dates of introduction of similar services in other countries.
- 1.67 To set an assessment in context the following are some national packet switching services (i.e. excluding international services such as IDAS, ICAS and MIDAS) with RFS dates as accurately as can be determined:

USA	ARPANET	1968 (Quasi public)
	TYMNET	1971 (1976 as a public service)
	TELENET	1972
	AUTONET	Public in 1982
	UNINET	Public in 1982
	GRAPHNET	
	(Freedom Network)	1981
	ATT (BPSS)	1982
	ATT (ACS)	1983 (planned)
UK	EPSS	1977 (experimental)
	PSS	1981
CANADA	DATAPAC	Mid 1977
	INFOSWITCH	1979
SPAIN	RETD	1971
JAPAN	DDX	Mid 1980
FRANCE	CYCLADES	1973 (experimental)
	RCP	1974
	TRANSPAC	Early 1979
GERMANY	DATEX-P	1980
BELGIUM	DCS	April 1982
HOLLAND	DNI	(?) (experimental)
SWEDEN	SWENET	1980
	TELEPAK	In service
NORWAY	NORPAK	1980
EUROPE		
REGIONAL	EIN	1976 (quasi public)
	EURONET	March 1980
ITALY	PLANNED	End 1982
BRAZIL	PLANNED	End 1982
ARGENTINA	PLANNED	(?) end 1982

SOUTH AFRICA is believed to have an experimental network.

- 1.68 Introduction of packet switched services has however to be looked at against the background of progress with CCITT in defining the X.25 and X.75 standards. These recommendations were produced in draft and incomplete form in 1976 and only approved in final form at the Plenary Assembly in November 1980.

- 1.69 Thus those countries that planned early implementation did so in the knowledge that their resultant system would almost certainly not conform to the ultimate CCITT standards, and would require subsequent and expensive modifications. TRANSPAC (France) and EPSS (UK) which went into service in early 1979 and in 1977 respectively are cases in point.
- 1.70 It appears that against a final ratification of the CCITT recommendations in end 1980, and the assumed level of data customers in Australia, an implementation date of December 1982 is reasonable though an earlier date could have been met, if demand warranted it, provided the attendant risks of costly changes were acceptable.

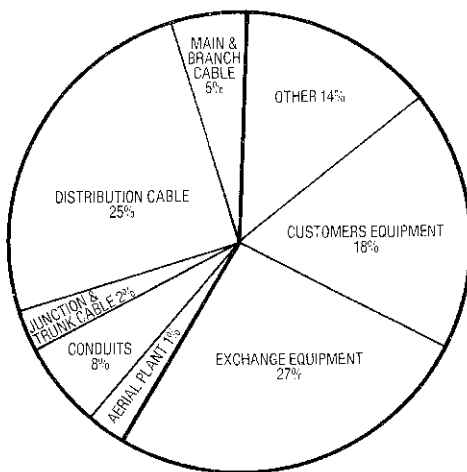
CONCLUSION

- 1.71 Telecom has provided a good telecommunications infrastructure at costs which in the main appears to compare satisfactorily with areas having comparable conditions. There is a need to accelerate the introduction and exploitation of an integrated digital system and the phasing out of space divided switching, and frequency divided trunks and junctions. There is a need to encourage more flexibility in staffing and acceptance of the need for specialist private sector participation in the very wide range of value added services which should be encouraged to use Telecom's infrastructure as the bearer. For this the Telecom infrastructure will need to establish a reputation for reliability and freedom from interruptions, whether deliberate or accidental.

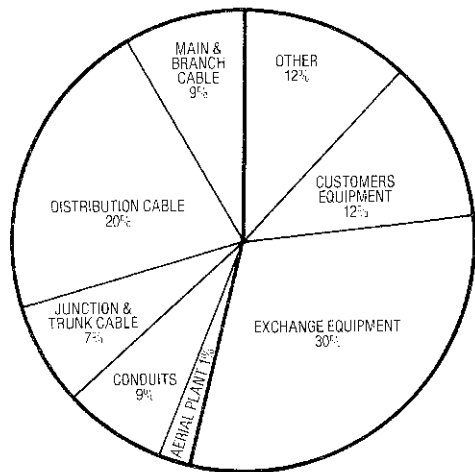
ACKNOWLEDGEMENTS

- 1.72 Thanks are owed to the Inquiry Committee members for their friendly understanding of the problems of making a suitable contribution in a total of four weeks.
- 1.73 For their suggestions and support thanks are also due to the Inquiry Secretariat, whose incisive thinking earned the admiration of the writer. Telecom Australia's rapid responses and helpful discussion on any aspect of their work were also much appreciated.

Figure 1.1: The lines share of Telecom Australia.



Communications Plant Investment 80/81
The external plant investment was \$417M or 41% of the \$1012M communications plant investment.



Communications Plant Assets June '81
The external plant assets were \$4767M or 46% of the \$10,302M communications plant assets.

Source: Telecom

INTERNATIONAL FEATURES

P.L. SKEY

Digital techniques— How do they affect telephone network development?

MUCH HAS been written about the advantages of integrated digital switching and transmission (IST) as a means of improving transmission, reducing building costs, saving staff (or improving productivity), reducing costs of trunk and junction provision, and so on, but little has been published about its potential for savings in that most expensive part of the telephone system, the local line plant between telephone exchanges and subscribers. In this article an attempt is made to quantify this saving. A

new philosophy is proposed for the adoption of low-cost ring main cables instead of the large and expensive multi-pair primary cables of the old space division techniques. A review is given of the reasons for the decision to adopt in Bahrain the digital exchanges now on order, and to pursue a similar policy for other territories where the telephone systems are owned, managed or advised by Cable and Wireless Ltd.

Telephone plant costs

A typical present-day cost of telephone plant per subscriber is \$2000. Of this sum, an average of about half is the cost of the local line plant from exchange to subscriber. In developing areas where subscribers

are sparsely spread the local line plant cost per subscriber can be far higher than \$1000, because the cost per pair increases more than linearly with distance due to increased copper size, smaller numbers of pairs and the need for transmission and signalling-improving devices such as loading, subscribers' amplifiers and loop extenders. In Bahrain the cost is usually high because of rock and a high water table. This dedicated pair from exchange to subscriber is on average used for only a few minutes a day and its high cost is the main reason why a local telephone system seldom produces an acceptable return on capital unless there are compensating large trunk and

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P.L. SKEY is with the Telephone Department of Cable & Wireless Ltd., London, England. This article has been adapted from a presentation made in April 1979 at the Middle East Electronic Communications Conference in Bahrain.

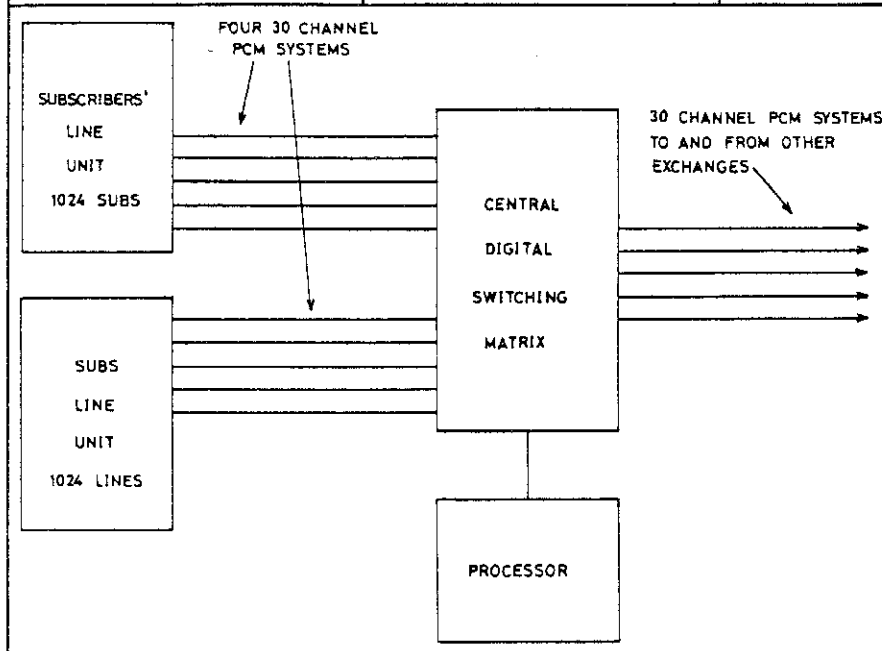


FIG. 1 A typical A-law 30 channel CCITT-approved stored program control system.

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junction or toll revenues. Whereas on telephone trunk links, wired broadcasting and electricity supply systems, a pair of wires is shared by many subscribers or consumers, the local telephone system alone has hitherto required a relatively long dedicated circuit per subscriber. Various palliatives such as subscribers' carrier, party lines and concentrators have been tried as a means of relief but they are either expensive or vulnerable or they degrade the service. This situation has been changed by the advent of digital switching, which enables an integral part of the telephone exchange to be "out-stationed" close to groups of subscribers.

Digital exchange

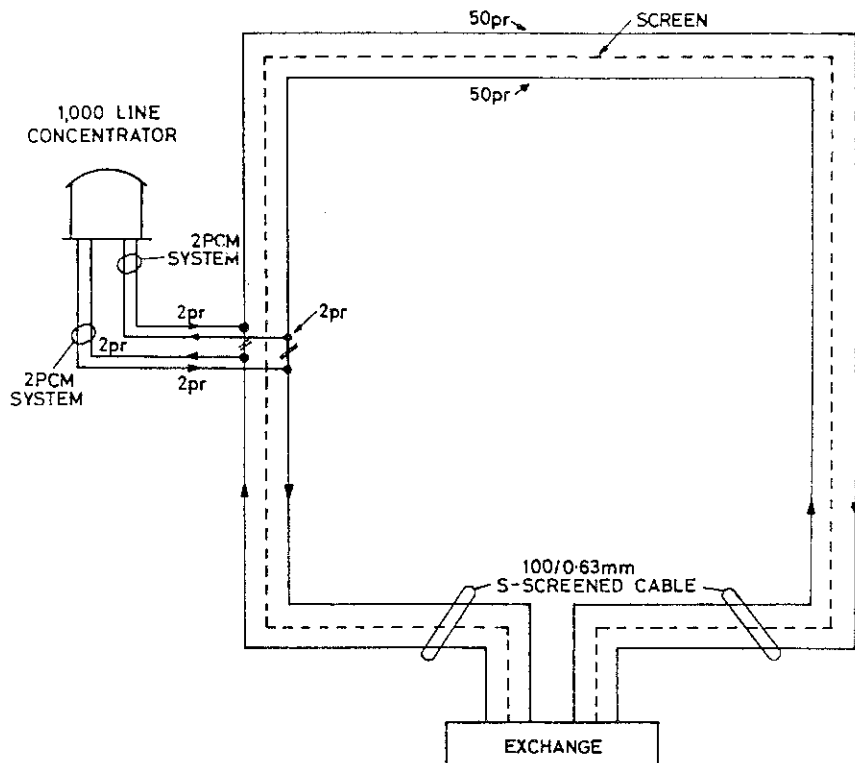
A simplified diagram of a modern digital telephone exchange is shown in Figure 1. The processor-controlled "group selector stage"

or central switching matrix looks out at the world through 30-channel 2.048 megabit PCM (pulse code modulation) highways which may either be connected to subscribers' line units or to other exchanges as junctions. If the other exchange is also digital each 30-channel junction highway can be connected to that of the other by means of only two cable pairs, a go and a return pair. Regenerators will normally be necessary at about 1830 meter intervals but the cost of these is low. There will be a 15:1 pair gain with no multiplexing additional to that inherent in the exchanges. The cost of junctions between digital exchanges is therefore very low. This involves a change of thinking because the assumption that junctions are expensive has been an important reason why the usual configuration of telephone networks includes group switching centers or toll offices to

concentrate traffic for the efficient use of junctions and trunks. In many cases this will now be less important. The case shown in Figure 1 is for a typical A-law 30-channel CCITT-approved stored program control system which has the advantage of permitting either common channel signalling or channel-associated signalling. The digital exchanges are of course 4-wire switching systems and can function simultaneously, both as transit and local exchanges. The old limitation in the number of 4-wire exchanges that may be connected in tandem will not apply because an integrated digital switching and transmission system (IST) will not present the same problems of stability of 4-wire amplified circuits between space-divided switching centers that were the basis of the previous limitations. The integrated digital network therefore read

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FIG. 2 S-Screened cable connected in ring main technique with a capacity of 20,000 lines.



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It provides for increased flexibility and alternative routing of trunks and junctions.

Thirty-channel highways also are used to connect remotely-located subscribers' line units to the central switching matrix. The subscribers' line units may be installed in the exchange or at a remote point many kilometers away. They are nevertheless an integral

part of the exchange. A typical subscribers' line unit serves 1024 subscribers through four 30-channel PCM systems requiring eight cable pairs. Smaller multiples of 256 lines can be employed. For example, 512 line units normally calling for two 30-channel systems are common. For security of service it is not usual to employ less than two PCM systems, so subscribers' units of

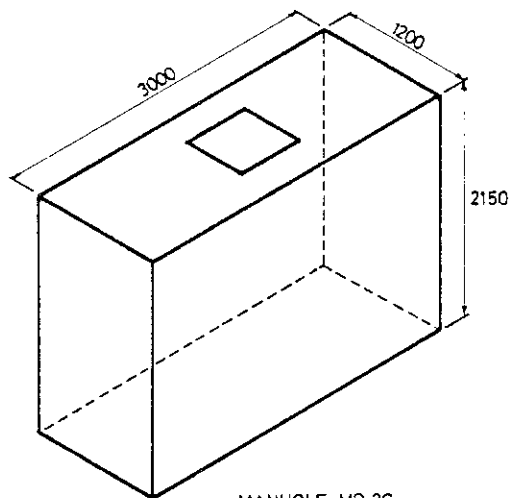
256 lines or less are somewhat costly in the use of the exchange's 30-channel highways. A subscribers' line unit calling for an exceptionally high average calling rate can be engineered with more than four PCM systems for 1024 subscribers, but four PCM systems on eight cable pairs plus, perhaps an alarm pair and a test pair to serve 1024 subscribers, are typical.

Since ten cable pairs are now serving 1024 subscribers the primary line plant requirements are reduced to about one per cent of those for a conventional space-divided exchange. By locating a subscribers' line unit in a position corresponding to a primary cross-connection point (sometimes known as cross-connection cabinet or service area interface) the primary cable pair needs are greatly reduced. The secondary pairs from line units to subscribers are virtually the same as for cabinets. This secondary part of the line plant cost, normally averaging 20% of the route, is therefore unaffected.

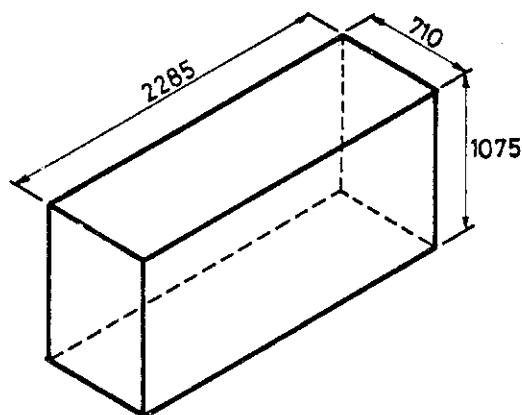
Security advantages

In addition to the security provided by the two or more PCM systems connecting the central switching matrix to a remotely-located subscribers' line unit, further security can be obtained by adopting a ring main system of distribution, as shown in Figure 2. This system of untapered ring main cables in place of conventional primary cables is now being planned for new work to be implemented in 1979 in Bahrain. A ring main will comprise a transverse-screened cable of 100 pairs of 0.063mm copper conductors. Both ends of the cable will be terminated at the exchange. A typical subscribers' line unit of 1024 lines will be connected to the ring main by cutting only four pairs, two on each side of the transverse screen, as shown in Figure 2. Eight pairs will connect the four cut pairs to the line unit. Two of the PCM systems will be connected to the exchange in one direction round the ring main and two in the other direction. If one direction is cut the PCM systems in the other direction need not be affected and

Continued on page 122



MANHOLE MR 2C



JOINT BOX JRF10

SCALE — 1:40.
DIMENSIONS — MM.

FIG. 3 A
comparison of the size of a typical manhole required for the old techniques with that of a surface-opening joint box having much greater capacity, using the remote-located subscribers' line units connected to a 100-pair ring main.

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the subscribers will suffer no more than a somewhat degraded service with 1024 subscribers served by 60 circuits to the "group selector stage" instead of 120 circuits, for example, about 0.04 erlang per subscriber. In contrast, the cutting of a conventional multi-pair cable in the old technology would result in total loss of service and slow restoration. The security of the ring main can be further improved by pressurizing the ring main cable from both ends. Experience shows that most of the incipient faults are then prevented or detected by the escape of air and before water enters the cable and affects service. In a ring main the air is blown to a leak from both directions. In practice it has been found that primary cables with joint closures made by polyethylene injection moulding techniques enable static pressurization techniques to be achieved for most of the time in Bahrain. In contrast with this, in a jelly-filled cable or unpressurized cable most faults are found only when they become electrical faults and service-affecting. The first characteristic of the ring main system is therefore improved security. A transverse screened cable is used in the ring main. It has an aluminum foil formed in an 'S' shape to separate 50 pairs from the other 50. A cable of this type may be loaded 100% with PCM systems, whereas a cable having no screen between the go and return pairs will normally not be suitable for more than a 25-40% penetration of PCM systems. Since in the digital era it is difficult to see what use will eventually be made of those physical pairs which cannot be loaded with PCM systems it seems wise to ensure that transverse screen cables are employed for all new junction cables or primary ring main cables using metal conductors. Straight jointed twin cables are said to be 6dB better per octave in near end crosstalk than test selected quad trunk cables, therefore twin cable formations are better suited to PCM and the digital era.

Economy

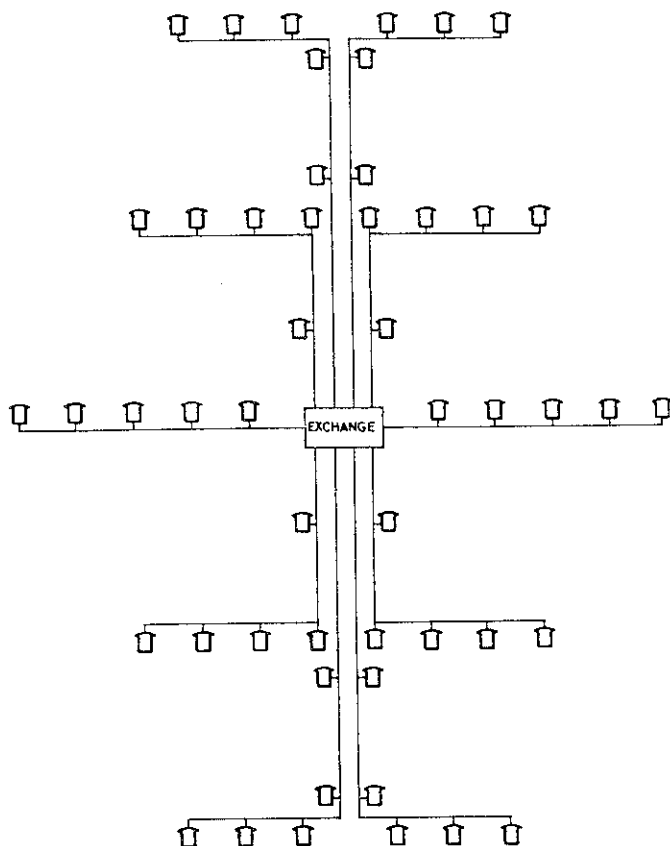
The second characteristic of the ring main system is economy. A

1024-line subscribers' remote line unit requires only 8 pairs, 4 in each direction in a ring main, therefore 25 of those line units can be attached on a ring main. It is a Cable and Wireless practice to guard the pneumatic integrity of both the ring main cable and the regenerators, and since pairs also have to be reserved for testing and order wires, the rating of a 100-pair ring main cable can be taken as 20 remote line units, say 20,000 subscribers. The ring main cable costs about \$4 per meter ex works, whereas each 2000-pair/0.4mm conventional cable costs about \$40 per meter ex works, and is much more costly to install. The small 100-pair cable can be installed in long unbroken lengths whereas the equiv-

alent capacity in conventional primary cable requires ten of the 2000-pair cables, each of which has to be jointed at intervals of several hundred meters or less. For these old primary cable techniques a large number of empty ducts has to be earmarked for gradual growth of the system. For example, if one 2000-pair cable is required now, fully occupying one duct, and the annual growth rate is 15%, then requirements double every five years. Two ducts will therefore be required at the fifth year, four ducts at the tenth year, eight ducts at the fifteen year and sixteen ducts at the twentieth year, that is, still within the planning period. Sixteen ducts costing about \$10 per

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FIG. 4 A simplified case of distribution from an exchange of ten 2000-pair cables tapering by 400 pairs at each primary cross-connection point.



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meter each installed (including jointing chambers) have to be provided now and yet only one would be occupied for the first five years. Large and costly manholes also would be required. This high "burden of spare plant" is a characteristic of the old distribution cable system requiring a pair per subscriber. This may be contrasted with the small ring main cable capable of serving 20,000 subscribers. Even when the ring system is lightly loaded in the early years the burden of spare or unused plant is very light.

Three of the ring main cables can be accommodated in a duct of nominal $3\frac{1}{2}$ in. (89mm) bore. A duct track of four bores provides a ca-

capacity of over 120,000 working subscribers. The jointing chambers for a duct track of only four ducts can be surface-opening type joint boxes rather than shafted manholes, with consequent great savings in excavation and construction costs, especially where, as in Bahrain, the water table is high and the cost of removing water pumped from excavations is high. Figure 3 contrasts the size of a typical manhole required for the old techniques with that of a surface-opening joint box having much greater capacity, using the remote-located subscribers' line units connected to a 100-pair ring main.

The third characteristic of this ring main philosophy is flexibility.

FIG. 5 A simplified ring main case of five ring mains with a capability of 100,000 subscribers.

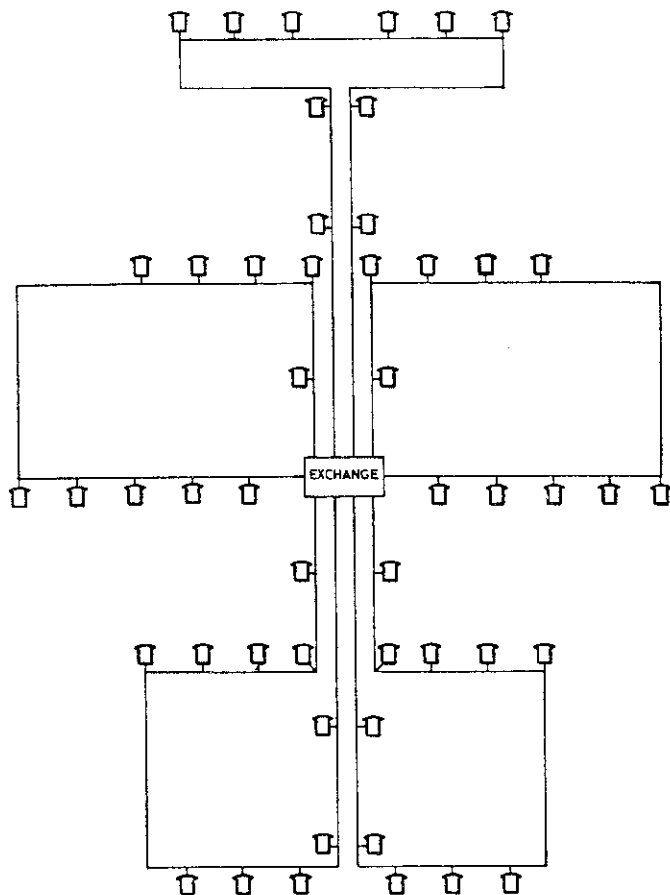


Figure 4 is a simplified case of distribution from an exchange of ten 2000-pair cables tapering by 400 pairs at each primary cross-connection point. For planning this type of cable scheme, demand forecasts had to be studied to enable the line planners to decide at what point to locate the cabinets and taper the cable by, for example, 400 pairs. If, as usually happens, the forecast is wrong and, for instance, less than 400 pairs are required at each of the first two cabinets and more than 400 at the further cabinets, there is no easy way to vary the pairs available at each. Figure 5 shows a simplified ring main case of five ring mains with a capability of 100,000 subscribers. The cabinets in this case would be remote line units. Bearing in mind that each ring is uniformly loaded with PCM systems at all points there is total flexibility in the position of each subscribers' line unit. This untapered system is therefore highly flexible and not so sensitive to errors of forecasting.

Improved transmission

The final characteristic of this ring main system of distribution is that it provides for greatly improved transmission and hence, if tariffs are correctly related to usage, an increase in the revenue-earning traffic which normally results from an improved service. The extension of the international 4-wire circuit to the end exchange and beyond makes it possible to meet the CCITT's recent recommendation on preferred Traffic Weighted Mean Reference Equivalent. It is virtually impracticable to comply with these recommendations if the territory has two 2-wire switches in tandem in an international call. Figure 6 shows the typical apportionment of Reference Equivalent (or loss compared with the NOSFER standard in Geneva) as shown in the CCITT Orange Books and as adopted by most administrations when planning on limits only. Note that the four-wire part of the circuit can be lined up to add no loss to the overall loss of the international circuit. In contrast, 17.5 dB of Sending Reference Equivalent is

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apportioned to the two-wire part and the subscribers' instruments. Figure 7 shows the way in which the overall loss of 19 dB between end exchanges (case 'a') can be reduced by 12 dB merely by having integrated 4-wire digital switching and junction transmission between Group Center (or Toll Office) and the end exchange as in case 'b.' A further improvement of about 2 dB takes place when the end ex-

changes are digital and hence part of the 4-wire circuit as in case 'c.' A further large improvement takes place when the 4-wire circuit is extended to subscribers' remote line units as shown in case 'd.' In this case most of the local line loss is eliminated, with typical additional improvements of about 16 dB. Finally when the digital 4-wire circuit is extended to subscribers as in the case 'e' the overall loss can be virtu-

ally as low as desired, and all subscribers will enjoy a similar high standard of transmission. A system for 64 kilobit 4-wire circuits to subscribers has already been developed and will fit into the philosophy of the digital exchanges now on order by phased changes which will be evolutionary.

To assess the extent of the economy resulting from the adoption of

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A. TRAFFIC WEIGHTED MEAN VALUES OF THE DISTRIBUTIONS OF SENDING AND RECEIVING REFERENCE EQUIVALENTS.

LONG TERM OBJECTIVES

SENDING REFERENCE EQUIVALENT 10-13dB

RECEIVING REFERENCE EQUIVALENT 25-4.5dB

(THESE ARE THE MEAN VALUES OF THE TRAFFIC-WEIGHTED DISTRIBUTIONS)

SHORT TERM OBJECTIVES

SENDING REFERENCE EQUIVALENT 10-16dB

RECEIVING REFERENCE EQUIVALENT 25-6.5dB

B. MAXIMUM SENDING AND RECEIVING REFERENCE EQUIVALENTS.

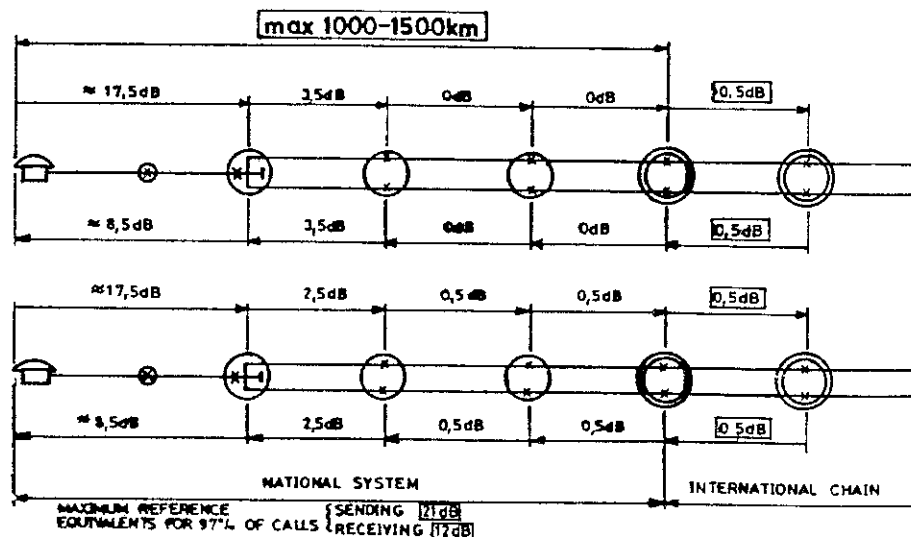


FIG. 6 Examples of the allocation of reference equivalents for an international connection in a country of average size.

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the ring main system and remote-located subscribers' line units a comprehensive study was made of the case of the town of Sharjah in the United Arab Emirates. Sharjah was recently completely cabled and ducted to high standards in accordance with the most modern space-divided techniques. Primary cables totalling some 43,000 pairs were led out of the exchange and the burden of spare plant was high because much of the town was developing with little certainty of the demand in vacant blocks of land. Complete records of the installed plant and its costs were available. A hypothetical plan using the ring

main system was then drawn up and accurately priced as if no line plant already existed. The saving, even after allowing for small buildings for each remote line unit was \$612 per working subscriber. Expressed another way, the ring mains provided for five times as much subscriber capacity for 38% of the cost of the conventional space-divided primary cable system.

A study also was made for the Mahooz area of Bahrain which, under the old technology would have had an exchange starting with about 10,000 lines. The area is already partly cabled by conven-

tional techniques. Comparisons were made between the cost of the old approach and the alternative approach of serving the area by means of the ring main system and remote line units (RLUs) parented on the Central exchange. The optimum solution was generally in accordance with a similar finding carried out by the Swedes for another territory in the area. In this case, as in Bahrain, the digital RLU militated in favor of fewer and larger exchange areas, each comprising many RLU areas looking very much like old cabinet areas.

The subscribers' remote line units envisaged in the foregoing plans at present require small buildings or a room in a high-rise building rather like transformer sub-stations. An evolutionary change expected in the next few years is that the remote line units will be available in external cabinet form like the Canadian DMS-1 digital concentrator already in use in hot-climate countries such as Barbados.

The continued rapid evolution towards digital exchanges of greater processing power, towards line units which are semi-autonomous and towards 4-wire service to the subscribers' premises are not good grounds for deferring the transition to digital switching because space-divided or analog switching installed at this stage entail buildings, cable vaults, duct tracks and cable systems much more costly than are now necessary with digital switching. Figure 8 shows a comparison of apparatus room space requirements. It appears unlikely that any administration will want to expand space-divided exchanges and cable systems in the next few years, especially if their existing exchanges are not Stored Program Controlled (SPC) exchanges.

For this and other reasons such as a single mode of transmission for speech and new data services it was decided in Bahrain to adopt integrated digital switching and transmission immediately, to begin to obtain the resulting economies on all new works and to take advantage of the further evolution of the digital system as and when it occurs. □

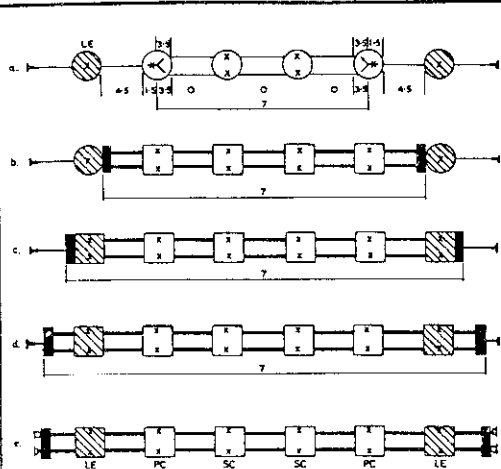


FIG. 7 An example of the way in which the overall loss of 19dB between exchanges (case a) can be reduced by 12dB merely by having integrated 4-wire digital switching and junction transmission between Group Center (toll office) and the end exchange as in case b.

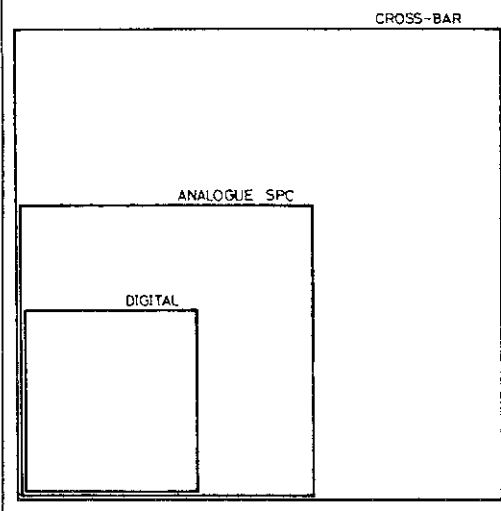
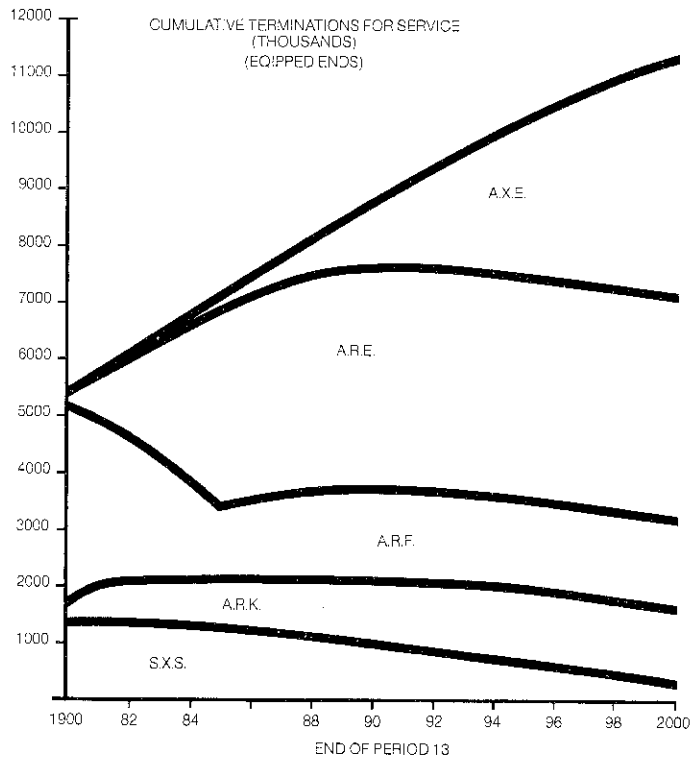


FIG. 8 Areas required for Bahrain exchange (6000 ports).

Figure 1.2



Telecom Australia's estimates of digital (AXE) and electro-mechanical (ARE, ARF, ARK, SXS) switching in Australia to the year 2000.

Extract of a paper dated January 1982 recommending adoption of AXE for the digital switching system in a new overseas operation.

"The purpose of this paper is to acquaint Directors with the case put forward and to seek their consent to open discussions as soon as possible with L.M.E.

The criteria for the telephone switch are as follows:

1. A CCITT-compatible system.
2. A well tried system with many lines in use in live operating conditions and with at least some of the exchanges well loaded in actual and not simulated traffic conditions.
3. A system manufactured by a company with a well-proven record of providing both local and international switching and signalling facilities.
4. Having a high average traffic capability of not less than 0.1 Erlang per local line suitable for areas with a high proportion of business users.
5. A digital switching system with the highest ultimate capacity in number of subscribers and trunk terminations.
6. A system whose manufacturer has a known programme and record of ongoing development to include features which users can reasonably expect to insist on shortly if not immediately, e.g.
 - a) new technology cordless manual boards with visual display units and with at least a planned phased timescale for features such as automatic methods of dealing with charging, ticketing, demand traffic, delayed advice, conference calls, alarm calls, directory enquiry information called up on screen etc.
 - b) digital switching at the subscriber stage (i.e. a codec per subscriber) whether co-located with the processor or remote from it.
 - c) remote subscriber switch units which are stand-alone when cut off from main exchange processor, and available down to say 120 line size suitable for roadside cabinet mounting.
 - d) subscribers 30 channel multiplexers to give fifteen to one pair gain from line unit to the equivalent of a 30 pair D.P.

- e) subscribers 10 channel multiplexers and facilities for combining into 30 channels.
 - f) ability to integrate new signalling standards (e.g. CCITT No. 7) into developments leading to the Integrated Services Digital Network.
7. Where all other things are equal preference be given to the manufacturer who has supplied most of the existing electro-mechanical exchange equipment in the territory, as it has been recommended that the cost and problems of interworking are reduced where the digital manufacturer has a detailed knowledge of the electromechanical equipment.
8. The manufacturer's digital exchange philosophy should preferably be part of a planned comprehensive digital system designed to evolve into an integrated network taking account of data and other services. For example the data and/or telex exchanges should preferably employ a similar technology with as much interchangeable equipment as practicable. By this means the training and interchangeability of staff are greatly eased. The transmission equipment racks should be similar to the exchange equipment racks and should all be designed to facilitate the rapid changes taking place in exchange facilities.

Cable and Wireless has for the past few years been maintaining a close watch on capability of manufacturers world-wide to supply digital telephone exchanges. This close scrutiny was occasioned by the Company's own need for these exchanges for directly-owned telephone undertakings overseas as well as for C&W managed systems, partnerships and consultancies. In all these it was necessary to satisfy governments, public utility commissions, clients, or ITU experts not only that the prices were the most cost effective but that there was sufficient accumulated experience of operation of any particular make of digital exchange for its adoption to be safe. Because of the nature of stored programme control exchanges this experience had to include well loaded exchanges operating under normal service conditions. The main sources have been N. America, Europe and Japan but the real options have hitherto been very few though price competition between these few has been keen.

CCITT-Compatibility

There are two main technical standards for digital exchanges and associated transmission systems. One is based on mu-law encoding, 24 channel transmission and channel-associated signalling and is the American domestic standard. It is used in North America and in a number of its spheres of influence.

The other is based on A-law encoding, 30 speech channels plus 2 dedicated signalling channels transmission and is the CCITT compatible system. The relevant extracts from CCITT Recommendation G.711 say 'digital paths between countries which have adopted different encoding laws should carry signals encoded in accordance with the A-law . . . Any necessary conversion will be done by the countries using the mu-law'. Some North American manufacturers (e.g. Northern Telecoms) say that to meet export requirements they '. . . hope to make the CCITT-compatible (A-law) system shortly'. We recommend and have hitherto employed the A-law system and have thereby incidentally enjoyed the benefits which this later standard confers, e.g. the 6 additional voice channels on each 4 wires and the dedicated signalling channels which facilitate the use of modern services which stored programme controlled exchanges can provide. For example some of these facilities require signalling between exchanges when conversations are not in progress, thus dedicated channels for signalling are more suitable than channel-associated signalling. Development of TDMA satellite systems are based on A-law encoding. Nearly all the A-law digital exchange systems that are in service are of the Swedish LME's AXE system or the French CIT-Alcatel's E10 system.

Well-tried systems

We favour digital systems which are well tried, with many lines in use. A number of manufacturers of A-law systems can cite firm orders placed but few can cite any significant number of public exchanges in service. Only two manufacturers of A-law digital exchanges have supplied nearly all the total lines in service.

The following are their figures at November, 1981:

C.I.T. 8 million digital lines on order or in service. Of these, 2 362 000 lines are in service in 208 exchanges in 25 countries, many of which are tropical.

L.M.E. 3 997 064 lines of AXE digital switching on order or in use. Of these 1 150 068 are in service in 133 exchanges in 30 countries, many of them tropical."

The paper went on to show, point by point, that only AXE could meet all these parameters at present and the conclusion appears same as Telecom Australia's view.

Extract on 'Tariffs and Customer Costs' from a report by Logica entitled 'International Comparison between Telecom Australia/leading Telecom Administrations' dated 11 June 1982

"4 TARIFFS AND CUSTOMER COSTS

4.1 Telecom Submission

In section C.2.1.4 of Telecom's submission a comparison is made of Telecoms Tariffs with other countries. The comparison indicates that Telecoms charges are comparable to other countries and lower than most. We are concerned with this comparison as indeed we are with most tariff basket comparisons. Telecom's index is based on an Australian traffic pattern and then uses hours of work as a measure of cost. The concern we have is firstly that traffic patterns are often influenced by tariff structure hence the Australian pattern is not relevant to the UK or France. Secondly, though hours of work overcomes the difficulty of exchange rates in a common currency comparison, it is influenced by distribution of income in any country. We have therefore produced an alternative index based on the French traffic pattern and used US dollar as the measure. This is discussed in section 4.2.

In section C.2.2.2 of Telecoms submission a comparison of Telecom's tariffs is made with the Consumer Price Index. We believe this is a reasonable comparison and shows Telecoms have kept their prices below the CPI. To evaluate whether this is a good achievement we have shown similar comparisons for other countries in section 4.3.

4.2 Tariff Index

For several years Logica and AFUTT (French Telecommunications User Group) have produced a tariff index based on the French traffic pattern. Figure 1 gives a description of this index. For the purpose of this report we have not included international traffic in our index. Tables 18 and 19 show the resulting indices for business and residential customers.

The results show that Australia is the most expensive country in both cases. No Conclusions should be reached from this result. We believe that European tariffs reflect the types of traffic in Europe. The only important conclusion is that the tariff comparison made by Telecom is unlikely to be valid.

4.3 Tariffs and the CPI

Figures 2, 3 and 4 show the basic telephone charge compared to the CPI for various European countries and Australia. Even this comparison has its difficulties nevertheless it does help put Telecoms achievement into perspective.

The graphs show that Telecom's performance is similar to West Germany's, that France has been very successful at reducing its tariffs in real terms, but that Italy and the UK have been less successful than Telecom.

4.4 Conclusion

These comparisons lead us to two conclusions:

- a) Telecoms claim that their tariffs are low is not substantiated, however it is not contradicted either. We do not believe a sufficiently good comparison has been made.
- b) Telecom's claim that they have kept their tariffs under control over time and been successful in providing real reductions is substantiated and of the European countries we have examined only France appears to have done better."

Table 18: (FRENCH) TARIFF INDEX -- DOMESTIC CALLS ONLY (IN US\$, 3/6/82) Tariffs April 82

	RESIDENTIAL CUSTOMERS (MONTHLY COST)
AUSTRALIA	30.8
GERMANY	26.4
UK	25.1
SWITZERLAND	24.0
FRANCE	22.5
ITALY	20.3
BELGIUM	19.7
JAPAN	19.1
USA	16.0
NETHERLANDS	15.6
SWEDEN	14.6
SPAIN	12.4

Sources: Logica's Tarifica,
Telecom's Submission--Annexe

Table 19: (FRENCH) TARIFF INDEX --- DOMESTIC CALLS ONLY
(IN US\$ RATE 3/6/82)

<u>MONTHLY COSTS</u>	<u>BUSINESS CUSTOMERS</u>
AUSTRALIA	282.4
UK	269.5
GERMANY	214.8
ITALY	202.6
FRANCE	192.4
SWITZERLAND	186.3
USA	173.5
JAPAN	167.7
BELGIUM	143.3
SPAIN	130.7
SWEDEN	91.92
NETHERLANDS	86.01

Sources: Logica's Tarifica,
Telecom's Submission--Annexe

Figure 1.3: Cost of meter pulse variation.

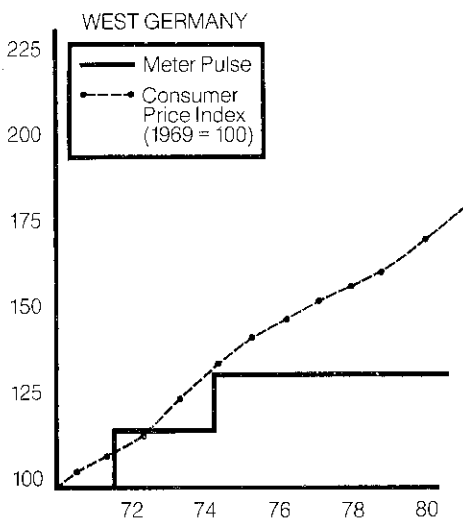
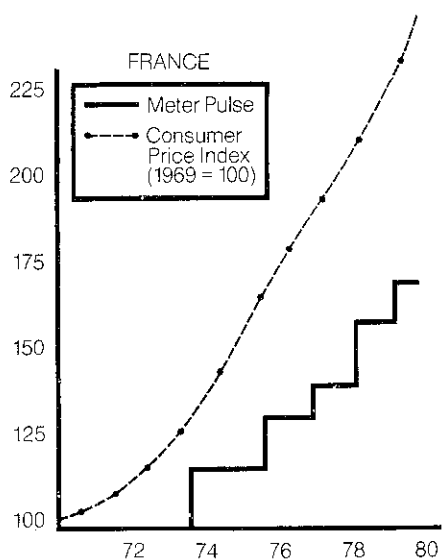
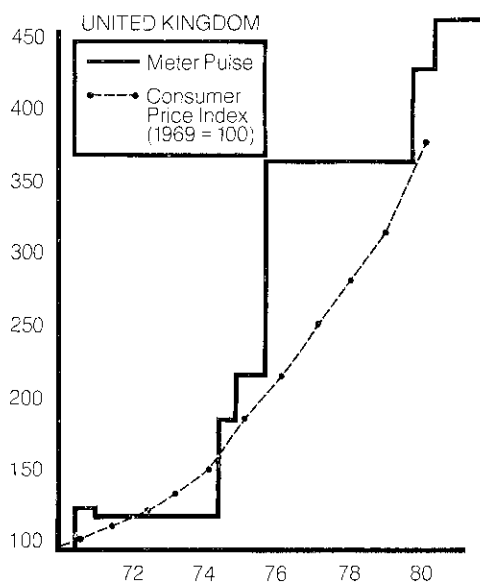
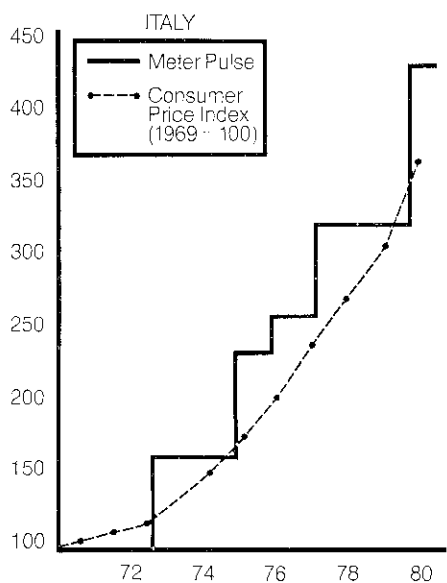
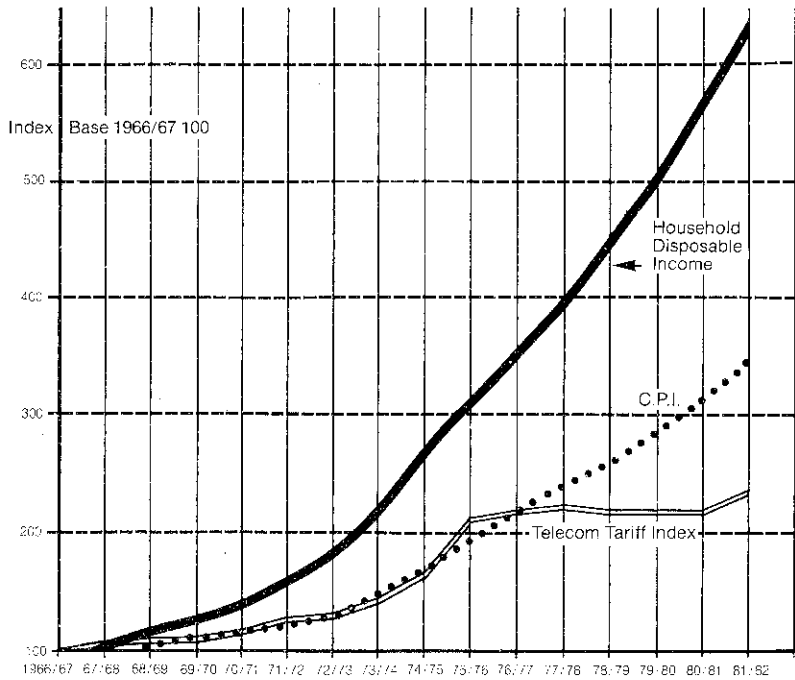


Figure 1.4: Comparison of Telecom Tariff, Price and Disposable Income Indices.



Extract on 'Fault Reports' and 'Fault Clearance' from a report by Logica entitled 'International Comparison between Telecom Australia/leading Telecom Administrations' dated 11 June 1982

"3.2.4 Fault Reports

The measure we have used here is the number of reports per 100 telephone stations per annum. Tables 13 and 14 show the comparative performance.

Telecom's performance is noticeably poor. We have not studied the definitions in depth to ensure that are comparable but the difference is so high that we believe this should be pursued. The UK figure is also high and though both are decreasing we believe they should cause concern.

