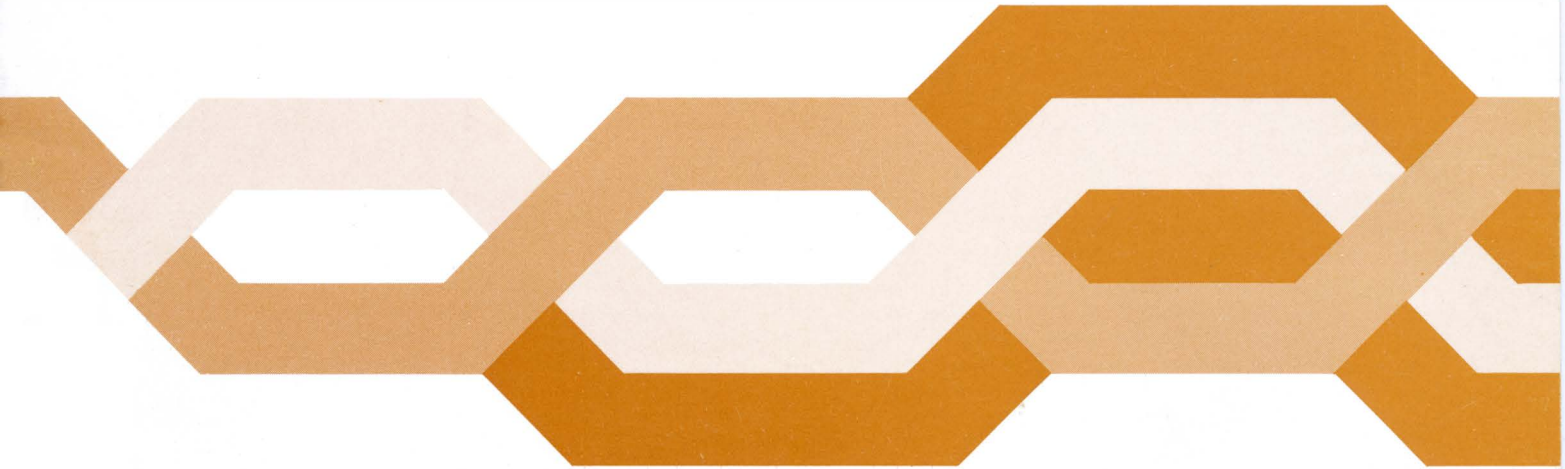
Maintenance News

12
Autumn
1977



Editor : Derek Knight (Sv5.4.2)

Production & Sub-editor : Naqi Ali (TMk3.2.1)

Published by THQ/Sv5.4.2. Room 4089,
Tenter House, Moorfields,
LONDON EC2Y 9TH
01-432 9041

Produced by THQ Internal Communication Unit (TMk3.2.1)
Room 415, Cheapside House, Cheapside,
LONDON EC2V 6JH

Maintenance News aims to provide a medium for two-way communication – that is, between Headquarters and the field. If you want to write about anything you may have seen in *Maintenance News,* or indeed, about any maintenance topic, send your letter to : The Editor, Maintenance News, Room 4089, Tenter House, Moorfields, London EC2Y 9TH. Say what you like but the editor may tone comments down if he decides to publish. Do please give your full address.

Contents

JULIE-a dial before you dig service

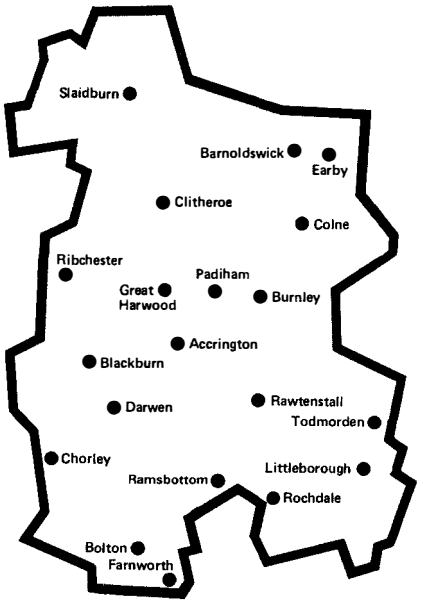
by **Frederick Smith,** NWTB

JULIE – Joint Utilities Location Information for Excavators – is a co-operative venture between the North West Telecommunications Board and the local Gas and Water authorities covering the area shown on the map. It enables anyone, who needs to excavate, to obtain information about the location of buried gas, water and telephone plant merely by making a Freefone call.