We note, however, from various Telecom sources that the operational target for fault reports is 6 reports per 100 telephones per 4 weeks or 78 faults per 100 telephones per year. Clearly Telecom are performing better than the target, but we are surprised by the target.

3.2.5 Fault Clearance

For this measure we have used the percentage of faults cleared by the end of the next working day. Where the reported measure is different we have used estimating techniques to make the data comparable. Tables 15 and 16 show comparative performance.

Telecom's performance at fault clearance is very high indeed. Only Germany seems to have as good a record. Comparison with the UK is very flattering though one suspects examining Table 16 that they are more cause for concern to British Telecom than pride for Telecom. The French network exhibits its usual improvement in performance. Telecom sets a target of 90% fault clearance and we believe this is a workable target, though comparing Fault Clearance with Fault Reports we believe that either a great many faults reported are trivial in which case the fault clearance record is not as good as it appears, or greater preventative maintenance is needed rather than remedial maintenance."

Table 13: Fault Reports per 100 telephone stations per year

<u>Country</u>	<u>Year</u>	<u>Number of Reports</u>
Australia	78/79	74.8
Canada	79	42
France	79	24.5
Germany	79	30.1
Sweden	78/79	22
UK	78/79	64

Table 14: Fault Reports: 1976--1980

	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
Australia	92.3	83.2	76.7	74.8	76.7
France	29.6	28.1	26.8	24.5	22.09
UK	68	67	66	64	--

Sources: PTT Statistics
UK Quality of Service
Telecom Service Performance and Costs

Table 15: Percent Faults Cleared by End of Next Working Day

<u>Country</u>	<u>Year</u>	<u>Percent</u>
Australia	78/79	82.2
Canada	79	63.7
France	79	77.8
Germany	79	86.7
Sweden	78/79	63.0
UK	78/79	49.9

Table 16: Fault Clearance: 1976--1980

	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
Australia*	74.7	83.9	82.2	82.2	82.5
France	69.1	67.3	71.5	77.8	80.8
UK	82.2	74.4	68.4	49.9	--

* approximate, metropolitan only

Sources: PTT Statistics
UK Quality of Service
Telecom Service Performance and Costs

Mr J.A. Davidson, A.O.
Chairman
Telecommunications Inquiry
153 Walker Street
NORTH SYDNEY N.S.W. 2060

October 1982

Dear Sir

TELECOM AUSTRALIA'S ACCOUNTING SYSTEM AND RELATED MATTERS

2.1 We have pleasure in submitting this report summarising the findings and conclusions of a review of Telecom Australia's accounting system and related matters which we conducted in accordance with the instructions contained in your letter of 3 March 1982 and subsequent meetings. The terms of reference for our review were to:

- "1. (a) examine and report on the structure of the Australian Telecommunications Commission's accounting system and the accounting principles adopted by the Commission in the presentation of its accounts, and to identify any areas of departure from accounting practices generally followed in large business enterprises within the private sector;
 - (b) assess the implications of the adoption by the Commission of Current Cost Accounting principles, in lieu of Historical Cost Accounting;
 - (c) assess the value of services obtained by the Commission at less than full commercial value;
 - (d) assess the value of taxes, royalties, duties, etc payable if the Commission was not statutorily exempted from these charges;
 - (e) examine and report on the Commission's procedures for control and identification of 'capital expenditure';
 - (f) identify the basis for, and appropriateness of, the Commission's budgeting and product costing procedures; and
 - (g) examine and report on alternative tariff structures for telecommunications services, and their implications in a competitive market.
2. provide the Committee during the course of its inquiry and in the final compilation of its report with information and advice on a range of financial and accounting matters relevant to the Committee's terms of reference."

- 2.2 The review was conducted mainly during the period March to June 1982 and further advice was provided to the Inquiry during the period July to September. Our findings were based on a series of meetings with officers of the Australian Telecommunications Commission and information provided by them, together with a review of relevant submissions to the Inquiry and other reference material and reports.
- 2.3 Our terms of reference required us to focus on a number of specific accounting and related matters of interest to the Inquiry. It was not a comprehensive management or systems study and accordingly our conclusions were presented in a series of briefing papers on separate, although related, matters, supplemented by oral presentations to the Committee. The briefing papers are reproduced in the detail of this report, and in the following pages we summarise the main findings in the areas covered by our terms of reference.

SUMMARY OF MAIN FINDINGS AND CONCLUSIONS

- 2.4 Our main findings and conclusions are summarised below under the following headings in which this report is structured:

- . overview of accounting systems;
- . standards and principles in financial statements;
- . financial management information system;
- . application of current cost accounting principles;
- . taxation and other duties;
- . capital expenditure;
- . product costing and profitability analysis;
- . pricing policy;
- . financial model.

In this report we refer for convenience to the Australian Telecommunications Commission as 'Telecom'.

Overview of accounting system (Paragraphs 2.51 to 2.105)

- 2.5 Telecom's accounting system comprises three main elements:
- . a financial accounting system which maintains normal accounting records for revenue, cash receipts and payments, and general ledger;

- a responsibility accounting system which provides a form of budgetary control, recording actual expenditure against budgets analysed into responsibility areas;
- a cost accounting system which analyses capital and maintenance costs by plan account and for other service which are recharged to responsibility areas.

2.6 Although revenue and expenditure accruals are calculated for year end and certain other accounting purposes, the system is essentially a cash accounting and budgeting system designed to provide the information needed for statutory stewardship and reporting purposes. We comment later in the sections on financial management information systems and product costing and profitability analysis, on the need for modifications to the basic accounting and costs accounting systems to provide integrated information for management.

Standards and principles in financial statements (Paragraphs 2.106 to 2.145)

2.7 With some exceptions, Telecom's published financial statements are presented in accordance with established accounting standards and principles. We make the following observations on areas which could be regarded as departures from generally accepted accounting principles in large business enterprises in the private sector:

- In addition to direct capitalisation of fixed assets purchased from outside parties, Telecom incurs considerable expenditure on the construction and installation of its own plant. Included in this capitalisation of construction and installation costs is a proportion of interest on borrowings, certain administration costs and the depreciation of vehicles and mechanical aids used. Capitalised interest, depreciation and administration overheads amounted to \$182 million of a total capital expenditure of \$1 164 million in the 1980--81 financial year. While it is not common practice in commercial enterprises to capitalise interest, depreciation and administration, it could be argued that Telecom's practice of capitalising these costs is justifiable, having regard to the highly capitalised nature of Telecom's operations and the large proportion of fixed assets constructed and installed internally.
- With the exception of buildings, conventional fixed asset accounting procedures are not followed by Telecom and it is not possible to determine the values of individual plant items for accounting purposes. Whilst the nature of Telecom's plant and equipment is such that it must be maintained in ongoing working order, and whilst the future working lives of all major categories of fixed assets are assessed on a regular basis, the accuracy of the fixed asset and depreciation amounts in the financial statements can only be substantiated by the introduction of more detailed fixed asset cost recording procedures.

- The adequacy of the long service leave provision is currently under review by the Commonwealth Government Actuary. We are not aware of the assumptions used by the Actuary in assessing the provision and therefore are unable to comment on how the basis adopted compared with the basis normally adopted by the private sector companies. Since 1978--79 only part of Telecom's liability for superannuation has been paid to the Commonwealth. The amount paid each year is determined by the Minister for Finance and is based on the amount required to meet Telecom's share of annual pension payments to former employees. The remainder is retained to assist in financing the capital works program. The internal use of funds provided for superannuation is not a normal commercial practice for public companies in the private sector.
- Telecom's depreciation policy is not strictly in accordance with the Australian Accounting Standard, in that:

 - a nil residual value is assumed to apply at the end of the asset's life;
 - assets are not depreciated from the point in time individual assets are put into, or held ready for use.

However, Telecom has estimated the effect of these departures from the Accounting Standard (which are not unusual) and, based on these estimates, the effect on the accounts is not material.

- Telecom does not make a provision for annual leave accrued. It is generally accepted accounting practice that leave costs should be accrued in the year in which they are earned rather than charged as they are paid. Telecom has estimated that, had the costs of leave due to staff, but not taken as at 30 June 1981, been accrued, expenses for that year would have increased by some \$4.3 million and fixed asset values by some \$1.6 million.

Financial management information system (Paragraphs 2.146 to 2.173)

2.8

Since its formation in 1975 Telecom has been transforming from a governmental towards a commercial style of management. However, it is still in somewhat of a hybrid situation and the responsibilities of management for the achievement of profitability and return on investment, while recognised in principle, are not clearly specified. The emphasis in financial management reporting still appears to be geared towards the control of cash expenditure (both capital and operating expenditure combined) against the fiscal budget and the control of cash receipts for sales and services provided. Generally, profitability is reported only at the half year. In other respects reports are essentially on a cash basis.

- 2.9 While certain information is produced on a uniform basis for consolidation into national reports at headquarters, states have a degree of autonomy with respect to the management reports produced locally within each state. Reports are produced at three main levels:
- . at headquarters to the 'Headquarters Co-ordination Committee' and to the Commission;
 - . to state managers;
 - . to operating managers within states.
- 2.10 The financial information for management is supplemented by a considerable amount of detailed statistical reporting which we have not examined in this review. The information provided may well be adequate for current management needs. However, if Telecom were organised along typical private enterprise lines, the financial management information produced during the year would need to be enhanced considerably to meet normal commercial requirements.
- 2.11 To enable these requirements to be met the reports would need to be developed to include significantly more information on operating costs and revenues and profitability, distinguished from capital expenditure, and the capital expenditure reports would need to be developed to include commitments reporting on a project by project basis where appropriate. The concept of responsibility accounting needs further development to provide reports on controllable costs and revenues regularly at all management levels.
- 2.12 One of the most important developments is the planned installation of a general ledger and reporting software package, ACCUDATE, which is intended to facilitate the preparation of period profit statements and other management reports. We have not examined the specifications of the package in this review but, subject to its appropriateness as a suite of software for Telecom's needs, we support the introduction of an integrated general ledger and reporting system as a necessary step in Telecom's commercial development.
- 2.13 However, it is clear that, before such a system can be successfully implemented, considerable work needs to be done in defining the organisational and reporting philosophy and structure appropriate for Telecom's future operations as a commercially oriented enterprise, and specifying the hierarchy of management reports and the underlying charts of accounts, responsibility accounting, costing and budgetary control systems.

APPLICATION OF CURRENT COST ACCOUNTING PRINCIPLES

- 2.14 In a capital intensive operation such as Telecom, the most significant effect of inflation arises in respect of fixed assets and depreciation. Telecom revalued some of its fixed assets in 1975. The communications plant was revalued by the application of Telecom's Capital Works Index ('CWI').
- 2.15 The accounts for the year ended 30 June 1981 have been restated to incorporate the adjustments which would result from fixed assets being valued on a current cost basis. In summary, the broad effects on the accounts were that the net book value of fixed assets increased by \$2 799 million, depreciation expense for the 1981 year increased by \$228 million and profit for the year decreased from \$232 million to \$4 million, subject to the validity of the CWI as a basis for the revaluation of fixed assets to current cost.
- 2.16 In our opinion, the capital works index has been carefully compiled and applied so as to reflect the effect of price changes on Telecom's plant and other equipment. It is a broad index approach and this may have merit, having regard to the wide range of cost ingredient factors that impound into Telecom's capital works program. However, we consider that greater precision could be achieved by developing a more specific series of indexes applicable to the various groups of assets which it is known are subject to particular price change patterns.

Taxation and other duties (Paragraphs 2.204 to 2.249)

- 2.17 Prior to the revised tax depreciation rates announced by the Federal Government in July 1982, we estimated the income tax and other duties that would be payable if Telecom was not statutorily exempted from these charges. Our estimates, subject to a number of assumptions and qualifications detailed in the paper, were as follows for 1981 fiscal year:

	<u>\$ millions</u>
Income tax	76.0
Sales tax	81.0
Payroll tax	67.0
Customs and other duties	46.0
Motor vehicle registration and insurance	8.0
Local and state taxes	55.0

- 2.18 We have estimated income tax on the assumption that Telecom was an existing taxpayer at 1 July 1980. We consider this to be the most appropriate approach in providing the Committee with meaningful information. Clearly, if a tax exempt body such as Telecom became taxable at any given point in time, the calculation of its income tax liability for its first year of income as a taxpayer would be distorted

in some areas and would be significantly affected by the manner in which assets were brought to account. We would also point out that if Telecom was not tax exempt, it may well be that tax considerations would influence the manner in which its operations were financed.

- 2.19 Since the announcement of the new tax depreciation package on 19 July 1982 we have estimated that if the 1980--1981 financial results and fixed asset additions were projected unchanged to the year ending 30 June 1983, being the first year upon which the new rates and allowances would impact, the additional deductions would be sufficient to render any income tax liability insignificant.

Capital expenditure (Paragraphs 2.250 to 2.279)

- 2.20 The procedures laid down for the development of the capital works program and the basis of investment evaluation of projects appear generally thorough. We have not examined the appropriateness of the internal rate of return thresholds for evaluating capital investment proposals, although on the surface they appear high. While we recognise that Telecom is obliged to ration capital currently, we could see value in more detailed studies of the economic evaluation criteria adopted and the impact of capital rationing on service to the public.
- 2.21 Although we have not examined the system in detail, the monitoring of capital works appears to be comprehensive. The progress of individual projects is being closely monitored by officers in charge of the particular projects.
- 2.22 However, we consider that a greater degree of cost control over capital expenditure could be exercised by:
- . placing greater emphasis on individual project cost control and reporting;
 - . utilising standard costing techniques to provide feedback on routine type capital expenditure.
- 2.23 To control individual major projects effectively, there is a need for integrated physical and cost control systems and a consistent, structured management reporting system to enable the progress and costs of major projects to be monitored on an exception basis and in summary total at successive levels of management. The present practice of focussing control reporting to management mainly on projects when costs approach 80 percent of estimate, may not always alert attention to exceptions early enough for corrective action. In our opinion control reporting should aim to identify variances as early as possible in the project cycle. This would involve developing the project costing and reporting systems to provide progressively summarised reports to each level of management concerned, on a regular reporting cycle, comparing estimated costs with actual and forecast costs to completion and highlighting the impact of both actual and forecast variations from estimated costs.

Product costing and profitability analysis (Paragraphs 2.280 to 2.369)

- 2.24 Historically, in countries where telecommunications have been operated as government owned or regulated monopolies, product costing typically has been on a highly aggregated full cost absorption basis, with average total costs being the main costing consideration. This had led to certain widely held and largely unchallenged assumptions about the profitability of certain classifications of services and the implications of cross subsidisation that follow from these assumptions.
- 2.25 In the future, Telecom Australia, in common with other telecommunications organisations overseas, is likely to face major and critical challenges on the validity and adequacy of its product accounting data and the implications for pricing and investment decisions, since:
- rapid technological advance means that Telecom's average total costs may vary considerably from its marginal cost and those of its potential competitors;
 - pressure is likely to increase on Telecom to provide more detailed justification of its prices in relation to the costs of providing particular services;
 - cross subsidisation is likely to come under increasing scrutiny, which will increase the need for meaningful and defensible measures of profitability as between different services, regions and classes of user;
 - Telecom marketing management, faced with increasing competitive pressures, will need better information for estimating the effects on profitability and market share of changes in marketing policies and pricing structures.
- 2.26 Telecom's product accounting systems are in a state of continuing development, and improvements are being made progressively as management's needs for information crystallise and basic accounting and statistical systems are modified. At present the systems serve two main purposes:
- to provide summarised annual results of financial performance by broad product type;
 - to provide more detailed product profitability information to management, particularly commercial services management, for product management, pricing and investment analysis purposes, during the year.
- 2.27 The main use which appears to have been made of Telecom's annual product accounting information has been in reviewing the relative profitability of different products and classes of user of the network. Based on these reviews and other factors, deductions about the extent

of cross subsidisation have been made and pricing policies presumably have been influenced. Submissions to the Inquiry and Telecom's response to questions refer to 'loss products' accounting for \$290 million and from this reach conclusions concerning cross subsidisation, which may not be valid if based on this figure of \$290 million alone.

- 2.28 Because of the importance of these conclusions to future policy in relation to Telecom investment and pricing, we have attempted to appraise the validity of the profitability and cross subsidisation conclusions drawn from the present product accounting system. This appraisal is based on a limited study and it was not possible in the time and with the information readily available from Telecom's accounting and product costing systems to conduct an authoritative analysis. However, the appraisal does raise some important questions for pricing policy.
- 2.29 The product accounting system suffers from significant difficulties with regard to both revenue and cost apportionment, difficulties which are well recognised by Telecom. The conceptual problems inherent in describing products in terms of terminals and traffic are highlighted in the treatment of revenue from leased coin and public telephones. Arguably, the practice followed understates the real revenue that those products have generated and does not identify all the costs caused. However, given the present revenue accounting system, the product accounting does not (and cannot) identify the revenue generated by all products.
- 2.30 Similarly, the question of which costs to include and how to allocate them to products is complex. Many costs are joint costs which relate to the total network and depending on the objective for which the cost allocation is being done, can be allocated many different ways to produce many different results.
- 2.31 When this uncertainty regarding the methods of apportioning costs is added to the difficulties with the allocation of revenue under present revenue accounting systems, the analysis of product profitability produced by the product accounting system is unreliable for the uses being made of the data externally.
- 2.32 Recognising the inadequacy of the original product accounting system in providing information for commercial management planning and decision making, Telecom have been developing a number of additional approaches to product profitability analysis. These include:
- . ad hoc costing studies;
 - . cost modelling.

2.33 Since 1979, Telecom has been operating a modelling system aimed initially at establishing the contribution from the various physical products classified as 'Vertical Products' and 'Other Data Services', which generally relate to terminals and attachments and leased data lines. The strength of this approach is that it highlights both the direct variable costs and the direct costs in evaluating the product contributions. The weakness of the system, which is recognised by Telecom, is that it is not possible currently to integrate it with the financial accounting system, and its results are therefore difficult to reconcile and verify.

2.34 The term 'product' is used in Telecom to define those parts of the total revenue earning services for which management requires information about profitability for purposes of investment and pricing policy. Information relating revenue earned with the costs of generating that revenue can be considered in three different categories, which can be regarded as overlaying each other in a three dimensional form:

- . by type of service or 'product' (trunk calls, local calls, terminal equipment etc);
- . by geographical region (country, metropolitan, etc);
- . by type of user (class of customer, business, etc).

2.35 There are two fundamentally different ways of analysing product profitability in telecommunications:

- . treating the type of terminal device and the traffic it generates in the network as one combined product, and attempting to measure the revenue and costs caused by that terminal and its associated traffic; this requires a means of disaggregating network usage and costs by terminal product and has not proved feasible to date;
- . treating the terminal as one product and the network as a separate product (or products). In this case costs and revenues of terminals need to be separated from costs and revenues of the network. This requires a transfer pricing policy between terminals and network in deciding how to allocate revenue.

Many of the present product accounting problems arise because of the mixing of these two approaches and the three categories (service, region, user) in Telecom's original product definitions.

- 2.36 Because of the importance of reliable profitability information to Telecom in the rapidly changing future for the telecommunications industry, we consider that a new product definition and profitability analysis system will be needed and could be designed to provide the facility for analysing contributions made by:
- . services (products);
 - . types of user;
 - . regions.
- 2.37 The extent of the analysis would depend upon a full appraisal of management's needs (and the needs of any regulatory bodies) for profitability and cost information. The system should be integrated with the financial accounting and management information systems. Depending on the objectives agreed for the product accounting information, substantial changes to the basic revenue accounting, financial accounting and plant cost recording systems would probably be needed.
- 2.38 For the purpose of profitability analysis we agree with Telecom's product accounting management that a contribution approach should be adopted, which means that only those costs which are direct to product (but not necessarily variable with traffic in the short term) should be compared with the revenue generated directly by the product, to determine a contribution to the remaining indirect costs. Contributions can be assessed at different levels -- e.g. contribution for product, for product group and in total for all product groups. For this purpose, the main costs that could be regarded as direct would be the facilities costs of interest and depreciation and that part of maintenance which can be related directly to the product. On this basis we estimate that some 36 percent of total cost would not be allocated directly to products, and would represent the 'overhead' which product contributions, in total, are expected to cover.
- 2.39 Although valuable developmental work has already been done by a Telecom working party and the product accounting section, the detailed design and implementation of a costing and profitability analysis system of this type to provide meaningful information in up to three different dimensions and different levels of cost aggregation would be a major task for Telecom and would require considerable time and resources. The extent to which this range of information is needed by Telecom and the costs of providing it would require careful evaluation by senior management. Nevertheless, we believe that future demands on Telecom will make this type of information of increasing importance to management.

Pricing policy (Paragraphs 2.370 to 2.412)

- 2.40 A major difficulty for Telecom in setting prices for the future therefore is the inadequacy of product or service costing information. Until the development of the cost models during the last two or three years, mainly for terminal products (which are a relatively small proportion of Telecom's total revenue earners), management has had insufficient reliable product costing information with which to review prices from a profitability or return on investment viewpoint or to evaluate cross subsidisation.
- 2.41 There has been much debate on the subject of cross subsidisation in telecommunications in recent years, both in Australia and overseas. The debate is complicated because there is no universally agreed definition of what is meant by 'cross subsidisation'. In the widest sense of the term there is the potential for cross subsidisation in at least the following respects:
- . as between products, through commercial price differentiation, where elasticities of demand are different;
 - . as between current and future subscribers, where excess capacity is provided with a future growth of demand anticipated, i.e. current subscribers may be subsidising future subscribers;
 - . as between types of subscribers -- e.g. city/country, business/non-business;
 - . in respect of remote installations, where connection may be provided and maintained below direct cost;
 - . in respect of certain social services (e.g. provision of free emergency calls).
- 2.42 In principle, provided there are adequate safeguards against monopolistic abuse, either through competition or regulation, a degree of price differentiation can, in our view, be justified on both commercial and economic grounds. It would be impractical to expect all products, regions and customer groups to return similar levels of profitability, or return on investment, as this could lead to a reduction in profitability overall and a distortion of investment policies, with consequent misallocation of resources.
- 2.43 However, there are some pricing policies that are neither commercially justified (in the sense of utilising price elasticities to optimise contributions) nor economically justified (in the sense of optimising net social benefits). In our opinion, these types of social cross subsidisation should be recognised and measured. Consideration could then be given to the alternative of direct governmental subsidisation, if it can be demonstrated that the pricing policy in these cases is essentially for social purposes and not commercially justifiable. Cross subsidisation in this sense occurs only when a product's revenue fails to cover its direct costs, that is, it makes no positive contribution to joint costs, indirects or profit.

- 2.44 A commercial pricing policy requires prices to be determined by reference to a number of key factors. In practice, most well managed commercial organisations pay close attention to the relationship between product costs and prices and focus on the contribution earned by product groups, customer groups and, where appropriate, regions or profit centres. Thus, pricing is cost related, although often not directly determined as a formula relationship to cost. The determination of price is a complex process involving market and strategic considerations as much as cost relationships. Nevertheless, a close knowledge of product costs and cost/volume relationships is vital in commercial management.
- 2.45 If a wholly commercial pricing policy was adopted, the objective would be to optimise the contribution from products/services so that the sum of all contributions (revenue less direct costs) exceeds the indirect costs of the business by the required financial return. As far as practicable prices should be cost related, subject to any overriding requirements for social subsidisation, which should be identified separately and measured.
- 2.46 The long run pricing structure should be based on the practical equivalent of long run marginal cost (sometimes referred to as average incremental cost). The closest equivalent in accounting terms is long run variable direct cost, based on current rather than historical capital costs where appropriate. Within this structure, there should be commercially flexible short run differential pricing. Prices would be set at a level above direct cost, based largely on 'what the market will bear' to recover joint and indirect costs overall and achieve profit objectives. Fundamental to these objectives for pricing policy is the need to have a clear understanding of product costs, revenues and market elasticities and current replacement values of fixed assets.
- 2.47 New communications technology is now making competitive telecommunications networks feasible. Telecom pricing practices that include the recoupment of average total costs, including elements of technologically superseded 'sunk' costs, can make the use of the new technology look unjustifiably attractive to potential competitors and could lead to misinformed investment decisions. Much work has been done by Telecom in recent years to correct apparent anomalies in the pricing structure, including recently announced changes, but more effort will be needed before prices can be regarded as closely cost related and commercially optimised.

Financial model (Paragraphs 2.413 to 2.420)

- 2.48 We were asked to construct a simple financial model designed to show the extent to which Telecom's average unit prices would need to change to maintain ongoing cash flows under various sets of assumptions

regarding inflation, growth and funding. Although the models were kept deliberately simple, some interesting conclusions can be drawn from them, in particular:

- . they demonstrate that the higher the growth and fixed asset inflation, the higher the profit needed to generate internal funds for capital investment;
- . in all the twelve combinations of assumptions modelled (all assuming no company taxes payable) while there is an initially higher price increase in the 100 percent internal funding alternatives, there is no significant price sensitivity to the funding alternatives over the longer term, when the cumulative effect of high interest rates offsets the funds generated by additional borrowings, both of which under the model are reflected in prices; if income tax were payable, price would be more sensitive to funding alternatives, particularly with high growth, since the interest deductions on external borrowings would have the effect of reducing tax payable;
- . in the case of high growth (10 percent), the price in the first year of the model has to increase substantially to fund the higher level of growth; the extent of this initial increase is affected significantly by the level of external borrowings, but after the first year the impact of the funding alternatives reduces progressively over the longer term;
- . under the conditions of inflation assumed in the models, it is demonstrated that even in cases of no growth, Telecom must achieve continually increasing historical cost profits through higher actual prices, or alternatively increase its debt, merely to fund the replacement of existing fixed assets, if it is to balance its cash flows.

CONCLUSION

- 2.49 This review has raised a number of important questions relating to Telecom's financial and management accounting systems, product costing and profitability analysis and pricing policy. By its nature the review was relatively brief; it was not possible or appropriate to undertake detailed examinations of the systems and procedures nor to carry out any forms of verification or audit and we have relied substantially on the information and advice given to us by Telecom's management. Most of the observations raised in the review have been recognised previously by Telecom, and in many cases developments are proceeding to improve the information available to management and develop more commercially oriented approaches to financial management. In this respect, we consider that priority should be given to:

- improving the financial management information available to management for profit planning and control, and integrating improved revenue analysis, costing, responsibility accounting and product accounting systems with the proposed new computerised general ledger and reporting system;
- developing the product profitability analysis system, based on direct costing rather than average costing, to provide the facility for analysing contributions by services (products) and if needed by regions and customers;
- introducing costed plant registers based on more detailed fixed asset cost recording procedures and developing capital works indexes for specific asset groups for the purpose of regular fixed asset revaluation;
- integrating physical and cost control systems on major capital works projects and developing the management reporting system for monitoring progress and costs at successive levels of management;
- developing a more cost related commercial pricing policy.

2.50 We wish to record our appreciation for the willing cooperation and valued advice and assistance received from the management and staff of Telecom Australia and from the members and officers of the Inquiry.

Yours faithfully

COOPERS & LYBRAND SERVICES

OVERVIEW OF ACCOUNTING SYSTEMS

INTRODUCTION

- 2.51 The purpose of this briefing paper is to provide an overview of the structure of Telecom's accounting systems.
- 2.52 The objectives of financial accounting, as applied in Telecom, are:
- " . To provide information for management to enable it to effectively monitor and control the Commission's revenue and expenditure and to ensure that expenditure is contained within the budget of each Responsibility area.
 - . To provide information to enable accurate plans and programs to be developed within the Commission's forward planning arrangements.
 - . To enable optimum use to be made of the Commission's funds.
 - . To ensure by the means of control accounts the correct recording and balancing of detailed data in subsidiary records.
 - . To periodically present a Profit and Loss Statement and Balance Sheet."
- 2.53 In meeting these objectives, Telecom operates a financial accounting system and supplementary sub-systems supporting the financial accounting system, comprising:
- . a responsibility accounting system;
 - . cost accounting systems.
- 2.54 These accounting systems operate within each state and, with the exception of the cost accounting systems, at Headquarters. Within the overall organisational structure, each state and the Headquarters administration is a self-accounting entity, with each maintaining a set of accounting records covering the operations at that level.
- 2.55 The structure of Telecom's accounting systems is described in the remainder of this paper under the following main headings:
- . financial accounting system;
 - . responsibility accounting system;
 - . cost accounting system.

FINANCIAL ACCOUNTING SYSTEM

2.56 The main elements of the financial accounting system are described in the following paragraphs, under the headings:

- . revenue accounting systems;
- . cash accounting system;
- . accrual accounting system;
- . general ledger system.

Revenue accounting systems

2.57 The Commission's earnings are recorded in the financial accounting records under the following categories:

- . telephone earnings, which consist of:
 - rents;
 - metered calls, which comprise local and STD calls;
 - call fees -- public telephones;
 - trunk calls -- manual, that is, calls which are booked with, and connected by, an operator;
 - overseas calls which comprise the value of terminal charges in respect of incoming calls and Telecom's portion of outgoing call charges; 'settlement' is made with OTC monthly;
 - installation fees which comprise connection fees paid by intending subscribers;
 - miscellaneous charges in subscriber's accounts; for example, statement fees;
 - proceeds of sale -- telephone;
 - directory advertisements; percentage of the gross proceeds received by agencies contracted to sell advertising space in the yellow pages directory;
 - telephone -- other;
- . telegraph earnings, which comprise:
 - internal telegrams; included under this heading are earnings associated with telegraphic, picturegram and printergram traffic within Australia;

- overseas telegrams;
- telex calls -- internal;
- telex calls -- overseas; OTC charge the subscriber directly and Telecom receives a terminal fee from OTC;
- telex rents;
- leased services, that is leased lines for point to point of telegraphic (teleprinter) services;
- code address fees;
- telegraph -- other;
- . non tariff earnings, which comprise:
 - non tariff earnings -- public; for example, work carried out for the public including local councils, and amounts recovered from third parties for damages to Telecom's plant, equipment and motor vehicles;
 - non tariff earnings -- B/C and T/V; this mainly comprises recoupment of expenditure incurred on behalf of the Department of Communications and the Special Broadcasting Service;
 - apprenticeship training -- rebate;
 - sales of PABX's;
 - sales of multicomms.

2.58 Earnings are brought to account as:

- . credit transactions, that is, by the rendering of an account or invoice;
- . cash earnings, that is, earnings which are received as cash receipts and brought to account through the journalisation of the 'cashier's cash book'; call fees from public telephones is an example of cash earnings.

2.59 The systems and procedures which are operating to account for the credit transactions are briefly described in the following paragraphs.

Telephone earnings

- 2.60 A computerised telephone debtors system ('Tel/Drs') operates to handle the full range of billing and debtors accounting activities. Subscriber's telephone accounts are automatically calculated and compiled from input data such as meter readings, telephone orders, trunk charges, etc. The system maintains detailed debtors records which are automatically updated for accounts rendered and from cash receipt details input to the system.
- 2.61 The billing for telephone services in a number of the more remote country districts is not covered by the 'Tel/Drs' system and is therefore done by manual processes using accounting machines. The manual system is operated centrally in that the Revenue Branch in each State head office renders accounts from information supplied by the Districts and maintains the detailed debtors records.
- 2.62 The Revenue Branch summarises, on a monthly basis, charges included in subscribers' telephone accounts from reports generated by the computer system and summaries of manually processed accounts. The 'debtors summary' is the medium for postings to the appropriate general ledger control accounts.

Telegraph earnings

- 2.63 The billing system for telegraphic services is a manual (accounting machine) system. The accounts, which are rendered on a monthly basis by the Revenue Branch, are:
- . recorded in the detailed debtors records;
 - . summarised on monthly 'debtors summaries' which are journalised for posting to the appropriate general ledger control accounts.

Non tariff earnings

- 2.64 Non tariff earnings are brought to account through the rendering of invoices, miscellaneous debtors accounts or recoverable works accounts.
- 2.65 The value of invoices and accounts rendered each period are collated and summarised by the Revenue Branch into 'debtors summaries' which are journalised for posting to appropriate general ledger control accounts. The invoices and accounts are also manually recorded in the detailed debtors records which are maintained by the Revenue Branch.

Cash accounting system

- 2.66 Cash transactions are managed through the operation of a 'receipts account' and a 'drawing account' by each state head office and a 'funding and investment account' at Headquarters, under the control of the Finance Directorate.
- 2.67 The total revenue received by the states each day is paid into their respective 'receipts account' and then transferred to the 'funding and investment account'.
- 2.68 Each day the states advise Headquarters the total estimated value of cheques to be presented on the following day and the funds required to meet the payments are transferred from the 'funding and investment account' to the state's 'drawing account'.
- 2.69 Drawing accounts are also maintained at the district level for payment of most types of incidental expenses. These bank accounts are operated on an imprest basis and are reimbursed from the state head office 'drawing account' daily or as required.

Recording of cash transactions

Cash receipts

- 2.70 All cash receipts are processed and recorded by the Revenue Branch in each state head office and Headquarters, as appropriate. The cashier's section in the Revenue Branch maintains a 'cashiers receipts book' in which cash receipts are recorded daily and progressively for each four week period, analysed by the various debtor groups or types of earnings.
- 2.71 At the close of each period, the total receipts for the period, as recorded in the cash book, are journalised and posted to the appropriate general ledger control accounts.

Cash payments

- 2.72 A 'cash book' is maintained at each state head office and at Headquarters in which cash payments are recorded daily. Cash expenditure details are input to a computerised processing system, 'RAS', wherein the cash expenditure is recorded:
- against the section or similar area responsible for incurring the expenditure; under the 'responsibility accounting system', each section or area within the Commission has its own identification code and all expenditure documentation is coded accordingly;

- and analysed by 'budget head', that is, labour, incidentals or material expenditure.

2.73 At the close of each four week period, the total cash expenditure, as recorded and analysed by responsibility code and budget head, is recorded in a 'cost register -- cash'. This register, which records cash expenditure on a period and year to date basis, is the source for reporting cash expenditure under the responsibility reporting system and the medium for posting cash expenditure, on a summarised basis, to the appropriate general ledger accounts.

Accrual accounting

2.74 During the course of the year, earnings and expense transactions are normally recorded as credit or cash transactions as they are incurred. However, in preparation of the annual financial statements a number of 'balance day' adjustments are affected at the year end to bring the accounts onto a full accrual basis.

2.75 Under this system of 'balance day' adjustments:

- expenses incurred but not recorded are assessed and charged in the accounts and any advance payments recorded are written out of expenses;
- revenue earned but not brought to account is assessed and included as earnings; revenue brought to account but which relates to the following year is assessed and written out of earnings;
- the annual charges for depreciation, long service leave and superannuation are determined and brought to account.

In addition certain types of expenditure are finally apportioned between asset and expense accounts. For example:

- major mechanical aids' operating costs are distributed to plant accounts throughout the year on a hire rate basis and, at the year end, any under or over recovery is apportioned between plant accounts (both asset and maintenance plant accounts) on the basis of the costs charged to the plant accounts during the year; the use of plant accounts is described under the section on costing systems;
- at year end, engineering administration costs are distributed between asset and expense accounts in accordance with specified bases.

General ledger system

- 2.76 As described in the Introduction, each state and headquarters is a self-contained accounting entity, with each maintaining a general ledger and supporting accounting records. At year end, the general ledgers are consolidated into a 'national' general ledger.

States' general ledger system

- 2.77 The general ledgers maintained by the states' and headquarters' administration comprise:

- . a current general ledger;
- . a perpetual general ledger.

Current general ledger

- 2.78 The current general ledger records all the financial transactions throughout the current year, including the year end 'balance day' adjustments.
- 2.79 Transactions are summarised for each four week period in subsidiary accounting records and posted to the relevant accounts at the close of each period. Each account is therefore a 'control' account, the balances of which are reconciled with appropriate subsidiary records. Currently, the current general ledger is maintained by the use of accounting machines. However, at year end, the accounts are finalised using the 'COMAC' computerised system.

Perpetual general ledger

- 2.80 The perpetual general ledger is only operated at the close of the financial year when the balances of the current general ledger are transferred into it. It provides the record of progressive balances on all asset and liability accounts and is the medium for consolidation into the 'national general ledger'.

National general ledger

- 2.81 The account balances as recorded in the respective perpetual general ledgers are consolidated and recorded in the 'national general ledger'. It records the final account balances separately for each state and headquarters as well as for national totals. The transfer and consolidation of the perpetual general ledger account balances is effected through the use of the 'COMAC' computerised system.

Published financial statements

- 2.82 Once the national general ledger has been finalised, the financial statements for the year are prepared and published.

RESPONSIBILITY ACCOUNTING SYSTEM

- 2.83 The 'responsibility accounting system' is a budgetary control system, whereby:
- . annual expenditure budgets are established for each 'responsibility area' within the Commission, through the budgeting process;
 - . actual expenditure is:
 - recorded against the 'responsibility area' which incurs the expenditure;
 - monitored and controlled by reporting, for each four week period, actual expenditure incurred by each 'responsibility area' against its budgeted expenditure.
- 2.84 The areas of responsibility are defined and identified by a 'responsibility code' which is a numerical code designed on a hierarchical structure basis. It usually commences at the section level with the sections consolidated into a branch and branches, in turn, consolidated into departments.
- 2.85 The responsibility code is further subdivided into 'budget heads' which represent the various types of expenditure which are incurred. The 'budget heads' are specified for cash expenditure and 'costed' expenditure (that is, cash expenditure which is further costed by the costing systems or as issue of material from stores, etc).
- 2.86 The 'budget heads' for cash expenditure are:
- . labour, which comprises:
 - normal pay;
 - overtime;
 - other extra duty;

- . incidentals, which comprises:
 - hire of plant;
 - contract works;
 - repairs to plant;
 - travelling allowances and expenses;
 - other incidentals;
- . material, which comprises:
 - minor material;
 - local purchases;
 - collective schedule purchases;
 - asset purchases.

The 'costed' expenditure budget heads comprise:

- . stores issues;
- . information systems;
- . engineering;
- . workshops;
- . other.

- 2.87 All expenditure documents are coded under the appropriate responsibility code and thereafter recorded in the cash book and/or input to the computerised processing system 'RAS' under budget heads against the relevant responsibility area.
- 2.88 At the end of each four week period, 'RAS' summarises the expenditure by responsibility area in a 'cost register' and compiles reports detailing the expenditure incurred by each responsibility area. These reports, which show actual expenditure incurred, by budget head, on a period and year to date basis, against budgeted expenditure are forwarded to managers of each responsibility area. Summary reports are also compiled for senior management in the states and Headquarters.

COST ACCOUNTING SYSTEM

- 2.89 The cost accounting systems are complementary to the financial accounting systems in that they provide detailed cost information on work carried out by various areas within Telecom. The main cost accounting systems are:

- . telecommunications plant construction and maintenance costing;
- . automotive plant costing;
- . workshops costing;
- . information systems costing.

Each of these systems are described hereunder.

Telecommunications plant construction and maintenance costing

This costing system records the capital and maintenance costs incurred on telecommunications plant through the use of 'plant accounts'. All telecommunications plant is divided into specific functional groups which are identified by an alphabetical symbol known as a 'plant account'. The plant account identifies the type of plant, work categories associated with that type of plant and distinguishes between capital and maintenance work. For example, the cost of installing a telephone instrument in a subscriber's residence is identified by the plant account 'XIP', where:

- . X indicates it is a cost to telephone plant;
- . I identifies it as a telephone instrument;
- . P describes the cost as being of a capital nature.

Where the work relates to repairing a telephone in a subscriber's residence, the plant account is 'XIM' where 'M' denotes the cost as being of an operating nature.

Expenditure which is initially charged to the engineering and operations departments and the technical sections in the commercial department is then further costed in the costing system to the plant account appropriate to the type of work being undertaken. The procedures by which this is done are described briefly in the following paragraphs.

All documentation relating to incidental expenditure and material issues is coded to the plant account for which it is incurred. This documentation is forwarded to the costing areas in the district or engineering section offices.

The technical workforce, comprising linesmen and technicians, record, in working reports, the manhours worked against plant accounts. The labour hours and costs of incidentals and materials are recorded and summarised by plant account at the district/section offices and a final summary for the period is forwarded to the state head office for input to the computerised cost accounting system. This system

automatically calculates the labour cost by applying labour rates to the reported labour hours and records the total labour, material and incidental costs for the period against the plant accounts.

- 2.94 A final costing summary is produced from this process. This summary details the charges for the period to the appropriate asset, maintenance and other general ledger accounts and is the source for subsequent postings to the general ledger accounts.

Automotive plant costing

- 2.95 The costing system operates to record the costs incurred in operating the automotive plant.
- 2.96 Throughout the year, the costs of operating major mechanical aids and motor vehicles are charged out to the work activities in which they are engaged. This is achieved by the use of predetermined internal hire rates which are set to cover:
- . the 'direct' operating costs, that is, fuel, oil, tyres, repairs and servicing costs, etc;
 - . automotive plant overheads;
 - . 'costed' services and depreciation and 'assessed' interest costs on automotive plant.

The hire rates for motor vehicles are on a kilometre basis whereas the mechanical aids are charged out at a rate per half day.

- 2.97 The users of the vehicles/mechanical aids record the actual usage and details of the plant account or responsibility codes to be charged. This information is then costed by the costing areas in the district or engineering section offices using the internal hire rates and summarised by plant account/responsibility code. The final summaries for each district and engineering section are forwarded to the state head office for input to the computerised cost accounting system for recording in plant accounts.
- 2.98 The final costing summary from this process details the charges to the asset, maintenance and other accounts for recording in the 'cost register -- costed' and subsequent postings to the general ledger accounts.

Workshops costing

- 2.99 A workshop complex is located in each state. The workshops carry out extensive programs of work including the manufacture, repair and reconditioning of specialised telecommunications equipment.

- 2.100 All costs associated with the workshop's activities are initially charged to a workshop's suspense account in the general ledger. These costs comprise labour, material, incidentals and workshop overheads including 'costed' services and depreciation and 'assessed' interest on workshop plant.
- 2.101 Each workshop operates a job order costing system wherein labour, material, incidentals and workshop overheads are costed to individual jobs. Labour and overhead costs are charged to individual jobs by the application of a predetermined labour and overhead rate to the manhours expended on the individual jobs. Materials and incidentals are costed to individual jobs from stores issue 'invoices' and payments documentation respectively.
- 2.102 At the close of each four week period the costs of completed jobs are collated and summarised by plant account/responsibility codes and subsequently cleared from the workshop's suspense account and charged to relevant asset or expense accounts.

Information systems costing

- 2.103 This cost accounting system provides for recording all costs associated with the computer network and other work performed by the information systems department. As part of this system, individual responsibility areas are charged with the costs of their usage of data transcription, data processing and ADP systems development.
- 2.104 The main bases for charging user areas are as follows:
- for data transcription work, charges are made on the basis of the number of keystrokes punched, at a predetermined rate;
 - for computer processing, charges are based on the elapsed time for 'on line' processing work, at a predetermined rate; for some large jobs, standard prices are set for the various processing runs involved;
 - for ADP systems development projects, a predetermined price is established for all stages of the work after completion of the systems specification with users and up to, and including, the implementation of the systems.
- 2.105 The charges are rendered on the user areas each four week period. Details of the charges are input to the computerised processing system, 'RAS', for recording against the relevant responsibility areas and inclusion in the monthly costed expenditure reports under the heading 'information systems'. Entries to the general ledger control accounts in respect of these recoveries are taken up from the summarised output from the computerised processing system 'RAS'.

- for ADP systems development projects, a predetermined price is established for all stages of the work after completion of the systems specification with users and up to, and including, the implementation of the systems.

STANDARDS AND PRINCIPLES IN FINANCIAL STATEMENTS

INTRODUCTION

- 2.106 The purpose of this paper is to report our findings on our examination of the accounting standards and principles adopted by Telecom in the presentation of its annual financial statements for the year ended 30 June 81.
- 2.107 The accounting policies adopted by Telecom in the preparation of its financial statements are detailed in Note 1 to the published accounts. The accounts for the year ended 30 June 1981, comprising the balance sheet and profit and loss statement, are incorporated in Volume 1, Appendix A, of the Report.
- 2.108 Our comments on the interpretation and application of a number of these these policies are set out under the following main headings:
- . basis of accounts;
 - . fixed assets;
 - . stores;
 - . long service leave and superannuation;
 - . depreciation;
 - . interest;
 - . other matters.

BASIS OF ACCOUNTS

- 2.109 Section 77 of the Telecommunications Act 1975 requires Telecom to keep "proper accounts and records of the transactions and affairs of the Commission in accordance with accounting principles applied in commercial practice...".
- 2.110 The financial statements are prepared on the accrual basis, the essential feature of which is that revenue earned is matched with the costs of earning that revenue regardless of the actual accounting period in which the related cash is received or disbursed. The underlying accounting systems are largely maintained, however, on a cash accounting basis, and a number of balance day adjustments are made at year end and half year end to present the financial statements on an accrual basis. With some exceptions, which are commented on in this paper, Telecom's published financial statements are generally presented in accordance with established accounting standards and principles.

Fixed assets

- 2.111 A major revaluation of fixed assets was conducted as at 1 July 1975. The revaluation applied to the majority of communications plant and resulted in the restatement of some 68% of the total fixed assets at that date. Additions subsequent to that date have been recorded at historical cost.
- 2.112 Details of the fixed assets as at 30 June 1981, distinguishing between those carried at 1 July 1975 revaluation and those included at cost, are included at Attachment A.

Capitalisation policy

- 2.113 As noted in paragraph 2.110, the published financial statements are prepared on the accrual basis so that revenue earned is matched with the costs of earning that revenue. In matching revenue and costs it is essential to make the distinction between capital expenditure, that is, expenditure which is intended to benefit future periods, and revenue expenditure which benefits the current period.
- 2.114 The capitalisation policy adopted by Telecom is in accordance with the basic principle that all additions to, or major replacements of, fixed assets should be charged to fixed assets. For practical implementation of this policy, the main points of distinction between capital and revenue expenditure are summarised in Telecom's Accounts Instruction Manual, an extract of which is at Attachment B.

Cost elements

- 2.115 In addition to direct capitalisation of fixed assets purchased from outside parties, Telecom incurs considerable expenditure on the construction and installation of its own plant. This necessitates careful consideration of the internal cost elements which are charged to fixed asset accounts.
- 2.116. The cost elements which are charged to fixed asset accounts consist of:
- direct labour costs, that is, labour directly engaged in the construction and/or installation of fixed assets; the labour costs comprise:
 - 'prime' labour costs, that is, wages, labour related allowances and labour on-costs including superannuation and long service leave;
 - workmens' overheads, which include protective clothing, leave costs, transfer costs, etc;

- material which is required in the construction of fixed assets or which is installed as a 'whole' asset;
- incidental costs incurred in the construction and/or installation of fixed assets; for example, travelling allowances paid to 'direct' labour;
- the costs of using motor vehicles and mechanical aids in the construction and/or installation of fixed assets; these costs include depreciation and interest attributed to the investment in this automotive plant;
- a proportion of interest on borrowings which is deemed to relate to construction work in progress; the amount of interest capitalised on this basis is calculated by applying an assessed rate of interest to the monthly average value of construction work in progress;
- certain administration costs which are considered to have a direct relationship to the construction program; for example, the administration costs of the Construction Branch and a proportion of the Supply Branch costs are charged to fixed asset accounts.

2.117 The total expenditure charged to fixed asset accounts in the year ended 30 June 1981 amounted to \$1 164 million, of which interest, depreciation and administration costs comprised:

	<u>\$ millions</u>
• Interest	43.9
• Depreciation	15.4
• Administration overheads	<u>123.6</u>
	\$182.9

2.118 Whilst conforming with generally accepted accounting principles, it is not common practice in commercial enterprises within the private sector to capitalise interest, depreciation and administration overheads attributed to the construction and/or installation of plant and equipment. However, having regard to the highly capitalised nature of Telecom's operations and the large proportion of fixed assets constructed and/or installed internally, it could be argued that Telecom's practice of capitalising these costs is justifiable.

Accounting procedures

2.119 'Best practice' for fixed asset accounting requires the maintenance of fixed asset registers or similar records which are in sufficient detail to determine the age, cost and written down value of individual items, or groups of items, of plant and equipment. Such records not only permit the correct entries to be recorded when assets are sold or scrapped, but also facilitate the physical control of assets which can be periodically reported and reconciled with the financial records.

2.120 With the exception of buildings, these conventional fixed asset accounting procedures are not followed by Telecom. The main features of Telecom's fixed asset accounting procedures are as follows:

- . accounting records are maintained only by categories of assets in total, analysed by reference to the year in which expenditure was incurred; thus the fixed asset records do not permit the cost of each individual asset to be identified;
- . service lives are set for each category of fixed assets rather than for individual assets; service lives are reviewed annually and, where appropriate, the service lives are adjusted;
- . for each category of fixed assets, annual expenditure is automatically written out of the accounts at the expiry of the service life;
- . when communications plant is taken out of service, the cost of recovery less any value of recovered material is included in expenses and no adjustment is made to the fixed asset account for any residual value of the original equipment;
- . it is not possible therefore to ascertain:
 - the amounts included in the net book value of fixed assets in respect of assets no longer in use;
 - the amounts excluded in respect of assets written out but still in use;
- . also, it is not possible to determine the individual plant item balances for correct recording of the effects of changes in the estimated useful life or of the recording of any profit or loss on disposal of assets (sales proceeds are treated as earnings).

2.121 At present asset (plant) registers are maintained on a statistical basis showing the number of units provided, transferred, dismantled or abandoned and, having regard to the high value and large number of fixed assets in use by Telecom, there is unlikely to be any short term solution to the problems referred to in paragraph 2.120 which result from the present procedures. Unless steps are taken to introduce detailed recording identifying particular items of plant, date of installation, and purchase price plus cost of installation it is not possible to quantify the effect on asset values of the departures referred to in paragraph 2.120.

2.122 Whilst the nature of Telecom's plant and equipment is such that it must be maintained in ongoing working order and whilst the future working lives of all major categories of fixed assets are assessed on a regular basis, the accuracy of the fixed asset and depreciation amounts in the financial statements can only be substantiated by the introduction of more detailed fixed asset cost recording procedures.

Stores

- 2.123 The amount for stores included in the accounts for the year ended 30 June 1981, comprised:

	<u>\$000</u>
Stores in stock	209 329
Workshops' work in progress	<u>44 623</u>
	253 952

- 2.124 Stores in stock consists of materials and supplies for construction, maintenance and operations. Stores are valued at standard cost rates which are set at the beginning of each financial year.
- 2.125 The standard rate for each stock item is calculated as an average of the value of stock on hand, at the standard rate applying for the preceding year, and the estimated cost of purchases to be made in the forthcoming year. Such purchases are normally made under supply contracts and the cost estimates are based on the contract prices, adjusted, where applicable, for estimated cost escalations provided for in the contracts.
- 2.126 The variance from the standard rate is identified at the time of payment of purchases and the total price variance amount is allocated, at the end of the financial year, to the accounts which have been charged with stores issues at the standard cost rates throughout the year. Stock on hand at the year end is not adjusted for price variances and is carried at standard cost rates until adjusted in the following year.
- 2.127 Workshops' work in progress is valued at cost and includes an appropriate portion of workshop overheads.

Long service leave and superannuation

- 2.128 In accordance with generally accepted accounting practices, long service leave and superannuation are accounted for on the accrual basis.
- 2.129 As recommended by the Commonwealth Government Actuary, the amount provided for long service leave is currently based on a rate of 2.5 percent of salary and wage payments for the year. The adequacy of the long service leave provision is currently under review by the Actuary. We are not aware of the assumptions used by the Actuary in assessing the provision and, therefore, are unable to comment on how the basis adopted compares with the basis normally adopted by private sector companies.

- 2.130 Telecom's total annual liability for superannuation is determined by the Minister for Finance and currently represents 20 percent of salary for superannuation purposes. Since 1978--79, only part of the annual liability has been paid to the Commonwealth. The amount paid each year is determined by the Minister and is based on the amount required to meet Telecom's share of annual pension payments to former employees. The remainder is retained to assist in financing the capital works programs. The portion of the annual liability retained in the year ended 30 June 1981 amounted to \$96 million.
- 2.131 Interest is charged on the amount retained, at rates comparable to those applicable to Telecom loan stock. The provision for superannuation therefore records the total amount of Telecom's liability for superannuation which has been retained and the interest thereon. The internal use of funds provided for superannuation is not a normal commercial practice for public companies in the private sector.
- 2.132 Of the total annual liability for superannuation and the amount provided for long service leave, the portion applicable to staff engaged on capital works is charged to fixed asset accounts.

Depreciation

- 2.133 The depreciation charge for the year ended 30 June 1981 amounted to \$557.3 million. Of this amount, \$15.3 million was charged to fixed asset accounts as it related to plant which was engaged directly in the construction and/or installation of fixed assets. A depreciation schedule which details the depreciation for each category of fixed assets, is included at Attachment A.

Depreciation policy and practices

- 2.134 The depreciation policy is described in Note 1 (ii) in Telecom's 1980--81 financial accounts. Depreciation is calculated on a straight line basis whereby the value of each category of fixed assets is allocated over the estimated service life for that category. Assets are assumed to have a nil residual value at the end of the service life.

Service life

- 2.135 The service life for each category of fixed assets is assessed annually. The review of service lives takes into account such factors as technical and commercial obsolescence factors, industry trends and, where possible, statistical turnover studies. The service life is estimated:
- . on the basis of 'life in one position' rather than the physical life of the asset; by this means, the practice of recovering material, reconditioning and reissuing it is 'built in' to the estimated service life;
 - . for the asset category and therefore can be an average of the assessed lives of each type of asset comprising the category.

- 2.136 Where the service life of a category of assets is adjusted, the asset and depreciation provision accounts are 'reconstructed' and the adjustments to the depreciation charges are amortised over the new service life.
- 2.137 The service lives currently applying for the categories of fixed assets are detailed at Attachment C. For comparison, the estimated useful lives of British Telecom's fixed assets are also shown at Attachment D.

Commencement of depreciation

- 2.138 Fixed assets are depreciated as from 1 July of the year following expenditure. This procedure is followed because it is not possible to identify, from the fixed asset records, the point in time that individual assets are put into, or held ready for, use.

Accounting standards for depreciation

- 2.139 Telecom's depreciation policy is not strictly in accordance with the Australian Accounting Standard, in that:
- . a nil residual value is assumed to apply at the end of the asset's service life;
 - . assets are not depreciated from the point in time individual assets are put into, or held ready for use.
- 2.140 However, Telecom has estimated the effect of these departures from the Accounting Standard (which are not unusual) and, based on these estimates, the effect on the accounts is not material.

Interest

- 2.141 In accordance with the principle of matching costs with revenue earned, interest which is deemed to relate directly to construction work in progress, or to plant engaged in the construction and/or installation of fixed assets, is capitalised.
- 2.142 The total interest paid and payable for the year ended 30 June 1981 amounted to \$456 276 000. Of this amount:
- . \$408 125 000 was charged directly to the profit and loss statement;
 - . \$39 761 000 was deemed to relate to construction work in progress and was therefore charged directly to asset accounts; as depreciation on new assets commences only on 1 July of the following year, none of this amount will have been expensed in the year in which the interest cost arises;
 - . \$8 390 000 was charged to internal services areas such as the workshops and automotive plant; this amount was further costed, through the application of job costs and internal hire rates to asset accounts or other expense accounts, as appropriate.

OTHER MATTERS

Annual leave costs

- 2.143 As disclosed in Note 1 (viii) to Telecom's 1980--81 financial accounts, leave costs are taken into account in the financial year in which leave is taken and are charged to expenses, with the exception that leave costs of staff employed on new construction work are charged to fixed asset accounts.
- 2.144 It is a generally accepted accounting practice that leave costs should be accrued in the year in which they are earned rather than charged as they are paid. Telecom have estimated that, had the costs of leave due to staff, but not taken as at 30 June 1981, been accrued, expenses for that year would have increased by some \$4.3 million and fixed asset values by some \$1.6 million.

Insurance

- 2.145 Telecom carries its own insurance risks with any losses being charged in the accounts for the year concerned. Commercial enterprises within the private sector do not normally carry all their own insurance risks. Thus, Telecom's financial statements do not include the cost of the insurance premiums which would normally be incurred by private sector companies, but they do include the effect of losses incurred, which, over the long term should approximately compensate.

FINANCIAL MANAGEMENT INFORMATION SYSTEM

INTRODUCTION

- 2.146 In the preceding papers we described the principles and accounting policies adopted in the presentation of Telecom's year end financial statements and the accounting systems underlying these statements.
- 2.147 In addition to providing information for annual (and six-monthly) published statements, the financial accounting system and subsidiary costing systems provide the basis of Telecom's financial management information system, providing reports to successive levels of management on a four weekly period basis. This paper reviews the main period financial reports produced in Telecom and the systems which provide information to those reports. It does not attempt to cover the total information system, but rather concentrates on information that is explained in financial terms. The paper is set out under three main headings:
- . the need for management information;
 - . Telecom's period financial reports;
 - . the financial information system.

THE NEED FOR MANAGEMENT INFORMATION

- 2.148 The management information system must necessarily follow the management philosophy, objectives and organisational structure.
- 2.149 If Telecom were organised along entirely commercial lines one would expect the financial management information system to focus on certain key financial performance indicators compared with budgets or targets at appropriate levels in the organisation. For example:
- . sales performance for the revenue earning units;
 - . profitability for the enterprise as a whole and for those organisational units within it which are organised as profit centres (these may be divisions, regions or product groups);
 - . operating and overhead costs incurred by responsibility centres;
 - . capital expenditure incurred and estimated costs to complete compared with authorisations;
 - . control information on the level of inventories, debtors and other elements of working capital;
 - . cash flow and working capital for the total enterprise and profit centres.

- 2.150 Since its formation in 1975, Telecom Australia has been transforming from a governmental towards a commercial style of management. However, it is still in somewhat of a hybrid situation, and the responsibilities of management for the achievement of profitability and return on investment, while recognised in principle, are not clearly specified. For this reason the emphasis in financial management reporting still appears to be geared towards the control of cash expenditure (both capital and operating expenditure combined) against the fiscal budget and the control of cash receipts for sales and services provided. The bulk of the management information provided to managers is of a statistical nature and there is detailed reporting of installation and development performance in physical terms and of operating performance in terms of fault service, demand, orders issued, connections achieved, etc.
- 2.151 However, before it would be feasible to develop the financial management information system further along commercial lines, considerable work would need to be done in specifying the key financial objectives of managers at each level in the organisation and this would probably require rethinking of some aspects of Telecom's organisation structure. Following the clarification of the management objectives and organisation structure, particularly the responsibilities for profitability, the management information system could then be developed to enhance the presently comprehensive statistical information base with the financial information needed for planning and controlling the profit performance of the organisation.

TELECOM'S PERIOD FINANCIAL REPORTS

- 2.152 We found it difficult to establish authoritatively the complete hierarchy of financial management reports currently produced within Telecom. It is possible that there are other reports which we have not seen. The position is complicated also by the fact that while certain information is required to be produced uniformly each period for consolidation into national reports at headquarters, the states have a degree of autonomy with respect to the management reports produced locally within each state. We did not visit all states and have based this assessment on the reporting systems in Victoria and New South Wales.
- 2.153 Reports are produced at three main levels as follows:
- . at headquarters to the 'Headquarters Co-ordination Committee' and to the Commission;
 - . at the state level to state managers;
 - . within states to operating managers.

Headquarters level

- 2.154 The Headquarters Co-ordination Committee, comprising the Chief General Manager, Deputy Chief General Manager, general managers and directors of headquarters departments and the Commission secretariat, meets monthly to review Telecom's operations. State Managers attend each quarterly meeting. The following main financial reports provided to this committee are compiled from the separate state reports:
- statements of cash receipts and cash expenditure on a state and Australia wide basis (capital and operating expenditure combined);
 - a comparison of cash receipts and cash expenditure with budgets for the period to date;
 - cash expenditure by type of expenses and cash receipts by revenue category compared with budgets for the period to date;
 - graphical presentation of the movement of telephone debtors;
 - stores stock on hand and movements for the period;
 - capital expenditure on a state and Australia total basis.
- 2.155 An abbreviated form of this information is reported to the Commission together with a projected profit and loss statement for the year and a projected balance sheet at year end. The projected profit and loss statement and balance sheet are presented in a very summarised form based on the budgets for the year, adjusted for any major variations that have occurred or are anticipated.
- 2.156 During the course of the financial year, apart from these projections, profitability is reported only at the half year. (We understand that a form of profit reporting at the March quarter has recently been added.) For period reporting purposes accruals are not calculated and earnings are not matched with operating expenditure. It is essentially cash reporting.

State level

- 2.157 The State Coordination Committee (comprising the State manager and departmental managers) receives the following main financial information each four weekly period:
- total cash receipts under each main revenue heading;
 - value of billings for the period analysed by major revenue categories;

- . total cash expenditure (operating and capital expenditure combined), analysed into the main budget headings of labour, materials and incidental expenses;
 - . the value of outstanding telephone debtors;
 - . the value of stock holdings;
 - . capital expenditure incurred, that is total labour, material and incidental expenses incurred under the engineering construction program and for purchases of motor vehicles and mechanical aides.
- 2.158 This information, which is supplemented by detailed statistical reports, is provided on a period and year to date basis compared with year to date targets (budgets).
- 2.159 Supplementary reports providing more detailed analysis of variations from budget are also provided, with explanations for any major variances in a particular area. However, there is no attempt to report profitability on a state basis.

Operating manager's level

- 2.160 The detail of the financial reports produced within states varies from state to state. The reports generally have as their source the responsibility accounting system, with certain costs recharged through the cost accounting system and the allocation of capital, maintenance and certain overhead expenditure into plant accounts. Examples of reports received are:
- . by section managers -- a report on the cash and 'costed' expenditure incurred by the section;
 - . by branch managers -- a report on the total cash and 'costed' expenditure incurred by the sections within the branch;
 - . by departmental managers -- a report on the total cash and 'costed' expenditure incurred by branches throughout the department.
- 2.161 The reports detail, under budget heads (types and items of expenditure):
- . period and year to date expenditure incurred (operating and capital expenditure combined);
 - . period and year to date budget expenditure;
 - . variation from budget for the year to date.

2.162 In respect of capital expenditure and maintenance works undertaken by the engineering, operations and commercial departments, various reports are produced by the plant account costing system detailing the expenditure incurred for each plant account at the section, branch and department levels and for the state in total. These reports provide information for monitoring total expenditure on capital and maintenance works against budgeted expenditure at each of these management levels, but the systems provide this information on a plant account basis and do not generally report on the costs of a particular project compared with the estimates for that project. The reporting system does not recognise committed costs not yet paid. There is a separate major works order costing system (refer our paper on capital expenditure) which provides individual project cost information four weekly to district engineering management.

THE FINANCIAL MANAGEMENT INFORMATION SYSTEM

2.163 In assessing the adequacy of the financial management information system at Telecom there are two main considerations:

- . whether the reports produced meet the needs of management;
- . whether the system by which they are produced is efficient and effective.

The structure of the present system is illustrated at Attachment E.

2.164 We have raised earlier the question of objectives and organisation structures of Telecom management. As it is presently organised the information provided may well be adequate for management needs and we have not, in the time available, conducted a review of management's attitudes to the adequacy of the information they receive. However, if Telecom were organised along typical private enterprise lines it is our opinion that the financial management information produced during the year, as far as it has been explained to us, would be considered inadequate for effective management control.

2.165 To meet normal commercial requirements the reports would need to be developed to include significantly more information on operating costs and revenues and profitability, distinguished from capital expenditure and the capital expenditure reports would need to be developed to include commitment reporting on a project by project basis where appropriate. The concept of responsibility accounting needs further development to provide reports on controllable costs and revenues regularly at all management levels.

2.166 The basic accounting and costing systems needed to support the kind of commercial reporting system described would need to be developed on a standardised national basis, even though the data processing and report preparation may rightly be done at regional levels. What is important

is that there should be a standard form of reporting throughout the organisation nationally and an easily understood manual of accounting and reporting for use by receivers and providers of information nationally.

- 2.167 In developing the management information system consideration should be given to the feasibility of simplification of the present cost accounting and plant costing systems to reduce the extent of the recycling of prime costs. Consideration could also be given to the further development of standard costing methods in certain of the recurrent maintenance and installation processes.
- 2.168 We have not examined critically the data processing systems used to generate management information in Telecom and are not in a position to comment on their effectiveness or efficiency from an EDP system point of view. There are a number of national systems and some local systems processed mainly on EDP installations in Victoria and New South Wales, and a number of developments are taking place.
- 2.169 One of the most important developments is the planned installation of a general ledger and reporting software package, ACCUDATE, which is intended to facilitate the preparation of period profit statements and other management reports.
- 2.170 When implemented, ACCUDATE is intended to provide the basis of a more commercially oriented management information system. We have not examined the ACCUDATE specifications in this overview but, subject to its appropriateness as a suite of software for Telecom's needs, we support the introduction of an integrated general ledger and reporting system as a necessary step in Telecom's commercial development.
- 2.171 However, it is clear that, before ACCUDATE or any other such system can be successfully implemented, considerable work needs to be done in defining the organisational and reporting philosophy and structure appropriate for Telecom's future operations as a commercially oriented enterprise, and specifying the hierarchy of management reports and the underlying charts of accounts, responsibility accounting, costing and budgetary control systems.
- 2.172 Some of the conceptual questions that will need to be answered before developing the integrated reporting system include:
- . what measure(s) of profitability are most appropriate for Telecom -- e.g. return on capital, funds employed or total assets; net profit to sales etc;
 - . where should profitability be reported organisationally -- e.g. at national level only, at regional level, by functions, by products, by customers etc, and to which levels of management;

- . what revenues and costs are controllable at the different management levels in the organisation -- how should the responsibility accounting concept be developed in practice;
- . who is responsible for controlling fixed capital and working capital;
- . should capital expenditure be controlled on a project basis or, as at present, in total by plant account;
- . how frequently should profit based reports be produced -- quarterly, monthly, weekly etc;
- . what levels of detail in variance analysis are appropriate in reporting variances from budget or standard -- should reports be comprehensive or on an exception basis;
- . how will the system be integrated with the needs for product costing for investment analysis and pricing purposes.

2.173 In our experience, the specification of an integrated management reporting system such as proposed with ACCUDATE is a major task, which will need careful planning, considerable resources and significant time to complete satisfactorily. Once designed and implemented, and when management have been trained and have adjusted to the management approach involved, the benefits can be substantial.

APPLICATION OF CURRENT COST ACCOUNTING PRINCIPLES

INTRODUCTION

- 2.174 Under the terms of reference we were to assess the implications of the adoption by the Commission of current cost accounting principles, in lieu of historical cost accounting.
- 2.175 The three principal areas of a company's accounts that are most affected by inflation and hence give rise to adjustments when current cost accounting principles are applied are:
- . fixed assets and depreciation;
 - . inventories and cost of goods sold;
 - . monetary items.
- 2.176 In a capital intensive operation such as Telecom, the most significant effect of inflation arises in respect of fixed assets and depreciation.
- 2.177 We do not consider that there would be a significant effect on inventories and cost of goods sold given that Telecom's inventories are valued at a standard cost rate which is updated each year and that inventory items are mainly used in capital works or for maintenance rather than held for resale.
- 2.178 The adoption of current cost accounting principles would effect Telecom's monetary items, particularly in respect of its long term debt funding. At the request of the Committee, we have not examined this area in detail. However, because of the financial impact of revaluing fixed assets in a highly geared operation such as Telecom, we discuss this aspect briefly at the end of this paper.

FIXED ASSETS AND DEPRECIATION

- 2.179 Telecom revalued some of its fixed assets in 1975, and has since conducted an internal exercise, covering the years 1975--76 to 1980--81. This exercise extended the initial revaluation to most other fixed asset categories and updated the earlier revaluation for price changes occurring since 1975. As our assessment of the effects on fixed assets and depreciation resulting from the adoption of current cost accounting principles has been based on the results of these assessments, we briefly comment upon the principles employed and the methods used.

Revaluation of fixed assets, 1 July 1975

- 2.180 Telecom revalued certain classes of communications plant as at 1 July 1975. This revaluation effectively resulted in the restatement of some 68 percent of the total fixed assets and increased the net book value of fixed assets, as at 1 July 1975 by \$1287.5 million.

- 2.181 The communications plant which was not revalued was excluded on the grounds that:
- . due to technical advances the current replacement cost was not greater than the historical cost; or
 - . the assets were of a more or less permanent nature; for example, ducts and conduits.
- 2.182 Also excluded from the revaluation were the other categories of fixed assets such as buildings, motor vehicles, mechanical aids, etc.
- 2.183 The net book value of the revalued fixed assets represents some 28 percent of the total net book value of fixed assets as at 30 June 1981. A schedule of fixed assets as at 30 June 1981, which distinguishes between those assets carried at 1 July 1975 valuation and those assets included at historical cost, is included at Attachment A.
- Methodology used
- 2.184 The communications plant was revalued by the application of the Capital Works Index (CWI). A review of Telecom's CWI is at attachment F.
- 2.185 The CWI is an internal index, constructed each year from Telecom's own records, which measures the average annual movement in the cost of capital works. The CWI is composed of the following three major indexes, each of which are, in turn, built up from component indexes:
- . materials index;
 - . labour index;
 - . incidentals index.
- 2.186 The overall CWI is a weighted average of these three major indexes in which the weighting is the percentage of the current year's expenditure on materials, labour and incidentals.
- 2.187 The materials index measures the average annual percentage change in costs of the major items of materials used in capital works. The annual percentage change for each item is weighted according to the percentage of the current years expenditure on each of the major items of materials. The regimen of the index covers almost all direct material expenditure on capital works.
- 2.188 The labour index measures the average annual percentage increases in Telecom's wages costs. The regimen of this index comprises virtually all staff designations, excepting the more senior management levels. The annual percentage increases for each designation are weighted on the basis of the percentage of each designation's wages costs to total wages costs.

- 2.189 The incidentals index measures the average annual percentage cost increase in incidental expenditure. The regimen of this index covers the major types of incidentals expenditure and the annual average percentage cost increases for each type are weighted on the basis of the percentage of the current year's expenditure on each item.

Update of 1975 revaluation

- 2.190 Telecom has carried out a notional exercise to update the revaluation conducted in 1975 for inflation that has occurred up to 30 June 1980. Also included in this revaluation exercise were certain other categories of fixed assets which had been excluded from the 1975 revaluation.
- 2.191 The notional revaluation applied to some 86 percent of the gross book value of fixed assets as at 30 June 1981. Assets not included in this exercise were those assets considered to be of a permanent nature or were of the type where technical advances have resulted in replacement costs being less than the original cost. Such assets consisted of communications plant which had been excluded from the 1975 revaluation, computer equipment and office machines.

Methodology used

- 2.192 Various indices were used to revalue the different categories of fixed assets. The indices used were as follows:
- the Capital Works Index was used to revalue communications plant and other plant and equipment such as workshop plant, mechanical aids, etc;
 - building and leasehold improvements were revalued on the basis of an internally constructed building index; this index comprised the weighted average of the wholesale price index for materials, excluding housing, and the index for adult wage rates in the building and construction industry;
- for motor vehicles, the motor vehicle component of the Consumer Price Index was used;
- the Consumer Price Index was used to revalue light and power equipment, furniture and other equipment.

Commentary on methodology used

- 2.193 In our opinion, the capital works index has been carefully compiled and applied so as to reflect the effect of price changes on Telecom's plant and other equipment. It is a broad index approach and this may have merit, having regard to the wide range of cost ingredient factors that impound into the Telecom's capital work program. However, we would make the following three points on the methodology used:

- . whilst the assets being revalued were those on hand as at 30 June 1981, the indexes used reflected price changes only up to 30 June 1980;
- . some 14 percent of the gross book value of fixed assets have not been revalued on the basis that the assets were 'considered to be of a permanent nature or were of the type where technical advances have resulted in replacement costs being less than the original cost'; on the former point, it would be unreasonable to expect any asset to last for ever and some allowance for inflation should be anticipated, particularly having regard to the exceedingly long life cycle of such assets; on the later point, if prices are in fact decreasing because of technical advances, consistent application of the current cost accounting principle should call for some reduction in the value of these assets; however, it will be seen that the effect of these two cases is to some extent (not quantifiable) offsetting and for this reason the basis adopted for this relatively small proportion of fixed assets may be acceptable;
- . the CWI uses a different method from other common indices (such as the CPI) -- the difference being mainly in the methods of weighting and chaining the index -- it is essentially a current weighted index.

2.194 Subject to these comments, we believe that the methodology adopted provides a reasonable indicator, for the purposes of the Committee's review, of the impact a current revaluation of fixed assets would have on the financial position of Telecom. In this regard, we expect that the Committee will be well aware that an index is only an approximation of the effects of price changes and the wider the extremes of variation in price movement in different sub-categories of assets, the less reliance can be placed on the individual revaluations of those particular assets.

2.195 Greater precision could be achieved by developing a more specific series of indexes applicable to the various groups of assets which it is known are subject to particular price change patterns. We would recommend that consideration be given to such a refinement of the CWI for any future revaluations to be recorded in the books of Telecom.

RESULTS OF THE REVALUATION EXERCISE

2.196 The accounts for year ended 30 June 1981 have been restated to incorporate the adjustments which result from fixed assets being valued on a current cost basis. A copy of the restated accounts is at attachments G and H.

- 2.197 In summary, the effects on the accounts are as follows:
- . the gross book value of fixed assets, as at 30 June 1981 increased by \$4 856 million to \$16 556 million, an increase of 42 percent;
 - . the net book value of fixed assets increased by \$2 779 million to \$10 977 million, an increase of 34 percent;
 - . depreciation expense for the year ended 30 June 1981 increased by \$228 million to \$762 million; profit for year therefore decreased from \$232 million to \$4 million;
 - . the additional depreciation expense for the year ended 30 June 1981, together with the additional depreciation expense applying in the years 1975--76 to 1979--80, reduced the general revenue reserve by some \$731 million to \$405 million;
 - . the asset revaluation reserve increased by \$3 510 million to \$4 798 million.
- 2.198 The effect of the additional depreciation on the reported profits for each year since 1975--76 is summarised in a table at Appendix I.
- 2.199 The most significant points arising from valuing Telecom's fixed assets on a current cost basis are that:
- . it demonstrates that the true earning rate of the business is declining and Telecom is only just earning sufficient revenue to meet the real (current) cost of providing its services;
 - . it discloses the actual amount of funds required to be retained to replace existing assets.
- 2.200 When considering the effect of these revaluations on the funding, cash flows and rate setting policies of Telecom, however, consideration should also be given to the funding and gearing policies adopted in the past, and likely to be adopted in the future, by Telecom.
- 2.201 In this regard, it is common practice for capital intensive organisations to partly fund the increasing cost of fixed asset replacement by resorting to additional borrowings. However, such additional borrowings in real terms may be no more than the restoration of the previous gearing ratio based on current asset values.
- 2.202 At the other extreme, the policy may be to maintain (or even reduce) borrowings at existing money levels. This alternative policy would effectively result in the gearing ratio progressively reducing with corresponding increases in the internal funding of asset replacement.

2.203 The financial implications of these two alternative extremes of funding policy, when viewed in the context of adopting current cost accounting for depreciation and pricing, can in certain circumstances have significant consequences on the cost of services provided to current customers when compared with the cost of services to be borne by future customers.

TAXATION AND OTHER DUTIES

INTRODUCTION

- 2.204 The purpose of this briefing paper is to report our findings in estimating the value of taxes, royalties, duties, etc payable if Telecom was not statutorily exempted from these charges.
- 2.205 Our estimates of taxes and other duties for the year ended 30 June 1981 have been made largely by reference to information contained in Telecom's Annual Report 1980--81. Where more detailed information was required, we obtained it direct from Telecom personnel, who also provided us with copies of working papers which they had prepared in producing their own estimates of tax liabilities for submission to the Committee. In making our estimates of taxes and duties other than income tax, we have found it necessary, having regard to available time and the practicalities of obtaining detailed information for ourselves, to make extensive use of Telecom's working papers, commenting on areas which we consider would affect the accuracy of our estimates.
- 2.206 Our comments on detailed aspects of our estimates are set out in the main body of this paper. A schedule supporting our estimate of the hypothetical liability to income tax for the year ended 30 June 81 is at Attachment J.

SUMMARY OF ESTIMATES

- 2.207 We set out below a summary of our estimates, which represents total liabilities in each area of taxation for the year ended 30 June 1981:

	<u>\$ millions</u>
Income tax	76.0 (1)
Sales tax	81.0
Payroll tax	67.0
Customs and other duties	46.0
Motor vehicle registration and insurance	8.0
Local and state taxes	55.0

- (1) Refer attachment K regarding recently announced new tax depreciation rates and allowances which could render the liability for income tax insignificant in the future.

- 2.208 If these figures were incorporated in Telecom's financial statements for 1980--81, the effects would be apparent both in the Profit and Loss Statement and throughout the Balance Sheet. Furthermore, it would be necessary to consider the provision of deferred taxation in respect of certain items of income and expense where tax treatment differs from accounting treatment. We consider these matters to be beyond the scope of this assignment.

- 2.209 We have estimated income tax on the assumption that Telecom was an existing taxpayer at 1 July 1980. We consider this to be the most appropriate approach in providing the Committee with meaningful information. Clearly, if a tax exempt body such as Telecom became taxable at any given point in time the calculation of its income tax liability for its first year of income as a taxpayer would be distorted in some areas and would be significantly affected by the manner in which assets were brought to account. As an example, depreciation could be increased if assets were transferred to a new taxpaying company at market valuations in excess of book values.
- 2.110 We would also point out that if Telecom was not tax exempt it may well be that tax considerations would influence the manner in which its operations were financed. Tax efficient financing devices such as leveraged leasing might be employed which would of course also have significant effects upon financial statements.
- 2.211 Telecom's exempt taxation status gives rise to a situation in which its accounting records are not maintained in a manner which readily provides the information necessary for the calculation of taxation liabilities. This is particularly so in the case of fixed assets, and this area is dealt with in detail in our comment on estimates. The problems of dissemination of tax information have therefore rendered the tax estimates less than precise, although we consider that all areas of materiality have been covered. In particular we have adopted a prudent approach in the estimation of liability to income tax, with the result that our estimate of \$76 million is more likely to be overstated than understated.

COMMENTS ON ESTIMATES

- 2.212 Our comments on the principles underlying our estimates and the assumptions employed therein, are dealt with below under the following headings:
- . income tax:
 - income recognition;
 - tax depreciation;
 - investment allowance;
 - income tax effects of other taxes and duties;
 - taxed provisions;

- provision for doubtful debts;
- capitalised interest;
- stores;
- prepayments;
- other matters;
- . sales tax;
- . customs and other excise duties;
- . motor vehicle registration and insurance;
- . payroll tax;
- . local and state taxes;
- . stamp duties.

Income tax

Income Recognition

- 2.213 In quantifying earnings for inclusion in its annual profit and loss account, Telecom takes credit for services provided but not billed at year end. We consider that this treatment of unbilled services is in line with that which would be required of a taxpaying concern for the preparation of income tax returns. No adjustments in this respect are therefore necessary in computing an estimated liability to income tax.

Tax depreciation

- 2.214 This is an area which posed considerable problems for us in terms of making an independent estimate within the limits of our assignment. Our discussions with Telecom personnel revealed that, in producing their tax estimates for the Committee, they used a computer program to carry out the necessary calculations. We have used the results of this exercise, provided to us by Telecom personnel, in our own estimate of income tax. The calculation is however subject to a number of weaknesses which are discussed below in conjunction with an explanation of the method of calculation.

- 2.215 In order to be able to calculate a tax depreciation charge for the year ended 30 June 1981 it is first necessary to analyse the tax depreciable assets owned by Telecom at the beginning of that year by reference to asset type and age and, on the basis of this analysis, calculate the tax written down values of the assets at that point in time. Telecom's computer program was provided with information on the value of purchases in categories of assets for each relevant previous year. Disposals of assets were not however taken into account with the result that the balances produced by this exercise include amounts in respect of assets previously disposed of by Telecom.
- 2.216 This situation results from the fact that Telecom's method of accounting for fixed assets, does not enable the disposal of individual assets to be distinguished. No profit or loss is calculated on the disposal of an asset other than land and buildings, and sales proceeds are merely credited to the revenue account in the year of disposal.
- 2.217 The tax effect of the above treatment of disposals of fixed assets is that the estimated taxable income is overstated by the inclusion of the sale proceeds, but that this is to some extent offset by the overstatement of the tax depreciation deduction which includes depreciation on assets previously disposed of by Telecom. The extent to which these two factors cancel each other out in a given year is not capable of estimation, and in the circumstances we do not consider that any realistic adjustment can be made to improve the tax estimate.
- 2.218 The diminishing value method of tax depreciation was used with the intention of maximising the amount of tax depreciation. We have used the results obtained from the program when it was run under the assumption that one half a year's depreciation was available on assets in the year of purchase. This assumes that assets were purchased at the mid point of each year, or constructed equally throughout each year and is in line with practice adopted by the majority of large taxpayers. We consider it the most appropriate approach for the estimation of Telecom's income tax liability.
- 2.219 All assets capitalised in the accounts under the category of Land and Buildings were excluded from the tax depreciation calculations. It is possible that some proportion of buildings expenditure might qualify for tax depreciation under the extended meaning of plant for taxation purposes.
- 2.220 The total value of additions to fixed assets for the year taken into the tax depreciation calculation is broadly in line with the total value of additions other than land and buildings, disclosed in the Statistical Supplement to the Annual Report 1980--81. Adjustment was made to eliminate capitalised depreciation and capitalised interest. We are in agreement with the elimination of capitalised interest. Capitalised depreciation may, however, qualify for tax depreciation in as much as it forms part of the capitalised costs of manufacture or installation of tax depreciable assets. The amount of additional tax depreciation which might be available in this respect is not significant.

- 2.221 Overall additions to fixed assets include approximately \$124 million of capitalised administration overheads attributed to the construction and installation of assets. We would not dispute the capitalisation of these amounts, but we would point out that a taxpaying organisation might in similar circumstances charge some proportion of these expenses to revenue in order to achieve accelerated tax deductions (refer also paragraph 2.118 of our briefing paper on standards and principles in financial statements).
- 2.222 In establishing the tax rates of depreciation used for each category of asset, Telecom, wherever possible, followed the rates accepted by the Taxation Office. Where no rate is specified for a particular category the rate for the closest equivalent asset type was used. We agree with this principle for the purposes of this estimate. The categories are, however, broad, and we would point out that in practice it might be possible to negotiate with the Commissioner of Taxation specific rates of tax depreciation for specialised equipment which would be likely to accelerate the availability of tax depreciation.
- 2.223 The depreciation calculations do not take into account the value of sales tax, payroll tax, customs duties and any other such charges which might have been capitalised if Telecom was not statutorily exempted from them. The inclusion of such taxes would result in an increased tax depreciation charge. Based on estimates of the proportion of these taxes which might have been capitalised for 1980--81, and assuming that none of the amounts concerned were attributable to additions to land and buildings, we consider that additions for that year upon which depreciation has been calculated are understated by approximately \$128 million. Using the average rate of depreciation for all assets, this gives rise to a possible increase in tax depreciation for the year of approximately \$3 million. Information is not available to enable us to accurately assess the amount by which the brought forward tax written down values would have been similarly affected and the resultant effect upon 1980--81 tax depreciation. If, however, the brought forward tax written down values are uplifted by the proportion that attributable assets bear to tax depreciable additions for 1980--81, it is possible to estimate that the tax depreciation charge for the year would be increased by a further \$38 million in this respect.
- 2.224 In summary, although we consider that the estimate of depreciation which we have used is deficient in many areas it provides the best approximation available. It could only be improved upon if a major exercise was undertaken to trace all individual fixed asset movements since Telecom was established in 1975. Total tax depreciation taken into account in our estimate of liability to income tax amounts to approximately \$339 million. This would change significantly if the recently announced new taxation depreciation rates and allowances referred to in attachment K were applicable.

Investment allowance

2.225 Our estimate of investment allowance for 1980--81 has been calculated upon additions to fixed assets for 1980--81 excluding land and buildings, and as adjusted for capitalised interest and depreciation. The rate of 18 percent of cost has been used, which is the rate applicable to acquisitions on or after 1 May 1981. We consider the application of this rate to all acquisitions to be reasonable and in line with the principles adopted in our estimate in calculating tax depreciation on additions to fixed assets. The legislation governing the availability of investment allowance specifically excludes claims for certain types of assets. We have considered below those types of assets purchased by Telecom which might be ineligible for investment allowance:

- . The allowance is only available in respect of units of property costing in excess of \$500. Thus a large volume of low value items may have been incorrectly included in our overall estimate. One such example might be Telecom's purchases during the year of new telephone instruments. We note from the Annual Report for 1980--81 that expenditure on telephones amounted to \$28.6 million in the year. Thus if all this expenditure was ineligible, investment allowance would be reduced by approximately \$5 million in this area alone.
- . In order to qualify for the allowance in a given year, the assets must be either brought into use during the year or be installed ready for use at the end of that year. Expenditure capitalised for 1980--81 in respect of communications plant in the course of construction at year end amounted to approximately \$257 million. However, similar expenditure amounting to \$250 million appeared in Telecom's 1979--1980 accounts. On the assumption that plant under construction is brought into use within twelve months of the date of the balance sheet in which it appears, adjustment need only be made in respect of the increase in value of \$7 million. The effect of this adjustment would be to reduce our overall estimate of investment allowance by approximately \$1 million.
- . Investment allowance is not available in respect of motor cars, station wagons, panel vans, utility trucks or similar vehicles, or other road vehicles designed to carry a load of less than one tonne or less than nine passengers. The analysis of Telecom's motor vehicle fleet used in estimating motor vehicle registration charges discloses that a large part of the fleet consists of vehicles of a type which do not qualify for investment allowance. Expenditure on the purchase of all types of motor vehicles in 1980--81 was approximately \$30 million. Assuming that ineligible vehicles accounted for more than 50 percent of this expenditure, a reduction could therefore be made in our overall estimate of investment allowance for the year of between \$3 million and \$5 million to cover this point.

- 2.226 It has not been practicable within the limits of this assignment to obtain detailed figures to support adjustments to our overall calculation of investment allowance based on total additions, but in order to recognise the existence of ineligible additions we have reduced our overall estimate of investment allowance by \$10 million. The total deduction for investment allowance taken into account in our estimate of liability to income tax amounts to \$186 million.

Income tax effects of other taxes and duties

- 2.227 In calculating estimated taxable income for 1980--81, we have made adjustment to reflect the income tax effects of the inclusion of our estimates of other taxes and duties. The effects upon fixed assets and the calculation of tax depreciation have been dealt with above. The greatest impact, however, is in the area of amounts which would have been charged against revenue. These amounts would all be fully deductible for income tax purposes, and our estimate of income tax payable incorporates the effects of their inclusion. As a result of the inclusion of these amounts taxable income is reduced by \$129 million.

Taxed provisions

- 2.228 It is necessary to make adjustments in respect of certain provisions in order to reflect the fact that deductions would only be available for amounts actually paid by Telecom during the year. Our adjustments to taxable income in respect of such provisions are limited to the proportion of the total provisions shown in the balance sheet which have actually been charged to the Profit and Loss statement. These amount to increases in taxable income of approximately \$19 million and \$41 million for long service leave and superannuation respectively.
- 2.229 With regard to the provision for superannuation we note that with the exception of that portion of the total annual liability which is required to meet Telecom's annual share of pension payments to former staff, the annual liability for contributions is retained to assist in funding capital works. These retentions are subject to an annual interest charge which is embodied in the total provision, the tax effects of which are mentioned below. As deductions for superannuation contributions would only be available on a paid basis, we would expect a tax paying organisation to obtain full deductions in each year for superannuation by actually paying over the contributions to the fund and then borrowing back some proportion to meet requirements for financing capital works.

Provision for doubtful debts

- 2.230 In accordance with normal practice, we have added back to estimated taxable income the increase in provision for doubtful debts. A deduction is only available in respect of specific debts written off. Taxable income has been increased by \$1 million in this respect.

Capitalised interest

- 2.231 We have adjusted taxable income to take into account a deduction for interest which has been capitalised for accounts purposes. We consider that this is the only way in which interest should be treated for tax purposes. In making this adjustment we have eliminated the interest charge relating to superannuation which is unpaid at year end and therefore considered by us to be non deductible in the year. The overall adjustment for interest reduced taxable income by approximately \$14 million.

Stores

- 2.232 Stores in stock consist of materials and supplies for construction, maintenance, and operations. Workshops' work in progress is valued at full absorption cost which is an appropriate method of valuation for tax purposes.
- 2.233 As Telecom's business does not involve the holding of stocks of goods for resale the value of stores effectively represents expenditure which is awaiting capitalisation in fixed assets, or expensing against revenue as maintenance or other similar expenditure. Consequently no tax deductions would generally be available for this expenditure until the items were either capitalised or otherwise utilised. We consider that if Telecom was a taxpaying organisation, it might be possible to obtain some acceleration of deductions in respect of expenditure on stores by means of earlier capitalisation into fixed assets for tax depreciation, or by identifying stores of a consumable nature which could be expensed as and when purchased.
- 2.234 No attempt has been made to quantify possible adjustments for tax purposes in this area as detailed information would be required which is not readily available. The value of stores included in Telecom's balance sheet at 30 June 1981 was approximately \$254 million.

Prepayments

- 2.235 Prepaid expenses are generally deductible for income tax purposes in the year in which they are paid on the grounds that they have been incurred at the time of payment. Thus, where prepayments are claimed annually, the increase or decrease in the balance of prepayments from one year end to the next is incorporated as an adjustment in calculating taxable income. The increase in the balance of prepayments, which consists largely of rentals and prepaid annual leave, has been deducted in our estimate of taxable income. This amounts to approximately \$3 million.

Other matters

- 2.236 . Investment income: a measure of deferral of income might be possible in respect of interest accrued at year end but not yet received. No adjustment has been made in this respect as the amounts involved are relatively small;
- . Maintenance of plant: the charge for maintenance may include some items which should for tax purposes be capitalised and depreciated. However, in view of the fact that Telecom's capitalisation policies are extensive in their scope, we consider it unlikely that such items would be of a material amount;
- . Loan flotation expenses: for tax purposes such expenses are deductible over the term of the loan or five years, whichever is the shorter. Telecom's accounting practice is to fully expense these amounts in the year in which incurred. A review of amounts expensed over the five years ended 30 June 1981 discloses that any tax adjustment in this respect would not be material in size.

Sales tax

- 2.237 We have based our estimate of the value of sales tax from which Telecom was statutorily exempted in the year ended 30 June 1981 upon information supplied to us by Telecom of the total value of its purchases of materials for that year as adjusted to exclude purchases of petrol. The liability to sales tax has been calculated by applying a general rate of 15 percent to material purchases, with the exception of certain broadcast receiving equipment which would have suffered the higher rate for the year of 27.5 percent.
- 2.238 Our estimate is approximate and suffers from the following weaknesses:
- . although a general review of the types of materials purchased by Telecom revealed that the rate of 15 percent, would have been widely applicable for the year ended 30 June 1981, significant quantities of goods which are exempt from sales tax, such as conduits, piping, hand tools etc, were acquired;
 - . suppliers may not be required to charge sales tax on their actual selling prices, and in certain circumstances lower taxable 'sales values' may be available;
 - . if Telecom has been a taxable entity for sales tax purposes, sales tax liabilities would also have arisen on any taxable goods such as communications equipment, or even printed matter, which is manufactured for its own use. In such circumstances, sales tax on self manufactured goods would have been payable at the general

rate for the year ended 30 June 1981 of 15 percent, but would have been based on a sales value of 'manufactured cost + 10 percent' thereby bringing into charge some measure of attributable labour costs and overheads. In this context it is important to note that self manufactured goods must be distinguished from self installed goods in respect of which labour and overheads are also capitalised by Telecom. Information regarding the value of goods manufactured by Telecom for its own use in the year ended 30 June 1981 is not readily available, although we understand that expenditure undertaken by Telecom in respect of self manufactured assets is small by comparison with expenditure undertaken in the installation and assembly of communications equipment.

- 2.239 In summary we consider that our estimate of sales tax for the year ended 30 June 1981 is likely to be overstated rather than understated, but within the scope of this assignment we are unable to produce a more accurate estimate. We consider that our estimate is unlikely to be materially incorrect. Of the total estimated liability of \$81 million, \$71 million has been attributed to capital expenditure and \$10 million to revenue expenditure. This allocation has been based upon the results of a similar exercise carried out by Telecom in respect of the year ended 30 June 1980 and we consider it reasonable in view of the types of purchases undertaken by Telecom.

Customs and other excise duties

- 2.240 We have estimated duties in two areas -- the importation of telecommunications equipment and components, and purchases of petroleum and diesel fuel. Our estimates were made by applying the relevant rates of duties for the year to the values of the different types of dutiable purchases as supplied to us by Telecom personnel. Of the total estimated duties of \$46 million, \$36 million has been allocated to capital expenditure and \$10 million to revenue expenditure. This allocation has been made by reference to the results of a similar exercise carried out by Telecom in respect of the year ended 30 June 1980, and we consider the allocation reasonable in terms of the nature of the expenditure on which the duties have been estimated.

Motor vehicle registration and insurance

- 2.241 Our estimate of liability to motor vehicle registration and third party insurance has been based upon the details of Telecom's motor vehicle fleet as disclosed in the Statistical Supplement to its Annual Report 1980--81. Our estimate of \$8 million represents an average composite unit cost of approximately \$330 per vehicle, which we consider reasonable in view of the high annual charge which would arise on the larger vehicles such as semi-trailers. This amount has been wholly allocated to revenue expenditure for the purposes of our estimate of income tax liability.

Payroll Tax

- 2.242 We have estimated Telecom's liability to payroll tax for 1980--81 by applying a rate of 5 percent to the total salaries and wages expenditure for the year of \$1 330 million as disclosed in the Statistical Supplement to the Annual Report. Minor exemptions from payroll tax would have applied in certain states, and the rate of payroll tax for 1980--81 in the Northern Territory was 4.5 percent. We do not consider that either of these factors would materially affect the total estimated liability of \$67 million. Of this total estimated liability, \$21 million has been attributed to capital expenditure and \$46 million to revenue expenses. This allocation has been based on the results of a similar exercise carried out by Telecom for 1979--80 and we consider it reasonable in view of the high proportion of labour costs which are capitalised.

Local and state taxes

- 2.243 It is necessary to recognise the fact that Telecom's tax-exempt status also extends to the area of local and state taxes, such as land tax and rates generally, although payment is made for services provided such as power, water supply and sanitation. The information which we require in order to make accurate independent estimates in these areas is not however readily available, and the circumstances we have had to rely upon Telecom's own estimates as provided to us by their personnel. We set out below our observations on these estimates, which amount in total to \$55 million for 1980--81. Our comments should in no way be construed as critical of Telecom's adopted methods, as we appreciate that they could not necessarily be improved upon without undertaking a detailed valuation of the Commission's properties.
- 2.244 Telecom have estimated liabilities for 1980--81 in two areas -- land tax and municipal rates.
- 2.245 Land tax is charged by reference to unimproved capital values as assessed by the Valuer General. We understand that unimproved capital values have not been established in respect of land owned by Telecom. The estimated liability to land tax has therefore been based upon Telecom's estimate of the total market value of its land for 1980--81. This has been estimated as \$920 million, which represents approximately ten times the original cost of the land as shown in the 1980--81 accounts. We are unable to comment upon the validity or reasonableness of this valuation. We would, however, point out that in general unimproved capital values as assessed by the Valuer General fall short of current market values due to a time lag in their determination. As a result we consider that if \$920 million is an accurate assessment of current market values for 1980--81, the estimate of land tax made by reference to this figure is overstated to some extent.
- 2.246 In estimating the liability to land tax for 1980--81 of \$23 million Telecom have applied a general rate of 2.5 percent to estimated market value. The rates of land tax and the levels of exemptions were different for each State in 1980--81, but we

consider that the use of a general rate of 2.5 percent would provide a reasonable approximation if applied to accurate unimproved capital values.

2.247 Telecom's estimate of liability to municipal rates for 1980--81 is \$32 million. This has been calculated by reference to estimates of market value for 1980--81 of both land and buildings. Municipal rates are generally levied by reference to rateable values placed upon each individual property, whereas charges for utilities may be levied by reference to other factors such as volume of usage. Owing to the wide range of variables which would have to be considered in assessing the reasonability of an estimated total liability in this area, we are unable, within the scope of this assignment, to comment further upon the estimate of municipal rates produced by Telecom.

2.248 In order to recognise the existence of liabilities in the areas of land tax and rates generally, we have adopted Telecom's estimates as our own, and have incorporated the total liability of \$55 million as an expense in calculating the income tax liability for 1980--81.

Stamp duties

2.249 Specific provision is contained within the Telecommunications Act 1975 to exempt Telecom from stamp duties in respect of certain types of transactions. We understand from our discussions with Telecom personnel that no stamp duties whatsoever are paid by the Commission, but that no attempt has been made to estimate liabilities to stamp duties which could have arisen in 1980--81. Because stamp duties are levied on a wide range of transactions and at rates which vary from State to State, this is not an area which lends itself readily to estimation. In the circumstances, we recommend that Telecom should be asked to provide the Committee with an estimate of the value value of stamp duties which might have been suffered on its transactions in 1980--81.

CAPITAL EXPENDITURE

INTRODUCTION

- 2.250 The provision and development of the national telecommunications system involves a significant, ongoing program of capital expenditure. This is illustrated in the table below which shows the additions to Telecom's fixed assets in each of the past five years.