Disruption caused by excavation work led to 124 exchange isolations in 1976. The isolations resulted from 174 cases of major damage to the national main underground and junction cable network. In the local network during the same period the NWTB alone suffered damage amounting to about £250,000 due to some 840 excavation incidents. Other authorities are constantly affected. In any one year millions of gallons of water and thousands of cubic feet of gas are lost.

To reduce damage to its buried plant the PO has operated a Freefone one-double-one service in all telephone areas for several years. Other utilities usually provide a similar service. However, contractors who need to make excavations and wish to check the location of underground services normally have to contact each of the authorities separately. This can take several telephone calls and, evidence suggests that, faced with this effort, they tend not to bother – which means a high risk of damage.

JULIE'S AREA



How the service works

The scheme has two functions. The main one is to provide a 24 hour service whereby contractors can obtain details of buried plant belonging to the public utilities concerned. As soon as possible before starting work the contractor dials 100 and asks the operator for Freefone one-double-one. The call is extended to the JULIE centre where the particulars of the enquiry are recorded on a special docket. A facsimile of this docket is then transmitted to each of the authorities concerned. If the authority has no plant in the vicinity in question a return telephone call to the contractor informs him accordingly. If, on the other hand, records show that plant is likely to be affected, the authority warns the contractor by telephone and sends staff to mark the site, if this is possible.

The secondary function is to provide an effective means of communication between the public utilities themselves. When work on its own underground plant is impending an authority uses facsimile equipment to transmit the necessary details to the centre. From there the information is broadcast to the authorities' partners by the same means so giving the opportunity to check plant locations or perhaps schedule work accordingly. For the PO this information forms a basis for the work programme of its plant protection officers.

The scheme started in September 1976 for a 12 months trial. During the trial the JULIE centre is staffed by PO personnel. Blackburn external plant maintenance centre is the daytime control and a radio station in Manchester North Area takes over outside normal hours.

Spreading the word

Karen Palmer – the girl recruited to spearhead

the publicity for JULIE – brought some obvious assets into effect. Clad in safety helmet and bikini she looked good on television and appeared frequently in trade journals and newspapers. Posters, leaflets, stickers and key-fobs brought Karen – and JULIE – further attention. These were distributed to local firms and authorities using a specially designed letter heading. Karen also visited sites and chatted to firms' employees.

Optimism

Each authority in the scheme closely monitors and evaluates the results. Meetings, held periodically, are also attended by the North West Electricity Board who, although not directly participating in the scheme, have expressed an interest.

The results so far have been very satisfactory, particularly from the PO point of view. A major factor in this success has been the enthusiastic support given by the management and staff of Blackburn and Manchester North Areas.

NWTB/S21 (061-863 7458)

Chambers of horror

by **Alan Wilson,** Sv5.1.1

Staff in six telephone areas have been engaged recently on looking into joint boxes and manholes in the underground cabling network, and in many cases they were most unhappy with what they saw.

A THQ and Staff Side Committee, suspecting that all was not well, requested the survey because some facts were needed before the problem could be tackled in an economic and systematic way. Each area chose a week in which to carry out the inspection, and during this period some 2522 joint boxes and manholes were examined.

The reports were forwarded to THQ for analysis, which brought to light many disturbing facts – congestion of the structure, accumulation of rubbish and, in many cases, cables not given adequate support – these points were just part of the overall picture.

National approaches to these difficulties are at present being discussed at THQ. The aim is to see all cables neatly supported, so giving adequate and more pleasant working conditions. However, at the end of the day, it is the people who work in the jointing chambers who will have the greatest influence on this environment – both for themselves and those who follow.

Sv5.1.1 (01-432 1375)

Secrets of line 6

An analysis of cleared customer apparatus faults.

by **Dave Manning,** Sv5.2.3

It won't come as a surprise to faultsmen to learn that 67 per cent of customer apparatus faults, business and residential combined, are on 700-type telephones – these are installed in very large numbers. Faultsmen also know very well what are the most usual causes of trouble. But design improvements have to 'cost in', and therefore THQ need accurate information about fault rates. So, in August 1976, Roy Burrows, a PO degree student on vacational training from Bath University, collected and worked on some detailed information. Customer apparatus fault clears from 28 repair service controls (RSCs) in 22 areas were analysed – the RSCs being selected as typical of the country overall. In effect the analysis covered the experience of about 150 faultsmen who cleared 5856 faults in the week 20-26 August.