YEAR ENDED 30TH JUNE	COMMUNICATIONS PLANT \$ millions	LAND AND BUILDINGS \$ millions	OTHER PLANT EQUIPMENT \$ millions	TOTAL \$ millions
1977	712	125	61	898
1978	779	88	70	937
1979	793	71	59	923
1980	857	76	70	1 003
1981	1 012	73	79	1 164

- 2.251 The question of Telecom's strategy for capital expenditure and the approaches to investment evaluation and financing were dealt with in some detail in a report by McKinsey & Co. in June 1980 to the Department of Communications. In accordance with our brief we have not attempted to re-examine the matters covered by that report in any depth. The purpose of this paper is to provide an overview of Telecom's procedures for control of capital expenditure, under the following main headings:

- . capital expenditure budgeting;
- . progress control and reporting.

CAPITAL EXPENDITURE BUDGETING

- 2.252 The planning and programming of capital investment is an extensive and involved process, culminating, each year, in the production of capital works programmes which detail the proposed capital investment in telecommunications plant and equipment, sites and buildings and other ancillary equipment. As such, these programmes constitute the annual capital expenditure budgets.

Engineering construction programme.

- 2.253 The major capital works programme is the 'Three Year Engineering Construction Programme' (ECP) which details the proposed capital investment in telecommunications plant. The ECP is prepared annually and is a three year 'rolling' programme of the capital works planned for the following major areas:

- customer services, that is, the provision of subscribers' instruments, PABX equipment, subscriber's carrier and radio equipment and distribution plant;
- local networks, that is, the provision of exchange switching equipment and cables, junction carrier and radio bearer equipment and junction cables;
- trunk network, that is, the provision of trunk switching equipment, cables and telephone carrier and radio bearer equipment;
- data services, which encompasses the provision of data terminal, switching and transmission equipment.

2.254 The ECP includes details of:

- the total estimated manhours and labour, material and incidental expenditure requirements for the proposed capital works, by each plant account;
- major individual projects, including the estimated expenditure involved in each project;
- the physical achievement targets of the programmes; for example, number of new lines connected, number of gross auto equipped ends installed, number of duct kilometres of conducts laid, etc.

2.255 The ECP is developed by each state, within the overall corporate policies and strategies as formalised in Telecom's corporate plan, and in accordance with objectives and guidelines as established with Headquarters, covering such matters as the provision of new products or services, upgrading of existing services, changes in the level of services, etc. For example, two of the major objectives of the 1982--83 to 1985--86 ECP for Victoria are to:

- satisfy the expected demand for small business systems, premium telephones, telex and data;
- eliminate all manual exchanges by June 1984.

2.256 The formulation of the programmes within the framework of the established objectives and guidelines, are based on numerous factors, including:

- forecasts of demand for services and lines, at both the macro and micro level;
- marketing plans;

- . State and regional network development plans;
 - . exchange and cable occupancy studies;
 - . manpower plans, labour productivity targets, material availability;
 - . level of funds available for the programmes; etc.
- 2.257 The process of preparing the three year ECP usually commences in June each year. The draft detailed programmes are completed and submitted to Headquarters for examination in December. Thereafter, the draft programmes are revised to incorporate changes that may occur as a result of the finalisation of manpower plans and the borrowing programme and/or revised demand forecasts, etc.
- 2.258 The final programmes are approved, in principle, by the Commission. This is an overall approval in that the Commission authorises a maximum level of expenditure for the first year of the ECP. Individual projects within the ECP are subsequently approved in accordance with delegated authorities.

Investment evaluation of projects

- 2.259 We are advised that return on investment studies are carried out to evaluate proposed new services, that is, technologically new 'products', or a major change in the type of equipment used. The basis of evaluation varies depending on the nature and importance of the investment but in principle, should follow broad guidelines laid down by the Finance Directorate in their 'Guidelines for Investment Evaluation', an extract from which is at Attachment L.
- 2.260 Not all major projects included in the ECP are subject to economic evaluation. Many projects are considered 'essential' projects in that they involve the extension or upgrading of the network or basic services to meet increased demand. As such, these projects usually result from policy decisions which were made when the development as a whole was considered and evaluated and they are approved essentially on the basis of service demand projections, rather than being individually evaluated. However, economic studies of alternative methods are made where special sets of circumstances make this necessary, for example, where a new exchange area is proposed or where a new building is required.
- 2.261 For projects involving the expansion or extension of plant, the extent to which the capacity of the plant is increased is based on general rules developed from studies on the economic utilisation of plant. For example, in increasing the capacity of an exchange, the amount of switching equipment installed should be sufficient to meet the expected increased demand for the ensuing eighteen months to two years.

- 2.262 The procedures laid down for the development of the capital works programmes and the basis of investment evaluation of projects appear generally thorough although we have not tested the extent to which they are followed in practice, nor have we analysed the quality of the forecasting and cost data on which projects are evaluated. As indicated at paragraph 2.251, we have not examined the appropriateness of the internal rate of return thresholds for evaluating capital investment proposals from the point of view of their strategic impact on the profitability of Telecom and the satisfaction of user demand. On the surface, however, a threshold of 28 percent appears high for low risk projects, although we understand projects in the range 15 percent to 28 percent can be acceptable in some circumstances. While we recognise that Telecom is obliged to ration capital currently, we could see value in more detailed studies of the economic evaluation criteria adopted and the impact of capital rationing on service to the public.

PROGRESS CONTROL AND REPORTING

- 2.263 The Engineering, Operations and Commercial departments within each state are involved in implementing the ECP, with the:
- . construction branch of the Engineering department carrying out the capital works mainly relating to the installation of local and trunk exchanges, main cable runs and major transmission systems;
 - . district operations personnel mainly responsible for the provision of customer services, that is, the installation of subscribers instruments, distribution, cables, etc; the Commercial department undertakes this work in the 'central business district' in the capital cities, as well as installing subscribers' telegraph, data and PABX equipment.
- 2.264 The progress control and reporting systems are discussed in the following paragraphs as they apply to:
- . individual projects;
 - . overall progress of the ECP.

Detailed project control

- 2.265 The approved ECP does not constitute formal approval for commencement of work on individual capital works projects. Prior to work commencing on a 'major works' project (projects involving a total cost exceeding \$15 500), the detailed engineering specifications of the work, and detailed estimates of the manhours and costs -- labour, material and incidentals -- are prepared and incorporated in a project proposal. The proposal must then be approved in accordance with delegated authorities. For example, the State Manager's approval is required for projects exceeding \$500 000 with the Chief State Engineer and Superintending Engineer authorised to approve projects up to \$500 000 and \$300 000 respectively, and so on.

- 2.266 The function of monitoring and controlling the progress of individual projects is principally carried out at the section level, by the project engineers or line control officers in charge of particular projects. The progress of individual projects is monitored and controlled in physical terms and for major works, through the works order costing system. For example, the following information on major exchange equipment installation projects is reported to the project engineer and line control officer each fortnight:
- extent of physical completion of the project;
 - project efficiency, that is, actual manhours compared to scheduled manhours for the work activities undertaken;
 - projected over or under expenditure, in manhours, at project completion.
- 2.267 Detailed costing of individual major works projects (over 15 500) is done within the 'work order' costing system and the total manhours and labour, material and incidental costs incurred on each major works project are reported, on a four weekly basis, to the sections undertaking the particular projects. A card record for each project is maintained by the sections to record the progressive total manhours and costs incurred against the total estimated manhours and costs for the project.
- 2.268 During the course of the work, the officers in charge of 'major works' projects are required to report any known major variations or departures from the estimated manhours and quantities of materials or cost of incidentals which would cause the final project costs to vary from the estimated costs by more than ten percent. The procedures also provide that when total costs approach 80 percent of the total estimated costs, the officer responsible for the work is required to review the costs and determine whether the final costs are expected to exceed the total approved costs by more than ten percent. Where this situation occurs the additional expenditure should be approved by the relevant authorised personnel.
- 2.269 On completion of a 'major works' project, a report is prepared which details the total manhours and costs recorded and the estimated manhours and costs. Where the actual costs vary by more than ten percent from the estimated costs, the engineer responsible for the work is required to provide an explanation of the variation.

Overall progress of the ECP

- 2.270 The progress of the ECP is closely monitored on an overall basis, that is, by plant account categories, in terms of both costs incurred compared with budget and physical achievements.
- 2.271 As described in the briefing paper on Telecom's accounting systems, the labour, material and incidental costs incurred in carrying out capital works are recorded for each category of plant by means of the 'plant account costing system'.
- 2.272 Reports produced from the plant account costing system detail, for each plant account category, total manhours and labour, material and incidental expenditure incurred each four week period and for the year to date. This information is reported, in detail, for each operations district or construction branch section and, in summary form, by departments and for the State in total.
- 2.273 Each four week period, the progressive total labour, material and incidental expenditure incurred in each plant account is monitored against the budgeted expenditure for the period to date.
- 2.274 The progress of the ECP, in terms of physical achievements (for example, number of lines installed, duct kilometres of cable laid, etc), is also recorded and reported each period against the targeted physical achievement levels as set in the programmes.
- 2.275 Periodically during the year, the progress of programmes for each plant account are reviewed in detail to identify any significant variations from the total budgeted expenditure for the year. Three such major reviews are carried out during the year by the construction branch in Victoria. Based on detailed reviews of individual major projects, the total expenditure expected to be incurred for the year is estimated for each plant account and compared with the total budgeted expenditure for the year. This information, with explanations for any significant variations from budgeted expenditure, is reported, in a progressively summarised form, to the State Chief Engineer, State Manager and Headquarters.

CONCLUSION

- 2.276 Capital works carried out under the ECP fall into two broad categories, namely:
- major projects, which may extend over a number of months or financial years;

- . 'routine' works, encompassing mainly the provision of customer services in response to demand.

Although we have not been able to examine the system in detail, the monitoring of capital expenditure appears to be comprehensive. The progress of individual projects is being closely controlled by officers in charge of the particular projects. At progressively higher levels of management, capital expenditure is being monitored and controlled, on a periodic basis, in terms of total man hours and labour, material and incidental expenditure incurred, compared with budget and by comparison of physical achievements against targets.

2.277 However, we consider that a greater degree of cost control over capital expenditure could be exercised by:

- . placing greater emphasis on individual project cost control and reporting;
- . utilising standard costing techniques to provide feedback on 'routine' type capital expenditure.

2.278 To control individual major projects effectively, there is a need for integrated physical and cost control systems and a consistent, structured management reporting system to enable the progress and costs of major projects to be monitored on an exceptions basis and in summary total at successive levels of management. The present practice of focussing control reporting to management mainly on projects when costs approach 80 percent of estimate, may not always alert attention to exceptions early enough for corrective action. In our opinion control reporting should aim to identify variances as early as possible in the project cycle. This would involve developing the project costing and reporting systems to provide progressively summarised reports to each level of management concerned, on a regular reporting cycle, comparing estimated costs with actual and forecast costs to completion and highlighting the impact of both actual and forecast variations from estimated costs.

2.279 In the case of 'routine' type capital works where the work is largely repetitive in nature, the use of standard costing techniques could provide an effective means of providing feedback for controlling expenditure, with variances from standard being reported, in a progressively summarised form, to higher levels of management each period.

THE NEED FOR PRODUCT COSTING INFORMATION

- 2.280 In common with most industrial companies and with overseas Telecommunications organisations, Telecom Australia has recognised the need for a range of cost and revenue information that will assist it in:
- analysing the profitability of particular services (products), regions, types of customer etc, and monitoring the extent of any cross subsidisation involved;
 - price determination, where prices are based partly or wholly on cost;
 - investment analysis in respect of new or extended services (and by corollary, divestment analysis, where redundant or uneconomic services may be considered for withdrawal).
- 2.281 Historically, in countries where telecommunications have been operated as Government owned or regulated monopolies, product costing typically has been on a highly aggregated full cost absorption basis, with average total costs being the main costing consideration. This has led to certain widely held and largely unchallenged assumptions about the profitability of certain classifications of services and the implications of cross subsidisation that follow from these assumptions.
- 2.282 With the developing emphasis in some countries on liberalisation of the telecommunications monopolies and the potential competitive pressures on Telecom organisations, both from technological and socio-political developments, the importance of profitability analysis has accelerated faster than the ability of most organisations' revenue analysis and costing systems to provide the type of information needed.
- 2.283 In the future, Telecom Australia, in common with other telecommunications organisations overseas, is likely to face major and critical challenges (internal and external) on the validity and adequacy of its product accounting data and the implications for pricing and investment decisions, because:
- rapid technological advance means that Telecom's average total costs may vary considerably from its marginal costs and those of its potential competitors;
 - pressure is likely to increase on Telecom to provide more detailed justification of its prices in relation to the costs of providing particular services;

- . cross subsidisation in pricing is likely to come under increasing scrutiny, which will increase the need for meaningful and defensible measures of profitability as between different services, regions and classes of user;
- . Telecom marketing management, faced with competitive pressures, will need better information for estimating the effects on profitability and market share of changes in marketing policies and pricing structures.

2.284 In this paper, we review the state of Telecom's product accounting systems and offer some suggestions for alternative approaches that may be more appropriate for meeting future demands. It is emphasised that we have not carried out a detailed study of product accounting requirements and our proposals are, therefore, in the nature of an overview to illustrate some of the questions and principles involved.

TELECOM'S PRODUCT PROFITABILITY ANALYSIS SYSTEMS

2.285 About ten years ago Telecom formed a Product Costing section as part of its Accounting and Supply department. The objectives of section were set out in a 'Product Costing Manual' (which we are advised is now out of date) and related principally to providing information for managerial planning, control and pricing by dissecting earnings, expenses, profitability, capital investment and return on investment over a range of products or services provided to the public.

2.286 From the outset, the product costing system has suffered from the disability that the basic accounting systems in Telecom were not designed and could not readily be amended to produce revenue or cost information on a product or service basis. Accordingly, a variety of methods had to be developed, outside the accounting system, to analyse data or estimate it in a form suitable for product evaluation purposes. This has increased the complexity of the system and weakened the accuracy and validity of its results, difficulties that are well recognised by Telecom.

2.287 The Vernon Committee commented on the need for better product costing systems in its report and subsequent consulting studies have also made recommendations for improving product costing. About two years ago a working party was set up at the direction of the Chief General Manager to review the product costing system. The working party made a considerable number of important recommendations for changes in principle and procedures in an internal report drafted in 1980. While some progress has been made in evaluating and implementing the recommendations, many depend on revisions to the basic accounting systems which have not yet taken place.

2.288 Arising from the working party review, it was decided to rename the 'Product Costing' system as the 'Product Accounting' system, recognising that the system analyses earnings as well as costs in

deriving product profitability. Subsequently, as a result of an organisational review it was decided to relocate the Product Accounting section in the Commercial Services department rather than in Accounting and Supply.

2.289 The product profitability analysis systems are therefore, in a state of continuing development, and improvements are being made progressively as management's needs for information crystallise and basic accounting and statistical systems are modified. At present the systems serve two main purposes:

- . to provide summarised annual results of financial performance by broad product type (refer to Table 4 in Volume 1, Appendix A of the Report);
- . to provide more detailed product profitability information to management, particularly commercial services management, for product management, pricing and investment analysis purposes, during the year.

We comment on the information and underlying systems used to meet these two main purposes in the following paragraphs.

SUMMARY OF FINANCIAL RESULTS BY PRODUCT TYPE

2.290 The summary of results by product type is of importance because it is relied upon in much of the public debate about Telecom's pricing and subsidisation policies. We therefore pay some considerable attention in this report to the basis on which products are defined and revenue and costs allocated in arriving at the summary.

Definition of a product

2.291 Products are broadly defined by Telecom in two categories -- the physical units ('terminals') -- basic telephone facility, PABX, public telephones, etc -- which interface with the communication network to enable a subscriber to use the network, and the activity (traffic) generated by the terminals -- telephone calls, telex, telegrams, etc. The product groups are listed at Attachment M.

2.292 For the basic telephone services, the products are:

- . basic telephone facility (business and non business metropolitan and country);
- . local calls (metropolitan and country);
- . trunk calls.

The basic telephone facility relates to the line which connects the subscriber's handset to the local telephone exchange and also the first telephone handset attached to that line. Trunk calls include STD and international calls.

- 2.293 Some of the difficulties inherent in the product accounting system arise from the current definition of products, because it separates physical items (such as the basic telephone facility) from the network traffic which these products generate and it mixes a regional analysis with a product and customer type analysis. The normal matching of a product's costs with all the revenue it generates is not achievable under this definition. The Telecom working party recognised this problem and proposed a revised definition which is being developed but has not yet been implemented for annual reporting.

Product accounting system

- 2.294 The product accounting system is a 'top down' annual operation whereby all the revenue and expenditure reported in the financial accounting system is allocated over product groups. The process of allocation is complex and time consuming. Historically, for a variety of reasons, the results have not been available until well after the close of the June financial year (1979--80 figures were completed in December 1980 and 1980--81 figures in April 1982).
- 2.295 A basic difficulty for Telecom is that the financial accounting system does not identify revenue or expenditure by product group. The product accounting system therefore has to commence with the revenue or expenditure as it is described in the financial accounting system and distribute it over products using a variety of assumptions and estimates. The processes which are involved in allocating revenues and costs to products are discussed in Attachment N, which identifies a number of problems of principle and precision in the allocation bases.
- 2.296 The system is a detailed full cost absorption process, which suffers from all the conceptual and practical difficulties of average costing systems. Given the revenue and cost allocation principles and assumptions on which it is based and the difficulties in obtaining revenue and cost data in appropriate analysis from the financial accounting systems, the system appears to be thoroughly and conscientiously followed. However, because of the nature of the system, the information produced in its annual reporting is, in our opinion, of doubtful validity and needs to be interpreted and used with great care.

Use made of product accounting information

- 2.297 The need to interpret this information carefully in relation to the use to be made of it is well recognised by Telecom management. However, because this product information is quoted outside, there is every possibility that the results derived from the products may be accepted as absolute, without the qualification that they are only as valid as the assumptions and estimates on which they are based.

- 2.298 The main use which appears to have been made of Telecom's annual product accounting information has been in reviewing the relative profitability of different products and classes of user of the network. Based on these reviews and other factors, deductions about the extent of cross subsidisation have been made and pricing policies presumably have been influenced. Submissions to the Inquiry and Telecom's response to questions refer to 'loss products' accounting for \$290 million and from this reach conclusions concerning cross subsidisation, which may not be valid if based on this figure of \$290 million alone.
- 2.299 In its management of the financial performance of its services, and to a lesser extent in pricing policy, Telecom places considerable, although qualified, reliance on judgements based on its product accounting system. This is described in the following extract from the 1980--81 Telecom Australia Annual Report (page 23):

"Four major services make up the national telecommunications system, namely Telephone, Telegraph, Telex and Data. Each service uses its own separate terminal equipment but shares common communications channels, which constitute the major part of the national system, with the other services. Because of this common use of major parts of the network it is not practicable to identify directly all items of expenses and earnings with the individual services, therefore conclusive financial results cannot be determined for each service. However, information is available from other sources that, used in conjunction with data derived from the accounting system, allows judgements to be made in regard to the respective financial performances of each of the services.

In terms of direct expenses, direct earnings and traffic volumes, the telephone service is by far the most significant category and had a major influence on the overall profit earned in the year. Within that service, however, results varied widely. While the basic telephone facility and local call service in metropolitan areas more or less broke even, corresponding earnings in the country fell far short of the associated costs of servicing the capital, maintenance and operating costs involved and resulted in a heavy drain upon the overall results. Public telephones and customer services other than the basic telephone facility were also unprofitable but the continuing profitability of the trunk service offset losses in other areas."

Validity of profitability conclusions

- 2.300 Because of the importance of these conclusions to future policy in relation to Telecom investment and pricing, we have attempted to appraise the validity of the profitability and cross subsidisation conclusions drawn from the present product accounting system. This appraisal is based on a limited study and it was not possible in the time and with the information readily available from Telecom's accounting and product costing systems to conduct an authoritative analysis. However, the appraisal does raise some important questions for pricing policy.

2.301 The final output of the annual product accounting system is summarised in the 'summary of financial performance by product type 1980--81' which is reproduced in Volume 1, Appendix A, Table 4 of the Report. This indicated, inter alia, that country services generally resulted in substantial 'losses', whereas metropolitan services, while not profitable overall, did not incur the same magnitude of loss. It concluded that trunk call services were highly profitable and effectively subsidised most of the other services. It indicated also that certain other services, particularly leased call telephones and public telephones, incurred significant losses. We comment on some of these conclusions below.

Public telephones

2.302 For 1980--81 the product costing system reported that public telephones incurred a loss of \$43.3 million, derived as follows:

	<u>\$ millions</u>
Revenue	5.9
Costs	<u>49.2</u>
Loss	(43.3)

2.303 Revenue was comprised almost entirely of public telephone call fees, shown as \$5.6 million; the balance, \$0.3 million, was made up mainly of interest received on investments (funds on deposit) and sales proceeds. The amount of \$5.6 million did not represent the total call fees passing through public telephones, which amounted to \$55.6 million. The reduction of \$50.0 million was based on the premise that the call fees generated by public telephones should be classified with all other local and trunk call revenues which are displayed separately in the product accounting system. On this basis, it was deemed by Telecom that for each 10 cent public telephone call, 9 cents should be allocated to local calls and only 1 cent should be classified as public telephone call fees.

2.304 While the approach followed in the product accounting system is logical, given the premise on which it is based, we consider that this premise could give a misleading result if the information is being used to evaluate the contribution made by a product to the overall results of the network. For that purpose, it can be argued that the revenue from public telephone call fees should include the total call element, which would have the effect of increasing public telephone revenue to \$55.9 million and reducing local or trunk revenue accordingly.

2.305 The product accounting system allocates all costs over all products. Therefore, public telephone revenue is charge with a variety of costs in arriving at profitability. These are:

\$ millions

Direct costs

Maintenance	21.4	
Depreciation	8.6	
Interest	3.6	
Operations - postal fee	5.9	
Operations	<u>5.0</u>	44.5

Indirect costs

General administration	2.0	
Engineering	1.2	
Research	0.5	
Accommodation services	0.5	
Customer services	0.4	
Other	<u>0.1</u>	<u>4.7</u>
		49.2

- 2.306 Maintenance (\$21.4 million) is derived from maintenance records for service calls together with an allowance for supervision and engineering overhead costs. Depreciation (\$8.6 million) and interest (\$3.6 million) are related to the level of investment in public telephones including a share of ducts and tunnels, subscribers cable distribution, main and aerial lines, but excluding the costs of the trunk network. The charge of \$5.9 million for 'operations -- postal fees' represents fees paid to Australia Post for services relating to public telephones. The other operations costs (\$5.0 million) are regarded as mainly direct costs of the product. The total of these costs (\$44.5 million) is reasonable as a direct charge against public telephone revenue.
- 2.307 The remainder of costs (\$4.7 million) represents a share of overhead and other joint costs. The basis of allocation is reasonable given that the objective is to allocate all costs.
- 2.308 To determine the contribution of public telephones in 1980--81 we would suggest that the following presentation is more relevant:

\$ millions

Revenue	55.9
Direct costs	<u>44.5</u>
Gross contribution	11.4
Overhead allocation	<u>4.7</u>
Contribution to network costs	<u>6.7</u>

- 2.309 On this basis public telephones made a positive gross contribution to the network of the order of \$11 million which, after the allocation of overheads, still left a contribution of nearly \$7 million, before charges for the use of the network. While it is not feasible with the

present product accounting system to apportion the joint costs of the network to source of traffic with any accuracy, Telecom has estimated that, if all direct costs of the network were apportioned in proportion to the approximate number of calls made in the year, the public telephones' share of network joint costs would be about \$32 million.

Leased coin telephones

- 2.310 For 1980--81 the product accounting system reported that leased coin telephones incurred a loss of \$10.5 million, derived as follows:

	<u>\$ millions</u>
Revenue	1.4
Costs	<u>11.9</u>
Loss	<u>(10.5)</u>

- 2.311 Under the agreement with Telecom, before the 1981 charge increase, lessees of telephones received a discount of 2.7 cents per call if the telephones were STD-barred. However, following the same logic as with public telephone calls, an amount of 9 cents per call was transferred to local calls. Since many fees actually received were at the reduced value of 6.3 cents per call the transfer of 9 cents left a deficit on call revenue of 2.7 cents per call in these cases. The actual call fees for 1980--81 were gross of \$21.1 million against which discounts of \$4.5 million had been allowed. In our opinion, the gross revenue and the discount should be taken into account in evaluating the contribution of leased coin telephones.
- 2.312 The other significant revenue item was rental of \$5.6 million. There was a problem in deriving this figure because rental from leased coin telephones was not specifically earmarked in the accounting system. However, an acceptable approximation was arrived at by applying the annual rental for a leased coin telephone to the number of telephones being leased.
- 2.313 Revenue from leased coin telephones could, therefore, be restated as:

	<u>\$ millions</u>
Gross call fees	21.1
Less discount	<u>4.5</u>
	16.6
Rentals	5.6
Connection fees	0.2
Other	<u>0.1</u>
	<u>22.5</u>

(Under the new arrangements for leased coin telephones, following the 1981 increase in public call fees to 20 cents per call, the lessee keeps all the money in the coin box of the red phone, and pays Telecom

15.6 cents per call. The lessee therefore obtains a commission of 4.4 cents per call. Under this new arrangement, the product accounting system will transfer 12 cents to local call revenue and leave 3.6 cents per call as leased coin phone revenue, which, if volume does not change, will make red phones appear less unprofitable under the present system).

- 2.314 The costs allocated to leased coin telephones in the product accounting system were:-

	<u>\$ millions</u>	
<u>Direct costs</u>		
Maintenance	3.9	
Depreciation	2.7	
Interest	1.0	
Operations	<u>2.5</u>	10.1
<u>Indirect costs</u>		
General administration	0.6	
Customer services	0.5	
Accommodation services	0.3	
Engineering	0.2	
Other	<u>0.2</u>	<u>1.8</u>
		<u>\$11.9</u>

- 2.315 To determine the contribution of leased coin telephones we would suggest that the following presentation is appropriate (using 1980--81 figures):

	<u>\$ millions</u>
Total revenue	22.5
Direct costs	<u>10.1</u>
Gross contribution	12.4
Overhead allocation	<u>1.8</u>
Contribution to network costs	<u>10.6</u>

- 2.316 On this basis leased coin telephones made a positive gross contribution of over \$12 million, which, after the allocation of overheads, still left a contribution of more than \$10 million before charges for the use of the network. Using a similar basis for apportioning joint network costs as for public telephones, Telecom have estimated that leased coin telephones' share of direct costs of the network would be approximately \$11 million.

Country subscribers

- 2.317 The 1980--81 results of country subscribers services were reported in Telecom's product accounting system as losses, as follows:

\$ millions

Basic telephone facility

Country business	(50.1)	
Country non-business	(<u>138.6</u>)	(188.7)
Local call service -- country		(<u>63.3</u>)
	Loss	(<u>252.0</u>)

- 2.318 If an objective of management is to determine the contribution of country services, then in our opinion the present definition of products is not adequate. It should be extended to include all the revenue generated by country subscribers and the direct costs incurred in generating that revenue.
- 2.319 At present, the Telecom product accounting system reports \$167 million as 'local calls, country' and \$1039 million as 'trunk calls' (including STD calls). Some part of this \$1039 million must include traffic generated by country subscribers but the revenue accounting system does not identify which part of trunk revenue is generated by country subscribers and the product accounting system does not allocate any portion of trunk revenue to the country products. Further, it could be argued that for certain types of decision, some allowance should be made for revenue generated by trunk calls received by country subscribers which would otherwise be lost if the network was not serving country areas.
- 2.320 Allocation of costs is not a simple process in a telecommunications network, particularly in trying to determine what it costs Telecom to get country subscribers onto the network and to keep them in operation. It is not difficult to identify the costs for physical items (subscribers' handsets, lines, cables and exchanges) in terms of depreciation, interest and maintenance, and it is possible to identify these physical categories of costs in geographical areas (districts). The problem occurs in attempting to allocate the total 'network cost' across the basic telephone facility, local and trunk calls. There is a large proportion of joint costs which, if they are to be allocated to products or regions, can be allocated only on the basis of assumptions which are technically debateable.
- 2.321 The original product costing system allocated the cost of maintaining exchanges to local calls (metropolitan or country) depending on whether the costs were for metropolitan or country exchanges. This could be challenged because, if costs of local exchanges were to be allocated this way, then there was an implicit assumption that the costs of maintaining local exchanges were caused solely by local traffic. However, local exchanges are part of the whole network, essential for local and trunk calls; a trunk call cannot be made unless there are at

least two local exchanges, one to switch the call over to the trunk exchange at the originating end, the other to receive the call from the trunk exchange at the receiver's end and switch it through to the recipient. For this reason Telecom now allocates some of the exchange costs to the trunk calls product, particularly that part of the local exchanges and the local inter-exchange trunk distribution costs which relate to trunk calls.

- 2.322 In this analysis we have not challenged the allocation of all other Telecom expenses to country subscribers. The shares of these expenses that have been allocated are:

	<u>\$ millions</u>	<u>% of total</u>
Operating expenses	77.2	15.9
General and administrative expenses	49.6	25.9
Accommodation	28.2	24.2
	<u>155.0</u>	

- 2.323 These percentages are not, prima facie, unreasonable. However, to the extent that these costs are not direct, the principle of allocating them is debateable, in evaluating the contribution of country subscribers. Various methods of allocating these costs could be utilised, based on justifiable assumption and all possibly producing different answers.

- 2.324 The resulting 'loss' on country subscribers of \$252 million is therefore debateable on cost allocation grounds. More important, however, it can be argued that the total revenue which country subscribers generate, including trunk revenue, should be allocated to the country products in evaluating their contribution to the costs of the network. If they generated 25 percent (\$260 million) of the total trunk traffic (\$1039 million) then on this basis country subscribers made a positive contribution, before charge for the use of the trunk network. We understand that Telecom statistics indicate that country subscribers generate something in the order of 40 percent of trunk (STD) traffic.

- 2.325 Our intention in this paper is not to state what profit or loss can be properly attributed to country subscribers. This would require a much more extensive analysis of revenues and costs and the estimation of the country share of the network costs. Rather, we have aimed at questioning the validity of the reported loss on country services which, we believe, could result in misleading conclusions.

Trunk versus local call services and other products

- 2.326 For 1980--81 the product accounting system reported that trunk call services yielded a profit of \$600.1 million compared with a local call loss of \$62.7 million taking metropolitan and country call services together.

- 2.327 Under present arrangements, trunk call revenue can only be generated if there is a total network in existence and cannot be viewed in isolation from the terminal products which connect the subscriber to the network, or from the metropolitan and country exchanges which link the subscriber to the trunk system. Further, the statistical methods for analysing revenue as between trunk and local calls are recognised as being imprecise.
- 2.328 In addition, the earlier analysis of the product accounting system indicates that there are many issues that can be debated about the methods and assumptions for allocating costs to the network. These conceptual costing difficulties, together with the questions concerning revenue allocation weaken the conclusions about the relative profitability of trunk calls compared with local calls and compared with other products as currently defined. Nevertheless, it is unlikely that these difficulties would negate the general conclusion that trunk calls are a major contributor to overall profitability -- but the conclusion needs to be tempered with the recognition that the present figures are far from precise.

Conclusions

- 2.329 The product accounting system suffers from significant difficulties with regard to both revenue and cost apportionment, difficulties which are well recognised by Telecom. The conceptual problems inherent in describing products in terms of terminals and traffic are highlighted in the treatment of revenue from leased coin and public telephones. Arguably, the practice followed understates the real revenue that those products have generated and does not identify all the costs caused. However, given the present revenue accounting system, the product accounting does not (and cannot) identify the revenue generated by all products.
- 2.330 Similarly, the question of which costs to include and how to allocate them to products is complex. Many costs are joint costs which relate to the total network and depending on the objective for which the cost allocation is being done, can be allocated many different ways to produce many different results.
- 2.331 When this uncertainty regarding the methods of apportioning costs is added to the difficulties with the allocation of revenue under present revenue accounting systems, the analysis of product profitability produced by the product accounting system is unreliable for the uses being made of the data externally.

INFORMATION FOR COMMERCIAL MANAGEMENT

- 2.332 Recognising the inadequacy of the original product accounting system in providing information for commercial management planning and decision-making, Telecom have been developing a number of additional approaches

to product profitability analysis. These include:

- . ad hoc costing studies;
- . cost modelling.

Ad hoc studies

- 2.333 Over the years a number of ad hoc costing studies have been conducted. In 1972--73 a substantial network costing exercise was undertaken to estimate from engineering data the capital, maintenance and operating costs of typical components of the network (e.g. a two-way telephone bearer) and express these as costs per mile. These mileage costs were developed for all main components of the network, although the main purpose of this study was to estimate the costs of private lines. The study was updated to some extent in 1974--75.
- 2.234 However, it is stressed that because the accounting system was not geared to produce this type of information, the costs were estimates based on engineering data and were not integrated with, nor fully reconciled with, the financial records.
- 2.235 Engineering traffic studies were also used to estimate the revenue attributable to different parts of the network. In related studies, a comparison of the attributed revenue and the estimated costs per mile yielded some conclusions about the profitability of the network; for example, there was some evidence to support the view that long haul trunk traffic was more profitable than short haul traffic. Current pricing policy is based on that understanding.
- 2.236 While the results of the 1972--73 network costing exercises are out of date in cost terms now (and the basis of the cost estimates was not examined by us in any detail) the exercise provided some confirmation that detailed analyses of the costs and revenues of particular segments of the network are feasible, at least for the trunk network. Further, the engineering traffic studies demonstrate that it is possible to obtain estimates of revenue on a source/destination basis and attributable to particular segments of the network. However, because they are necessarily ad hoc, and not supported by appropriate accounting and costing systems, they are time consuming and expensive and their accuracy is not easily verifiable.

Costing models

- 2.237 Since 1979, Telecom has been operating a modelling system aimed initially at establishing the contribution from the various physical products classified as 'Vertical Products' and 'Other Data Services' which generally relate to terminals and attachments and leased data lines. The system uses a computer model and manual processing which

allows for costs to be built up from data obtained outside the financial records (such as the hours allowed under Telecom engineering productivity standards for installing a particular product). It has been used by Telecom to evaluate the relevance of current prices and to assess the potential profitability of new products for investment evaluation purposes.

2.338 The approach is a 'bottom-up' technique which relies on building up the costs from a zero base. It is being extended to cover most products and ultimately could be used to cost all products.

2.339 This system is based on the contribution method. 'Contribution' is defined as the surplus of revenue over the direct costs of earning that revenue; this surplus is then referred to as a contribution towards the total indirect costs of the organisation. If the sum of all contributions exceeds these indirect costs the organisation makes a profit. Profits can be increased by increasing the sum of the contributions or reducing the indirect costs, or a combination of both.

Calculation of costs and contributions

2.340 Costs are calculated at two levels -- 'direct variable costs' and 'total direct costs'. The following elements are included in calculating the 'direct variable costs' of a product:

- labour and direct material costs while on the job; derived from engineering work performance standards;
- district and state engineering overheads;
- superannuation and long service leave associated with the above;
- capital charge, calculated on the basis of the cost of capital (original asset cost, installation and interest) amortised over the 'accounting' life of the item.

2.341 The following direct 'fixed' costs are added to this direct variable cost to produce 'total direct cost':

- the cost of administration and support;
- the related superannuation cost (25%) and long service leave (5%).

2.342 The contribution per product is derived by deducting this total direct cost from the annual rental or other revenue.

Evaluation of this approach

- 2.343 The strength of this approach is that it highlights both the total direct variable costs and the total direct costs in evaluating the tariff contribution. The direct variable costs fairly represent the cost of holding and maintaining the product over its accounting life. The other costs allowed for in reaching the 'total direct cost' involve more assumptions and are more subjective in terms of cost allocation. The weakness of the system, which is recognised by Telecom, is that it is not possible currently to integrate it with the financial accounting system, and its results are therefore difficult to reconcile and verify.

Use of this information

- 2.344 Telecom's commercial services organisation includes product managers who are responsible for planning and marketing of new and existing products; this responsibility includes advising the Commission on appropriate prices. The cost modelling information is used by product managers for:

- . certain products currently in use, to assess whether current prices cover costs and to arrive at appropriate charges;
- . new products, to assess their expected profitability, as a basis for price determination and investment evaluation.

- 2.345 We endorse the cost modelling adopted by Telecom as a useful approach to highlighting those costs which are relevant for decisions relating to investment and prices. The system, which is relatively new, is still being developed, particularly with regard to testing the reasonableness and the impact of the percentage allowances for overhead and administrative support. As yet, the system has not been reconciled with the financial records and it applies only to certain categories of products.

- 2.346 Results generated by this system to date indicate that Telecom's prices for products do not always cover direct costs (as defined). In such cases, it has been recommended within Telecom that prices be increased, provided the increase is no higher than 20 percent in any one year.

AN ALTERNATIVE APPROACH

- 2.347 There are a number of approaches to product accounting that could be considered to overcome some of the difficulties discussed earlier in this chapter. A more detailed study of the needs for product management information and of the revenue accounting and cost recording systems

would be required to specify the ideal product accounting system to meet the various needs of management for cost and profitability analysis information. However, we offer suggestions in this section on the general nature of a revised product accounting system which we think could be appropriate for Telecom. We recognise that a number of costing studies have been undertaken in recent years by and for Telecom, but they do not appear to have resulted in any substantial charges in the system for product accounting.

- 2.348 In suggesting an alternative approach to product accounting we support the views of Telecom's product accounting management, who are moving towards a different definition of products and an approach to allocating revenue and costs to products which concentrates on direct costs rather than attempting full cost absorption. While full cost absorption would be feasible under this approach it would require the adoption of relatively arbitrary allocations of joint costs and overheads and, in our opinion, would not be helpful in most areas of decision making. In the final section of this part of the paper we provide some broad estimates of the effect of adopting the alternative approach.

Definition of products

- 2.349 The term 'product' is used in Telecom to define those parts of the total revenue earning services for which management requires information about profitability for purposes of investment and pricing policy. Information relating revenue earned with the costs of generating that revenue can be considered in three different categories, which can be regarded as overlaying each other in a three dimensional form:
- . by type of service or 'product' (trunk calls, local calls, terminal equipment etc.);
 - . by geographical region (country, metropolitan, etc.);
 - . by type of user (class of customer, business, etc).
- 2.350 It would be possible to conceive of a product accounting system which analyses revenue and cost in total in three dimensions covering each of the above categories but this would depend on clearly defining Telecom management's needs for information in these areas. In practice, Telecom has opted for a composite approach which analyses the total revenue and costs over a mixture of the above three categories. It is this mixing of the categories which causes the difficulties of interpretation outlined earlier in this paper.
- 2.351 If, for example, it was considered necessary and worth the cost to have information on the relative contribution of country services compared with metropolitan services, then all services should be included in

this analysis. Under Telecom's product accounting system only some of the revenue and some of the costs are allocated to country and metropolitan product types. Similarly, an analysis of contribution by type of user would require all services to be classified over the different user groups being considered. This may require a more detailed analysis than just business versus domestic user; for example, many industrial organisations evaluate profitability of large customers versus small customers, and some go as far as analysing the profitability of individual large customers.

2.352 In this review we have not examined the type of information that Telecom may require in respect of regional analysis or customer analysis. However, we have given some thought to the way in which services could be analysed to provide contribution information on a service or product type basis and we have taken into account the research and conclusions drawn by the Product Accounting Working Party in this respect.

2.353 There are two fundamentally different ways of analysing product profitability in telecommunications:

- treating the type of terminal device and the traffic it generates in the network as one combined product and attempting to measure the revenue and costs caused by that terminal and its associated traffic; this requires a means of disaggregating network usage and costs by terminal product and has not proved feasible to date;
- treating the terminal as one product and the network as a separate product (or products). In this case costs and revenue of terminals need to be separated from costs and revenues of the network. This requires a transfer pricing policy between terminals and network in deciding how to allocate revenue.

Many of the product accounting problems referred to earlier arise because of the mixing of these two approaches in Telecom's original product definitions. However, there may be cases where, depending on the use to be made of the information, management need product cost and revenues analysed both ways.

2.354 On this basis, we consider that Telecom's total services can be considered as comprising three separate product segments:

- terminal equipment, whereby subscribers can establish connections with the communications network;
- subscribers' lines, which provide the link from the subscribers' terminals to the network, ending at the subscribers' exchange;
- the telecommunications network, comprising local and trunk exchanges, cables, wires, carrier and radio equipment Australia wide.

2.355 Within each of these three broad categories, however, it is feasible to undertake more detailed revenue and cost analyses for specific purposes, but it is essential that the results of such analyses are used for the correct purposes and not generalised for other purposes. For example:

- (a) the revenue and direct costs of groups of terminal equipment, or individual terminal products, could be assessed and reported for performance monitoring and pricing and investment considerations;
- (b) the costs of subscribers' lines and the interface with the network at the subscribers; exchange could be analysed by region, by type of user or by individual subscriber to establish a basis for pricing and investment policy in relation to connecting and maintaining subscribers to the network and evaluating subscriber subsidisation;
- (c) the network could be analysed to obtain estimates of revenue and costs relating to particular types of services using the network (local calls, trunk calls, telexes, DDS etc.).

2.356 For these purposes the broad product classification we have suggested appears appropriate overall, but within that classification careful consideration needs to be given to the individual categories of users and services.

Effect of proposed broad product segmentation

2.357 Given the information and time available it was not possible to attempt a complete recosting of Telecom's services within the three broad product segments described in paragraph 2.354 above. However, we have attempted in the following table to adjust the 1980--81 summary of financial performance by product type to show the approximate impact of adopting a broad product classification as proposed above.

2.358 It is possible to allocate direct maintenance, depreciation and interest costs to the three segments. However, revenue is not collected on the basis of separate terminals or line charges. Therefore terminals and subscribers' lines must be combined in this presentation.

Table I - Alternative Presentation of
1980--81 Financial Performance by Product Type

			<u>\$ millions</u>
<u>Terminals and Subscribers Lines</u>			
Rental		704	
Connection fees and miscellaneous		<u>120</u>	
		824	
<u>Less:</u>	Direct maintenance	<u>342</u>	
		482	
<u>Less:</u>	Interest	192	
	Depreciation	<u>270</u>	<u>462</u>
	Segment contribution		20
<u>Network</u>			
Total call revenue		1562	
<u>Less:</u>	Direct maintenance	<u>286</u>	
		1276	
<u>Less:</u>	Interest	216	
	Depreciation	<u>217</u>	<u>433</u>
	Segment contribution		<u>843</u>
	Total segment contributions		863
<u>Add:</u>	Sundry income (directory advertising, telegraphs, interest received and sales proceeds)		<u>224</u>
			1087
<u>Less: General overhead cost:</u>			
Operational, commercial and customer service expense		485	
Accommodation		116	
General administration		192	
Depreciation (other than plant)		47	
Sundries		<u>14</u>	<u>854</u>
Net Profit reported			<u>233</u>

TOWARDS A NEW PROFITABILITY ANALYSIS SYSTEM

- 2.359 Because of the importance of reliable profitability information to Telecom in the rapidly changing future for the telecommunications industry, we consider that a new profitability analysis system, will be needed and could be designed to provide the facility, if required by management, for analysing contributions made by:
- . services (products);
 - . types of users;
 - . regions.
- 2.360 The extent of the analysis would depend upon a full appraisal of management's needs (and the needs of regulatory bodies) for profitability and cost information. The system should be integrated with the financial accounting and management information systems. Depending on the objectives agreed for the product accounting information, substantial changes to the basic revenue accounting, financial accounting and plant cost recording systems would probably be needed.
- 2.361 In telecommunications, costs can be considered in three broad categories:
- . those costs which vary directly per unit of activity (short run variable or marginal costs):
 - . other operating costs which do not vary per unit of activity but will vary with larger increments of activity in the longer term (stepped or semi-variable costs);
 - . facilities costs, that is costs of owning and maintaining a facility including depreciation and interest on capital (fixed or long run marginal costs).
- 2.362 Some of the costs in each of these categories can be regarded as 'direct' in the sense that they can be identified directly with a product or service. Others are 'indirect' or joint costs, which cannot be related to any one product or service other than by arbitrary and questionable apportionment. Some direct costs are variable with volume of traffic, but most are fixed in the short term.
- 2.363 Initially revenue and direct costs should be allocated into the three major categories of services described at paragraph 2.354. If needed, the additional facility could be provided to analyse these revenues and costs into greater detail and to report them by regional and user classifications.
- 2.364 As a basis for this system, the concepts of the 1972--73 network costing exercise would need to be re-established, costed asset registers introduced and a capital cost data base developed and regularly updated, which could be used for deriving reliable depreciation and interest allocations over product groups, individual products and to provide regional analyses.

- 2.365 Maintenance and operating costs are currently not analysed in the accounting or costing systems in sufficient detail for them to be allocated to individual terminal products. The redesigned system should provide for this level of analysis.
- 2.366 Greater emphasis should be placed on the traffic sampling studies carried out by the engineering division and the results of these studies integrated with the profitability analysis system, so that, if needed, it is possible to estimate incoming and outgoing traffic revenue on a regional basis and if necessary to allocate revenue to particular segments of the network.
- 2.367 For the purpose of profitability analysis we agree with the working party that a contribution approach should be adopted, which means that only those costs which are direct to product (but not necessarily variable with traffic in the short term) should be compared with the revenue generated directly by the product to determine a contribution to the remaining indirect costs. Contributions can be assessed at different levels -- e.g. contribution for product, for product group and in total for all product groups. For this purpose, the main costs that could be regarded as direct would be the facilities costs of interest and depreciation and that part of maintenance which can be directly related to the product. On this basis we estimate that some 36 percent of total cost would not be allocated directly to products, and would represent the 'overhead' which product contributions, in total, are expected to cover.
- 2.368 Further study would be needed to verify this, but with an adequate data basis of capital costs and using engineering traffic studies, it may be feasible to ascribe the direct costs of the network to segments of capacity and to unconnected capacity. The direct costs could then be ascribed to services or products by deriving a cost per unit of capacity for each segment of the network and identifying separately the facilities cost of unutilised capacity. The direct costs per unit of capacity could be used as a basis for reporting contributions against particular types of service, regions or customer groups, provided revenue can be analysed or estimated in similar categories. Under present systems, revenue analysis is not adequate for this purpose, but we understand that engineering traffic studies can be utilised to provide a reasonable approximation of revenue analysed in this way.
- 2.369 Although valuable developmental work has already been done by the Telecom working party and the product accounting section, the detailed design and implementation of a costing and profitability analysis system of this type to provide meaningful information in up to three different dimensions would be a major task for Telecom and would require considerable time and resources. The extent to which this range of information is needed by Telecom and the costs of providing it would require careful evaluation by senior management. Nevertheless, we believe that future demands on Telecom will make this type of information of increasing importance to management.

PRICING POLICY

INTRODUCTION

2.370 This paper describes the approach Telecom uses for pricing currently and discusses some of the options available in pricing policy. The paper is set out under the following headings:

- . current telecommunications practice;
- . cross subsidisation;
- . economic pricing theory;
- . commercial pricing practice.

CURRENT TELECOM PRACTICE

2.371 The basic approach to telecommunications pricing in Australia is to provide the same service at the same price nationally. Where there are identifiable cost differences, broad price differentials exist, for example, trunk rates vary with distance and there is an increased connection charge for subscribers more than a specified distance from the exchange. Prices for each service are based broadly on costs averaged across all subscribers to that service, in order to recover total costs and achieve the required rate of return. In this context, costs are historical (but subject to the 1975 revaluation of fixed assets) and the rate of return is geared to the 50 percent internal funding objective in respect of capital expenditure.

2.372 Telecom's operations from a pricing point of view are divided into two categories:

- . a basic service, comprising:
 - rentals payable for telephone exchange services;
 - charges for telephone calls made within Australia;
 - charges for telegrams sent within Australia;
- . non basic services comprising:
 - rentals and sale prices for customer terminal equipment including PABX's and small business systems;
 - installation and removal fees;
 - telex rentals and call fees;
 - private line rentals;

2.373 Prices for the above services are based on the following general principles:

- . rentals of basic telephone services are set nationally, broadly to recover capitalised installation costs and maintenance over the life of the installation;
- . charges for telephone calls made within Australia are in two categories:
 - local calls (i.e. calls between subscribers in the same charging zone or in adjoining charging zones) are charged at a flat rate per call irrespective of distance or duration of call;
 - trunk calls (i.e. calls between subscribers in non-adjacent charging zones) are charged at a rate related to the duration of the call, the time of day and the distance over which the calls are made;
- . prior to the formation of the Commission in 1975 telephone trunk call fees were not closely cost related; the changes since then have been designed to move rates closer to overseas equivalents and to take account of general cost inflation and demand factors, but there is still a considerable way to go in moving towards cost related pricing, because of the limitations of product cost data and the historical structure of the rates.
- . charges for telegrams are based on the number of words in the message with a fixed minimum charge, and there are special rates for urgent or special deliveries; again the rates are largely historically based, and adjusted to take account of general cost inflation and demand factors -- telegrams are regarded as being fairly price elastic because of competing technologies and there is a limit to the extent by which cost increases can be recovered by price increases;
- . sale/rental prices for the several hundred terminal products offered to customers by Telecom have been determined on a number of bases historically, but more recently have been the subject of detailed market planning, computer cost models and rate of return considerations. These developments have been introduced to achieve a more commercial, cost related pricing policy, although there are still anomalies in the pricing structure which have to be worked out over time;
- . connection charges for new telephone exchange services are set at a level which takes into account subscriber demand, availability of capital and resources and social considerations, including the need to keep waiting lists at an acceptable level. The charge is a flat national rate for connections up to 16 kilometres from an automatic exchange, and is not directly cost related. Special arrangements were introduced for subscribers in rural and remote areas in 1982.