Line 6 of the A51 form

In normal day-to-day repair service work, details of report clears from faultsmen are permanently recorded only on customers' fault record cards. These cards give fault histories for all customers' installations, and can occasionally help speed up fault clearance or aid the tracking down of elusive and recurring troubles.

Each clear is also recorded on a temporary docket or report register, and 'analysed' by marking the docket or register with the appropriate line number of form A51. Thus, if a report is cleared by locating and repairing a fault on the customer's apparatus, the docket or register is marked '*line 6*'. Every week the RSC makes a return to the area office giving the week's totals of clears in all such line categories ; and every month the area totals them onto the A51 forms. The area also works out various performance indexes, such as subscribers' apparatus reports per station per annum from '*line 6*'. These indexes enable local managers to monitor the performance of the units which they supervise and similarly, A51 returns to the region and THQ permit measurement over whole areas and regions.

Special forms

The basic information for Roy Burrows' study could have been obtained from customers' fault record cards but he did not have the time for wading through these. Instead, the RSCs agreed to fill in special forms. The repair control officers (RCOs) made an entry on them for each '*line 6*' clear which came in. Part of one of the forms is shown here. We are grateful to the RCOs and their faultsmen for the extra work they did. Inevitably a few oddities came up which are ignored in our final results but generally the scheme worked well. The pillargraphs show what came out of it.

700-type telephones

The results for 700-type telephones exclude faults on keyphones, trimphones, telephones on house exchange systems and loudspeaking telephones. To get the 67 per cent figure mentioned at the beginning we need to combine the totals of 'tele 700 series' faults on both the business and residential pillargraphs, taking into account that 64 per cent of all customer apparatus faults are on business stations and 36 per cent are on residential – the widths of the two pillargraphs are roughly proportional.

Measured in numbers of telephone stations the system we have to maintain is expected to grow by 80 per cent between 1976 and 1986. Last year 44 per cent was business and service and 56 per cent was residential. It is clear that if the system is to be maintained efficiently increased reliability is needed, particularly in telephone instruments. A new basic range of telephones is due to be brought into use by the mid-1980s. But meanwhile, a value analysis (VA) exercise is under way which will determine what can be done to improve existing telephones as well as what needs to be incorporated in any new design.

Some countries already have telephones which appear to be more reliable than ours but they are considerably more expensive, part of the extra cost being attributed to more rigorous testing during manufacture.

Subs No. for local use only if reqd.	Type of line — Tick (✓)						Description of faulty apparatus — Indicate type		Tick (✓)										Indicate type	Part or component	Clear action — Tick (✓)						Other (please indicate)
	Bus	Res	Exclusive S/S	PABX Extn	PMBX Extn	PMBX SWBD	Plan No.	HES	PRE 700	700 Series	Trimphone	Keyphone*	LST	RCB	Extn bell	Earth S/S line	Intl wiring	K & LU	Other apparatus		Change	Adjust	Clean	Re-wire	Re-term	Re-fix	
Example 1		✓	✓				1A			✓										Tele	✓						
Example 2	✓				✓	5+25														Key contacts		✓					
Example 3	✓			✓							✓								Block terminal	Transmitter	✓			✓			
Example 4		✓	✓				107			✓										Plan set N625							Re-soldered
																				Internal wiring							

Premium telephones

Technical improvement is not the only reason for introducing new telephones. A premium instrument commands a higher rental than the basic rate largely because of attractive styling. The Trimphone is a prime example. The Jubilee Compact telephone is another premium instrument, so-named on account of its introduction this year. This should be less prone to gravity switch faults but basically it is a re-packaging of 700-type components – marketability rather than improved reliability is the main reason for its introduction.

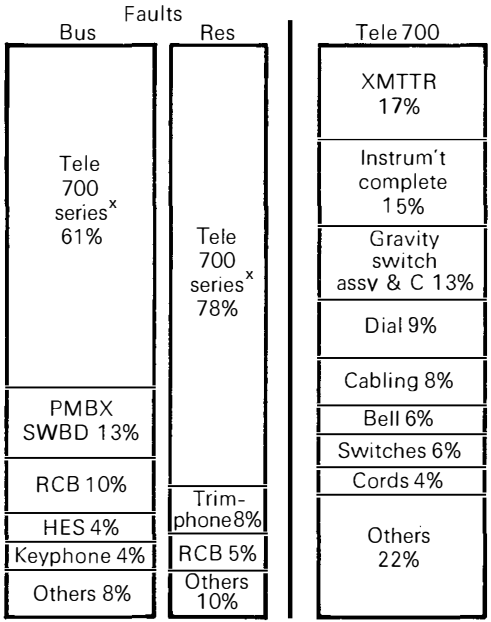
Components

The TELE 700 pillargraph shows that transmitters, gravity switches and dials come high on the list of faults.

Our carbon granule microphone, though much developed over the years, is the same in principle as that used by Graham Bell. It is still cheap, but clearly, we want greater reliability. TDD are already studying possible replacements. If any new transmitter is dearer to manufacture the increase will have to be offset by maintenance savings. It will need to be developed as a 'drop in' replacement for existing transmitters.

There is certainly scope for improving gravity switch design. The VA team will be considering improved operating mechanisms, taking into account case and handset design. They will also consider whether the microswitch is really better than an open springset.

The dial is another pioneer development still the cheapest device for its purpose. But, overwhelmingly, customers already prefer keyphones to dial telephones if cost is not mentioned. Keyphone signalling can be



much faster than dialling, allowing full advantage to be taken of fast switching in and between common control (electronic and crossbar) exchanges. Extra facilities can be given to keyphone customers. For all these reasons, keyphone penetration will steadily increase ; but even by the turn of the century there will still be 20 million or more telephones with dials. This means that the new basic range will have to be produced in both keyphone and dial versions, and the VA team will need to consider how to improve dial reliability.

The pillargraph shows that there are several other features of the telephone which merit further study. A number are lumped together in the 22 per cent 'other' faults. Where the '*line 6*' study produced fewer than 60 examples of a fault they are taken to be a grouping of random failures not statistically significant as a guide for redesign.

Telephones changed

The pillargraph shows that 15 per cent of faults on 700-type telephones are cleared by changing the instrument complete. To assist in the value analysis exercise, Factories Department will examine large numbers of telephones returned for repair, in case they reveal design weaknesses not disclosed by the '*line 6*' study. Some will be examined in section stocks, because the original cause of failure can often be obscured by subsequent damage caused in transit.

PMBXs and renters' coinboxes

Two particular non-telephone '*line 6*' secrets revealed in the study are that 40 per cent of faults on PMBXs are cleared by changing cords, and that renters' coinboxes, which are only about one per cent of business stations, account for 10 per cent of business faults. Both findings suggest further study is needed.

Other lines on the A51 form

This article is not meant to give the impression that '*line 6*' of A51 gives a measure of the total activities of customer apparatus faultsmen. Many faults are obscure and have to be written off as FNF. These are totalled on 'line 5', along with line plant FNFs. Many more reports are cleared RWT, and included on 'line 15'. Miscellaneous 'other' reports, including those due to customer errors, are summed on 'line 16'. To get to the total of faultsmen's visits to customers' premises we have to add something like 40 per cent to '*line 6*' figures. Then again, many faultsmen also deal with public call office reports, recorded on lines 11 to 14. '*Line 6*' is just the line that gives a fair measure of actual faults found and corrected on rented telephone apparatus. Roy Burrows' extraction of details from it has given useful pointers to the savings that can be expected from some redesign work.

Sv5.2.3 (01-739 3464 Ext 7722)

TIs and you

by **Ron Quinney,** Sv5.4.2

Although much has already been written about TIs (see, for example, MN 10) my first few months as TI Adviser for E (Maintenance) Division has underlined for me some of the problems confronting both file holders and authors. Most engineers (myself included) have criticised the TI system at some time but I suspect that much of the criticism has been due to a lack of appreciation of how the system operates.

The writing and distribution of TIs is, in a sense, a co-operative undertaking between authors and file holders and here I would like to take this aspect a little further.