- 2.374 Proposed changes to charges for basic telephone and telegram services must be approved by the Minister of Communications. Prices for other services and facilities may be varied with the Commission's approval. In addition to the above requirement, the Commission can and does get occasional ministerial directives. All tariff changes are promulgated in the Australian Gazette.

Ministerially approved charges

- 2.375 There have been five main changes in the last ten years in basic telephone charges, as follows:
- . in 1974 telephone rentals increased from a flat \$55 per annum for all subscribers to \$85 for business users, and \$65 for non-business users thereby introducing a differential rental for different classes of subscriber; at the same time, local call charges increased from 4.75 cents to 6 cents, and public telephone call charges increased from 5 cents to 10 cents;
 - . in 1975, business rentals increased from \$85 to \$120, and non-business rentals from \$65 to \$85; local call charges increased from 6 cents to 9 cents;
 - . in 1981, business rentals increased from \$120 to \$158 and non-business rentals increased from \$85 to \$95; in 1982 local charges went from 9 cents to 12 cents and public telephone calls from 10 cents to 20 cents;
 - . STD call fees remained largely static from 1975 until 1981/82 when the tariffs for short distance calls were increased and long distance calls (over 645 kilometres) were reduced. The fees for all STD calls made outside the 8 a.m. to 6 p.m. period were reduced;
 - . local call rates and short distance STD rates were increased again in August 1982 and longer distance STD rates reduced further.
- 2.376 We were advised that the general increases in rental and short distance call fees were designed to bring the charges more into line with costs and to raise additional revenue. The more recent changes in STD rates have been designed to progressively redress the imbalance between long distance and short distance call fees. Long distance call fees appeared to be very high compared with those applying in overseas countries and highly profitable to Telecom.

Basis for determining prices

- 2.377 A major difficulty for Telecom in setting prices for the future is the inadequacy of product or service cost and revenue information. This has been analysed in our paper 'Product Costing and Profitability Analysis'. Until the development of the cost models during the last two to three years, mainly for terminal products (which form a relatively

small proportion of Telecom's total revenue earners), management has had insufficient reliable product costing information with which to review prices from a profitability or return on investment viewpoint or to evaluate cross subsidisation. Also, the demand elasticity data on which pricing decisions should be based in a commercial environment is limited, because of the relatively infrequent changes in the pricing structure and the difficulty of market research and test marketing.

2.378 In the absence of adequate product profitability and elasticity data, considerable reliance appears to have been placed on comparisons between Telecom and overseas (particularly North American) operators to obtain a guide as to the appropriateness of Telecom's pricing structure. This presupposes that overseas prices are properly derived and that overseas product cost structures are validly defined and comparable, assumptions which are questionable. To our knowledge, telecommunications product costing in the UK and USA has been based on full cost absorption, average costing, and suffers from many of the conceptual and practical difficulties experienced in Telecom Australia.

2.379 Based on overseas pricing comparisons and such product cost data as is available, Telecom management believes that there are some fundamental and largely historical anomalies in the present pricing structure which give rise to significant cross subsidisation, in particular:

- . short distance STD (and local call) charges are too low relative to longer distance call fees;
- . connection charges for longer distance and remote country connections to exchanges generally fall well below direct costs;
- . some terminal products are being sold or rented at below direct cost.

2.380 It is recognised by Telecom management that there is insufficient product cost and revenue data to make precise judgements on these issues. In the meantime, pricing policy is directed toward progressively redressing the apparent anomalies in the structure and in particular reducing the cost of longer distance STD calls relative to shorter distance and local calls.

CROSS SUBSIDISATION

2.381 There has been much debate on the subject of cross subsidisation in telecommunications in recent years, both in Australia and overseas. The debate is complicated because there is no universally agreed definition of what is meant by 'cross subsidisation'.

- 2.382 In the simplest sense, it is commonly used to describe a pricing situation where 'profits' on one product, service or customer group are used to finance 'losses' on another. This is an over-simplification because of the difficulty of measuring profits and losses on an absolute basis by product or customer group.
- 2.383 In its widest sense, taking the concept to its logical conclusion, cross subsidisation can be held to occur in any situation where different products or customer groups contribute different rates of return on their investments.
- 2.384 In Telecom Australia, the main concerns about cross subsidisation have been in relation to country services, public telephones, leased coin telephones, short versus long distance calls and the telegraph service. In our paper on product costing and profitability analysis we pointed to the difficulties in drawing conclusions about cross subsidisation based on the annual 'results by product type' data published by Telecom, because of the nature of the product accounting system and the assumptions involved.
- 2.385 If adequate product cost and revenue data were available, it would be possible to evaluate more closely the extent of cross subsidisation involved in Telecom's pricing structure. In the widest sense of the term there is the potential for cross subsidisation in at least the following respects:
- as between products, through commercial price differentiation, where elasticities of demand are different;
 - as between current and future subscribers, where excess capacity is provided with a future growth of demand anticipated, i.e. current subscribers may be subsidising future subscribers;
 - as between types of subscribers - e.g. city/country, business/non-business;
 - in respect of remote installations, where connection may be provided and maintained below direct cost;
 - in respect of certain social services (e.g. provision of free emergency calls).
- 2.386 In practice, in a commercial environment, prices are based mainly on market factors and tend to be set closest to variable (or marginal) costs in the most price elastic (and probably most competitive) markets and further from variable cost in the least price elastic markets. In essence, this leads to price differentiation. That is, it does not equalise the rate of return for each product or service. In principle, provided there are adequate safeguards against monopolistic abuse, either through competition or regulation, a degree of price differentiation can, in our view, be justified on both commercial and

economic grounds. It would be impractical to expect all products, regions and customer groups to return similar levels of profitability, or return on investment, as this could lead to a reduction in profitability overall and a distortion of investment policies, with consequent misallocation of resources.

- 2.387 However, there are some pricing policies that are neither commercially justified (in the sense of utilising price elasticities to optimise contributions) nor economically justified (in the sense of optimising net social benefits). It is these policies which, as we understand it, involve cross subsidisation for essentially social reasons. For example, the pricing of some remote country installations, where the installation fee is well below the direct costs of installation, is subsidised effectively by other classes of subscriber or services. In our opinion, these types of social cross subsidisation should be recognised and measured. Consideration could then be given to the alternative of direct governmental subsidisation, if it can be demonstrated that the pricing policy in these cases is essentially for social purposes and not commercially justifiable. It can be argued that cross subsidisation in this sense occurs only when a product's revenue fails to cover its direct costs, that is, it makes no positive contribution to joint costs, indirects or profit.

ECONOMIC PRICING THEORY

- 2.388 Much of the discussion on pricing in the telecommunication industry centres on its monopoly position. In theory a monopolist can increase prices and restrict production in order to maximise profits, directing part of the consumer surplus (difference between price paid and maximum price that would be paid, times volume) achieved in a competitive structure to the producer surplus (profit). This practice, by diverting demand, could lead to a misallocation of resources throughout the economy.
- 2.389 The justification sometimes argued in favour of a monopoly is that because of economies of scale and given the size of the market, only one firm can operate efficiently.
- 2.390 Because of the potential for monopolists to earn super profits and to distort the resource allocation, there is an argument that they should be controlled to keep prices closer to those pertaining under perfect competition. In telecommunications this has been attempted by regulation of the private sector industry or by nationalising the industry.
- 2.391 During the 1960's there was a growing awareness by governments that nationalised industries needed sound economic criteria to enable them to plan and operate efficiently. The economic criteria chosen were based on the concepts of welfare economics.
- 2.392 In theory an optimum allocation will be achieved automatically through the price mechanism, under perfect competition. In a situation of non-perfect competition economic welfare theory argues that for the

optimal use of national resources (that is the maximisation of net social benefit), the prices of all resources used and the prices of all outputs produced should be related to their marginal costs.

- 2.393 Marginal cost pricing is, therefore, advocated by many economists for nationalised monopolies. If prices are based on average or apportioned total cost, it is argued that the resulting net social benefits can never be greater, and generally will be lower, than those derived from a price based on marginal cost.
- 2.394 However, as some of the inputs into the production process, for example plant and machinery, can, by reason of their lead times, only be varied in the long run, it was concluded that for industries such as telecommunications this marginal cost should be the long run marginal cost (LRMC).
- 2.395 In practice, the use of LRMC pricing poses problems. For the rule 'set price at long run marginal costs' to be theoretically valid, all the inputs and outputs should be priced at their LRMC. The practical calculation of a LRMC is difficult; to be truly long run all factors of production must be variable and it is likely this means looking ahead to a period beyond any current capital purchase commitments. The distance ahead of this period introduces large elements of uncertainty into the calculations, for example, the uncertainty of future technology and the uncertainty of future cost movements. Furthermore, LRMC's are the marginal costs of services to be produced by the network in the future and are not necessarily helpful in establishing prices now for the existing network which, due to the long lead times of many telecommunications investment projects, is already largely determined for the period for which the price is to be calculated.
- 2.396 A further difficulty is that LRMC pricing may not cover total costs or yield the required accounting rate of return. Assuming that a reasonable return on net assets is included in prices, in an industry where average costs are increasing with increasing output, the financial target will be more than met by a pricing policy based on marginal costs, since marginal costs always exceed average costs in this case. In an industry where average costs are falling with increases in output, marginal costs will be less than average costs; consequently a pricing policy based on marginal costs will produce an accounting loss. In the latter case, the pricing policy will, therefore, have to be distorted from that which is economically the most efficient if the organisation is to meet its financial objectives.
- 2.397 Therefore, as Telecom must meet a financial target, the basic marginal cost approach to setting tariffs needs to be modified so that the target is reached. It can be argued that a systematic raising of the marginal cost based price, in inverse relation to the demand elasticities, to achieve the financial target, will give a value of net social benefit greater than that achieved by basing prices on average

or apportioned costs. In practice, this recommendation is likely to result in raising the prices of those services with the most inelastic demand. This could be said to be broadly in line with commercial pricing practice; however, if used systematically the approach would lead to a more differentiated pricing structure.

COMMERCIAL PRICING PRACTICE

- 2.398 A 'commercial' pricing policy requires prices to be determined by reference to a number of key factors, including:
- the financial and other objectives of the organisation (rate of return, growth, market share etc.);
 - the elasticity of demand for the product or service;
 - competitors' pricing and marketing policy;
 - if little or no competition, the profitability/price threshold at which new competitors may be attracted or substitute products demanded;
 - the short and long run variable (or marginal) costs of the product or service and the contribution towards overheads achievable at proposed prices;
 - the cost/volume structure of the business and the impact of break even levels of sales.
- 2.399 In practice, most well managed commercial organisations pay close attention to the relationship between product costs and prices and focus on the contribution to fixed costs and profit earned by product groups (and individual products), customer groups (and individual customers) and, where appropriate, regions or profit centres. Thus, pricing is cost related although often not directly determined as a formula relationship to cost. The determination of price is a complex process involving market and strategic considerations as much as cost relationships. Nevertheless, a close knowledge of product costs and cost/volume relationships is vital in commercial management.
- 2.400 The present annual product accounting system produces average total costs measured in historical terms and distributes all costs over products and services, even though there are large elements of cost which are wholly or partially joint costs, which do not vary with activity levels of individual products or services. The apportionment of these costs over products and services is of limited value in pricing policy and may lead to sub-optimal commercial pricing in some cases if not used with care and understanding. Telecom has recognised this and during the last two or three years has been developing new cost modelling approaches for commercial pricing, based on the direct contribution approach.

- 2.401 In a wholly commercial pricing policy, the objective would be to optimise the contribution from products/services so that the sum of all contributions (revenue less direct costs) exceeds the indirect costs of the business by the required financial return. As far as practicable prices should be cost related, subject to any overriding requirements for social subsidisation, which should be identified separately and measured.
- 2.402 In our opinion, Telecom needs (and appears to be moving towards) a pricing policy which is:
- . based on sound knowledge of long and short run variable (or marginal) costs and revenues;
 - . commercially oriented - taking account of market demand, elasticities and competitive factors, and based on achieving sufficient contribution from products and services to cover joint and fixed costs and yield the required rate of return, taking into account the internal funding objective for capital investment;
 - . flexible enough to permit differential pricing of certain products and services on a short term basis, (e.g. relatively frequent adjustments to off-peak pricing) to maximise contributions and respond to competitive action, while permanent enough to permit business users to make investment decisions based on reasonably long term pricing considerations;
 - . able to take into account the impact of inflation and changing technology on cost structures, particularly the asset base;
 - . sensitive to social and legislative obligations but able to identify separately and measure accurately the extent of any socially predicated cross subsidisation.
- 2.403 To achieve this, the long run pricing structure should be based on the practical equivalent of long run marginal cost, sometimes referred to as long run average incremental cost. The closest equivalent in accounting terms is long run variable direct cost based on current rather than historic capital costs where appropriate. It represents the average cost per unit of product or service that would be incurred over the long run (usually the economic life of the capital investment involved) in raising the level of output or usage by a significant increment above full capacity.
- 2.404 The definition of which costs to include in long run variable direct cost for particular products and services would require a detailed analysis of Telecom's cost and network structure, which was beyond the scope of this review. However, subject to such analysis, we would expect the following types of cost to be included:
- . for terminal devices, the direct costs of the current capital cost of the terminal, the interest on that cost at current cost of capital, and the direct installation, maintenance and administration costs, amortised over the economic life of the terminal to obtain a cost per terminal unit;

- for subscribers' lines, the current capital cost of installing a subscriber's line and connection to the subscribers' exchange, the interest on that cost at current cost of capital, and the direct maintenance and administration costs, amortised over the economic life of the subscribers' lines to obtain a cost per unit of distance from exchange to subscriber;
 - for the network, the current capital cost of providing a significant increment of peak capacity, the interest on that capital at current cost of capital, and the direct maintenance and administration costs, amortised over the economic life of the additional capacity, to obtain an annual cost per unit of capacity/distance.
- 2.405 Prices would normally be set at a level above direct costs, based largely on 'what the market will bear' and profit objectives. That is, taking into account elasticities of demand, current and potential competitive pressures, social and other factors, the pricing policy should aim to achieve a price/volume mix which provides sufficient contribution overall to cover the total indirect costs and yield the required rate of return.
- 2.406 Within this structure, there should be commercially flexible short run differential pricing, based on reliable product cost/contribution information, for the marketing of products and services such as:
- off-peak services, within existing capacity, to maximise overall contribution for the network;
 - other services where there is spare capacity, e.g. it may be feasible to increase total revenue by reducing the connection charge (via discounts, bonuses etc.) temporarily in areas where new capacity has just been installed.
- 2.407 For the purpose of short run pricing, only those costs which are direct to product and variable in the short run should be taken into account; for the network this would usually exclude capital and interest costs (except where capacity is currently fully loaded) and include only limited administrative and maintenance costs.
- 2.408 Ideally, where capacity is limited, the pricing policy should be designed to optimise the rate of contribution per unit of limiting factor of capacity. (This has particular implications for short run pricing policy in respect of, for example, peak versus off-peak pricing). In the long run, an optimal investment policy should balance capacity, but inevitably there will be short run congestion limits, which costing and pricing policy should recognise.
- 2.409 Fundamental to these objectives for pricing policy is the need to have a clear understanding of product costs, revenues and market elasticities and current replacement values of fixed assets. In determining long run variable direct costs for pricing purposes the cost modelling approach (currently being developed by Telecom) is the most appropriate since it takes into account expected future costs, but it needs to be extended to cover the whole network, suitably segmented.

- 2.410 However, cost modelling suffers from the disadvantage that it is not easily reconcilable with verifiable historical costs. To provide a verifiable cost base and for historical assurance that the pricing cost models have been validly determined, the product accounting system needs modification to recognise and report on the same elements of cost as are used in the models. For this purpose variable direct costs should be recorded, including depreciation on current replacement values of fixed assets applied over realistic asset lives.
- 2.411 In this respect it is interesting to note that similar recognition of the need for improved product cost and revenue information and the growing importance of cost related pricing, is emerging in major overseas telecommunications organisations.
- 2.412 New communication technology is now making competitive telecommunications networks feasible. Telecom pricing practices that include the recoupment of average total costs, including elements of technologically superseded 'sunk' costs, can make the use of the new technology look unjustifiably attractive to potential competitors and could lead to misinformed investment decisions. Much work has been done by Telecom in recent years to correct apparent anomalies in the pricing structure, including recently announced changes, but more effort will be needed before prices can be regarded as closely cost related and commercially optimised.

FINANCIAL MODEL

INTRODUCTION

- 2.413 In our briefing paper 'Application of Current Cost Accounting Principles', it was observed that:

"the most significant points arising from valuing Telecom's fixed assets on the current cost basis are that:

- . it demonstrates that the true earnings rate of the business is declining and Telecom is only just earning sufficient revenue to meet the real (current) cost of providing its services;
- . it discloses the actual amount of funds required to be retained to replace existing assets".

- 2.414 More specifically, it was noted that the 1980--81 reported profit of Telecom of \$232 million would be reduced to only \$4 million if allowance was made for the current cost of replacing fixed assets based on the revaluation conducted using the Capital Works Index.

- 2.415 Following discussion of this briefing paper, we were asked to construct a simple financial model designed to show the extent to which unit prices would need to change in order to maintain ongoing cash flows under various sets of assumptions regarding inflation, growth and funding. The model was based broadly on existing financial data and ratios of Telecom and on a number of assumptions that are dealt with below.

- 2.416 A number of different assumptions were tested in the development of the model including historic cost and current cost accounting alternatives. It was decided by the Committee that the twelve combinations of assumptions summarised below were the most appropriate for the purpose of the Inquiry.

Reference	HC1	HC2	HC3	HC4	HC5	HC6	HC7	HC8	HC9	HC10	HC11	HC12
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Variables

Fixed asset												
inflation %	8	8	8	8	8	8	4	4	4	4	4	4
Growth %	0	0	5	5	10	10	0	0	5	5	10	10
Internal												
funding %	100	60	100	60	100	60	100	60	100	60	100	60

KEY ASSUMPTIONS

- 2.417 The model extends for a period of 10 years with yearly increments. The opening prices and balances are shown as year '0'. Results in the form of summarised balance sheets, profit and loss accounts and cash flows were printed out. A general rate of inflation of 10 percent per annum was assumed for expenses (cost of sales), but not for fixed asset inflation which was treated as a variable.
- 2.418 The key variables in the model were:
- . the rate of fixed asset replacement cost increases ('fixed asset inflation %');
 - . growth in the real volume of sales ('growth %');
 - . the rate of internal/external funding of the annual cost of fixed asset additions ('internal funding %').
- 2.419 These variables were applied at the commencement of each year and remained constant throughout the year (i.e. it was assumed all consequent price and cost adjustments were made on the first day of the year). Increments of 3 or 6 months could have been used if more frequent changes had been desired but over a 10 year period the relative trends of the alternative print outs would not have been materially different.

RELATIONSHIP OF THE MODEL TO TELECOM'S FINANCIAL STATEMENTS

- 2.420 The following table summarises the key financial figures and ratios disclosed in the 30 June 1981 financial statements of Telecom and compares these with the hypothetical figures used in the model.

Table of Financial Ratios

	Telecom year end 30.6.81 \$ million	Model year 0
<hr/>		
<u>Profit and Loss Statement:</u>		
Sales	2 609	1 000
Less expenses (cost of sales)	1 435	550
Gross Profit	1 174	450
Less Depreciation	534	Computed
Less Interest	408	by
Net Profit	232	Model
	=====	
 <u>Balance Sheet:</u>		
Fixed Assets:		
Gross Book Value (GBV)	11 700	4 480
Less Acc. Depreciation	3 502	1 340
Net Assets (NBV)	8 198	3 140
	=====	=====
 Financed by:		
Share Capital	-	954
Shareholders Reserves	2 424	930
Debt	5 774	1 256
	8 198	3 140
	=====	=====
 Ratios:		
Expenses to sales	55%	55%
Acc. Depreciation to GBV	30%	30%
Sales to NBV	32%	32%
Reserves to NBV	30%	30%
Debt to NBV	70%	40%

DETAILED ASSUMPTIONS

- 2.421 The detailed assumptions adopted in the model have been developed by the Committee and are designed to reflect the past financial experience of Telecom under the various alternative projected assumptions regarding future levels of inflation and interest rates. These assumptions are summarised below:

Profit and loss account

- 2.422 The basic profit and loss account assumptions were:

- . Sales volume (year '0' = 1000):
 - the real volume of sales increase by applying the selected growth rates to the volume of sales for the preceding year;
- . Sales price adjustment:
 - this is the dependent variable in the model and is the amount by which average unit sales prices (year '0' = .22) must increase in each set of assumptions to balance the cash flow for the year;
- . Expenses (Cost of sales):
 - is 55 percent of value of sales of previous year increased in proportion to growth and general inflation (inflation was 10% per annum for all models). The initial level of expenses (55% of sales for year '0') increases in volume by the growth rate and in price by the general rate of inflation;
- . Depreciation:
 - depreciation is calculated at the straight line rate of 5% on the Gross Book Value of fixed assets at the end of previous year. (Telecom 1981 = $534/10926 = 4.9\%$);
- . Interest:
 - interest on the original level of debt assumed at the commencement of model is calculated at the rate of 8 percent per annum. (Telecom paid 1981 $408/5406 = 7.55\%$). The rate of 16 percent per annum is applied to additional borrowing added during the model and is based on the level of debt at the end of each year.

Funds employed

- 2.423 For simplicity, it has been assumed that funds employed comprises only fixed assets. Stocks, current assets, current liabilities, and provisions for long service leave and superannuation have been omitted.

The net effect of these items based on the 30 June 1981 balance sheet of Telecom is to reduce the funds employed by \$163 million which represents 2 percent of fixed assets. As the trend of these relatively minor items follows the cost trend their omission has no significant effect on the trends produced by the model.

- 2.424 Telecom being a statutory corporation has no issued capital. The funds are provided by reserves retained in the business plus debt consisting of public loans and loans from the Federal Government.
- 2.425 For modelling purposes part of the debt has been deemed to be issued capital so that, together with initial reserves, it represents 60 percent of opening funds employed, the balance of 40 percent representing the initial level of debt.
- 2.426 Dividend is paid on the issued capital at the rate of interest previously applied to the debt (8 %). For simplicity the dividend is held constant throughout the ten years. In commercial practice, the quantum of reserves as well as issued capital would be taken into account in determining the dividend policy.
- 2.427 Over the life of the model funds employed increases by profits retained and by the increase in borrowings that result from the funding assumptions.

Taxes

- 2.428 No allowance for payment of Company Tax has been made, on the assumption that a new taxation depreciation rate of 20 percent average, would provide Telecom with allowable deductions equivalent to any likely operating surplus, even if it were not exempt from tax.
- 2.429 Whilst this assumption is likely to be valid for the 10 year period in those cases where growth is assumed and if the tax depreciation rates remain unchanged, on the 'no growth' basis it may not be the case that the higher depreciation rates will completely extinguish the tax liability. In any event, the application of tax effect accounting principles that currently apply in Australia would require the booking of a tax expense and the establishment of a provision for deferred tax. As these would both be non-cash items, however, there would be no effect on the sales price adjustment computed by the model.
- 2.430 Other taxes and duties (sales tax etc.) referred to in our paper on 'Taxation and Other Duties', from which Telecom is currently exempted, have been ignored in the model. While allowance would need to be made for these taxes if Telecom were not in an exempt position in the future, they would simply have the effect of increasing the commencing level of expenses above the 550 allowed for in the model and would thereafter increase approximately proportionately with inflation, with no significant effect on the conclusions drawn from the model.

Fixed asset additions

- 2.431 The model assumes that before allowing for real growth (if applicable) the existing telecommunications network must be maintained by replacing old assets retired, at current prices.
- 2.432 Therefore fixed asset additions each year represent:
- the replacement of assets equivalent to the historical cost depreciation charge, adjusted to current fixed asset price levels (using the F/A inflation rates), plus;
 - the assumed growth in fixed assets arrived at by applying the growth factor (if applicable) to the volume of fixed assets represented by the GBV at the end of the preceding year.
- 2.433 It should be noted that the fixed asset cost inflation rates assumed in the model of 4 percent and 8 percent respectively are both lower than the assumed rate of general inflation, 10 percent. This is a reflection of the pattern of cost changes in a high technology industry where enhancements brought about by new technology are expected to have the effect of reducing the cost per unit of capacity.

Fixed asset retirement

- 2.434 The gross book value (GBV) of fixed assets must be reduced each year by the value of the assets which are 'retired' because they have been fully depreciated. On a theoretical basis, the assumed depreciation rate of 5 percent implies a twenty year life of fixed assets before retirement. In practice, however, the assets included in the GBV at commencement of the model reflect the asset life, growth and F/A inflation of the previous history of Telecom. We understand that your inquiry into the past pattern of asset retirements and 'changes of service lives' by Telecom indicates that retirement after 15 years is more realistic and whilst this is at variance with the depreciation rate adopted, the model uses this assumption.
- 2.435 The deduction from gross fixed assets is calculated by discounting the current 'additions' figure for 15 years, depending on the growth and inflation assumptions of the model, i.e., retirements are those assets purchased 15 years previously at a price equal to the current price discounted for 15 years.
- 2.436 The following table shows the discount factors used by the model for various sets of growth and inflation assumptions. In each case the calculation is:

$$\text{discount factor} = \left[\left[1 + \frac{\text{F/A INFL}}{100} \right] \left[1 + \frac{\text{GROWTH}}{100} \right] \right]^{-- 15}$$

CASE	HC1	HC2	HC3	HC4	HC5	HC6	HC7	HC8	HC9	HC10	HC11	HC12
F/A	8	8	8	8	8	8	4	4	4	4	4	4
GROWTH	0	0	5	5	10	10	0	0	5	5	10	10
INT FNDG	100	60	100	60	100	60	100	60	100	60	100	60
FACTOR	0.315		0.152		0.075		0.555		0.267		0.133	

- 2.437 A corresponding deduction is made from the accumulated depreciation. This presupposes that the assets are fully depreciated at the time of retirement. We point out, however, that whilst this may reflect past history of Telecom, it is inconsistent with the adoption of a 5 percent, 20 year asset life assumption.

Funding of asset additions

- 2.438 The internal funding assumption (100% and 60%) is applied to the proportions of fixed asset additions in each year (replacement and, if applicable, growth). It corresponds to the definition in Section 73 of the Telecommunications Act if stores and working capital are omitted. The internal funding ratio therefore represents the rate at which fixed asset additions are financed from cash generated in the business. The balance financed from outside the business is reflected in additional borrowings.
- 2.439 Because the funding ratio is applied to fixed asset additions each year rather than to the balance of fixed assets on hand, the model does not result in a constant balance sheet gearing ratio as would more normally be the case in the private sector. As a result the gearing ratios under the external funding alternatives increase with corresponding reductions in interest cover.

RESULTS OF THE MODELS

- 2.440 Prints outs of each of the above twelve combinations were submitted to the Committee and an example of one (HC6) is given at attachment O. By way of summary, we set out below a comparative tabulation of the dependent variable in the twelve combinations of the model -- the average price that needs to be charged per unit of service in order to maintain stable cash flows -- expressed as an index of price change, taking year '0' as a base of 1.

INDEX OF MOVEMENT IN AVERAGE PRICES
(based on prices generated by model including inflation)

<u>Reference</u>	<u>Fixed Asset Inflation %</u>	<u>Internal Funding%</u>	<u>Year 1</u>	<u>Year 4</u>	<u>Year 7</u>	<u>Year 10</u>
<u>No Growth</u>						
HC7	4	100	1.02	1.24	1.54	1.94
HC8	4	60	0.94	1.20	1.54	1.98
HC1	8	100	1.02	1.29	1.63	2.09
HC2	8	60	0.94	1.24	1.62	2.12
<u>Growth 5%</u>						
HC9	4	100	1.22	1.45	1.76	2.17
HC10	4	60	1.07	1.36	1.73	2.19
HC3	8	100	1.23	1.53	1.93	2.46
HC4	8	60	1.08	1.42	1.89	2.44
<u>Growth 10%</u>						
HC11	4	100	1.40	1.64	1.97	2.40
HC12	4	60	1.19	1.51	1.89	2.38
HC5	8	100	1.43	1.76	2.21	2.81
HC6	8	60	1.20	1.59	2.09	2.72

- 2.441 As the model life extends ten years into the future and as a rate of 10 percent general inflation has been assumed, the price movements summarised above have been discounted to 'constant' present day price levels to highlight the comparisons of the 'real' price that would need to be charged under the various alternatives, expressed as an index taking year '0' as a base of 1.

INDEX OF MOVEMENTS IN AVERAGE 'REAL' PRICES
(based on model prices deflated by 10% general inflation factor)

<u>Reference</u>	<u>Fixed Asset Inflation %</u>	<u>Internal Funding%</u>	<u>Year 1</u>	<u>Year 4</u>	<u>Year 7</u>	<u>Year 10</u>
<u>No Growth</u>						
HC7	4	100	0.92	0.85	0.79	0.75
HC8	4	60	0.85	0.82	0.79	0.76
HC1	8	100	0.93	0.88	0.84	0.80
HC2	8	60	0.86	0.84	0.83	0.82
<u>Growth 5%</u>						
HC9	4	100	1.11	0.99	0.90	0.84
HC10	4	60	0.97	0.93	0.89	0.85
HC3	8	100	1.12	1.05	0.99	0.95
HC4	8	60	0.98	0.97	0.96	0.94
<u>Growth 10%</u>						
HC11	4	100	1.27	1.12	1.01	0.92
HC12	4	60	1.08	1.03	0.97	0.92
HC5	8	100	1.30	1.20	1.13	1.08
HC6	8	60	1.09	1.09	1.07	1.05

COMMENTS ON THE RESULTS OF THE MODELS

2.442 Although the models have been kept deliberately simple, some interesting conclusions can be drawn from them. In particular:

- . the highest unit prices at the end of the ten year period arise under the 10 percent growth, 8 percent fixed asset inflation assumptions (HC5, HC6) and the lowest prices under no growth, 4 percent fixed asset inflation (HC7, HC8); this demonstrates that the higher the growth and fixed asset inflation, the higher the profit needed to generate internal funds for capital investment;
- . in all the twelve combinations of assumptions modelled (all assuming no company taxes payable) while there is an initially higher price increase in the 100 percent internal funding alternatives, there is no significant price sensitivity to the funding alternatives over the longer term, when the cumulative effect of high interest rates offsets the funds generated by additional borrowings both of which under the model are reflected in prices; if income tax were payable, price would be more sensitive to funding alternatives, particularly with high growth, since the interest deductions on external borrowings would have the effect of reducing tax payable;
- . in the case of high growth (10%), the price in the first year of the model has to increase substantially to fund the higher level of growth; the extent of this initial increase is affected significantly by the level of external borrowings, but after the first year the impact of the funding alternatives reduces progressively over the longer term;
- . under the conditions of inflation assumed in the models, it is demonstrated that even in cases of no growth, Telecom must achieve continually increasing historical cost profits through higher actual prices, or alternatively increase its debt, merely to fund the replacement of existing fixed assets, if it is to balance its cash flows.

SCHEDULE OF FIXED ASSETS - 30th JUNE, 1981

CLASS OF FIXED ASSETS	VALUE		PROVISION FOR DEPRECIATION		NET BOOK VALUE	
	At Cost	At Valuation	At Cost	At Valuation	At Valuation	Total
	\$	\$	\$	\$	\$	\$
COMMUNICATIONS PLANT						
CUSTOMER EXCHANGE EQPT.	1,074,433,265	1,565,938,425	95,450,570	782,892,530	978,812,695	1,761,858,590
CUSTOMER INSTRUMENTS	984,991,087	1,251,593,415	208,458,638	170,222,238	776,552,449	872,632,328
CUSTOMER PAXES	55,423,278	31,506,099	17,664,943	(2,644,924)	37,773,315	36,154,973
CUSTOMER CARRIER EQPT.	7,469,602	1,328,463	82,383,058	571,913,387	6,418,600	6,865,595
CUSTOMER CABLES - DISTRIB.	969,619,980	1,113,530,264	82,383,058	571,913,387	883,234,922	1,429,056,799
CUSTOMER CABLES - MAIN	245,245,244	672,969,167	18,956,607	340,723,426	226,988,531	558,534,398
JUNCTION CARRIER EQPT.	62,465,552	108,350,687	8,216,630	61,427,290	55,463,920	101,172,419
JUNCTION CABLES	119,224,159	371,286,131	10,350,965	142,856,209	108,371,940	337,303,112
TRUNK SWITCHBOARD EQPT.	161,882,054	209,636,009	14,738,470	100,294,994	147,441,586	256,464,596
TRUNK CARRIER EQPT. - TELEPHONE	108,568,834	321,157,956	14,361,404	192,064,873	94,202,430	273,200,513
TRUNK CARRIER EQPT. - TELEGRAPH	8,234,021	20,067,535	928,082	11,898,682	7,303,939	16,402,874
TELEGRAPH EQUIPMENT	190,269,317	15,301,872	55,295,154	2,253,058	134,764,163	148,022,977
CUSTOMER RADIO EQPT.	31,694,452	-	4,243,290	4,243,290	27,451,162	27,451,162
DUCTS AND CONDUITS	985,449,638	-	119,188,791	-	866,260,847	866,260,847
CUSTOMER AERIAL WIRES	70,028,922	-	32,942,741	-	37,086,181	37,086,181
JUNCTION RADIO BEARER EQPT.	8,461,424	-	1,502,121	-	6,959,303	6,959,303
JUNCTION AERIAL WIRES	10,564,451	-	4,869,257	-	5,715,194	5,715,194
TRUNK RADIO BEARER EQPT.	221,440,662	-	77,073,737	-	144,366,925	144,366,925
TRUNK CABLES	189,777,927	-	49,058,786	-	140,719,141	140,719,141
TRUNK AERIAL WIRES	19,432,228	-	803,488	-	19,028,740	19,028,740
DATA TRANSMISSION EQPT.	77,267,445	-	23,388,140	-	53,879,305	53,879,305
Total	5,601,943,642	4,699,674,956	860,582,878	2,374,006,199	4,761,160,764	7,087,029,521
LAND AND BUILDINGS						
LAND	92,787,383	-	-	-	92,787,383	92,787,383
BUILDINGS	851,085,023	-	124,920,621	-	726,164,402	726,164,402
LEASEHOLD IMPROVEMENTS	22,390,903	-	8,619,843	-	13,771,060	13,771,060
Total	966,263,309	-	133,540,464	-	832,722,845	832,722,845
MOTOR VEHICLES						
Total	153,329,446	-	62,764,509	-	90,564,937	90,564,937
OTHER PLANT AND EQUIPMENT						
WORKSHOPS PLANT	18,637,842	-	6,623,585	-	12,014,257	12,014,257
MECHANICAL AIDS	53,592,466	-	20,450,410	-	33,142,056	33,142,056
PORTABLE AIDS	89,423,684	-	29,674,075	-	59,749,609	59,749,609
RESEARCH EQPT.	25,367,906	-	7,794,501	-	17,573,405	17,573,405
FURNITURE	40,356,141	-	11,653,193	-	28,702,948	28,702,948
OFFICE MACHINES AND AIDS	11,453,928	-	4,286,262	-	7,167,666	7,167,666
ADP EQPT.	25,784,873	-	5,966,035	-	19,818,838	19,818,838
MISCELLANEOUS PLANT	14,032,539	-	4,381,187	-	9,651,352	9,651,352
Total	278,649,779	-	90,829,248	-	187,820,531	187,820,531
TOTAL VALUE OF FIXED ASSETS	7,000,186,176	4,699,674,956	1,127,697,099	2,374,006,199	5,877,485,077	8,198,137,834
Total	-	-	-	-	2,425,668,757	2,425,668,757

EXTRACT FROM TELECOM'S ACCOUNTS INSTRUCTION MANUAL

Determination of Capital and Revenue Expenditure

1. Additional assets and additions to existing assets will be capitalised (except for minor items such as consumable tools etc).
2. Replacements of existing telecommunications assets where the replacement increases the number of plant units or provides a different service will be capitalised irrespective of cost.
3. Replacements of existing telecommunications assets where the replacement does not vary the number of plant units and provides the same service will be treated as follows:
 - . where the cost is estimated to exceed \$2 000, the expenditure will be capitalised (this limit will be increased to \$15 500 in 1981--82 year);
 - . where the cost is estimated not to exceed \$2 000 (1981--82 \$15 500) the expenditure will be charged to working expenses.
4. Replacements of other than telecommunications assets involve complete assets or major and separately identifiable portions of complete assets and, with the exceptions of certain consumable items, will be capitalised irrespective of cost;
5. Rearrangement of external telecommunications plant where such work is associated with an extension of plant or has the effect of increasing the capacity of existing plant, will be capitalised irrespective of cost, otherwise the cost will be treated as working expense.
6. Rearrangement of internal telecommunications plant, other than subscriber's equipment, where such work is associated with an extension of plant or has the effect of increasing the capacity of existing plant, or where such existing plant is moved to a new site in a different exchange area, will be capitalised irrespective of cost; otherwise the cost will be treated as working expense.
7. Rearrangement of subscribers equipment in another building will be capitalised irrespective of cost; rearrangements of such equipment in the same building will be treated as working expense.
8. Rearrangements of all plant, other than telecommunications plant and buildings, where such work is associated with an extension of plant or has the effect of increasing the capacity of existing plant, will be capitalised irrespective of cost; otherwise the cost will be treated as a working expense.
9. Rearrangements of buildings will be capitalised in all cases, irrespective of cost.

SCHEDULE OF SERVICE LIVES

	YEARS
Subscribers' Exchange Equipment	25
Subscribers' Instruments	10
Subscribers' PABXs	10
Subscribers' Carrier Equipment	11
Subscribers' Radio Bearer Equipment	15
Ducts and Conduits	60
Subscribers' Cables -- Distribution	25
Subscribers' Cables -- Main	30
Subscribers' Aerial Wires	15
Junction Carrier Equipment	20
Junction Radio Bearer Equipment	22
Junction Cables	35
Junction Aerial Wires	15
Trunk Switchboard Equipment	24
Trunk Carrier Equipment -- Telephone	20
Trunk Carrier Equipment -- Telegraph	20
Trunk Radio Bearer Equipment	22
Trunk Cables	40
Trunk Aerial Wires	15
Telegraph Equipment	7
Data Transmission Equipment	7
Workshops Machinery and Plant	20
Mechanical Aids	7
Other Plant	11
Trailers	11
Furniture and Office Equipment	20
Office Machines and Aids	8
ADP Equipment	12
Stores Handling Equipment	10
Other Equipment	12
Engineering Technical Assets (Headquarters)	9
Electric Light and Power Equipment	15
Motor Vehicles -- Engineering	5
Research Equipment	9
Leasehold Improvements	10
Food Services	12
Staff Amenities	12

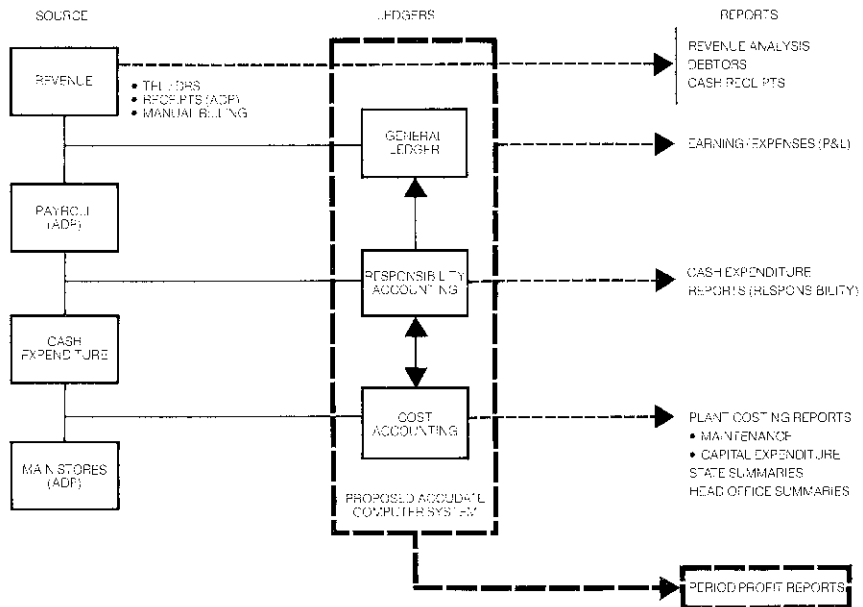
Buildings are depreciated over estimate useful life on a unit basis.

BRITISH TELECOM

ESTIMATED USEFUL LIVES

	YEARS
Telecommunications Plant	
Cables and transmission equipment	15--40
Duct for cables	40--60
Telephone instruments	6--17
Telephone installation costs/switchboard	9
Exchange equipment	7--25

STRUCTURE OF TELECOM'S PRESENT REPORTING SYSTEM



Attachment E

REVIEW OF TELECOM'S CAPITAL WORKS' INDEX (CWI)

Telecom's CWI index has been variously described as a 'current expenditure weighted index' or a 'chain linked Paasche index'. While it has some of the features of a Paasche index, and while it resembles a current expenditure weighted index, it is in fact a hybrid type of index.

The hybrid nature of the CWI is introduced by three factors:

- the method of pricing the components making up the CWI;
- the method of weighting the prices;
- the method of chaining the indices.

Method of Pricing

The CWI contains 3 major indexes which are materials, labour and incidentals, and each component contains several hundred individual indexes.

On 30 June each year, Telecom set a standard price for each item, and this standard price remains in force until 30 June of the next year. The CWI is calculated on the basis of the change in standard price between different years for stores issued materials, and the change in actual prices for labour and incidentals.

For example, for the 'materials' component, Telecom defines a 'Stores Issue Rate' (SIR) for each item in that group. In setting the SIR, a number of assumptions are made:

- the SIR calculated at 30 June will remain in force 12 months;
- the SIR should reflect as closely as possible the average cost to Telecom of the item during the next 12 months -- i.e. the cost in approximately 6 months' time -- and therefore the following factors are taken into account:
 - stock-on-hand at 30 June;
 - likely future price increases;
 - current purchase price.

The important thing to note is that the CWI is not a point-to-point index which reflects actual prices of items at 30 June, but instead is an annual-average index.

Method of weighting

In respect of stores issued materials the year during which the SIR applies is called the current year. Telecom estimates how many items will be issued during the current year. The product of current price (pc) and current quantity (qc) is called the current expenditure, and is used as the weighting factor which is applied to the change of price of the items. For labour and incidentals the actual average rate for the current year is used.

It would appear that there may be an element of compounding of current price in the use of current expenditure as a weighting factor to multiply the price ratio of current price to previous price. The magnitude of this compounding and the extent to which it is compensated for is difficult to assess. Telecom's Chief Statistical Officer has concluded that the CWI generally does not give a larger result than other indexing methods.

Method of chaining

The Telecom CWI may be considered to be a hybrid type of Paasche index because it uses current consumer pattern weighting. Unlike the pure Paasche index which requires the recalculation of the base year's index to allow for the current weighting, the CWI chains the latest current expenditure weighted index to the previous year's index.

The net effect is that the CWI is based on a changing collection of goods and services, and it simply describes the change from previous year to current year. By comparison, the CPI is a Laspeyre index which uses a constant base weighting; it can therefore be used to calculate the current cost of an historical consumer purchasing pattern. A Paasche index, on the other hand, uses current period weighting and is therefore appropriate for comparing historical and current costs of present consumer purchasing patterns. Theory predicts that, for a given set of statistics, the indexes calculated using the Laspeyre method will be greater than those calculated using the Paasche method, and the degree of discrepancy between the two depends on the dispersion of the statistics and the correlation between price movement and quantity sold.

Some examples of the various indexing methods, and the CWI, are given at Annex A.

Comparison with other indexes

The CWI has been compared with the CPI at Annex B. It can be seen from the graph at Annex B1 that, over the last 10 years, the CWI has closely followed the CPI.

Use of CWI for revaluations

The CWI may be appropriate for the general revaluation of capital works on a year by year basis, but is not necessarily suitable for the revaluation of all types of assets. Our experience shows that there may be a considerable difference between the indexes which apply to different groups of equipment. Electronic equipment, in particular, has not, over the past few years, seen the same price escalation as other types of equipment particularly where there are different levels of labour intensity in installation. This is evidenced in Annex C which compares average capital costs for different types of telecommunications plant between the years 1972--73 and 1980--81.

Furthermore, the method of upgrading the CWI for changing weighting patterns of expenditure does not seem to be an ideal basis for the revaluation of historical costs, because the weighting used is current rather than historical. However, it could be argued that the error under CWI is no greater than under any other general index system.

Conclusion

It is a fact that all methods of price indexing have some advantages and disadvantages, and none is appropriate for all purposes. The CWI is no exception. However, the following points must be borne in mind if using the CWI for revaluation purposes:

- . the CWI is an approximation due to the assumptions made to derive it; in particular, the SIR prices are not actual prices determined at a specific date;
- . while the CWI has some features of a Paasche index, it provides a year by year comparison through a unique method of weighting and chaining; it does not provide a comparison with a base year;
- . there may be some element of compounding of current price in the calculation of the CWI, but the magnitude and effect of this is difficult to assess;
- . over the last 8 -- 10 years, the CWI has closely followed the trend of the CPI;
- . the weighting used is current and not historical, and therefore not an ideal basis for revaluation of historical costs.

In our experience the best method of revaluing technological equipment is to separate the equipment into different groups or types of equipment, and to analyse price trends within each specific group. It is possible that the CWI could be analysed into specific asset groups for this purpose, and subject to the points raised above, such an analysis may prove a useful basis for future revaluations.

$$\text{Laspeyre index, } I_{no} = \frac{\sum p_n q_b}{\sum p_o q_b}$$

where I_{no} = index between current period n and previous period o.

p_n = price of an item in current period n.

p_o = price of an item in period o.

q_b = quantities purchased in selected base period b -- the same base period is used throughout.

$$\text{Paasche index, } I_{no} = \frac{\sum p_n q_n}{\sum p_o q_n}$$

where I_{no} , p_n and p_o are the same above,

q_n = quantity purchased in current period n - q_n changes every year and, therefore, affects all previously calculated indexes.

CWI

Index in period n = I_n

Index in period n+1 = I_{n+1}

$$\frac{I_{n+1}}{I_n} = \frac{\sum p_{n+1} (p_{n+1} \times q_{n+1})}{\sum p_n (p_{n+1} \times q_{n+1})}$$

Note the occurrence of the current expenditure, price (p_{n+1}) times quantity (q_{n+1}), in the numerator and denominator, so it is a type of Paasche index. The current price p_{n+1} is squared in the numerator so there is an element of compounding. p_{n+1} is the new 'Stock Issue Rate' estimated at June 30th each year, and q_{n+1} is the current estimated quantity.

The formula above is used to calculate I_{n+1} . That is,

$$I_{n+1} = I_n \times \frac{\sum P_{n+1}(P_{n+1} \times q_{n+1})}{\sum P_{n+1}(P_{n+1} \times q_{n+1})}$$

The next year, a similar process is used, i.e.

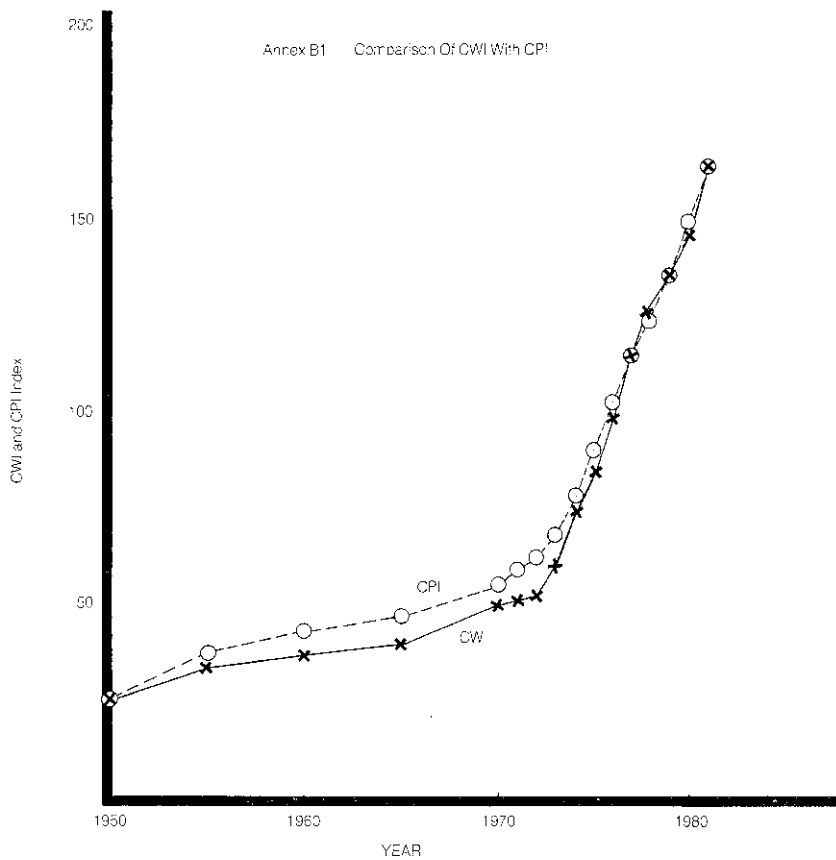
$$I_{n+2} = I_{n+1} \times \frac{\sum P_{n+2}(P_{n+2} \times q_{n+2})}{\sum P_{n+1}(P_{n+2} \times q_{n+2})}$$

$$I_{n+3} = I_{n+2} \times \frac{\sum P_{n+3}(P_{n+3} \times q_{n+3})}{\sum P_{n+2}(P_{n+2} \times q_{n+2})}$$

This is called 'chaining' the index. It avoids the recalculation of previous years' indices due to changing current weights.

COMPARISON OF THE CWI WITH THE CPI

Year	CWI	CPI, Australia wide four quarters, calender year	CPI (normalised to CWI)
1950	24.89	49.9	$\xrightarrow{\quad \times 0.4988 = \quad}$ 24.89
1955	34.48	75.1	$\xrightarrow{\quad \text{"} \quad}$ 37.46
1960	37.43	87.6	$\xrightarrow{\quad \text{etc.} \quad}$ 43.69
1965	39.69	95.8	47.78
1970	50.06	111.7	55.72
1971	51.38	118.5	59.11
1972	52.99	125.5	62.60
1973	60.33	137.3	68.48
1974	75.88	158.1	78.86
1975	85.24	181.9	90.73
1976	100.00	206.5	103.00
1977	115.91	231.9	115.67
1978	126.37	250.3	124.85
1979	136.19	273.0	136.17
1980	147.27	300.8	150.04
1981	163.93	329.9	164.55



AVERAGE CAPITAL COST MOVEMENTS TELECOMMUNICATIONS PLANT

PLANT ACCOUNTS	DESCRIPTION		1972--73	1980--81
			\$	\$
XIP	Telephone service	per unit	100	371
XU) XD)	Subscribers' cable to exchange	per unit	48	159
XE	Subscribers' side/ exchange equipment	per unit	206	310
TZ	Transmission equipment (average all equipment)	per channel end	945	1 119

PLANT ACCOUNTS	DESCRIPTION		1973	1980
			\$	\$
TZ	Co-axial bearer (average all instal- lations during the year, including labour intensive ploughing-in)	per kilometre (similar capacity)	5 200	15 000
TR	Radio bearer	per kilometre (different capacity)	3 580 (360 channels average)	5 700 (1 800 channels average)

Source: Telecom engineering department (extracted mainly from plant account records).

TELECOM'S BALANCE SHEETAS AT 30 JUNE 1981 (CCA ADJUSTED)

	Reported \$m	CCA Adjusted \$m
NET ASSETS		
Fixed Assets		
Communications Plant	10 302	14 177
Land and Buildings	966	1 819
Motor Vehicles	153	174
Other Plant and Equipment	<u>279</u>	<u>386</u>
	11 700	16 556
Less Provision for Depreciation	<u>3 502</u>	<u>5 579</u>
	8 198	10 977
STORES	254	254
Current Assets		
Cash	20	20
Investments	60	60
Debtors	256	256
Accrued Earnings	350	350
Prepayments	<u>10</u>	<u>10</u>
	<u>696</u>	<u>696</u>
(Less) CURRENT LIABILITIES		
Creditors	211	211
Advance Receipts	163	163
Telecom Notes	70	70
Bank	<u>14</u>	<u>14</u>
	<u>458</u>	<u>458</u>
NET CURRENT ASSETS	238	238
(less) Long Term Liabilities		
Long Service Leave Provision	316	316
Superannuation	<u>339</u>	<u>339</u>
	<u>655</u>	<u>655</u>
	<u>8 035</u>	<u>10 814</u>
FINANCED BY:		
Long Term Borrowings		
Advanced from Commonwealth	4 566	4 566
Telecom Loan Stock	<u>1 045</u>	<u>1 045</u>
	5 611	5 611
RESERVES		
General Revenue	1 136	405
Asset Revaluation Reserve	<u>1 288</u>	<u>4 798</u>
	<u>2 424</u>	<u>5 203</u>
	<u>8 035</u>	<u>10 814</u>

TELECOM'S PROFIT AND LOSS STATEMENTENDED 30 JUNE 1981 (CCA ADJUSTED)

	Reported \$m	CCA Adjusted \$m
EARNINGS		
Telephone Rents	674	674
Telephone Calls	1 533	1 533
Telephone Connection Fees and Rearrangement Charges	120	120
Telegrams	33	33
Telex Rents	30	30
Telex Calls	29	29
Other Earnings	<u>190</u>	<u>190</u>
	2 609	2 609
EXPENSES		
Maintenance of Plant	645	645
Operating	482	482
General and Administrative	192	192
Accommodation	116	116
Depreciation	534	762
Interest	<u>408</u>	<u>408</u>
	2 377	2 605
RETAINED PROFIT (TRANSFERRED TO GENERAL RESERVE)	<u>232</u>	<u>4</u>

EFFECT OF 'REVALUED' DEPRECIATION EXPENSE

YEAR	GROSS BOOK VALUE OF ASSETS	DEPRECIATION			PROFIT	
		Reported	'Revalued' Basis	Increase	Reported	'Revalued' Basis
	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
1975--76	7 870 942	312 358	326 358	14 000	152 393	138 393
1976--77	8 593 454	340 817	396 817	56 000	164 402	108 402
1977--78	9 370 432	366 514	478 514	112 000	184 918	72 918
1978--79	10 116 750	410 411	550 411	140 000	190 519	50 519
1979--80	10 926 423	447 383	626 383	179 000	211 545	32 545
1980--81	11 699 861	533 680	761 680	228 000	232 487	4 487

STATEMENT OF TELECOM'S ESTIMATED TAXABLE INCOME
FOR THE YEAR ENDED 30 JUNE 1981

	Paragraph Reference	\$m	\$m
RETAINED PROFIT PER TELECOM ACCOUNTS			232.5
<u>ADJUSTMENTS FOR OTHER TAXES</u> <u>AND DUTIES:</u>			
Payroll tax	2.242	46.0	
Sales tax	2.237--2.239	10.0	
Customs and other duties	2.240	10.0	
Motor vehicle registration and insurance	2.241	8.0	
Rates and land tax	2.243--2.248	55.0	(129.0)
RETAINED PROFIT AS ADJUSTED			103.5
<u>INCOME TAX ADJUSTMENTS:</u>			
<u>Add:</u> Depreciation per accounts		533.7	
Increase in provisions expensed to Profit and Loss Account:			
Long Service Leave	2.228	19.4	
Superannuation	2.228	40.5	
Doubtful Debts	2.230	1.0	594.6
			698.1
<u>Less:</u> Tax depreciation	2.214--2.224	338.6	
Investment allowance	2.225--2.226	176.0	
Increase in prepayments	2.235	3.2	
Capitalised interest	2.231	14.4	(532.2)
ESTIMATED TAXABLE INCOME			165.9
INCOME TAX THEREON @ 46%			76.3
ROUNDED TO			76

NEW TAX DEPRECIATION RATES AND ALLOWANCES

Recent developments

A new tax depreciation package was announced by the Federal Government on 19 July 1982, with new depreciation rates and allowances available on expenditure incurred after that date. Two aspects of the package would be relevant to Telecom if it was not statutorily exempt from taxation:

Depreciation -- new buildings: tax depreciation at the rate of 2.5 percent per annum on prime cost will be available in respect of new non residential income producing buildings, and on extensions and alterations to existing buildings where construction commences after 19 July 1982.

Depreciation -- plant and equipment generally: new depreciation rates based on prime cost will be available in respect of expenditure incurred after 19 July 1982. Broadly speaking this will result in depreciation being available at either 20 percent or 33.33 percent per annum on prime cost of additions after that date other than structural improvements and motor cars and other small motor vehicles which will continue to be depreciated on the current basis. The new rates will apply to purchases of both new and secondhand equipment.

In order to illustrate the effect that the new rates and allowances would have on the amount of tax depreciation which Telecom might annually claim if it was not tax exempt, we have projected tax depreciation figures forward to the year ending 30 June 1983 which is the first year upon which the new rates and allowances would impact. In projecting forward from the calculations for the year ended 30 June 1981 we have assumed that additions to fixed assets in each year would be identical to those of the year ended 30 June 1981, and our projection is of course subject to all the weaknesses and uncertainties discussed in the briefing paper on taxation and other duties. Our projections indicate that if the Commission's results for that year were similar in all respects to those of the year ended 30 June 1981 the new depreciation rates and allowances would give rise to additional deductions sufficient to render any income tax liabilities insignificant in magnitude.

Additionally, if any form of reorganisation of the Commission was undertaken such that its fixed assets were transferred to a taxable entity, it is possible that all tax depreciable assets would be eligible for the rates outlined above. As a result tax depreciation would be accelerated considerably in advance of that calculated for the Commission for the year ended 30 June 1981.

EXTRACT FROM TELECOM'S GUIDELINES FOR INVESTMENT EVALUATION

1. Introduction

Investment evaluation techniques are used in the process of allocating available funds between the many competing investment projects of Telecom Australia. While emphasis is given in these guidelines to economic factors, these are not necessarily the only factors to be considered in selecting or rejecting alternatives or projects which have been economically evaluated. There may be other factors such as technical standards, resource availability, customer requirements and community social benefits which impact on particular proposals and these will generally be considered.

The approach to investment evaluation adopted in these guidelines reflects the financial environment in which the Commission is currently operating and is expected to operate in the foreseeable future. The Commission's capital expenditure program is extensive and its considerable size creates pressures in actual funds provision. Given the limited size of the Australian capital market and the competing needs of other authorities, Telecom does not have unlimited access to funds and accordingly constraints are placed on the overall size of the capital program.

In this situation, it is important for Telecom to ensure that the most effective use is made of available funds. In order to ensure that the funds are used efficiently and that Telecom can finance its operations in the longer term, there is a need to evaluate all requirements for capital expenditure in terms of the expected return from that expenditure, i.e. return on investment.

This paper outlines the broad policies which should be followed when evaluating all investments. It also includes the policy on the treatment of inflation and overhead costs in investment evaluations and outlines the criteria to be used in selecting particular investment analysis techniques for a particular application.

2. Investment Evaluation Policy

The main elements to the policy on investment evaluation are:

- (i) All proposals for capital expenditure should be based on an appropriate investment evaluation.

The extent of the evaluation should depend on the importance of the decision to be made, the level of funds required and the uncertainties and risks associated with the proposal.

- (ii) Each study should include, as a first step, a thorough search for alternatives.

Where feasible alternative approaches exist they should be costed and compared. Where no alternatives are considered, the reasons for limiting the study in this way should be clearly stated. In general, the existing situation should provide one alternative.

- (iii) Where possible, studies should identify and quantify both costs and associated benefits. This is particularly necessary when the study considers 'discretionary' investments, i.e. investments involving a clear option to invest or not invest.
- (iv) Studies should include all relevant costs and benefits. A relevant cost (benefit) is defined as a cost (benefit) which is sensitive to, or affected by, the decision to proceed with a particular investment.
- (v) Studies should be based on the explicit calculation of future costs in each year. However, in some cases where the changing cost relativities are not significant, an approach based on constant prices may be acceptable.
- (vi) When discounted cash flow techniques are to be used in studies where all the costs and benefits can be identified, then both the Net Present Value and Return on Investment (Internal Rate of Return) should be calculated and used in the decision making process. Where the selection between alternatives is made difficult by the closeness of results, then economic ranking of alternatives should be based on the Present Value Index.

In studies where only the costs of the various alternatives are identified then either the Net Present Value of those costs or their Equivalent Annual Value may be calculated and used for decision making.

- (vii) any studies utilising discounted cash flow techniques should be undertaken using a discount rate which incorporates a margin over the cost of new capital to Telecom. Such a discount rate reflects both the opportunity cost of projects not undertaken due to the overall shortage of funds and Telecom's financial objectives regarding return on new investment.
- (viii) Studies should incorporate sensitivity analysis to assist in the decision making process. Sensitivity analysis provides some assessment of the risks and penalties associated with projects and the consequences if benefits and costs are analysed under changed assumptions.
- (ix) Where significant amounts of money are involved the impact on annual budgets and overall funding of Telecom should be specified for each year. That is, a Net Present Value analysis and rate of return study should be supported by a cash flow statement.
- (x) Post implementation reviews evaluating original investment proposal documentation are required of major and strategic investments. The basic objective of such reviews is to provide information for ongoing capital investment programs.

3. Capital Rationing

There are a number of methods available for handling capital rationing constraints within the project selection process, each with different levels of practicability given the Telecom planning and programming processes. The approach adopted of adding a margin to the cost of capital is believed to be the most practical for application in the decentralised decision making environment of Telecom.

As a consequence of this approach the overall number of investment options will be reduced and emphasis will be placed on those options which are most economically viable. In addition, projects which provide early positive net benefits and short live projects will be favoured. This could actually increase the number of projects undertaken although their size may be smaller than would be the case if a margin were not included in the discount rate. Staged developments and the shortening of provisioning periods should also result.

In all, it is considered that this approach will greatly assist in the establishment of priorities and meet the competing needs for capital within the current financial constraints.

4. Investment Categories

In applying the above policy and deciding whether or not to proceed with a particular investment proposal, there are three categories of investment that can be identified. These can be defined as follows:

(a) Economic Investments

Investments which are viable at the discount rate set by Telecom to reflect both the opportunity cost of funds and its overall financial objectives. This rate incorporates a margin above the average cost of new capital. The margin will be periodically reviewed in the light of new investment requirements and availability of capital.

Investments in that category are considered economic and should proceed subject to the ability to fund them in particular capital programs. Projects in this category will generate a NPV greater than zero at an appropriate discount rate⁽¹⁾ or IRR greater than the discount rate.

(b) Marginally Economic Investments

Investments which are viable at a discount rate above the cost of new capital but do not qualify under (a) above.

1. For a discussion of discount rates see Section 5, Decision Criteria.

Such investments, although profitable, are marginally economic and should not proceed unless special factors apply. The approving officer should consider carefully whether other factors and non-quantified benefits might qualify the investment as acceptable.

(c) Uneconomic Investments

Investments which are not viable at the cost of new capital are considered to be uneconomic.

These investments should not proceed unless they are certified as essential to Telecom. If the amounts involved are large, then a study of the impact of the proposed uneconomic investment on the overall finances of Telecom should be considered before approval to invest is given.

It is considered that the majority of studies that are performed to evaluate alternative methods of service provision or to determine the size of the initial investment should be evaluated under the conditions appropriate to Investment Category (a); Economic Investments.

This reflects the fact that although a large amount of Telecom Investment is of a non-discretionary nature, almost all projects contain discretionary elements with respect to their size and the timing at which all or parts need to be undertaken. In particular, the amount of spare capacity that is provided in plant and buildings to meet future growth is discretionary.

It should be emphasised that the above investment categories allow investment to proceed at all levels of return. However, for a project in the Marginally Economic and Uneconomic categories, the respective qualification of the importance of non-quantifiable factors, and essentiality of the project need to be carefully considered.

It will be observed that investments indicating rates of return in excess of the cost of new capital are in fact profitable, i.e. they cover all of the relevant costs involved, including Economic category if they do not achieve a sufficient level of profitability to exceed the return prescribed for Economic Investments. They generally do not proceed because of the overall shortage of funds and the prospect of higher returns if the money were invested in other projects.

5. Decision Criteria

The average cost of new capital to Telecom 1981--82 is estimated to be 15.2 per annum. With the addition of a margin to reflect the opportunity cost of funds and Telecom's financial objectives for new investment, the following profile of rates of return for the three investment categories defined above, is obtained:

Table 1: Decision criteria

INVESTMENT CATEGORY	COLUMN 1	COLUMN 2
	CASH FLOWS	CASH FLOWS
	BASED ON	BASED ON
	EXPECTED FUTURE PRICES %	CONSTANT %
Economic	28 or greater	15 or greater
Marginally Economic	15.5 to 28	4 to 15
Uneconomic	Less than 15.5	Less than 4

For cash flows which are based on the explicit calculation of future revenue benefits and costs, a discount rate related to the explicit cost of borrowed money should be used. The appropriate rate is the minimum rate of return for an economic investment as shown in Column 1 of Table 1, currently 28 percent.

For cash flows expressed in constant or present day prices, a discount rate related to the real (net of inflation) cost of borrowed funds should be used to identify viable projects. The appropriate rate for use in these studies is the minimum rate of return for an economic investment shown in Column 2 of Table 1, currently 15 percent.

6. Allowing For Inflation

(a) Methods

Because investment evaluation involves the analysis of projects over a period of time into the future, the effect of inflation on revenue, benefits and costs over that period needs to be considered. In addition, the effect of inflation on the discount rate needs to be taken into account.

Telecom Australia performs discounted cash flow studies in either of the following ways:

- (i) by explicit calculation of future revenues, benefits and costs, i.e. in terms of cash flows based on expected future prices;
- (ii) by eliminating real and inflationary components of price movements from expected future cash flows by using a constant or present day price structure.

Different discount rates will apply depending on the the method chosen.

(b) Preferred Approach

Option (i) above is preferred because it is considered that more meaningful cash flows are generated by the explicit calculation of future revenue, benefits and costs. However, it is appreciated that there may be situations where the simplicity of studies and nature of cost relativities is such that cash flows based on constant prices may be attractive and justifiable.

Because various elements of the Telecom cost structure are expected to increase at different annual rates, the decision as to which approach to adopt should be based on a consideration of the elements which make up the cash flows in the projects under consideration. For example, labour is expected to increase at a different rate to material which is expected to increase at a different rate to land and buildings. From this it can be seen that the effect of cost escalation on different projects will depend upon the proportion of the various cost elements that make up the overall cost structure of the projects. Similarly, Telecom tariffs are expected to increase at different rates to Telecom costs.

As a result, studies using cash flows based on constant price and wage levels do not, in some circumstances, adequately allow for the changing relativity between different cash flow elements. This is particularly the case with studies which include revenue obtained from Telecom tariffs and studies of this kind should not be based on constant prices.

The effects of different rates of escalation should be incorporated into the forecast cash flows of projects where this clearly influences investment decisions. In studies where the mix effects are considered to be minimal, then an approach based on constant money values is acceptable.

(c) Escalation Factors

Forecasts of various Telecom escalation rates for use in the calculation of future price movements are provided in Attachment 1. The rates should be used until revisions are issued via these Guidelines which will normally occur annually.

The forecasts are based on national averages and are broad representations of a generic nature. They may not be appropriate to all studies and where relevant, specific rates should be determined for particular cases. Rates reflecting local conditions may also be developed where these differ markedly from the national average and have significance for the results. However, where special rates are used, the reasons and bases of estimates should be incorporated into the study report.

1980--81 PRODUCT DESCRIPTIONS

1. Basic Telephones Facility -- Metropolitan
 - (a) Business services
 - (b) Non-business services
2. Basic Telephone Facility -- Country
 - (a) Business services
 - (b) Non-business services
3. Reserved
4. Local Call Service -- Metropolitan
5. Local Call Service -- Country
6. Trunk Call Service
7. Vertical Services
 - (a) Public telephones
 - (b) Leased coin telephones(1)
 - (c) PABX's(1)
 - (d) Other(1)
8. Private Line and Network Services(2)
9. Public Telegraph Services
10. Telex Service
 - (a) Telex subscriber services
 - (b) Telex call service
11. Telegraph Private Wire Services
12. Reserved
13. Other Data Services
14. Directory Publications

(1) other subs. equipment in addition to the basic telephone facility
(2) excluding telegraph

BASES FOR DISTRIBUTING REVENUE AND COSTS OVER 'PRODUCTS'PRODUCT ACCOUNTING SYSTEM 1980--81Allocation of revenue

1. The major revenue items in the financial accounting system, which represent 92% of total revenue, (year ended 30th June, 1981) are detailed below and commented on in the following paragraphs:

	<u>\$ millions</u>
Metered calls	1 293
Rental	674
Trunk calls	184
Connection fees and miscellaneous charges	120
Directory advertising	62
Call fees (public telephones)	56
	2 389
Other sundry items	220
Total revenue	<u>2 609</u>

Metered calls

2. Metered calls (\$1293 million) recorded in the financial accounting system include both local and STD calls, which are not recorded separately. The separation of local and trunk (STD) calls is carried out on the basis of STD traffic measuring equipment which is now installed in almost all trunk changing centres. This equipment counts the total STD calls and measures the volume of traffic in each distance changing step by time of day charging scale. After adjustment for estimated unpaid traffic STD earnings are estimated. These are subtracted from total metered call earnings to estimate local call earnings. Because of the difficulties in estimating unpaid traffic and differences in revenue cut-off timings in the financial accounting system, the resultant allocation between STD and local calls is not regarded as precise. In addition, certain adjustments are made to re-allocate portion of public telephone and leased telephone call fees to local and trunk call revenue.

Rental

3. The present financial accounting system identifies rental as a total rental figure only for most products. The amounts applicable for the basic telephone facility, leased coin telephone, PABX's, private line and data services products were derived in the product costing system by referring to statistics on the number of the products at the beginning of the year and monthly additions and deletions and by applying the basic rental rate to approximate the annual rental. Not all rental revenue can be allocated in this way. Telecom has hundreds of tariff items. The difference between total revenue in the financial accounting system and the total of the approximations derived was assumed to be accounted for by all other products. This amounted to \$85 million out of the \$674 million for 1980--81. Steps are being taken by Telecom to analyse this amount into greater detail by product.

Trunk calls

4. Revenue from operator connected trunk calls (\$184 million) is allocated in total to the trunk call product, where it is accumulated with the STD revenue. No attempt has been made to apportion trunk calls between metro and country, it having been considered infeasible to allocate revenue and expenses in this way.

Connection fees and miscellaneous charges

5. Revenue of \$120 million collected as one figure in the financial accounting system relates in total to new applicants for services already in place, for completely new services, removals to 'in place' locations or new locations, business and domestic, reconnection fees (after services have been cut off) and temporary connections.
6. The product costing system allocates this revenue over the basic telephone facility and other physical products by a number of estimations. Numbers for the various types of services are obtained from operational statistics and approximations of the total amounts payable for these various services are derived. The allocation between domestic and business is based on the ratio of all domestic to all business connections. However, it is difficult to obtain reconciled figures on the breakdown between domestic and business for categories such as new services, removal to an 'in place' connection etc.
7. Because of the need for estimation and approximations, the accuracy of the figures derived is questionable. Of the \$120 million, \$49 million (40%) was allocated to products other than basic telephone facility, leased coin telephones, PABX's, private lines and data services. The breakdown of this \$49 million is unknown -- it was essentially a residual figure.

Directory advertising

8. Directory advertising revenue (\$62 million) was allocated in total to a product called directory publication.

Call fees -- public telephones

9. Public telephone call fees (\$56 million) were apportioned in 1980--81 between the public telephone product and the local call products on the following basis. Of the 10 cents per call through a public telephone, 9 cents was deemed to be for a local call. Thus \$50 million of the \$56 million from public telephones was transferred to local calls, leaving \$6 million as public telephone revenue. Because the revenue from this source was adjusted by the product accounting system public telephones were stated as losing \$43 million for 1980--81. However, if allowance was made for the total revenue they generate, then public telephones could be held to have made a positive short term contribution to network costs provided the traffic generated was carried within existing capacity. This question is discussed in detail in the paper.

Allocation of expenditure

10. The major expenditure items in the financial accounting systems, which represented 92 percent of total expenditure (year ended 30 June, 1981), are listed below and commented on in the following paragraphs:

	<u>\$ millions</u>
Plant maintenance	628
Depreciation	534
Interest	408
Operations	328
General administration	134
Accommodation	98
Customer services	66
	<u>2 196</u>
Other sundry expenses	181
Total expenses	<u>2 377</u>

11. For product costing purposes some costs were allocated to products based on studies carried out in South Australia in 1972. Because the studies were carried out a decade ago it is questionable whether the results are still relevant; further there is no assurance that activities in South Australia are representative of all other States' activities and, given the nature of the Australian network, it is likely that they are not.

Plant maintenance

12. The cost of maintaining terminals (\$157 million) was allocated directly to the relevant terminal products. Maintenance of local exchanges and trunk switching equipment (\$185 million) was allocated directly to local and trunk calls products respectively and the remainder, ducts, cables, wires and conduits etc (\$286 million) was apportioned over products on a variety of bases, including the number of cables dedicated to a product and the 1972 Adelaide study. These bases may be reasonable but they are debatable.

Depreciation and interest

13. Depreciation (\$534 million) and interest (\$408 million) was allocated to products in accordance with the book values of assets, allocated on the basis of the 1972 South Australian studies, modified by changes in the asset base since. Accounting allocations of engineering administration were relatively arbitrary and could lead to questionable allocations of capital costs to products.

Operations

14. Operations (\$328 million) represented the costs of running district telephone offices and was allocated to products based on sample studies carried out regularly in most states. This basis is also used for allocating customer services costs (\$66 million) and accommodation costs (\$98 million).

General administration

15. General administration (\$134 million) was allocated to products in the same proportions as combined maintenance and customer services costs.

EXAMPLE OF FINANCIAL MODEL PRINTOUT

ATTACHMENT O

TELECOM MODEL HC 6										F/A INFL	9
=====										GROWTH	10
										INT FNDG	60
YEAR	OPENING BALANCES	1	2	3	4	5	6	7	8	9	10

PROFIT & LOSS											
=====											
SALES											
LAST YEAR		1000	1324	1601	1933	2331	2808	3381	4068	4892	5880
VOLUME		100	132	160	193	233	281	338	407	489	588
PRICE ADJUSTMT.		224	144	172	205	244	292	349	417	499	598
		1324	1601	1933	2331	2808	3381	4068	4892	5880	7066

EXPENSES:											
LAST YEAR		-550	-666	-805	-974	-1179	-1427	-1726	-2089	-2527	-3058
VOLUME		-61	-73	-89	-107	-130	-157	-190	-230	-278	-336
INFLATION		-55	-67	-81	-97	-118	-143	-173	-209	-253	-306
		-666	-805	-974	-1179	-1427	-1726	-2089	-2527	-3058	-3700

GROSS PROFIT		659	796	959	1152	1382	1655	1979	2364	2822	3366
DEPRECIATION		-224	-258	-297	-345	-401	-468	-547	-642	-754	-887
INTEREST:											
ORIGINAL		-100	-100	-100	-100	-100	-100	-100	-100	-100	-100
NEW		-46	-102	-167	-245	-338	-447	-578	-733	-917	-1136
		-146	-202	-267	-345	-438	-547	-678	-833	-1017	-1236

NET PROFIT		288	336	393	462	543	639	753	889	1050	1242
TAX		-76	-76	-76	-76	-76	-76	-76	-76	-76	-76
DIVIDEND											
		-76	-76	-76	-76	-76	-76	-76	-76	-76	-76

RETAINED		211	260	317	385	466	562	677	813	974	1166
=====											
CASH FLOW											
=====											
RETAINED		211	260	317	385	466	562	677	813	974	1166
DEPRECIATION		224	258	297	345	401	468	547	642	754	887
F/A ADDITIONS		-726	-862	-1024	-1217	-1446	-1717	-2040	-2424	-2880	-3421
ADDITIONAL BORROWINGS		290	345	410	487	578	687	816	970	1152	1368
		211	260	317	385	466	562	677	813	974	1166

SURPLUS/DEFICIENCY		0	0	0	0	0	0	0	0	0	0
=====											
BALANCE SHEET											
=====											
FIXED ASSETS											
GROSS	4480	5151	5949	6896	8022	9359	10948	12835	15077	17741	20905
ACC DEP	-1340	-1510	-1702	-1923	-2177	-2469	-2808	-3203	-3663	-4201	-4831
		3811	4439	5197	6105	6890	8140	9632	11414	13540	16074

TOTAL	3140	3642	4246	4973	5845	6890	8139	9632	11414	13540	16074
=====											
SHARE CAPITAL	-954	-954	-954	-954	-954	-954	-954	-954	-954	-954	-954
RESERVES	-930	-1141	-1401	-1718	-2104	-2570	-3132	-3809	-4622	-5596	-6761
DEBT-ORIGINAL	-1256	-1256	-1256	-1256	-1256	-1256	-1256	-1256	-1256	-1256	-1256
NEW	0	-290	-635	-1045	-1532	-2110	-2797	-3613	-4583	-5734	-7193
		-1256	-1546	-1891	-2388	-2966	-3653	-4469	-5414	-6590	-8049

TOTAL	-3140	-3642	-4246	-4973	-5845	-6890	-8139	-9632	-11414	-13540	-16074
=====											

Note: For simplicity, roundings from decimals to whole numbers were made after totals computed; accordingly, some columns do not add precisely on this summary. The rounding differences are non-cumulative and immaterial.

SECRETARIAT RESEARCH REPORT
OCTOBER 1982

SECTION 3: REVIEW OF NON METROPOLITAN TELECOMMUNICATIONS SYSTEMS AND SERVICES

PART A: ANALYSIS OF EXISTING NON METROPOLITAN
TELECOMMUNICATIONS SYSTEMS AND SERVICES

INTRODUCTION

Terms of reference

- 3.1 The study was commissioned by the Committee under the following terms of reference:
- "Having regard to Telecom's statutory responsibilities under s.6(1) and (2) and s.73(2) of the Telecommunications Act 1975, the Secretariat is to review information sources and available data to identify for the Committee:
- (a) significant areas of shortfall between the demand for and provision of rural telecommunications services as compared to non rural subscribers;
 - (b) the quality, availability and reliability of rural telecommunications services and facilities relative to those provided for non rural subscribers;
 - (c) the relationship between costs and tariff structures applicable to the provision of rural telecommunications services and in particular the components of cost subsidisation operating under existing Telecom arrangements."

Study objective

- 3.2 The study was designed to compare the quality, costs and accessibility of telecommunication systems and services in metropolitan and non metropolitan areas.
- 3.3 Systems and services in non metropolitan areas were assessed for three categories of locations:
- . urban country areas;
 - . rural country areas;
 - . remote areas.

Definitions

- 3.4 Urban country areas: regional cities and towns generally accessible to the standard of telecommunications systems and services comparable with that available in metropolitan areas.

- . Rural country areas: areas adjacent to or beyond the regional towns and cities included in the above category. They are typically characterised by:
 - low population densities per square kilometre;
 - population distribution over farming communities;
 - some significant, but relatively spasmodic, concentration of population in mining and other resource development areas;
 - low growth rates in terms of overall area population;
 - access to the public switched telephone network either by wholly Telecom provided distribution systems or part privately erected (PPE) lines between subscriber premises and a local Telecom exchange;
 - manual rather than automatic switching of calls carried over the public switched telephone network.
- . Remote areas: areas beyond the limits of Telecom's existing national terrestrial network in which some residents:
 - cannot subscribe directly to telephone services carried over the public switched telephone networks;
 - may access the public switched telephone network through interconnection of independent radio communications networks with the public switched telephone network;
 - have no current access to the public switched network but may be included in Telecom's remote area development plans; or
 - will not have access to the public switched telephone network in the foreseeable future.

Scope

- 3.5 The quality and accessibility of non metropolitan telecommunications systems and services has been assessed in terms of the:
- . standard and reliability of present transmission systems and associated exchange (switching) facilities for services connected to:
 - manual exchanges;
 - automatic exchanges;
 - . range of services available to existing subscribers;
 - . subscriber charges associated with provision of transmission systems (subscriber lines) between the local exchange and subscriber premises including:

- capital contribution for subscriber lines wholly provided by Telecom;
- capital costs to subscribers for PPE lines;
- annual rental charges;
- unit charges for calls to other subscribers;
- the number of other subscribers accessible to subscribers in particular non metropolitan areas;
- call charge revenues derived from urban country and rural country subscriber services;
- demand for new subscriber services measured by applications for connection to local exchanges (demand);
- satisfied and unsatisfied demand for new subscriber services and the incidence of deferred applications;
- fault occurrence.

3.6 Telecom's costs for establishment of transmission systems necessary for service provision were also examined -- in particular:

- capital investment per subscriber required for provision of subscriber lines (external plant);
- capital investment per subscriber required for provision of local exchange/switching facilities (internal plant);
- operational and maintenance costs associated with provision of external and internal plant;
- manhours per year per subscriber required to maintain both external and internal plant (maintenance productivity).

New technology options for provision of remote area services

3.7 The study reviewed information from Telecom on technology distribution options for provision of Telecom services in remote areas and assessed:

- existing planned and technically feasible transmission systems;
- the technical performance and service capability of the possible options;
- availability of present and planned transmission systems;
- Telecom's capital operational and maintenance costs of practicable options;
- estimated costs to prospective subscribers.

Metropolitan and non metropolitan comparisons

- 3.8 Relevant statistics for metropolitan telecommunications systems and services were also obtained to provide a basis for comparison of data analysed in relation to matters identified in paragraphs 3.5--3.6 above. A detailed comparison of metropolitan and non metropolitan systems and services is given in Part B of this Review.

Information sources

- 3.9 The study drew on information obtained from the following sources:
- . Telecom's public submission;
 - . material supplied by Telecom in response to Committee questions;
 - . discussions with Telecom personnel;
 - . public submissions from existing and prospective non metropolitan subscribers;
 - . Committee discussions with representatives of country based residential and business subscriber groups and community organisations.

Acknowledgements

- 3.10 Telecom personnel provided assistance throughout the study.

STUDY APPROACH

Availability of data

- 3.11 A major difficulty encountered during the study was the lack of data available in a form that would facilitate a separation between urban country and urban rural data components.
- 3.12 The above observation in no way reflects on the reliability of data finally obtained from Telecom. It seeks merely to highlight the fact that Telecom has had no previous need to distinguish between costs and revenues allocated to particular aspects of non metropolitan system and service provision.

District samples

- 3.13 Three non metropolitan and three metropolitan district samples were selected for detailed study and comparison. The non metropolitan districts were selected to provide representation of large and small districts.

3.14 Districts selected were:

- . non metropolitan:
 - Rockhampton (Queensland);
 - Dubbo (New South Wales);
 - Kempsey (New South Wales);
- . metropolitan:
 - 'Metro-south' (Brisbane, Queensland);
 - Chatswood (Sydney, New South Wales);
 - Bankstown (Sydney, New South Wales).

3.15 Unserviced remote areas were not selected for detailed analysis. The study drew on research data and findings of previous studies on demand for services in remote areas, either undertaken internally within Telecom or externally on Telecom's behalf.

OVERVIEW OF EXISTING ARRANGEMENTS

Service requirements

- 3.16 Study review of submissions to the Inquiry and Committee discussions with non metropolitan subscribers and non metropolitan based organisations and residents indicate the following priority requirements for communications services:
- . a good, reliable telephone service (i.e. the automatic STD service generally available to subscribers throughout Australia);
 - . facilities for access to and delivery of health and educational services (RFDS and School of the Air Services);
 - . data communications facilities for rural and remote industries (including pastoral, commerce and mining);
 - . access by rural country subscribers to a range of services comparable with those available to urban country subscribers.

3.17 New service applications

Telecom advised that:

- . Applications may be lodged at Telecom Business Offices (TBO's) or approved agencies (generally larger post offices).

- . Where applications are lodged at TBO's, Telecom staff can advise applicants of Telecom's responsibilities, policies, fees and facilities that can be or are planned to be provided.
- . On the basis of details provided by the applicant, applications are allocated a priority (based on the purpose of the service) and a business or non business classification.
- . In areas served by automatic exchanges, or in areas where manual exchanges are programmed for conversion to automatic, Telecom is responsible for constructing and maintaining external plant (i.e. cable and radio equipment) for the full distance from subscriber premises to local exchange.
- . In general, Telecom external plant will not be provided in manual exchanges programmed for rural conversion if such plant could become redundant when conversion takes place.
- . In areas served by manual exchanges not programmed for conversion, Telecom accepts responsibility for construction and maintenance of external plant within a radial distance of 8km from the local exchange.
- . If a service requires Telecom provided radio telephone equipment on the applicant's property, the applicant is required to agree to certain conditions concerning antenna mast site, accommodation, access road, power supply and firebreak.
- . If an application is for a service which cannot be connected within three months of application subject to lodgement of fees in advance -- i.e. is a deferred application -- the customer is advised of the estimated waiting time for connection.
- . Where internal (exchange) and external plant is not available (i.e. if the application for service is in what Telecom describes as a deferred area) the applicant is advised of the estimated delay in connection and the relevant reasons.
- . When applications are deferred, advance fees are either not required or are refunded if previously paid.
- . Deferred applications are automatically allocated a higher priority after certain periods of time.
- . Where the deferred application may result in a delay beyond a few years and any additional external plant that would be required would become redundant because of planned service upgrading, applicants have the option of erecting a PPE line.

Part privately erected (PPE) lines

3.18 Telecom advised that:

- Information on conditions applicable to PPE lines installations and services is contained in Telecom By-laws (Volume 2, Section 1 refers).
- Applicants interested in PPE lines may avail themselves of this information.
- If Telecom considers that connection of a PPE service is justified and Telecom internal plant is available, applicants must comply with the following conditions of service:
 - privately construct and maintain their own PPE plant to the point at which Telecom plant can be provided;
 - construct and maintain the plant to standards specified by Telecom;
 - pay the standard service connection fee (rural connection fee not applicable);
 - agree to the service being converted to a wholly Telecom provided and maintained service at Telecom's direction;
 - if applicable, agree to pay the appropriate rural conversion fee upon conversion (usually replacement) of the PPE plant to wholly Telecom provided plant when it is available;
- A fee of \$4 for inspection of the PPE facility upon completion is payable by the applicant.
- The applicant must remedy any defects to Telecom's satisfaction before a PPE line is connected to the exchange.
- The customer is responsible for all maintenance.
- Any maintenance by Telecom upon customer request is charged at cost.

PPE lines are discussed in detail at paragraphs 3.54--3.59 inclusive of this research report.

Conversion from manual to automatic exchanges

3.19 When a rural area containing more than 30 customers is due for conversion, Telecom may call a public meeting to discuss the proposed new facilities, timing of connection, directory entries, call charges, fees for conversion of PPE plant and provision of new Telecom plant if applicable. According to advice from Telecom, all customers and applicants are later quoted for any charges applicable and consultation is undertaken with individual customers/applicants upon request. The 'Rural Conversion Program' is discussed in detail at paragraphs 3.103 -- 3.113 inclusive.

Capital contributions

- 3.20 Prior to 1 January 1982, Telecom required subscribers located beyond specified distances from a local exchange to contribute to the capital costs associated with provision of external plant necessary to connect the subscriber to that exchange (Volume 2, Section 4 outlines the relevant policies and practices from 1973 to that date and summarises the policy presently in effect).

Country connection and conversion charges effective 1 January 1982

- 3.21 Telecom has stated that present country rural connection and conversion charges:
- . are not direct capital contributions based on the cost of providing the length of external plant line required;
 - . are related to 'standard' rental charges;
 - . are set at levels considerably lower than charges applicable under previous policies;
 - . are intended to reflect higher irrecoverable costs of providing country rural services.

Call charges and non metropolitan zoning

- 3.22 Telecom has advised that its 'charging zones and districts' are structured to:
- . give as many subscribers as possible access to the public switched telephone network;
 - . ensure that rural subscribers are not disadvantaged.
- 3.23 Effective May 1980 a new non metropolitan call charging policy -- 'Community Access 80' -- was introduced. This was designed to give non metropolitan subscribers in rural/country areas call access via their nearest local exchange to the nearest designated 'service' town at a unit fee STD rate. Relevant details of call charges, charging zones and districts and charges applicable under the 'Community Access 80' scheme are given in Volume 2, Section 4.

ANALYSIS OF EXISTING NON METROPOLITAN TELECOMMUNICATIONS SERVICES

Service penetration

- 3.24 Detailed statistics on service penetration in non metropolitan districts are not normally compiled by Telecom. Analysis of available data indicates that between 50 to 70 percent of non metropolitan households are connected to the public switched telephone network.
- 3.25 Analysis was confined to telephone services penetration in line with identified service priorities (paragraph 3.16 refers).

Service demand

- 3.26 Data available on NSW non metropolitan districts studies reflected significant demand for new telephone services as tabulated below for the year ending 30 June 1981.

Table 3.1: Demand for service for year ending 30 June 1981:
Dubbo and Kempsey Districts

DEMAND	DUBBO DISTRICT	KEMPSEY DISTRICT
Number of applications for new service	5 136	6 721
Number of applications as % of existing services	12.6%	22.2%

Source: Analysis of Telecom data.

Satisfied demand

- 3.27 Telecom measures the level of satisfied demand as the difference between the number of applications for new services and the number of actual service connections in any given financial year. Unsatisfied demand is the term used to describe those applications:
- . which are being investigated by Telecom;
 - . which have been deferred;
 - . for which installation or connection quotations have been issued; or
 - . which are in the process of being connected.
- 3.28 In non metropolitan areas investigation of applications may be lengthy. Actual connections may take some time to be completed. The lower the level of demand the more quickly connections are completed. Conversely, the higher the level the longer the applicant has to wait. Table 3.2 below shows relevant statistics for Dubbo and Kempsey charging districts for the year ending 30 June 1981.

Table 3.2: Applications and connections for year ended 30 June 1981:
Dubbo and Kempsey districts

STATUS OF APPLICATIONS FOR NEW SERVICES	DUBBO DISTRICT	KEMPSEY DISTRICT
Total number of applications for new services	5 136	6 721
Number of connections completed	4 331	4 152
Number of connections outstanding	805	2 569
Total number of unsatisfied applicants as % of all applications	16%	38%

Source: Analysis of Telecom data

Unsatisfied demand

3.29 In urban country and rural country areas, the distance between the applicant's premises and the local exchange has a significant bearing on the number of applications connected. Analysis of data indicates that:

- The greater the distance from the exchange the less likely the application will be processed to completion during the year in which it is lodged.
- In any given year new connections may exceed new applications because a number of the connections may involve connections relating to applications deferred from the previous year (or years) pending availability of external or internal plant.

3.30 For example, in Dubbo there were 44 new connections completed during 1980--81 for applications from potential subscribers within 16--40 kilometres from the nearest local exchange. In the same year there were only 21 applications for new service connection. The difference between the two was accounted for by completed connections of deferred services for which applications had been lodged prior to 1980--81.

Table 3.3 below summarises the relationship between distance from the exchange, new connections and unsatisfied demand.

Table 3.3

DISTRICT	DISTANCE FROM EXCHANGE			
	under 8 kms	8--16 kms	16--40 kms	over 40 kms
DUBBO				
No. of applications	4 931	180	21	4
new connections	4 157	129	44	1
% unsatisfied	15.6%	29%	-109%	75%
KEMPSEY				
No. of applications	6 217	491	13	--
new connections	3 861	292	--	--
% unsatisfied	38%	41%	100%	--

Source: Analysis of Telecom data

Deferred applications

- 3.31 An application for service connection is classified by Telecom as 'deferred' when provision of service cannot be guaranteed within a specified time. Applications are deferred due to unavailability of either external plant (lines and cable) or internal plant (switching equipment). Deferred applications are reviewed periodically and allocated higher priorities after a certain time. The period of deferral may vary from three months to many years, depending on other demands for service in the same locality.
- 3.32 Deferred applications still outstanding after six months from the date of application are reviewed and given a higher priority. The process is repeated for deferred applications outstanding after 18 months from the date of application.

Standards of service

- 3.33 Factors affecting the standard of service available to non metropolitan residents (and in particular those in rural country areas) include:
- . type of connection to the public switched telephone network -- whether automatic or manual;
 - . type of subscriber line to the local exchange -- whether wholly Telecom provided or a PPE line;
 - . in the case of PPE lines -- whether the line is exclusively used by one subscriber, or a party line shared by a number of subscribers.
- 3.34 The most important factor is whether the service is connected to an automatic or a manual local exchange (paragraphs 3.89--3.102 refer).
- 3.35 Some 61 000 subscribers access the public switched telephone network via manual exchanges. Manually connected subscribers suffer from the following disadvantages:
- . lack of STD facilities;
 - . lack of service continuity where local manual exchanges are operated during business hours only or other part time basis;
 - . lack of privacy where services are provided over shared (party) lines;
 - . high fault occurrence hence limited reliability where connection to local exchanges is via PPE lines.

Call charge revenue per subscriber service

- 3.36 Analysis of Telecom data on call revenue generated by each individual exchange in districts selected for study showed that the average revenue generated per subscriber service is higher in non metropolitan than metropolitan areas (paragraphs 3.192--3.195 refer).
- 3.37 Non metropolitan subscribers have limited access to other subscribers at local call rates. Hence non metropolitan subscribers make more trunk calls than do their metropolitan counterparts. The difference in level of use is related to:
- . level of business and industrial activity within the district;
 - . distance to capital cities;
 - . the subscriber density within the district.
- 3.38 The correlation of distances between subscribers and their nearest capital city with average service revenue in country districts was verified by a study of trunk revenue generated by the three country districts studied (paragraphs 3.36--3.49 refer).
- 3.39 Previous studies undertaken for Telecom have indicated that country rural subscribers generally incur higher average call expenditure than do urban country subscribers. The IMG Northern Territory study of 200 subscribers in 26 small exchanges indicated an average annual call revenue per subscriber of \$1 200 (\$1 500 business and \$900 private).
- 3.40 Telecom's National Study (1980) into remote area communications referred to two other studies made in Western Australia and South Australia. In Western Australia 236 subscribers from 15 rural exchanges produced an average annual revenue of \$650 per service. In South Australia a sample of 99 subscribers produced an average of \$780 per subscriber.
- 3.41 Estimates of average annual revenue per subscriber in this present study are based on detailed analysis of per subscriber revenues for all local exchanges in the Dubbo, Kempsey and Rockhampton districts for the six month period 1 January 1982--30 June 1982. Estimates of annual call revenues per service assumed that the same level of revenue would be maintained from 11 July to end December. The actual revenue for 1 January 1982--31 December 1982 could be significantly higher than the estimates because of increased call charges applied effective 1 January 1982.

3.42 Analysis of data showed that a higher call revenue per subscriber is generated in urban country than in rural country areas. The consistency of differential between the two may be attributed to:

- . a higher concentration of business activity in urban country areas;
- . the predominance of automatic STD services in urban country areas;
- . lower utilisation of services in rural country areas due to limited access to other subscribers at local call rates.

3.43 For purposes of analysis, exchanges were grouped into categories to identify those serving:

- . over 1 000 subscribers;
- . 100 to 1 000 subscribers;
- . 40 to 100 subscribers;
- . fewer than 40 subscribers.

3.44 Estimate of average annual call revenue per service by exchange category is tabulated below and also shown in Figure 3.4:

Table 3.4

DISTRICT	PER SUBSCRIBER REVENUE BY EXCHANGE CATEGORIES			
	OVER 1 000	100--1 000	40--100	LESS THAN 40
	\$	\$	\$	\$
Dubbo	476	388	316	316
Kempsey	416	318	312	212
Rockhampton	649	518	477	418
Average (all districts)	519	408	347	338

Source: Analysis of Telecom data

3.45 The study drew the following conclusions:

- . annual call revenue per service is lower in rural country than urban country districts, with the ratio for rural country varying from 0.5--0.66;

- services in high population density areas generate more revenue than sparsely populated areas;
- automatic exchanges generate higher call revenue per subscriber than do manual exchanges (See Table 3.5 below).