Author's Responsibilities

Once the need for a TI has been recognised, the author should carefully consider two fundamentals to avoid including superfluous information. First, the person who will use the TI and, second, with him in mind, its content. Ideally, a TI should contain *only* the information necessary to enable an engineer to carry out his work. If, for example, the task in hand is one of testing and adjustment then the text should be confined to this. This is particularly important when the TI will be part of a Type 1 file which needs to be carried from place to place. Other information, such as descriptions of apparatus, should be distributed to reference files (Type 2) normally located in the engineers' HQ. It is also important for supervisors and controlling officers to receive the same TIs as their staff,

as well as instructions containing management information, through their Type 3, Type 4 or Type 5 files.

Before he submits the TI for authorisation, therefore, the writer refers to the list of basic duty (BD) codes in *TI E1 A0002* and specifies those which are appropriate for its distribution. Thus, he is not only responsible for writing with the needs of the user in mind, but also for telling the distribution centre which duties need the TI.

File holder's responsibilities

Clearly, a file holder cannot expect to receive TIs distributed to his particular basic duty if that BD is not included on his file. Periodically, he should review his file record, (THQ 4611), having first obtained it from his TI distribution centre. Any discrepancies found can be corrected by referring to *TI E1 A0002*. This TI is updated regularly so it is important to refer to the latest issue.

TI Adviser's responsibilities

My own responsibilities include those of confirming or suggesting changes to the proposed distribution of TIs and vetting requests from file holders for changes in the composition of their files. Both these functions aim to reduce the quantity of unwanted paper distributed and to see that TIs reach the files of the maintenance staff who need them.

As part of the effort to ensure that our TI system is used for the benefit of all I would be pleased to assist with any queries from authors or file holders.

Sv5.4.2 (01-432 1380)

SERT-a small exchange route tester designed and developed in Cardiff

by **Peter Bushell,** WMTB

In the last issue of *MN* we reported on the new Measurement and Analysis Centres (MACs) for measuring exchange performance. But units with less than 1000 lines are not covered in this scheme. This is where WMTB's new tester comes in. Its purpose is to help bring some control to the performance of small exchanges which otherwise may not fully benefit from the MAC programme.

The tester consists basically of an electronic test call generator which sends test calls at predetermined intervals to local or distant test number circuits. Its main elements are :

Programme store and test call generator

The tester is able to store and send four different calls of 15 digits each. Either a single call may be sent repeatedly or groups of calls may be sent sequentially. The address of each call is keyed in using a keypad and the numbers are stored in 4 bit binary on a single 64 bit read/write Random Access Memory (RAM) integrated circuit.