Table 3.5: Comparison of call revenues per service in automatic and manual exchanges serving fewer than 40 subscribers

REVENUE PER SUBSCRIBER BY EXCHANGE			
DISTRICT	AUTOMATIC EXCHANGE	MANUAL FULL TIME EXCHANGE	MANUAL PART TIME EXCHANGE
	\$	\$	\$
Dubbo	386	344	202
Kempsey	236	--	136
Rockhampton	540	--	339

Source: Analysis of Telecom data

- 3.46 Most manual exchanges are in rural country areas. A few relatively densely populated urban country areas are also served by manual exchanges -- e.g. Wellington in the Dubbo district where the average call revenue of \$258 is approximately half the average urban (automatic) call revenue per subscriber of \$506.
- 3.47 Notwithstanding the rural urban differential, there are noticeable differences between the total average annual call revenue per subscriber from district to district -- e.g.
- Rockhampton \$607
 - Dubbo \$425
 - Kempsey \$383
- 3.48 The following factors appear to account for the per subscriber revenue variations over the three districts:
- accessibility of subscribers to large centres of population at local call rates -- Kempsey reflects a low level of calls at 'Community Access 80' rates because most subscribers have access to large centres at local call rates;
 - relative distances between the districts and capital cities;
 - the level of business and industrial activity in the district.

3.49 Estimates of average annual call revenue per subscriber are set out in tables 3.6--3.8 below:

Table 3.6: Revenue per subscriber -- Dubbo district

ESTIMATED AVERAGE ANNUAL CALL REVENUE PER SUBSCRIBER					
EXCHANGE CATEGORY	TOTAL ALL EXCHANGES	AUTOMATIC EXCHANGES	ALL MANUAL EXCHANGES	PART TIME MANUAL EXCHANGES	FULL TIME MANUAL EXCHANGES
over 1 000	476	506	258	--	258
100--1 000	388	456	318	--	318
40--100	316	378	206	--	206
less than 40	316	386	280	202	344
Total for all exchanges	425	482	283	202	288

Source: Analysis of Telecom data

Table 3.7: Revenue per subscriber -- Kempsey District

ESTIMATED AVERAGE ANNUAL CALL REVENUE PER SUBSCRIBER					
EXCHANGE CATEGORY	TOTAL ALL EXCHANGES	AUTOMATIC EXCHANGES	ALL MANUAL EXCHANGES	PART TIME MANUAL EXCHANGES	FULL TIME MANUAL EXCHANGES
Over 1 000	416	416	--	--	--
100--1000	318	318	--	--	--
40--100	312	316	196	196	--
less than 40	212	236	136	136	--
Total for all exchanges	383	384	162	162	--

Source: Analysis of Telecom data

Table 3.8: Revenue per subscriber -- Rockhampton district:

ESTIMATED AVERAGE ANNUAL CALL REVENUE PER SUBSCRIBER					
EXCHANGE CATEGORY	TOTAL ALL EXCHANGES	AUTOMATIC EXCHANGES	ALL MANUAL EXCHANGES	PART TIME MANUAL EXCHANGES	FULL TIME MANUAL EXCHANGES
	\$	\$	\$	\$	\$
Over 1 000	649	649	--	--	--
100--1 000	518	626	302	--	302
40--100	477	534	323	--	323
less than 40	418	540	339	339	--
Total for all exchanges	607	640	309	339	305

Note: Information for Tables 3.6--3.8 based on revenue per exchange statistics for January to June 1982. Results above projected for total annual call revenue.

Source: Analysis of Telecom data

Local call accessibility

3.50 Study analysis indicated that:

- about 60 percent of non metropolitan subscribers in the three Districts have access to more than 10 000 other subscribers at the local call rate eg:
 - in Kempsey and Rockhampton districts 60 percent (mainly urban) have access to about 20 000 others;
 - in Dubbo about 55 percent can access between 5 000 and 10 000 others;
 - only 3.7 percent of all subscribers in Dubbo access more than 10 000 others;
- in Dubbo and Rockhampton where average subscription density (per square kilometre) overall is low, some ten percent of subscribers access less than 1 000 other subscribers;
- in some rural country areas the figure drops to between ten and 20 subscribers.

- 3.51 The study showed that some rural country subscribers receive significant benefits from the 'Community Access 80' scheme whilst others have realised only a marginal improvement in terms of the unit cost of calls to their nearest designated service town. Tables 3.9--3.10 following refer.

Table 3.9: Access to other subscribers at local call rates:

PERCENTAGE OF ALL SUBSCRIBERS IN DISTRICT WITH ACCESS TO SPECIFIED NUMBER OF OTHER SUBSCRIBERS			
NUMBER OF OTHER SUBSCRIBERS ACCESSIBLE	DUBBO	KEMPSEY	ROCKHAMPTON
	%	%	%
Over 10 000	3.7	66.0	60.0
5 000--10 000	54.8	16.0	19.0
1 000--5 000	27.2	18.0	15.0
500--1 000	10.0	--	2.0
100--500	3.0	0.1	4.0
less than 100	1.3	--	0.4

Note: Rockhampton subscriber numbers are based on mid 82 figures

Source: Analysis of Telecom data.

Table 3.10: Non metropolitan subscriber access to designated service towns

DISTRICT	DESIGNATED SERVICE TOWN	NO. OF SUBS IN SERVICE ZONE	NO. OF SUBS GIVEN ACCESS AT COMMUNITY ACCESS 80 RATES
Dubbo	Bourke	767	291
	Brewarrina	358	134
	Cobar	923	91
	Coonabarabran	1 102	1
	Coonamble	658	103
	Nyngan	719	79
Kempsey	Kempsey	3 480	33
Rockhampton	Rockhampton	18 830	370
	Mt. Morgan	841	9
	Gladstone	6 689	201
	Biloela	1 819	181
	Blackwater	1 341	42
	Claremont	670	30
	Emerald	1 395	444

Source: Analysis of Telecom data

ANALYSIS OF PRESENT NON METROPOLITAN TELECOMMUNICATION SYSTEMS:
EXTERNAL PLANT

Wholly Telecom provided telephone lines

- 3.52 The technical standards of existing Telecom subscriber lines in rural country areas vary widely. Lines connected to automatic exchanges generally give satisfactory performance. Those lines connected to manual exchanges are generally inferior. The transmission quality of such lines is influenced by the length and condition of the subscriber line to the exchange and the age of (telephone) terminal equipment and wiring in the subscriber's premises.
- 3.53 Most instruments connected to manual exchanges are magneto telephone handsets. They utilise old technology which results in deteriorated performance.

Part privately erected (PPE) lines

- 3.54 PPE lines have played a major role in the development of rural country telephone services. They have enabled prospective subscribers to erect that part of the line required between their premises and the nearest local exchange beyond the 'free line plant entitlement' (Volume 2 Section 4 refers). PPE lines are often multi party lines connected to part time manual exchanges. Construction costs for multi party lines may be shared by a number of subscribers. Most are characterised by sub-standard performance, reflect poor construction and require frequent maintenance.
- 3.55 Telecom's policy on provision of PPE lines enabled connections for parties who would otherwise have to wait many years. PPE lines may also be installed for connection to a local exchange which is planned for conversion to an automatic exchange within a specified time (paragraphs 3.103--3.112 refer).
- 3.56 Volume 2, Section 1 outlines the Telecommunications (General) By-laws by which Telecom sets conditions applicable to construction, maintenance and use of PPE lines. Volume 2, Section 4, sets out relevant Telecom connection and capital contribution policies and charges.

Table 3.11 below gives the most recent information available from Telecom on the overall number of PPE lines in Australia broken down by distance from the nearest local exchange.

Table 3.11: Comparison of number and route length distribution
1956--1977

DISTANCE FROM LOCAL EXCHANGE	1956		1977	
	NUMBER	PERCENTAGE	NUMBER	PERCENTAGE
0--12 kms	36 4000	63	15 300	51
12--20 kms	7 600	13	6 200	21
20--40 kms	7 600	13	5 300	18
over 40 kms	6 400	11	3 400	11
TOTAL	58 000	100	30 200	100

Source: Telecom data

Telecom advises that there are currently some 20 000 PPE lines throughout Australia as a whole.

3.57

An analysis of the distribution of PPE lines in the three non metropolitan districts studied is given in Tables 3.12 below:

Table 3.12: PPE Lines in selected districts

DISTANCE OF PPE	DUBBO		KEMPSEY		ROCKHAMPTON	
	79--80	80--81	79--80	80--81	79--80	80--81
Less than 8 km	260	236	18	11		
8--16 km	368	333	8	8		
16--40 km	414	376	--	--		
Over 40 km	142	129	--	--		
TOTAL	1 184	1 074	26	19	189	175

Source: Analysis of Telecom data

3.58 Table 3.13 summarises the distribution of PPE lines and services in all country districts in New South Wales.

Table 3.13: Analysis of PPE and party lines in NSW districts

PPE AND TELECOM PARTY LINE SERVICES		
	NUMBER OF LINES	NUMBER OF SUBSCRIBERS
Exclusive PPE	2 530	2 530
Party PPE	1 622	5 540
Telecom Party	1 997	6 737
TOTAL	6 149	14 807

Source: Analysis of Telecom data

3.59 Table 3.14 gives a detailed breakdown of PPE lines and party lines in NSW non metropolitan districts:

Table 3.14: PPE lines and party lines in NSW non metropolitan districts
June 1981

DISTRICT	AUTOMATIC					MANUAL				
	EXC PPE	PARTY PPE	TELECOM SUBS	PARTY SUBS		EXC PPE	PARTY PPE	TELECOM SUBS	PARTY SUBS	
Goulburn	27	1	1	11	24	37	31	93	52	148
Grafton	15	4	11	27	79	4	5	13	13	38
Kempsey	4	--	--	2	10	1	2	9	5	20
Lismore	1	--	--	1	2	--	--	--	--	--
Maitland	25	2	6	12	29	6	4	7	13	42
Narrandera	151	6	11	26	53	180	178	591	186	643
Newcastle	1	--	--	--	--	--	--	--	--	--
Penrith	7	--	--	2	5	--	--	--	--	--
Tamworth	213	22	49	46	112	256	238	781	237	787
Wagga Wagga	20	--	--	30	71	127	123	464	123	412
Wollongong	1	--	--	7	19	--	--	--	--	--
Armidale	238	68	143	106	261	173	159	579	176	636
Bathurst	131	11	39	36	98	442	164	521	202	679
Canberra	--	--	--	--	--	--	--	--	--	--
Central Coast	--	--	--	--	--	--	--	--	--	--
Dubbo	99	16	45	45	109	371	588	2 177	639	2 431
TOTAL	933	130	305	351	901	1 597	1 492	5 235	1 646	5 836

Notes:

EXC PPE: PPE line dedicated exclusively to use of one subscriber.
 PARTY PPE: PPE line shared by several subscribers (party line).
 TELECOM PARTY: Telecom provided party line.
 SUBS: Subscribers.

Source: Telecom data

Remote area telecommunications systems

3.60 Telecom defines remote areas as those which are beyond the range of the existing national terrestrial network. For planning purposes Telecom classifies remote area locations as those:

- more than one single 'hop' line of sight radio transmission (40--50 km) from an existing trunk transmission system with the capability to service that location;
- not generally included in the rural (country) area manual conversion programme.

3.61 The relatively few existing remote area Telecom subscribers are connected to the public switched telephone network via Telecom provided local HF radio communications networks based at the following locations:

Broken Hill	(NSW)	--	15 subscribers
Katherine	(NT)	--	79 subscribers
Alice Springs	(NT)	--	76 subscribers

3.62 These systems are connected to the national public switched telephone network via local manual exchanges. They operate 24 hours a day. Typically, up to sixteen subscribers share a single voice circuit and delays up to four hours to make a call are common. Transmission quality is susceptible to atmospheric conditions and is unreliable.

Independent networks: Royal Flying Doctor Services outpost HF radio networks

3.63 The Royal Flying Doctor Service (RFDS) operates 12 independent 'outpost' HF radio networks throughout Australia. The bases are located at:

QUEENSLAND

Mt. Isa
Charleville
Cairns

NEW SOUTH WALES

Broken Hill

WESTERN AUSTRALIA

Derby
Wyndham
Kalgoorlie
Port Headland
Meekatharra
Carvarvon

SOUTH AUSTRALIA

Port Augusta

NORTHERN TERRITORY

Alice Springs

3.64 The RFDS HF public outpost radio networks provide the following services to remote area residents:

- . reception and transmission of public telegrams;
- . communications between RFDS HF transceiver owners including community or 'chatter' sessions;
- . School of the Air services.

The above are provided as a community service in addition to the regular RFDS medical consultation sessions and emergency medical services.

3.65 Recently, improved communications services have been provided for users of the RFDS HF network via interconnection between some of the outpost bases and Telecom's public switched telephone network. This is facilitated by connecting the RFDS radio link to a Telecom exchange. The service provided thereby is known as the 'Radphone' service. Telecom has identified the following limitations of that service:

- . conversations can be heard by all other users of the network;
- . only one call per network can be connected at any one time;
- . voice direction switching is manual;
- . voice reception is determined by the quality of the HF radio link;
- . hours of service availability are restricted.

3.66 The service allows participating outpost radio stations to make contact with telephone subscribers throughout Australia at charges applicable to their respective base stations. Limited hours of operation mean that use of the 'Radphone' service cannot take advantage of off peak STD calling rates. Outposts (transceiver owners) do not pay for access to this service in line with standard Telecom call charges. They are charged a per call handling fee by the RFDS outpost base.

3.67 'Radphone' services are available from Cairns, Mt. Isa, Charleville, Alice Springs, Port Augusta, Derby, Wyndham, Kalgoorlie and Meekatharra. Planning is undertaken to extend the service to Carnarvon and Port Headland.

3.68 School of the Air Services operated over the RFDS outpost bases in various states are administered by State Education Departments to complement correspondence courses for children living in remote and isolated areas.

'Private' HF radio networks

3.69 There is a number of private HF radiocommunications systems carrying communications services in remote areas (i.e. those which do not interconnect with Telecom's national terrestrial network). These are operated by organisations like:

- . Department of Health;
- . State Police Departments;
- . church missions;
- . aboriginal councils.

Private spur lines

3.70 Some 30 private spur lines have been installed in remote areas. These are constructed for the use of business customers at their own expense. They conform with technical specifications determined by Telecom and interconnect with Telecom's national terrestrial network. Relevant details are given in Volume 2, Section 2.

Technical and service performance

3.71 The technical performance of independent and private networks is highly variable. For the most part technical performance is poor, even compared with that of subscriber lines in urban country and rural areas. Service performance is typically impaired by:

- . severe signal interference due to changes in atmospheric conditions;
- . lack of privacy in communications carried over the networks;
- . delays in waiting for carriage of messages over the networks;
- . limited hours of operation.

Investment per subscriber service

3.72 Study analysis shows that capital investment required per non metropolitan subscriber is closely related to subscriber and population density (paragraphs 3.3.79--3.84 refer). Capital investment per subscriber in rural country areas is much higher than that per urban country subscriber. Another factor influencing the investment per subscriber is distance from the local exchange. Table 3.15 below estimates per subscriber costs for external plant required to connect a new subscriber to the nearest local exchange.

Table 3.15: Investment per non metropolitan subscriber by distance

DISTANCE FROM LOCAL EXCHANGE KMS	COST PER SUBSCRIBER \$
0--4	1 200
4--8	2 425
8--16	7 000
over 16	13 000

Source: Analysis of Telecom data

The above estimates were calculated on the basis of data available for the Dubbo, Kempsey and Grafton districts in New South Wales. Given the difficulties associated with extrapolation of relevant statistics, they must be viewed as indicative only. They do not include estimates of internal plant (network switching in local exchanges) capital costs (Paragraphs 3.95--3.96 refer).

- 3.73 One of the problems encountered in study analysis was the wide variation in the circumstances associated with provision of plant in rural country areas. Consequently, investment costs per subscriber are difficult to quantify. Telecom explained the problems in the following terms:

"The costs of providing services using physical lines/cable are primarily dependent on the distance between customers and only to a much lesser extent on the distance from the exchange (cost ratios approximately 30:1 in a range up to 40 km). The total cost is of the order of \$2 500 per km. For an isolated customer at 40 km a total cost of \$100 000 would be incurred. If there are several intervening customers, the costs would be apportioned in the ratio of the cable route distance between them".

Source: Telecom response to Committee question.

- 3.74 Use of physical lines and cable to connect new rural country subscribers to the nearest local exchange is being phased out. Telecom is now substituting VHF radio concentrator distribution systems for reticulated plant. Existing VHF radio concentrator systems now use analogue transmission techniques and are described as analogue radio concentrator systems (ARCS). Telecom expects that digital radio concentrator systems (DRCS) will become an economic alternative to ARCS installation in the very near future (paragraphs 3.116--3.124 refer).

- 3.75 Telecom data on new connections during 1980--81 indicates that only one new connection in the Kempsey district was provided via VHF ARCS equipment in that year at a cost of \$27 608. The system was installed within the 'free line plant entitlement' limit, so there was no capital contribution required from the subscriber thereby connected.
- 3.76 Drawing on available data, the study attempted to estimate the average capital cost per new non metropolitan subscriber connection to a local exchange for the following distance categories:
- . 0--4 kms;
 - . 4--8 kms;
 - . 8--16 kms;
 - . over 16 kms.

Detailed analysis was undertaken of capital costs per new subscriber connection in the Dubbo, Kempsey and Grafton districts of New South Wales. Detailed estimates are given in Table 3.16 below.

Table 3.16: Capital costs per new subscriber connection
(breakdown by distance in 1980--81 prices)

DISTRICT	AVERAGE BASIC SUBSCRIBER COST			
	0--4 km	4--8 km	8--16 km	OVER 16 km
	\$	\$	\$	\$
Dubbo	1 239	7 621	8 721	13 093
Kempsey	1 188	2 093	5 987	13 000
Grafton	1 110	2 752	7 306	15 556
Average	1 193	2 425	7 050	13 156

Source: Analysis of Telecom data

- 3.77 Estimates for the Dubbo district were compared with information provided by Telecom on actual costs incurred in the provision of new connections. These are summarised in Table 3.17 below.

Table 3.17:

DISTANCE CATEGORY	NO. OF NEW CONNECTIONS	UNIT COST PER CONNECTION \$	TOTAL COST \$M
0--4 km	4 108	1 239	5.08
4--8 km	49	7 621	0.37
8--16 km	129	8 721	1.12
Over 16 km	45	13 093	0.59
Total	4 331	--	7.16

Source: Analysis of Telecom data

Telcom has advised that the actual cost of new connections for the Dubbo district was \$6.66 million.

- 3.78 Telecom's current connection charges in no way reflect the actual investment per subscriber. In most instances the investment is an 'irrecoverable' outlay. The standard connection charge for those distant rural subscribers within the 'free line plant entitlement' limit represents about 2.1 percent of the per subscriber investment. Where subscribers are required to make a capital contribution, that contribution represents about six percent of the actual per subscriber capital connection cost.

Correlation between per subscriber connection costs and subscriber density

- 3.79 Service connection costs differ substantially between metropolitan and country urban areas. That difference is even more significant between metropolitan (and country urban) and country rural areas. The differential is related to:

- . distances between the subscriber and the operating exchange;
- . differing subscriber densities.

The latter factor is the more significant. The higher the service density, the lesser the distance between service terminations. Also, a multipair cable is used to connect a large number of subscribers to an exchange. The cost is therefore shared among a number of subscribers.

In metropolitan areas the service density is high and is in general uniform all over the exchange service area. In country urban areas, the subscriber density in an exchange service area is much lower whilst the distance between subscribers and exchange is not all that different to a metropolitan situation. The differentials in investment therefore can vary enormously over a given distance in accordance with varying subscriber density.

3.80 The following procedure was adopted to obtain a cost related to distance of the subscriber from the exchange:

- . derive a cost per subscriber as a function of subscriber density:
 - the information used in this instance was that available from Telecom Planning Information Bulletin No. 46;
 - this was further projected to cover high density situations. The estimate converged to the metropolitan average cost of \$533 per service.

Such a projection may not be entirely accurate for a number of reasons, one of which is that for high density, short distance reticulation, smaller gauge cables are used resulting in marginally lower costs. As only an overall order of costs is required the projection is considered valid. The projections were based on the following method of analysis.

- . A subscriber distribution was obtained for each district within the following distance categories:
 - 0--4 km
 - 4--8 km
 - 8--16 km
 - >--16 km
- . The extrapolated pattern of subscriber distribution was assumed to exist for all exchanges within the district.
- . The number of subscribers within each district was divided in the following exchange categories:
 - over 1 000 services
 - 100--1 000
 - under 100
- . It was assumed in this instance that the number of subscribers within the various distance zone categories depends on the size of the exchange.
- . From the above, subscriber density was computed for each category of exchange at the various distance categories.

- From costs derived as a function of subscriber density, the average cost per subscriber throughout each district at each distance category was computed. Distance zones were classified into areas as follows:

-- 0-- 4 km : 50 square km
 -- 4-- 8 km : 150 square km
 -- 8--16 km : 600 square km
 -- 16--40 km : 4 226 square km

3.81 The calculations are based on the following assumptions:

- DRCS costings would apply when service density was lower than 0.06 services per square kilometre.
- Cost of cable connection would be based on 0.9 mm cable using NSW costings.
- Projection of cost per subscriber for high density distribution was valid.
- Subscriber density is constant over the annular zones at various distances from the exchange.
- Distribution of services with distance from the exchange is constant for all exchanges within a district.

3.82 The calculations were applied to three NSW districts. The results are tabulated below:

DUBBO

Exchange and subscriber distribution

EXCHANGE CATEGORY	NO. OF EXCHANGES	NO. OF SUBSCRIBERS	NO. OF SUBSCRIBERS PER EXCHANGE
over 1 000	6	22 799	3 798
100--1 000	27	11 443	424
under 100	202	5 717	28

ZONE CATEGORY	SERVICES	PERCENTAGES %
0--4 km	38 118	93.2
4--8 km	451	1.1
8--16 km	1 527	3.7
over 16	804	2.0

Exchange Category		0--4 kms	4--8 kms	8--16 kms	over 16 kms
over 1 000	No. of Subs	3 540	42	141	76
	Density	70	0.28	0.235	.019
	Cost per Sub	700	4 600	5 000	10 000
100 -- 1 000	No. of Subs	395	5	16	8
	Density	7.9	.033	.027	.002
	Cost per Sub	1 200	9 500	9 800	16 000
under 100	No. of Subs	26	0.3	1	0.56
	Density	0.52	.002	.001	.0001
	Cost per Sub	3 500	16 000	20 000	20 000

Averaging Process

0--4 km	Costs	$700 \times (6 \times 3540)$	=	14 868 000
		$1\,200 \times (27 \times 395)$	=	12 798 000
		$3\,500 \times (202 \times 26)$	=	18 382 000
		37 157		46 048 000

Average \$1 239

4--8 km	Costs	$4\,600 \times (42 \times 6)$	=	1 159 200
		$9\,500 \times (5 \times 27)$	=	1 282 500
		$16\,000 \times (0.3 \times 202)$	=	969 600
		447.6		3 411 300

Average \$7 621

8--16 km	Costs	$5\,000 \times (141 \times 6)$	=	4 230 200
		$9\,800 \times (16 \times 27)$	=	4 233 600
		$22\,000 \times (1 \times 202)$	=	4,444,000
		1480.6		12 907 600

Average \$8 721

over 16 kms	Costs	$10\,000 \times (76 \times 6)$	=	4 560 000
		$16\,000 \times (8 \times 27)$	=	3 456 000
		$20\,000 \times (0.56 \times 202)$	=	2 262 400
		785		10 278 400

Average \$13 093

KEMPSEY

EXCHANGE CATEGORY	NO. OF EXCHANGES	TOTAL OF SERVICES	SERVICES PER EXCHANGE
over 1 000	9	23 102	2 566
100--1 000	31	8 208	265
under 100	45	2 445	54

Exchange and subscriber distribution

DISTANCE CATEGORIES	NO. OF SUBSCRIBERS	RELATIVE			
0--4 km	18 735	55.2%			
4--8 km	12 490	36.8%			
8--16 km	2 696	7.9%			
under 16 km	20	0.1%			

Exchange Category		0--4 kms	4--8 kms	8--16 kms	Over 16 kms
over	No. of Subs	1 416	944	203	3
1 000	Sub Density	28.6	6.3	0.34	. 0008
	Cost per Sub	900	1 200	4 250	20 000

100	No. of Subs	146	97	21	--
--	Sub Density	3	0.64	.035	--
1 000	Cost per Sub	1 400	3 300	9 200	20 000

under	No. of Subs	30	20	4	--
100	Sub Density	0.6	0.133	.007	--
	Cost per Sub	3 200	6 500	12 000	20 000

Average Costs

Costs required for all 0-4 km subscribers

900 x (9 x 1 416)	=	11 469 600
1 400 x (31 x 146)	=	6 336 400
3 200 x (45 x 30)	=	4 320 000
18 620		22 126 000

$$\text{Average} = \frac{22\,126\,000}{18\,620} = \$1\,188 \text{ per connection}$$

Similarly for 4--8 kms

Costs	1 200 x (9 x 944)	=	10 195 200
	3 300 x (31 x 97)	=	9 923 100
	6 500 x (45 x 20)	=	5 850 000
	12 403		25 968 300

$$\text{Average} = \$2\,093$$

Similarly for 8--16 kms

Costs	4 250 x (9 x 203)	=	7 764 750
	9 200 x (31 x 21)	=	5 989 200
	12 000 x (45 x 4)	=	2 160 000
	2 658		15 913 950

$$\text{Average} = \$5\,987$$

over 16 km

On the basis that these are isolated customers and likely to require a radio solution (DRCS) otherwise costs are prohibitive.

$$\begin{array}{l} \text{Average per} \\ \text{per subscriber (rural)} \end{array} = \$13\,000$$

GRAFTON

EXCHANGE CATEGORY	NO. OF EXCHANGES	NO. SERVICES	SERVICES PER EXCHANGE
over 1 000	4	14 292	3 573
100--1 000	28	9 422	336
under 100	36	1 942	5

Exchange and subscriber distribution

DISTANCE CATEGORY		SERVICES	PERCENTAGES			
0--4 km		20 993	74.8%			
4--8 km		5 745	20.5%			
8--16 km		1 242	4.4%			
over 16		73	0.3%			
Exchange Category		0--4 kms	4--8 kms	8--16 kms	over 16 kms	
over 1 000	No. of Subs	2 673	732	157	11	
	Density	53.4	4.88	0.26	.003	
		750	1 350	4 800	12 000	
over 100 under 1 000	No. of Subs	251	69	15	1	
	Density	5.02	0.46	.025	.00025	
		1 300	3 700	9 800	20 000	
over 100	No. of Subs	40	11	2.4	0.2	
	Density	0.8	.073	.004	.00005	
		2 850	8 500	13 400	20 000	

Averaging Process

$$\begin{array}{rcl}
 0--4 & 750 \times (2\,673 \times 4) & = 8\,019\,000 \\
 & 1\,300 \times (251 \times 28) & = 9\,136\,400 \\
 & 2\,850 \times (40 \times 36) & = 4\,104\,000 \\
 \hline
 & 19\,160 & 21\,259\,400
 \end{array}$$

Average \$1,110

$$\begin{array}{rcl}
 4--8 & 1\,350 \times (732 \times 4) & = 3\,952\,800 \\
 & 3\,700 \times (69 \times 28) & = 7\,148\,400 \\
 & 8\,500 \times (11 \times 36) & = 3\,366\,000 \\
 \hline
 & 5\,256 & 14\,467\,200
 \end{array}$$

Average \$2 752

8--16	4 800 x (157 x 4)	=	3 014 400
	9 800 x (15 x 28)	=	4 116 000
	13 400 x (2.4 x 36)	=	1 157 760
	1 134.4		8 288 160

Average \$7 306

over 16	12 000 x (11 x 4)	=	528 000
	20 000 x (1 x 28)	=	560 000
	20 000 x (0.2 x 36)	=	144 000
	79.2		1 232 000

Average \$15 556

3.83 Summary

The results of the preceding detailed calculations and projections are summarised below:

DISTRICT	0--4	4--8	8--16	16
Kempsey	1 188	2 093	5 987	13 000
Dubbo	1 239	7 621	8 721	13 093
Grafton	1 110	2 752	7 306	15 556
AVERAGE	1 193	2 425	7 050	13 156

3.84 Figures 3.8 and 3.9 on page 267 chart correlations between subscriber density and cost per subscriber.

Maintenance and operating costs

- 3.85 On the available data, it was not possible to differentiate between operational and maintenance costs per service for subscribers located in urban country and rural country areas. Indicative average costs per subscriber for a district as a whole were projected from data available for the Dubbo and Kempsey districts, as tabulated below:

Table 3.18: Operational and maintenance costs per subscriber
in Dubbo and Kempsey

DISTRICT	COST PER SUBSCRIBER \$
Dubbo	276
Kempsey	206

Source: Analysis of Telecom data

- 3.86 Analysis of available data has identified the following factors influencing the level of operational and maintenance costs per subscriber in non metropolitan areas:
- . geographic size of district;
 - . number of subscribers in the district (subscriber density);
 - . manhours per year required to operate and maintain individual subscriber services (paragraphs 3.87--3.88 refer).

Maintenance productivity

- 3.87 The correlation between subscriber density and maintenance costs is perhaps best reflected in an analysis of manhour maintenance productivity per subscriber per year in non metropolitan areas. Analysis indicates that the labour component of maintenance costs accounts for between 85--90 percent of overall operational and maintenance costs.

Table 3.19 below gives estimates of maintenance manhours per subscriber service per year in non metropolitan areas. The estimates give average maintenance manhours per service for all non metropolitan areas (national) and for two sparsely populated states (Western Australia and South Australia respectively).

Table 3.19: Estimates of annual maintenance manhours per non metropolitan service

CATEGORY	ANNUAL MAINTENANCE MAN HOURS PER SERVICE
National	2.92
Western Australia	4.00
South Australia	4.00

Source: Telecom data

3.88 In respect of external plant, analysis indicates that:

- maintenance costs rise steeply in those states with lower population and subscriber densities;
- higher maintenance costs in areas with lower subscriber densities are associated with long distance cable and wire installations required to connect the subscriber to the nearest local exchange.

ANALYSIS OF PRESENT NON METROPOLITAN TELECOMMUNICATIONS SYSTEMS:
INTERNAL PLANT

Distribution of exchanges in non metropolitan areas

- 3.89 There are some 61 000 non metropolitan subscribers connected to manual exchanges. Table 3.20 below summarises the distribution of manual and automatic exchanges in non metropolitan areas for NSW.

Table 3.20: Distribution of exchanges (NSW district)

EXCHANGE TYPE	NUMBER OF EXCHANGES	SUBSCRIBERS PER EXCHANGE
Automatic	1 297	578
Manual	379	70

Source: Telecom data

- 3.90 Data for Dubbo, Kempsey and Rockhampton districts indicating the number of subscriber connections to automatic and manual exchanges, together with the number of party lines are included in Table 3.21 below:

Table 3.21:

TYPE OF CONNECTION	DUBBO	KEMPSEY	ROCKHAMPTON
No. subs connected to automatic exchanges	32 587	28 974	32 685
No. subs connected to full time manual exchanges	6 904	1 194	2 653
No. subs connected to part time manual exchanges	495	100	234
Total no. subs connected to manual exchanges	7 399	1 294	2 887
No. of party lines	684	7	257

Notes to Table:

- The seven party lines in Kempsey connect 30 subscribers.

- . The 684 party lines in Dubbo connect 2 540 subscribers, an average of four subscribers per party line.
- . Of the 684 party lines in Dubbo, 604 are PPE lines serving 2 222 subscribers.
- . 78 percent of all subscribers in the Dubbo district have access to automatic STD services.

Source: Analysis of Telecom data.

Manual exchanges

- 3.91 A variety of arrangements are made by Telecom for staffing and operation of manual exchanges:
- . full time exchanges are staffed and operated by Telecom;
 - . very small exchanges are operated according to the contractual agreements between Telecom and private individuals who are authorised to operate an exchange either:
 - from their own premises; or
 - on the premises of a non official post office.
- 3.92 Full time exchanges are usually located in medium sized centres. They typically serve about 200 subscribers. A significant number of full time exchanges serve fewer subscribers: some serve many more than 200. A full time service is deemed by Telecom to be warranted when there are more than 40 subscribers connected to an exchange.
- 3.93 Hours of operation of very small part time exchanges depend on the number of subscribers and contractual arrangements between Telecom and the exchange operators. Hours of operation related to number of subscribers connected are summarised below:

Table 3.22:

NUMBER OF SUBSCRIBERS	HOURS OF OPERATION MONDAY--FRIDAY
Fewer than 10 subscribers	9 am--6 pm
11--14 subscribers	9 am--8 pm
14--24 subscribers	8 am--8 pm
25--40 subscribers	8 am--10 pm

Source: Telecom data

- 3.94 Telecom allows trunk calls connected via part time exchanges to be made at night time concession rates for at least the last hour of exchange operation each day.

Capital costs -- investment per service

- 3.95 Telecom has advised that it is difficult to identify accurately all cost components properly attributable to an individual new service connection. Telecom has explained that the difficulty in accurate allocation of costs per subscriber arises from the following factors:

- new connections are facilitated by 'incremental' growth of the network;
- past practices and policies in relation to use of spare capacity in existing plant;
- plans for provision of future spare capacity;
- investment decisions and cost allocation in respect of:
 - provision for increased traffic (volume) handling capability;
 - upgrading and replacement of existing plant;
 - substitution of old by new distribution technologies to provide improved services to existing customers and 'first' services to new customers;
- investments which facilitate provision for a number of different services (other than telephone services);
- allocation of overheads.

- 3.96 Telecom has estimated the breakdown of capital costs per non metropolitan service as below:

Table 3.23: Per service allocation of capital costs

ITEM	AVERAGE COST PER NON METROPOLITAN SUBSCRIBER
	\$
Basic telephone facility	1 880
Share of local inter exchange network investment	787
Share of trunk network investment	426

Source: Telecom data

Maintenance and operating costs: correlation with subscriber density

- 3.97 Internal plant maintenance and operating costs reflect similar correlation with subscriber density to that already identified in relation to external plant. The correlation is due to fragmented nature of the switching network in non metropolitan areas.

In this section, analysis is concerned only with the fragmentation of network switching in non metropolitan areas.

- 3.98 The reason for this fragmentation is that, in areas of low subscriber density, optimum network design requires dispersion of exchanges. This applies especially to rural country areas where the average number of subscribers connected per exchange is less than 100.

- 3.99 A detailed analysis of exchange statistics in Dubbo, Kempsey and Rockhampton is set out in Tables 3.24--3.26 below:

Table 3.24: Subscriber density per exchange in the Dubbo district

EXCHANGE CATEGORY	AUTOMATIC EXCHANGES	MANUAL EXCHANGES	TOTAL EXCHANGES	AVERAGE NO. SUBS. PER EXCHANGE
over 1 000	4	1	5	2 644
100--1 000	7	9	16	402
40--100	28	16	44	60
less than 40	14	50	64	18

Source: Analysis of Telecom data

Table 3.25: Subscriber density per exchange in the Kempsey district

EXCHANGE CATEGORY	AUTOMATIC EXCHANGES	MANUAL EXCHANGES	TOTAL EXCHANGES	AVERAGE NO. SUBS. PER EXCHANGE
over 1 000	17	-	17	1 606
100--1 000	23	-	23	174
40--100	32	1	33	66
less than 40	7	5	12	22

Source: Analysis of Telecom data

Table 3.26: Subscriber density per exchange in the Rockhampton district

EXCHANGE CATEGORY	AUTOMATIC EXCHANGES	MANUAL EXCHANGES	TOTAL EXCHANGES	AVERAGE NO. SUBS. PER EXCHANGE
over 1 000	9	-	9	2 727
100--1 000	23	8	31	270
40--100	15	6	21	58
less than 40	10	31	41	18

Source: Analysis of Telecom data

3.100 Table 3.27 below summarises the data in the three preceding tables. It demonstrates that in each of the three non metropolitan districts studied:

- . most urban country subscribers are connected to a few medium sized exchanges;
- . rural country subscribers are connected to a very large number of small exchanges.

Table 3.27

DISTRICT	DISTRICT CATEGORY	NUMBER OF EXCHANGES	EXCHANGE SIZE (AVERAGE)	PERCENTAGE OF SUBSCRIBERS %
Dubbo	Urban	5	2 644	56
	Rural	124	82	44
Kempsey	Urban	17	1 606	81
	Rural	68	94	19
Rockhampton	Urban	9	2 727	70
	Rural	93	111	30

Source: Analysis of Telecom data

3.101 Telecom advised that district staffing levels are not set or justified on the basis of subscriber density. They are set on the basis of detailed annual examination of:

- . past and current productivity performance;
- . future workload projections and productivity targets.

3.102 The following table shows staffing, subscriber density and maintenance for the Dubbo and Kempsey districts:

Table 3.28:

DISTRICT	SUBSCRIBER DENSITY PER SQUARE KM	STAFF PER 1 000 SUBSCRIBERS	MAINTENANCE COST PER SUBSCRIBER \$
Dubbo	0.1	13.89	276
Kempsey	1.7	13.15	206

Source: Analysis of Telecom data

THE RURAL CONVERSION PROGRAM

Background

3.103 In 1959, the then Australian Post Office commenced a plan (the 'Community Telephone Plan') for conversion of all manual exchanges to automatic operation. The plan was devised to:

- . provide automatic telephone services;
- . provide subscriber trunk dialling;
- . improve transmission standards;
- . reduce the number of applicants awaiting connection.

3.104 Capital costs of conversion program: 1977 estimates

In 1977 a preliminary Telecom analysis of the number, length and distribution of PPE lines and estimates of average conversion costs indicated a capital requirement of \$180 million in 1977 prices for all services. At that time, PPE subscribers were expected to contribute some \$87 million towards the cost of new construction beyond the 12 km free line plant entitlement point. If all subscribers beyond 20 kms were equipped with VHF radio with the option of a \$500 fixed annual rental, the total contribution would fall to \$37 million. Likely nett conversion costs to Telecom were estimated to be about \$120 million under the most favourable circumstances. Table 3.29 below -- extrapolated from data in that 1977 report -- sets out the report estimates of costs of replacement of then existing PPE lines using proven distribution technologies:

Table 3.29: PPE line reconstruction costs estimates (1977 prices)

LENGTH	NUMBER OF PPE POINTS	TOTAL LINE RECONSTRUCTION COSTS (*)	AMOUNT PAID BY PPE SUBS		
			PRESENT (CM2/76)	PROPOSED \$3 500	UPPER LIMITS \$3 500 & \$6 000
		\$M	\$M	\$M	\$M
0--12 kms	15 300	57	0	0	0
12--20 kms	6 200	30	7	7	7
20--40 kms	5 300	42	28	18	18
over 40 kms	3 400	54	52	12	20
TOTAL	30 200	183	87	37	45

* Assumes lines rebuilt to all PPE points as exclusive subscriber services.

Source: Telecom

Progress since 1977

- 3.105 Various changes in Telecom's charging policies and practices relating to provision of rural services were implemented in 1977 and 1978 (Volume 2, Section 4, refers).
- 3.106 By 1979, the following progress had been made on the rural external plant upgrading and exchange conversion programme:
- . the number of subscribers connected to part time manual exchanges had been reduced from 58 000 to 7 900 -- a reduction of 86 percent;
 - . the number of subscribers connected to manual exchanges had been reduced from 389 000 to 90 500 -- a reduction of 77 percent;
 - . the number of PPE line services and party line connection points had been reduced from 58 000 to an estimated 26 000 -- a reduction of 55 percent.
- 3.107 In 1979, Telecom announced details of its new 'Rural Conversion Program'. This aimed to complete conversion of all manual exchanges to automatic operation by 1990. As at June 1982:
- . the number of subscribers connected to manual exchanges had dropped from 90 500 to 61 000 -- a drop of 32.6 percent;
 - . the number of subscribers connected to part time exchanges had fallen from 7 900 to 5 400 -- a drop of 31.6 percent.
- 3.108 Telecom's progress on the 'Rural Conversion Program' is charted below:

Table 3.30: Progress on the Rural Conversion Program

YEAR	MANUAL SERVICES	NON CONTINUOUS SERVICES
1977	112 084	11 204
1978	104 158	9 456
1979	90 551	7 905
1980	73 474	6 268
1981	61 709	5 389

Source: Telecom Annual Report 1980--81

Rate of conversion

- 3.109 The rate of conversion is slowing compared with that achieved in previous years. This may be attributed to increasingly higher capital and other resource requirements per service with progression into the more distant rural country areas. Notwithstanding, the capital contribution per subscriber has been substantially reduced under the policy which came into effect on 1 January 1982.

Present policies and priorities

- 3.110 Telecom's policy for the allocation of priorities in the Rural Conversion Programme is contained in Circular Memorandum No. 3 of 1974 which states:

"The new policy recognises that in the allocation of resources, requirements for common plant come first, followed by provision of services for new subscribers and then service improvements such as the conversion to automatic working for existing subscribers. That is, automatic exchange installation programs need to be developed on the basis that although there is some continuing need to invest funds in the improvement of service to existing subscribers, provision of services for new subscribers must be considered as having a higher priority."

- 3.111 Accordingly, it is Telecom's policy to give priority for installation of automatic exchanges where:

- it is essential for an automatic exchange to be provided if service is to continue;
- the existing manual exchange can no longer meet growth in new connection demand or associated switching capacity;
- it is essential for an automatic exchange to be installed in order to provide service in the area (subject to financial viability);
- the installation of an automatic exchange will result in a significant financial advantage to Telecom;
- the installation of a small automatic exchange will enable the overall financial advantages of the conversion of a large centre to be realised.

Telecom recent estimates of capital conversion costs

- 3.112 Telecom estimates that, under its revised policy for capital contributions by non metropolitan subscribers, only 2 650 of the 61 000 subscribers still connected to manual exchanges will contribute to capital costs per service. These 2 650 will, Telecom estimates, contribute \$0.6 million -- or some 0.3 percent of the estimated outstanding capital investment of \$204 million required to complete the program.

PLANNING FOR SERVICE PROVISION IN REMOTE AREAS

Telecom policy on remote area services

- 3.113 Telecom is in the process of developing a detailed policy for provision of telecommunications services in isolated and remote areas. Planning is based on a number of studies undertaken by or on behalf of Telecom in recent years:

- . 1977 Telecom Corporate Planning Branch Study;
- . 'A Study of remote area telecommunications in the Northern Territory' Implementation and Management Group Pty. Ltd. for Telecom, May 1980;
- . 'Remote Area Telecommunications Study' (The National Report), Telecom Australia, August, 1980.

Findings of the National Report

- 3.114 Findings of the National Report included the following:

- . there were 44 000 people in remote areas of Australia without access to modern telecommunications services;
- . remote area residents have a high priority need for modern automatic telephone services (and other telecommunications services);
- . likely demand for an automatic STD telephone was estimated at 2 500 subscribers in 1985 increasing to 5 200 in year 2000. (This did not include any demand from major new mining developments);
- . 66 percent of the population in remote areas are Aboriginal and 38 percent of the forecast demand in 1985 was related to Aboriginal needs;
- . tariff policies applying to remote areas should be kept under review;
- . prices should be reviewed for both DRCS and satellite options for provision of services to remote areas.

Technical options for remote area service provision

- 3.115 Assessment of a range of technical distribution options to meet remote area communications has been undertaken as part of recent studies by and on behalf of Telecom. The two preferred options analysed in detail by Telecom are:

- . digital radio concentrator systems (DRCS);
- . satellite (using earth stations and NSS leased capacity).

Digital radio concentrator system (DRCS)

- 3.116 The DRCS concept of providing modern telecommunications services to sparsely populated areas was developed by Telecom.
- 3.117 DRCS has essentially the capability to deliver the following standard quality individual telecommunications services:
- . voice telephony;
 - . telex;
 - . digital data services;
 - . sound broadcasting (at the expense of a speech channel without capability to provide high fidelity sound quality).
- 3.118 A special characteristic of DRCS is the use of digital signal encoding and modulation techniques. These enable regeneration of the signal at regular intervals without loss of signal quality. Signal regenerators (repeaters) are required at intervals of 40 -- 50 kilometres. Up to nine repeaters can be used, enabling subscribers up to about 450 kilometres distance from an exchange to be connected to the exchange.
- 3.119 Costs of DRCS provision are dependent on the following factors:
- . number of subscribers accessing a single DRCS system;
 - . subscriber density within a given area;
 - . subscriber distribution patterns;
 - . distance from the designated service exchange.
- 3.120 Telecom has let tenders for the design and construction of three pre-operational DRCS systems. These are scheduled for installation and testing in 1983. Subject to evaluation of system performance, Telecom expects to place bulk orders for DRCS provision within the framework of the 'Rural Conversion Program'.
- 3.121 Telecom has projected costs for DRCS provision on the basis of the following assumptions (all in 1980 prices):
- . for an average of two subscribers per DRCS coverage zone:
\$22 000 average cost per subscriber;
 - . for an average of twenty subscribers per DRCS coverage zone:
\$11 000 average cost per subscriber;
 - . for an overall subscriber density of .001 per square kilometre:
\$9 000 per subscriber;
 - . for an overall subscriber density of .01 per square kilometre
\$4 000 per subscriber.

3.122 For DRCS, estimated overall costs of providing service to 3 400 remote subscribers by 1990 are given below in 1980 prices.

	\$ Million
Total cumulative capital cost	69 500
Maintenance	<u>21 485</u>
	90 958
Revenue Generated	54 490
Loss	36 468

3.123 For DRCS the estimates were based on the following assumptions:

- . commencement of project by 1985;
- . progressive provision of service to 1990;
- . to satisfy estimated demand of 3 400 services;
- . further provision of additional services (at a marginal costing) to a total of 4 159 services to year 2000;
- . use DRCS technology at average cost/subscriber to year 1990 of \$17 700;
- . revenue generated estimated on average call revenue per subscriber of:
 - N.T. & W.A. \$1 200 p.a.
 - S.A. \$ 800 p.a.
 - QLD & N.S.W. \$ 650 p.a.
- . \$500 rental for pastoral stations and no installation charge;
- . coin telephony (Aboriginals) only installation charge -- no rental;
- . all other services:
 - \$140 connection fee;
 - \$85 annual rental.

3.124 The report indicated that the subsidy of approximately \$37 million (paragraph 3.122 refers) would depend on the expected revenue; i.e. if revenue is halved, subsidy of \$56 million required, if revenue is doubled -- subsidy \$2 million.

Satellite (NSS)

- 3.125 The national satellite system (NSS) has been designed to deliver a wide range of telecommunications services, including:
- voice telephony including teleconferencing capability;
 - data communications in both analogue and digital modes (includes telex);
 - video and image services including slow scan television, videoconferencing and videotex services.
- 3.126 Service applications which could be delivered by the NSS and which are of potential interest to remote areas include:

Voice communications

- Standard telephone service (one to one, point to point);
- party calls (several callers connected in a conference call type application, or teleconferencing -- e.g. for RFDS 'chatter' type sessions, or School of the Air 'Singalong' and other sessions);

(NOTE: For this application, expensive additional switching and associated electronics would be required, together with a separate voice channel for each user involved in the party call where two way communications are required);
- emergency voice communications established via transportable earth stations in times of disaster and breakdown of existing telecommunications;
- temporary voice communications for survey or other operations operating remotely from a base camp in temporary outstations or field camps for two way communications between the base camp and outstations or field camps using transportable earth stations;
- distribution of sound (radio) broadcasting services for both information and entertainment programming;
- offshore communications (e.g. drilling rig to a land base station);
- communications between air and sea support vessel and rig, and between support vessels and land station.

Data

- . Standard telex services;
- . transfer of data relating to a wide range of business communications e.g. inventory control, personnel, financial and accounting, freight forwarding and cargo status;
- . weather information;
- . telemetry remote sensing, monitoring, surveillance and remote diagnostic applications relevant to mining and exploration; earth resources, general mapping and survey oil and mineral production and similar undertakings in remote and isolated areas;
- . distributed data processing;
- . information input to and retrieval from central processing units by remote terminals (non interactive).

Video/image

- . Text and graphic, also photographic facsimile transmissions;
- . slow scan television (using equivalent of a telephone voice bandwidth);
- . 'telemedicine' remote diagnosis and consultation;
- . interactive, instructional and educational uses (e.g. 'electronic blackboard' applications);
- . television program distribution;
- . videoconferencing.

3.127 Telecom has expressed the view that from an economic viewpoint, most of the potential NSS service applications would be cost prohibitive. Factors influencing the final cost to subscribers include:

- . number of subscribers for whom NSS delivery would be more cost effective than use of DRCS;
- . number and cost of subscriber earth stations required;
- . range of services to be delivered via satellite;
- . annual per transponder leasing charges set by AUSSAT.

3.128 Telecom has also pointed out that the major cost component for satellite earth stations is associated with the electronics required to enable reception of different types of signals (e.g. voice, data, image) and the number of voice, data or image signals to be accommodated.

Comparison of DRCS and NSS capital costs

- 3.129 Telecom estimates that there are no more than 3 400 potential remote area subscribers who would need to be serviced via either DRCS or the NSS. On the basis of detailed examination of relative costs per subscriber of the two distribution technologies, Telecom concludes that about 88--94 percent of these could be most cost effectively serviced by DRCS within a reasonable time frame. The remaining 6--12 percent will most likely be serviced via the NSS.
- 3.130 In planning for provision of telecommunications services to remote areas using the NSS, Telecom presently expects to develop a leased satellite network comprising some 60 earth stations. The network would have the capacity to serve from 200 to 400 prospective remote area subscribers. Initially, Telecom would expect to serve no more and perhaps fewer than 200 subscribers via this network, at an estimated installed cost of \$10 million, assuming per subscriber earth station costs of just under \$50 000.
- 3.131 The above projections are based on the following Telecom estimates (earth stations) of capital requirements for its proposed remote telephony satellite service (RTSS). Estimates are for earth stations configured to handle voice telephony traffic only.

No. of subscribers	No. of earth stations	Uninstalled Capital cost
\$ million		
100	30	5
200	60	8
400	90	12

- 3.132 Telecom has concluded that the capital cost per subscriber using satellite will be in the range of \$30 000 to \$50 000.
- 3.133 Telecom points out that the capital investment required to serve all 3 400 prospective remote area subscribers via satellite would be somewhere between \$102--170 million in 1982 prices.
- 3.134 Operating costs per subscriber to the RTSS are difficult to predict at this time. Telecom expects to be paying some \$2 million per annum or more in 1982 prices to lease one NSS transponder. Assuming that the entire capacity of one transponder is required to provide the RTSS service to a minimum of 200 subscribers, per subscriber operating costs relating to leased capacity would be in the order of \$10 000 per year.
- 3.135 With respect to subscribers to be served by DRCS, Telecom is projecting per subscriber capital costs on the basis of its 1980 national study estimates. These assume an average per subscriber capital cost of \$17 000 in 1980 prices. Were all 3 400 remote area subscribers to be served by DRCS, the overall capital costs would be just under \$70 million in 1980 prices. The overall capital cost of serving 88--94 percent of those subscribers by DRCS would range between about \$61--\$66 million in 1980 prices.

- 3.136 Assuming that Telecom uses the presently proposed mix of DRCS and NSS facilities to service the projected demand of 3 400 remote area subscribers by 1990, capital cost requirements would be around \$60--\$70 million. This estimate accords with the findings of Telecom's 1980 National Study which projected 'loss' or subsidy requirement in the order of \$36 million in 1980 prices.

PART B: COMPARISON OF METROPOLITAN AND NON METROPOLITAN
TELECOMMUNICATIONS SYSTEMS AND SERVICES

OVERVIEW

Introduction

- 3.137 Volume 2, Section 2 of the Committee's Report describes the present national terrestrial telecommunications infrastructure. It outlines components of Telecom's existing national terrestrial ('core') network and summarises the transmission and switching systems in Telecom's public switched telephone, telex, telegraph and data networks. Details of types of leased capacity available for dedicated use by business subscribers are included. A technical overview of the planned national satellite system (NSS) is also provided.
- 3.138 Volume 2 Section 3 of the Report describes the range of Telecom provided services presently available to metropolitan business and non business subscribers. These include a variety of voice, information and computer based data and image communications services, together with the public telegram service and public access telephone facilities. By 1985, the range of present services will have been expanded to include public switched data and integrated digital data services.
- 3.139 Non metropolitan subscribers have access to a comparatively restricted range of services. Those in the more populous urban country centres and some adjacent rural country areas have access to most public switched telephone, telegraph and telex services. In most other non metropolitan areas, services are limited to voice telephony and public telegram services. In the more remote areas, non metropolitan dwellers have no direct access to public switched telecommunications services. Most rely on private and independent radio communication distribution systems -- e.g. the Royal Flying Doctor Service HF radio network. Some have limited access to Telecom's public switched telephone network through the 'Radphone' Service.

Service penetration

- 3.140 The study confirmed that penetration of telephone services in metropolitan areas overall is approaching saturation point. There are some exceptions in rapidly developing outlying suburban areas or those with a high rate of new housing development. Trends in comparative penetration in metropolitan and non metropolitan areas are extrapolated from detailed analysis of data available for the following metropolitan and non metropolitan districts:

NON METROPOLITANMETROPOLITAN

Dubbo (NSW)
 Kempsey (NSW)
 Rockhampton (QLD)

Bankstown (Sydney NSW)
 Chatswood (Sydney NSW)
 Metro South (Brisbane QLD)

3.141 This review draws mainly on data assembled for New South Wales metropolitan and non metropolitan districts due to difficulties in obtaining comparable data for the one Queensland metropolitan area selected for study. NSW statistics cannot be taken as an absolute reflection of trends in metropolitan and non metropolitan districts in other states. Data available from Telecom suggests that the use of NSW district data enables assessment to be made which may be regarded as a valid indicator of trends and differences in metropolitan and non metropolitan districts in all states.

3.142 Comparative data on telephone service penetration in selected New South Wales districts is given in Table 3.31 below:

Table 3.31: Comparative telephone service penetration in selected NSW metropolitan and non metropolitan districts

SUBSCRIBER AND SERVICE DETAILS	DISTRICT			
	BANKSTOWN	CHATSWOOD	DUBBO	KEMPSEY
Total chargeable services	117 779	93 034	38 946	29 481
No. of business subscribers	22 368	16 498	13 031	8 368
No. of non business subscribers	95 411	76 536	25 715	21 113
No. of dwellings in district	133 536	69 898	50 894	37 796
Service Penetration (A)	0.71	1.09	0.51	0.59
Service Penetration (B)	0.78	0.9	0.56	0.53
Service Penetration (C)	0.73	1.12	0.63	0.67

Notes: (A) Non business subscribers: Number of dwellings.

(B) Telecom data 30.6.79 based ABS 1979.

(C) Modified to allow for component of business services in residential dwelling (metropolitan 10 per cent) (non metropolitan 50 percent)

Source: Analysis of Telecom data.

- 3.143 The table above indicates that penetration of telephone services in metropolitan areas is approaching saturation. This is exemplified by Chatswood which is reaching saturation point. Chatswood experienced a growth in new subscribers of 4.6 percent in 1980--81 and an estimated demand for new services of 2.5 percent per year, with the rate of demand declining.
- 3.144 Bankstown shows a slightly different pattern, reflecting the fact that the area is not as long established as Chatswood and is still characterised by significant new housing development. Service penetration in Bankstown is estimated at between 70 and 80 percent. New connections during 1980--81 account for 12 percent of all present subscribers.
- 3.145 Service penetration in non metropolitan areas overall is generally lower than in metropolitan areas, ranging between 50 and 70 percent.

Demand for telephone services

- 3.146 Assessment of demand for services was based on applications for service in 1979--80 and 1980--81 in the districts studied. The level of demand for new services is determined primarily by:
- . existing level of service penetration in each district;
 - . the cost to the subscriber for service provision.
- 3.147 Table 3.32 below summarises demand for service during 1980--81 in the four NSW districts studied.

Table 3.32: Demand for service during 1980-81

DEMAND FOR SERVICE	DEMAND BY DISTRICT			
	DUBBO	KEMPSEY	BANKSTOWN	CHATSWOOD
Number of applications	5 136	6 721	14 826	4 591
New applications as % of existing subscribers	12.6%	22.2%	12.5%	4.9%

Source: Telecom data

- 3.148 The demand for new services in Dubbo was lower than expected. This may be due to the size of the district and very low subscriber density overall. Another factor may have been the relatively high capital contribution per subscriber for provision of services in the more distant areas of the district under the then current Telecom 'free line plant entitlement' policy (Volume 2, Section 4 refers).

Satisfied demand

- 3.149 Available data for the four NSW districts found that in metropolitan areas most applications result in completed subscriber connections within 15 days of Telecom issuing an order for work to proceed.

Table 3.33: Satisfied demand: metropolitan and non metropolitan comparison

TIME TAKEN TO COMPLETE CONNECTION	DISTRICTS			
	NON METROPOLITAN		METROPOLITAN	
	DUBBO	KEMPSEY	BANKSTOWN	CHATSWOOD
less than 15 days	67%	28%	72%	78%
over 15 days	33%	72%	28%	22%

Source: Analysis of Telecom data

Unsatisfied demand

- 3.150 For reasons already explained (paragraphs 3.29--3.30, Part A refer), the actual level of unsatisfied demand in any area in any given year is difficult to quantify. This applies especially to rural country areas. The estimates given in Table 3.34 below are therefore subject to the qualifications referred to above.

Table 3.34: Unsatisfied demand during 1980--81: comparison
of metropolitan and non metropolitan districts

UNSATISFIED DEMAND	NON METROPOLITAN		METROPOLITAN	
	DUBBO	KEMPSEY	BANKSTOWN	CHATSWOOD
Applications for new service	5 136	6 721	14 826	4 591
New connections	4 331	4 152	13 767	4 361
No unsatisfied	805	2 569	1 059	230
% unsatisfied of total applications	15%	38%	7%	5%

Source: Analysis of Telecom data

- 3.151 Data in the preceding table indicates that:
- as a percentage of all applications for new service in any given year, the level of unsatisfied demand is much higher in non metropolitan than metropolitan areas;
 - the high level of unsatisfied demand in Kempsey may be attributable to the high level of demand and availability of resources to meet that demand;
 - Chatswood's relatively low level of unsatisfied demand (five percent) correlates with a near saturation of services in that district.

Deferred applications

- 3.152 Applications are deferred when transmission (external) or switching (internal) plant is unavailable to enable connection of a subscriber to the nearest local exchange. Eighty three percent of all deferred applications area are attributable to non availability of external plant. The remaining deferred application -- 17 percent -- are attributable to the fact that the nearest local exchange does not have existing switching capability to accommodate further new subscriber connections.

3.153 Table 3.35 below gives relevant statistics on deferred applications in the four NSW districts analysed in detailed.

Table 3.35:

AREA	DEFERRED APPLICATIONS		
	NUMBER	NUMBER	TOTAL
	ATTRIBUTABLE TO INTERNAL PLANT	ATTRIBUTABLE TO EXTERNAL PLANT	
Dubbo	128	63	191
Kempsey	50	325	375
Chatswood	--	1	--
Bankstown	--	--	--

Source: Analysis of Telecom data

3.154 In summary, the study found that:

- 96 percent of all deferred applications related to demand for service in non metropolitan areas:
- well over 90 percent of all applications for new services in metropolitan areas can be processed to completion within three months;
- a significant proportion of the deferred applications in non metropolitan areas may involve delays of anything from 18 months to several years before completion of subscriber connections;
- deferred applications in metropolitan and adjacent areas occur mainly in outlying suburban locations characterised by a high rate of new housing development -- e.g. 99.96 percent of deferred applications in the Sydney metropolitan area as at 30 June 1981 related to applications for subscriber connections in the Parramatta region.

Table 3.36 below gives statistics for total deferred application in the Sydney metropolitan area and for all NSW non metropolitan districts.

Table 3.36: Deferred applications for NSW as a whole:
metropolitan and non metropolitan areas as at 30.6.81

AREA	NUMBER OF DEFERRED APPLICATIONS		TOTAL
	ATTRIBUTABLE TO INTERNAL PLANT	ATTRIBUTABLE TO EXTERNAL PLANT	
NSW Metro	--	261	261
NSW Country	1 071	4 879	5 950

Source: Analysis of Telecom data

Service accessibility

- 3.155 One of the main differentials in the standard of service available to metropolitan and non metropolitan subscribers is their relative accessibility to other subscribers at local call rates.
- 3.156 There is a strong correlation between service utilisation (per average call) costs and the number of other subscribers accessible at local call rates. This correlation in turn depends on subscriber density within individual districts and charging zones. The lower the subscriber density per district, the higher the average call cost will be.
- 3.157 Metropolitan subscribers have access to a significant proportion of all network subscribers at a 'standard' local call charge (ie 12 cents for each call made to another subscriber within the same local charging area, irrespective of the call duration). Non metropolitan subscribers have far more limited access at the standard local call rate. The extent of accessibility to other subscribers decreases significantly for subscribers in rural country areas as subscriber density per district decreases.
- 3.158 Initiatives taken by Telecom to reduce this average call cost imbalance between metropolitan and non metropolitan subscribers are detailed in Volume 2, Section 4 discussion of the 'Community Access 80' scheme. The major initiatives under that scheme have been:
- . the introduction of a (timed) unit call fee to allow 'community access' for non metropolitan subscribers to the nearest designated service town;
 - . plans to introduce new (charging) zone arrangements to allow rural country subscribers to call more subscribers at lower rates.
- 3.159 Study findings on comparative subscriber accessibility for metropolitan and non metropolitan subscribers may be summarised as follows:

- . Sydney metropolitan subscribers have access to over one million other subscribers at the standard local call rate (12 cents per untimed local call);
- . Brisbane metropolitan subscribers have access to over 350 000 other subscribers at the standard local call rate;
- . no more than 60 percent of all non metropolitan subscribers have access to more than 10 000 other subscribers at that same standard local call rate;
- . non metropolitan subscribers with access to 10 000 or more other subscribers at that rate are located in the larger urban country population centres;
- . in Kempsey and Rockhampton districts, about 60 percent of all district subscribers have access to about 20 000 other subscribers at the standard local call rate;
- . in the Dubbo district, about 55 percent of all subscribers have access to between 5 000 and 10 000 other subscribers, whilst only 3.7 percent of all Dubbo district subscribers have access to more than 1 000 other subscribers;
- . in the more sparsely populated non metropolitan districts, about ten percent of all district subscribers have access to less than 1 000 other subscribers.

3.160 Tables 3.37--3.38 below show the comparative levels of subscriber accessibility in the metropolitan and non metropolitan districts selected for detailed study.

Table 3.37: Accessibility for metropolitan subscribers in selected districts

DISTRICT	NUMBER OF OTHER SUBSCRIBERS ACCESSIBLE AT STANDARD LOCAL CALL RATE
Chatswood	1.14 million
Bankstown	1.14 million
Metro--South	0.361 million

Source: Analysis of Telecom data

Table 3.38: Accessibility for non metropolitan subscribers
subscribers at CA 80 and local call rates

DISTRICT	SERVICE TOWN	NO. OF SUBS IN SERVICE ZONE	NO. OF SUBS GIVEN ACCESS AT C.A. RATES	AVERAGE LCA SUBSCRIBERS
Dubbo	Bourke	767	291	61
	Brewarrina	358	134	152
	Cobar	923	91	47
	Coonabarabran	1 102	1	313
	Coonamble	658	103	266
	Nyngan	719	79	120
Kempsey	Kempsey	3 480	33	192
Rockhampton	Rockhampton	18 830	370	156
	Mt. Morgan	841	9	293
	Gladstone	6 689	201	633
	Biloela	1 819	181	375
	Blackwater	1 341	42	103
	Claremont	670	30	19
	Emerald	1 395	444	315

Note: As an explanation of the above table -- in Cobar, the number of subscribers within the Cobar charging zone is 923. There are some 91 Cobar subscribers who have access to Dubbo at CA80 rates. Those 91 subscribers have, on average, access to 47 other subscribers at local call rates.

Source: Analysis of Telecom data

- 3.161 Attention is drawn to the number of non metropolitan subscribers within particular districts and charging zones who are not able to access subscribers in the nearest designated servicetown at the standard local call rates. These subscribers have to pay a higher average call rate (set on a timed unit fee basis as described in Volume 2 Section 4) for each call to their nearest designated service town.
- 3.162 This differential is clearly apparent from the Kempsey data. In that district, subscribers located in two of the total 21 charging zones within that district have to pay the higher timed unit fee CA 80 rate. All others (ie in the remaining 19 charging zones) are adjacent to major towns, (eg Gloucester, Taree, Kempsey, Mackville) and can call those towns at local call rates.

- 3.163 Data for the Rockhampton district reflects a different pattern again. Community access to Rockhampton has increased to the access level of 370 subscribers from 156 at local call access to over 18 000 subscribers at community access.

Standard of services

- 3.164 The major difference in the standard of service available to metropolitan and non metropolitan subscribers relates to whether the subscriber is connected to an automatic or a manual exchange. All metropolitan subscribers are connected to automatic exchanges. Over 61 000 non metropolitan subscribers are connected to manual exchanges. They are disadvantaged by:

- . absence of STD calling facilities;
- . delays in call connections;
- . inability to make any calls outside the operating hours for non continuous manual exchanges;
- . lack of privacy in party line services;
- . poor reliability -- particularly for subscribers connected to local exchanges via PPE lines.

Reliability

- 3.165 The best measure of service reliability is the incidence of fault occurrences. Available data was not sufficiently comprehensive to compare the reliability of metropolitan and non metropolitan services within an overall perspective.
- 3.166 The study approach was to draw on detailed statistics available for selected metropolitan and non metropolitan districts to enable assessment of:
- . the incidence of faults per service per year;
 - . comparison of fault incidence for different categories of service -- in particular:
 - manual connections
 - automatic connection;
 - PPE line connections;
 - party line connections.
 - . fault location -- ie whether the fault was found to be in:
 - external plant (subscriber lines to the local exchange)'
 - internal plant (exchange switching equipment);
 - terminal equipment (telephone handset and wiring) on subscriber premises.

Faults per service per year

- 3.167 Table 3.39 below summarises the incidence of faults per service year by service category for selected NSW country districts:

Table 3.39:

FAULT CATEGORY	DISTRICT			
	NON METROPOLITAN		METROPOLITAN	
	DUBBO	KEMPSEY	CHATSWOOD	BANKSTOWN
Total	0.64	0.84	0.41	0.66
Auto Services	0.53	0.81	0.41	0.66
Manual	0.96	1.60	--	--
PPE Lines	1.20	0.90	--	--
PPE Services	2.16	2.50	--	--

Source: Analysis of Telecom data

- 3.168 The conclusions drawn from the above tabulation are:
- On average metropolitan services have a lower fault occurrence (0.55) than country services (0.73). Approximately the same ratio was obtained from the Queensland sample.
 - Manual services have approximately twice the fault occurrence rate of automatic services. This gives some indication of the rural--urban fault ratio.
 - PPE services have approximately 3--4 times the fault occurrence rate of automatic services in country areas.

Fault location

- 3.169 Analysis of data available on all NSW districts indicated a breakdown of external and internal plant fault location incidence to be as tabulated below:

Table 3.40: Fault location: external versus internal plant

TYPE OF FAULT	METROPOLITAN	COUNTRY
Exchange Equipment	56%	11%
Lines/Cable	44%	89%

Source: Analysis of Telecom data

3.170 Analysis indicates that for non metropolitan services the incidence of external plant located faults is significantly higher than for internal plant. Reasons for the disproportionate incidence between the two may be attributed to:

- . lower utilisation, hence less wear and tear on exchange switching equipment;
- . relatively longer distances between subscribers and exchanges in non metropolitan -- particularly rural country areas.

The proportion of external plant located faults increases proportionately with the existence of PPE lines in rural country areas.

3.171 Both the Dubbo and Kempsey districts showed a very low incidence of exchange located faults (four to five percent of all faults) compared with 20 to 30 percent for metropolitan services.

3.172 Faults in terminal equipment and wiring in subscriber premises show no significant variation between metropolitan and non metropolitan services. Table 3.41 below refers.

Table 3.41:

TYPE OF FAULT	DUBBO %	KEMPSEY %	CHATSWOOD %	BANKSTOWN %	COUNTRY %	METROP %
Subscriber equipment	68	45.6	58.5	42.2	57	47
Internal	4.1	49	21.6	33	4.5	29
External	26.9	49.5	29.9	24.8	38	23

Note: Subscriber equipment comprises telephone handset and wiring on subscriber premises.

Source: Analysis of Telecom data

Fault correction times

- 3.173 From a subscriber viewpoint, the time taken to remedy faults and re-establish service is an important measure of service standard and reliability. Data provided by Telecom on fault correction times indicated that there is no significant difference between metropolitan and non metropolitan fault correction times (Figure 3.1 page 261 refers).
- 3.174 Telecom considers that fault correction response times are generally satisfactory. Fault correction statistics for non metropolitan areas generally follow the pattern tabulated below:

Table 3.42: Fault correction times in non metropolitan areas

CORRECTION TIME	% CORRECTED
within 1 day	15--20
within 1 days	30--35
within 3 days	40--50
over 3 days	3--14

Source: Telecom

Cost of service provision: capital investment

- 3.175 In providing estimates on capital investment per net subscriber connection, Telecom pointed out the difficulties associated with attempts to extrapolate data to allocate precise per service connection costs from investment in the overall capital works program. Telecom noted particularly that attempts to deduce cost per individual connection were complicated by the incremental upgrading and expansion of the network.
- 3.176 Telecom estimates based on 1980--81 investment and costs are tabulated below.

Table 3.43:

CAPITAL INVESTMENT CATEGORY	METROPOLITAN	NON METROPOLITAN
Basic telephone facility	936	1 880
Share of local inter exchange network investment	853	787
Share of trunk network investments	426	426
Total incremental costs	2 215	3 095

Note: The 'basic telephone facility' is Telecom terminology used to cover:

- . -- telephone handsets;
- . -- wiring in subscriber premises;
- . -- external plant (line) from subscriber premises to local exchange;
- . of the above components, the subscriber equipment (telephone handset and wiring) is a relatively constant cost, irrespective of whether the 'basic telephone facility' is for a metropolitan or a non metropolitan service;
- . the main component which varies in cost from one area to another is the line between the subscriber's premises and the local exchange;
- . further extrapolation of data provided by Telecom on cost components comprising the 'total incremental cost' produced the following estimates for the per subscriber cost of providing a new 'basic telephone facility';
 - cost per metropolitan subscriber -- \$533;
 - cost per non metropolitan subscriber -- \$1 380.

Source: Telecom

- 3.177 The cost differential between the two categories is attributable to the relatively lower service densities and longer distances for country services. In capital cities and metropolitan areas a distribution cable can be shared by a large number of subscribers so that larger cables can be used for distribution, costs of which can be shared by many subscribers. Country distribution however involve longer runs with relatively less number of subscribers to which costs can be apportioned. Similar reasons apply to differentials which have already been shown to exist between urban and country urban services.

- 3.178 Table 3.44 below summarises the estimated investment cost per subscriber connection by distance from the local exchange:

Table 3.44:

AREA	DISTANCE FROM LOCAL EXCHANGE	ESTIMATED AVERAGE COST PER CONNECTION \$
Metropolitan		533
Non metropolitan	0--4 km	1 200
	4--8 km	2 425
	8--16 km	7 000
	over 16 km	13 000

Source: Analysis of Telecom data

Notes:

The non metropolitan estimates are based on analysis of data to produce average costs over the NSW country districts studied;

The metropolitan average is based on Telecom provided estimates.

Operational and maintenance costs

- 3.179 A consistent finding from analysis of data available on operational and maintenance costs per service in metropolitan and non metropolitan areas was that these have a close correlation to subscriber density (para 3.85--3.86 refer). Broad comparisons of relative metropolitan and non metropolitan costs for NSW indicated that operational and maintenance costs per subscriber service in non metropolitan areas were about double that for metropolitan areas. Average maintenance costs were \$71 per subscriber service in metropolitan areas and \$143 per subscriber service in non metropolitan areas.
- 3.180 Analysis of data indicates that operational and maintenance costs per subscriber service rise steeply as subscriber density within a district drops. This trend may be attributed to:
- fragmented nature of the switching network associated with non metropolitan services;
 - longer distance, longer external plant connecting subscribers to the nearest local exchange and higher incidence in the use of open wires in non metropolitan areas.
- 3.181 Detailed analysis of data for the four NSW districts studied produced the following average estimates of maintenance costs per subscriber for each of the districts studied:

Table 3.45: Maintenance per subscribers

MAINTENANCE	NON METROPOLITAN		METROPOLITAN	
	DUBBO \$	KEMPSEY \$	CHATSWOOD \$	BANKSTOWN \$
Maintenance costs per subscriber	276	206	58	72

Source: Analysis of Telecom data

- 3.182 Of the four NSW districts studied in detail, Dubbo had the lowest subscriber density (0.1 per square kilometre) and the highest per subscriber maintenance per year of \$276. Chatswood, with a subscriber density of 337 per square kilometre, had the lowest per subscriber maintenance cost per year at \$76.
- 3.183 Notwithstanding the correlation between maintenance costs and subscriber density, variations in per subscriber cost patterns in different districts emerge from analysis of data available for all NSW districts. This is attributable to the different patterns of population concentration in particular districts. For example, some districts have a more even population and consequently subscriber distribution throughout the district overall. Others have large concentrations of population in particular areas, with little dispersion of population elsewhere throughout the district. Wollongong, Maitland and Lismore have a far more even distribution of subscribers than is the case for Dubbo, Narranderra and Goulburn. The latter are characterised by the existence of heavily populated urban country areas with extremely scattered, sparse distribution of subscribers elsewhere throughout rural country areas within those districts.

Subscriber density, maintenance costs per subscriber and staffing levels

- 3.184 Variations across all NSW districts have been plotted against the number of staff per 1000 subscribers in each district. The results are set out in Table 3.46. Figures 3.3, 3.6 and 3.7, pages 262, 265 and 266 also refer.

Table 3.46:

DISTRICT	DENSITY SERR/KM(2)	MAINT. COST PER SERVICE \$	OPERATIVE STAFF/1000 SERR
Armidale	0.4	231	13.15
Bankstown	235.0	72	6.4
Bathurst	0.9	199	11.36
Burwood	941.0	65	5.05
Canberra	13.0	88	7.25
Central Coast	28.0	86	8.62
Chatswood	337.0	58	5.1
Dubbo	0.1	276	13.89
Epping	220.0	66	4.76
Goulburn	0.5	222	12.65
Grafton	1.8	185	13.15
Kempsey	1.7	206	13.15
Lismore	4.7	165	12.34
Maitland	1.2	131	11.62
Narandera	0.2	210	13.15
Newcastle	73.0	82	8.4
Newtown	600.0	68	--
Parramatta	180.0	75	6.83
Penrith	7.9	158	12.04
Redfern	694.0	93	7.94
St. Leonards	1012.0	81	6.53
Sutherland	166.0	61	5.15
Tamworth	0.4	230	12.98
Wagga	1.1	180	10.86
Wollongong	6.0	96	8.84

Source: Telecom data

- 3.185 Maintenance expenditure reflects a very high manpower component. A sample check of Dubbo and Chatswood districts indicates the labour component to be as follows:
- . subscriber equipment (terminal equipment and wiring) 70%
 - . internal plant (exchange) 90--95%
 - . external plant 85--90%
- 3.186 As depicted in Table 3.46 above, there is a distinct correlation between staffing levels per 1 000 subscribers, subscriber density and per subscriber annual maintenance costs. Productivity decreases as subscriber density drops. Studies undertaken by Telecom based on June 1980 staffing levels for most districts throughout Australia confirm this correlation (Figures 3.5 and 3.6 refer).

3.187 In summary, the study showed that maintenance costs, like costs of service provision, increase rapidly with lower service densities. Overall factors contributing to higher external plant maintenance costs of non metropolitan services are:

- . fragmented nature of the switching network associated with country services resulting with a large number of small exchanges in country areas;
- . in metropolitan areas optimum network design results in fewer, larger exchanges which lead to better productivity because fewer technicians are required for a given number of services;

Maintenance productivity: external and internal plant

3.188 This relationship between service density and maintenance cost further becomes evident from the 1980--81 Maintenance manhours and cost. (Reference -- Service Performance and Service Costs 1980--81). Telecom separates costs and productivity indicators between external and internal plant maintenance, with internal plant deemed to cover such items as customer equipment, exchange equipment and PABX's etc. whilst external plant covers such items as cables (distribution, junction and trunk) open wire pole routes and ducts etc. A summary of the related performance statistics are shown in Table 3.47.

Table 3.47

	NATIONAL	NATIONAL	WEST AUST.	SOUTH AUST.
CATEGORY	Metro	Country	Country	Country
EXTERNAL (x)	1.28	2.92	4.0	4.0
INTERNAL	2.18	2.87	4.4	4.9

Note: (x) -- manhours per service per year

Source: Analysis of Telecom data.

From the above the following can be deduced:

- . on a national basis maintenance costs for both external and internal plant are greater in country areas than metropolitan areas;

- country external maintenance costs are more than twice that for metropolitan services. Metropolitan costs are on average about 42 percent of country costs;
- external plant maintenance costs increase rapidly with those States which have a lower service density. The costs in both South Australia and Western Australia are nearly 4 times the National metropolitan average;
- similar trends are noted for internal costs.

Maintenance productivity: subscriber equipment

3.189 Fault occurrence in and maintenance requirements for subscriber equipment should not vary much for metropolitan and non metropolitan subscribers, assuming that similar equipment is provided for both. Analysis of available national statistics confirms that view. For subscriber equipment maintenance (XIM), the comparison is as follows:

- metropolitan services: 0.76 manhours per telephone station per year;
- non metropolitan services: 0.77 manhours per telephone station per year.

3.190 The minor differential between the two does not so much reflect variations in fault occurrence in subscriber equipment as the distances that service technicians must travel to remedy the fault. This differential is more apparent in the less populated states. Western Australia, for example, has an average maintenance productivity level per subscriber XIM equipment of 1.2 manhours per telephone station per year.

3.191 It is assumed that maintenance productivity would show further variations per telephone station between urban country and urban rural areas. No detailed statistics were available to enable verification of this assumption. The following points are, however, noteworthy:

- most non metropolitan subscribers are concentrated in or around large urban country towns and cities;
- it can be expected that maintenance and associated costs per subscriber in urban country areas would be generally comparable with those for metropolitan subscribers;
- the major element contributing to higher per telephone station maintenance costs in non metropolitan areas would be higher costs associated with rural country areas.

Call revenues and service profitability

3.192 The study identified a number of factors which impact on service profitability. The most significant single factor is whether a service is connected to a manual or an automatic exchange. Per subscriber revenue generated by services connected to manual exchanges is lower than that generated by services connected to automatic exchanges. The study found that, in many instances, per subscriber revenue generated

by manually connected services does not cover the costs of operating and maintaining those services. This applies especially to services in rural country areas connected to part time manual exchanges.

- 3.193 Table 3.48 below charts the relative per service profitability for subscribers connected to manual exchanges in selected NSW districts:

Table 3.48: Manual service profitability

PROFIT			CONTRIBUTION		
DISTRICT	%	CONTRIBUTION	DISTRICT	%	CONTRIBUTION
	MANUAL	PER SERVICE		MANUAL	PER SERVICE
		\$			\$
Dubbo	18.4	- 294	Maitland	1.6	- 84
Tamworth	13.0	- 78	Grafton	0.3	+ 108
Armidale	11.8	- 262	Penrith	0.1	- 109
Bathurst	9.9	- 145	Wollongong	0	- 33
Wagga	6.2	- 20	Central Coast	0	- 23
Nerranderra	4.4	- 84	Lismore	0	+ 52
Goulburn	4.4	+ 80	Newcastle	0	+ 100
Kempsey	4.2	- 97	Canberra	0	+ 344

Source: Analysis of Telecom data

- 3.194 The study found that services connected to automatic exchanges (hence with access to STD calling facilities) are used more than those connected to manual exchanges. This applies to services operating in comparable environments. In some instances, utilisation of manual services was less than half that of automatic services. Notwithstanding, detailed analysis of call revenues generated per service in the six districts selected for detailed study showed that, overall, revenue per service in non metropolitan areas is higher than that in metropolitan areas.
- 3.195 This apparent inconsistency may be due to the fact that non metropolitan subscribers are able to access far fewer subscribers at the standard local call rate than can their metropolitan counterparts. Consequently, notwithstanding 'CA 80' arrangements, non metropolitan subscribers make far more trunk calls than do metropolitan subscribers. The higher average call revenues per service in non metropolitan areas appear to derive from urban country, rather than rural country areas. This is probably related to the level of business activity in urban country areas, and the significantly higher call revenues generated by urban country business compared with urban country non business subscribers.

Table 3.49: Metropolitan and non metropolitan per service
call revenues for the years 1979--80 and 1980--81

YEAR	AVERAGE CALL REVENUE PER SERVICE (\$)					
	METROPOLITAN			NON METROPOLITAN		
	CHATSWOOD	BANKSTOWN	METRO SOUTH	KEMPSEY	DUBBO	ROCKHAMPTON
1979--80	225	228	250	236	325	360
1980--81	248	258	316	265	293	490

Source: Analysis of Telecom data

- 3.196 Study analysis of comparative per service call revenues in metropolitan and non metropolitan areas first drew on national data on average call revenues for metropolitan and non metropolitan services overall. On a national basis, average call revenue per service was \$269 per annum for metropolitan subscribers and \$333 per annum for non metropolitan subscribers.
- 3.197 Comparative data for the individual states confirmed study findings on the correlation between average call revenues per service and subscriber density. In a more densely populated state -- Victoria -- the ratio between average call revenues per non metropolitan and metropolitan subscribers was 1:1.06. In a more sparsely populated state -- Western Australia -- the comparable ratio was 1:1.726.
- 3.198 The differential in comparative ratios appears to be due to:
- level of accessibility of metropolitan to other metropolitan subscribers at local call rates;
 - sparsely populated states covering large geographic areas are subject to higher distance dependent charging rates for trunk calls.

Figure 3.4 page 263 shows the differential in per subscriber average annual call revenue between rural country and urban country areas for the Rockhampton, Dubbo and Kempsey districts.

The latter assumption is confirmed by a comparison of the average chargeable value per call in different area categories:

Table 3.50:

AVERAGE CHARGEABLE VALUE PER CALL		
AREA CATEGORY	METROPOLITAN	NON METROPOLITAN
	\$	\$
National	0.213	0.286
South Australia	0.222	0.651
Western Australia	0.234	0.511

Source: Analysis of Telecom data

Figure 3.1: Analyses of fault clearance and correction times.

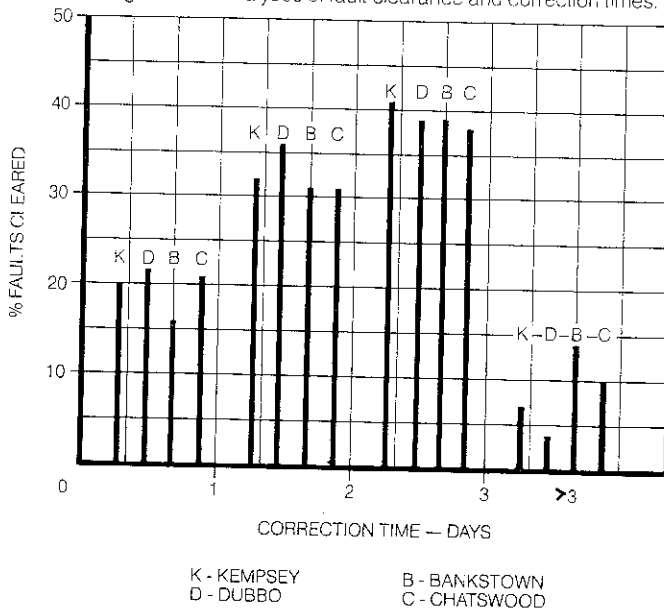


Figure 3.2 withdrawn

Figure 3.3: Staff requirements related to service density.

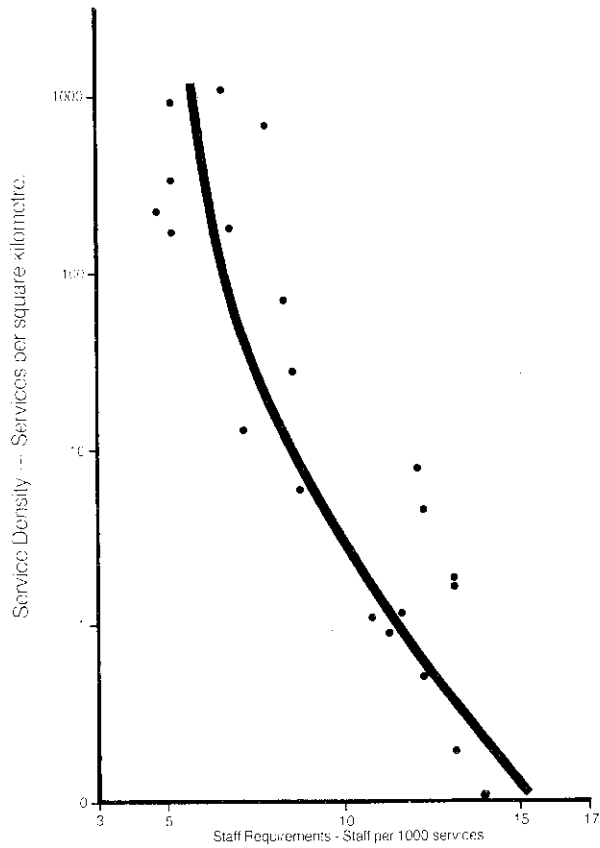


Figure 3.4: Call revenue per service related to local exchange size

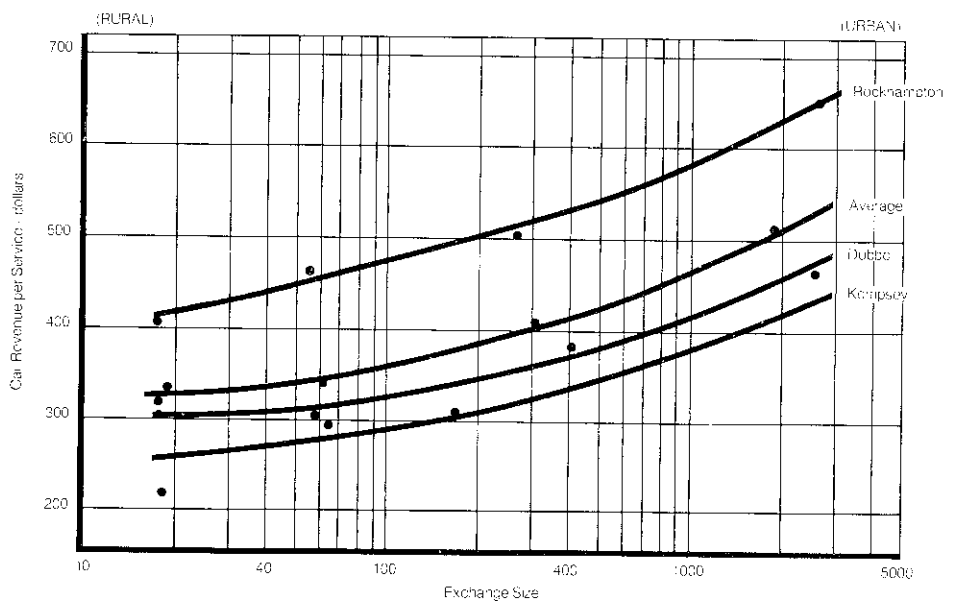


Figure 3.5: Relationship of customers per square kilometre per staff.

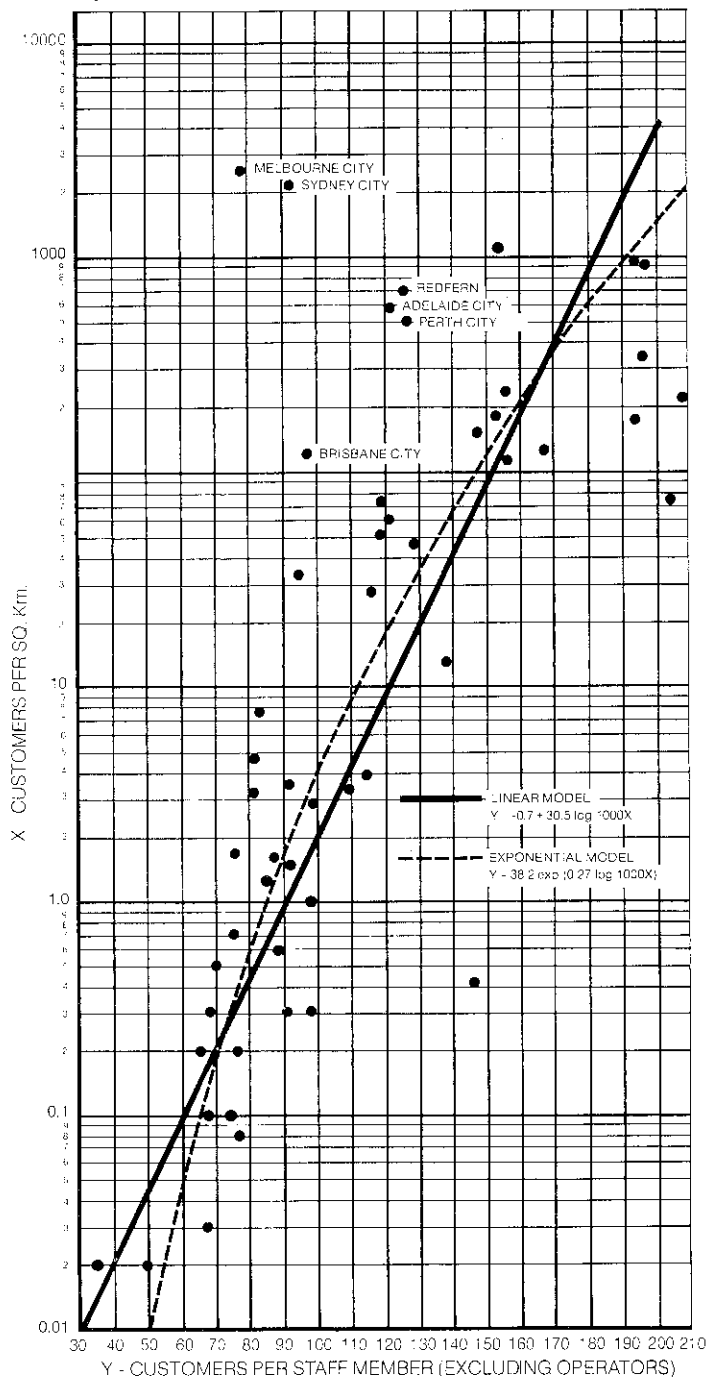
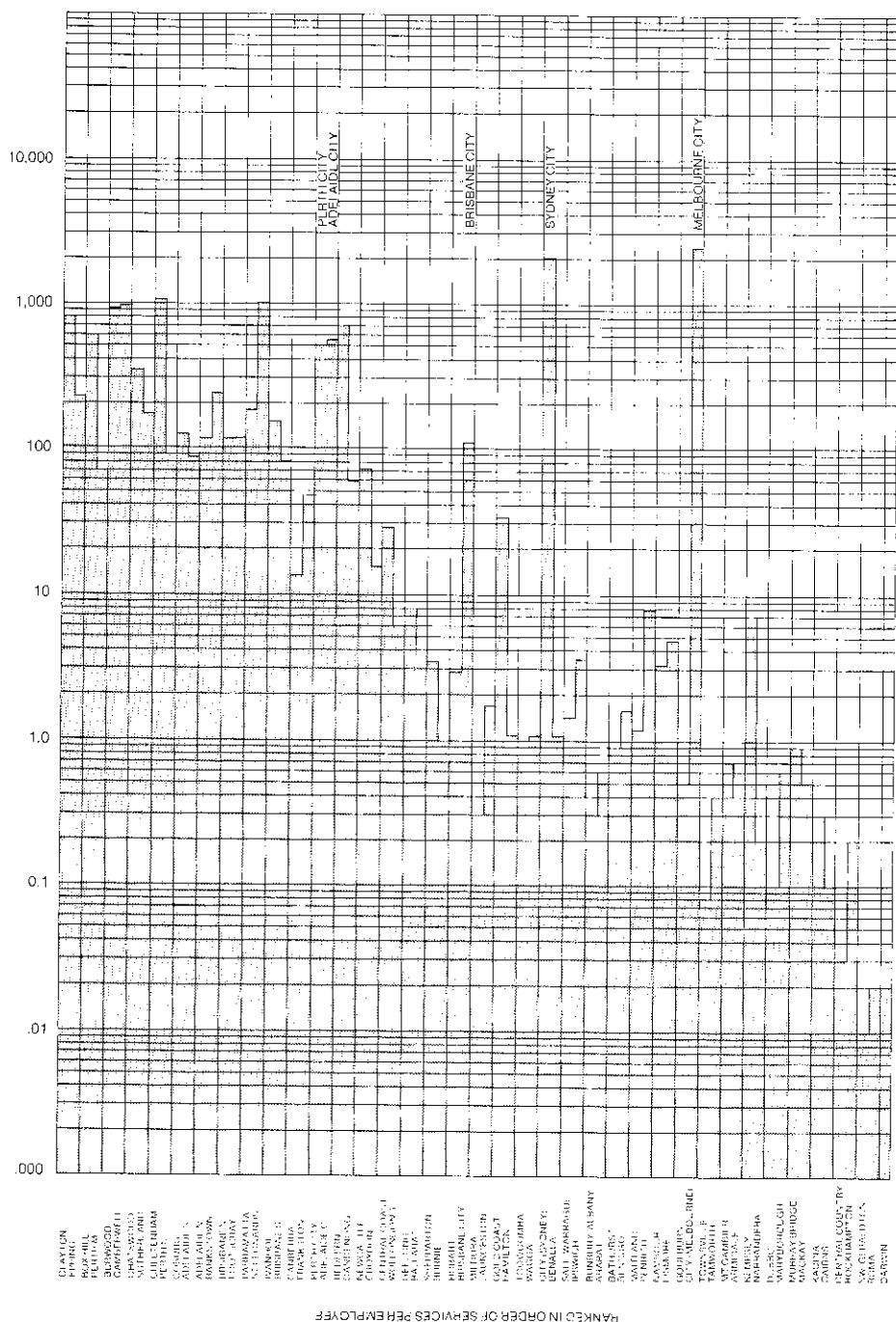


Figure 3.6: Customer services per square kilometre related to services per



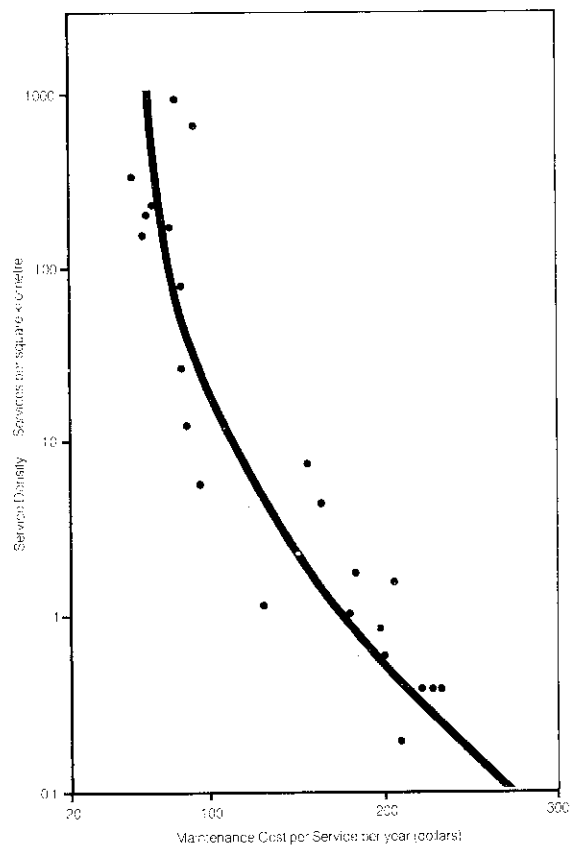


Figure 3.8: Basic Telephone Facility Cost with Subscriber Density

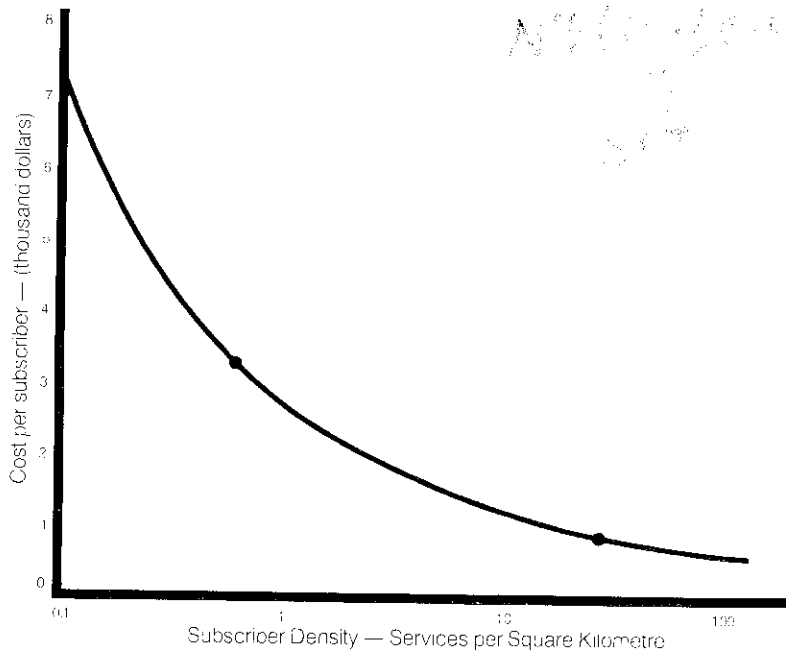


Figure 3.9: Basic Telephone Facility Cost with Service Density