Tone identification and recording

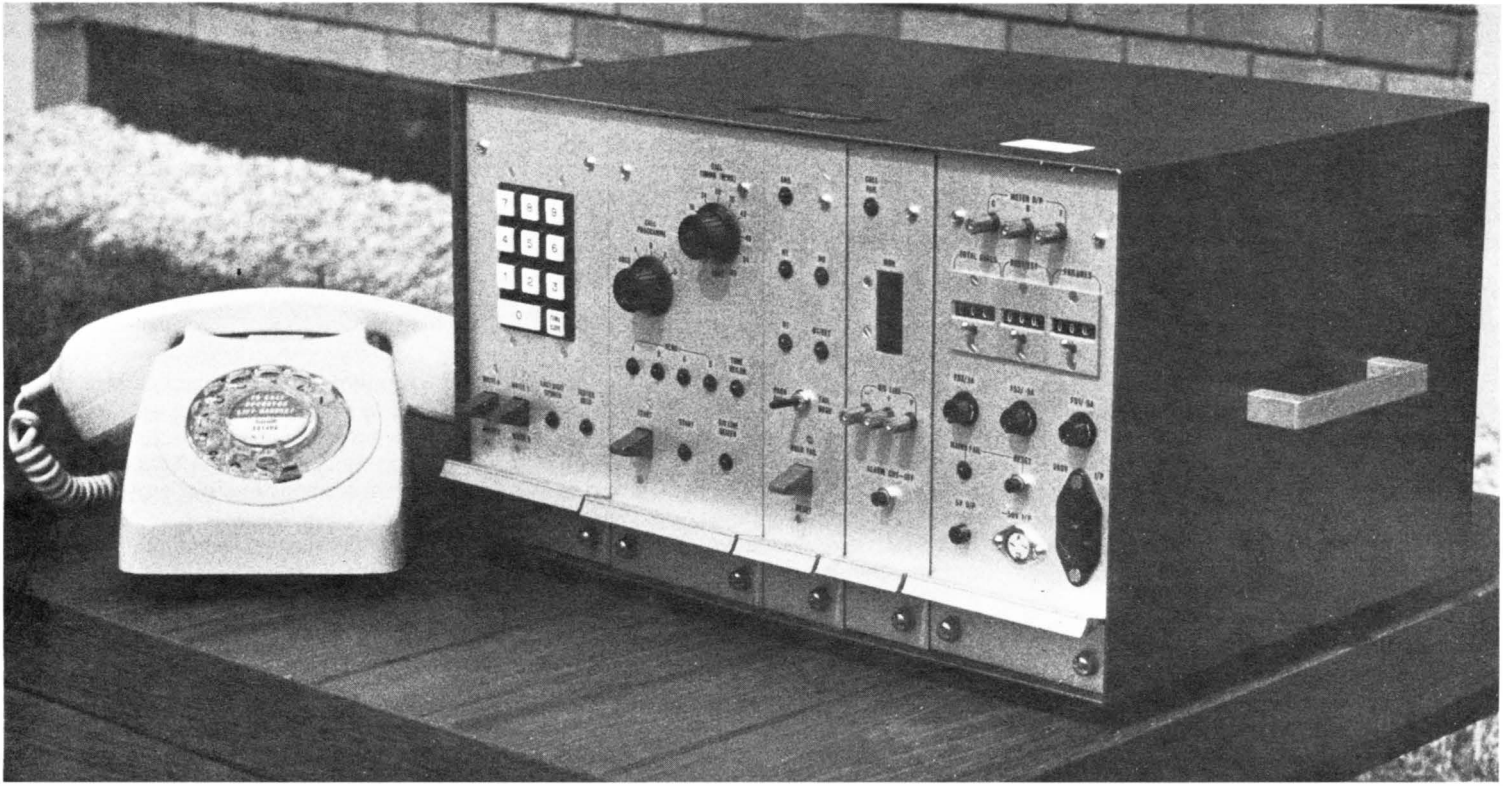
On receipt of supervisory signals an identification circuit examines the tones received and records the result on a resettable meter. Separate meters record total calls, total fails, and plant engaged. Also, an 'English Numbering Machines' printer which delivers printouts of all failed calls can be attached.

Timer

With this facility calls can be sent continuously or at pre-set intervals variable in six minute steps up to a maximum of one hour. The timing is set by turning a rotary switch on the front panel.

Power pack

Power is derived from the mains and is converted to a 5 V stabilised supply for the logic circuitry. When the mains are restored following a failure sending is inhibited until the equipment is re-set and programmed.



Wales'small exchange route tester

General

The tester's design follows conventional modern practice – 54 TTL integrated circuits are used. The main circuit components are assembled on slide-in modules so that circuit changes can be carried out quickly and easily if the need arises.

The equipment can be used in either 'service measure' or 'stop-on-a-fault' mode. A local audible alarm and a 'step-over-busy' feature are also provided. The reliability of the equipment is of a very high order, the prototype having completed several million cycles without failure. Although the original intention was to use the tester to control service from small exchanges, it has proved to be a very useful general maintenance aid. It can be used at a variety of access points throughout the automatic switching network.

Although the prototype was made in WMTB's tester design workshop some were later made by Chester Area for their own use. More recently arrangements have been made for a small production run to be undertaken by FacD, Enfield to meet a keen general demand. They will meet further orders if the demand arises.
WMTB/SMD/S3.2.1.4 (0222 391406)

Maintenance philosophy for Strowger exchanges

by **Ken Henley,** Sv6.5.5

Almost all Strowger exchange systems are expected to be withdrawn from service in the UK by the end of this century. They should be replaced by Electronic, Crossbar and other new systems at the rate of three or four per cent each year. But until recently our public exchange network used Strowger almost exclusively and during the past 15-20 years techniques for its maintenance have been considerably refined. Strowger may be obsolescent but it still has a major role to play and cannot be neglected. Here is an outline of how our present approach to its maintenance has developed.

We can apply three basic objectives to all fields of telecomms maintenance :

☐ Achieving a planned equipment life.
☐ Giving customers the required quality of service.
☐ Economising in terms of time and materials.

In pursuing these for Strowger equipment three broad categories of maintenance have been established :

Preventive maintenance – Taking steps such as regular lubrication, cleaning and inspection to prevent things going wrong.

Corrective maintenance – Putting things right after they have gone wrong.

Qualitative maintenance – Mixing both preventive and corrective maintenance to achieve the best balance for meeting the basic objectives.

Our philosophy for Strowger maintenance has always been qualitative but until the mid-1950s the emphasis was on preventive maintenance which included regular routine overhauls. Corrective maintenance amounted, in the main, to locating and repairing faults reported by customers or traffic staff although a limited amount of fault location was carried out by engineers making manual test calls. Automatic routiners – thinly provided – were operated only during normal working hours and could not test all the equipment quickly enough to play a prominent role in detecting service-affecting faults. They served mainly as a preventive maintenance aid – indicating equipment which had drifted out of adjustment or away from performance tolerances.

The problem with preventive maintenance is that when it is done regardless of need it becomes uneconomic. Selector overhauls, for example, are a waste of time and money if done without the indication that they are really necessary. This is why a steady shift in emphasis has taken place over the years. Preventive maintenance has decreased while corrective maintenance has increased.

Current maintenance philosophy

The first move to reduce the amount of preventive maintenance was the abandonment of scheduled overhauls in the late 1950s. This was followed by improvements in maintenance practices which led to longer intervals between bank cleaning and selector lubrication.

The new approach to preventive maintenance is to group associated routine tasks, such as bank cleaning, wiper inspection and lubrication into a single MRI known as a block-routine. For conversational equipment the interval between block routines has now been set at three years. This has been made possible by the introduction of a long life lubricant (oil bearing no 19) and the test-bed exchange experiment (see the article on block routines) which showed that wiper wear in this period does not present problems if the TIs concerned are followed.

The limiting factor for short holding equipment is usually wear, not lubrication, so reduced intervals between block routines have been set for this equipment based, where possible, on usage.

Preventive maintenance is now limited to doing the minimum which is necessary to restrict wear, checking essential equipment functions and ensuring safety. The nominal periods between block routines, as listed in *TI E6 R5011*, are the longest intervals between maintenance attention at which we can be reasonably sure that the equipment will continue to give good service. Occasionally though, due to environmental conditions or equipment age, local experience may prove it necessary to do some preventive maintenance jobs on an interim basis.

For maintenance tasks which are not included in the block routine, such as outlet testing and frame inspections, flexibility is the order of the day. Exchanges can differ widely in their needs and local management and staff know best where and when this maintenance attention is necessary.

Apart from the inefficiency involved in too much preventive maintenance what other influences have caused the shift of emphasis to corrective maintenance ? Automated network-surveillance has been a key factor – using devices such as Call Failure Detection Equipment (CFDE), Artificial Traffic Equipment (ATE) and other aids which have been locally developed. The nightly use of auto-routiners, following their connection to fault recording equipment, has greatly increased their capability for detecting faults which can be removed from the system before being encountered by customers.

Increased fault location activity has resulted in more FNFs (Faults Not Found) being recorded, but attempting to solve each one of these is a costly process and can frequently be unrewarding. So now the preferred action is to investigate only when a given number of FNFs have occurred within a pre-determined period. The RANCH scheme (Routining at Night with Centralised History) is currently on field trial. It uses the night routining docket output as a fault incidence record and identifies those items of equipment which malfunction repeatedly.

Finally, it is worth stressing that we must continue to maintain Strowger systems for the basic objectives mentioned earlier. These exchanges will be with us for some time yet and will play a vital part in our plans for giving improved service.

Sv6.5.5 (01-432 1348)

Block routines for Strowger exchanges

by **Ken Henley,** Sv6.5.5

Following on from the more general article on Strowger maintenance we now look a little closer at the new block routines referred to in issue 4 of TI E6 R5011 and which are scheduled for introduction by 1978.

In recent years first-line supervisors have been encouraged to group individual maintenance routines together as much as possible and to vary their periodicities using local fault statistics as a guide. But firm rules – aimed at gaining consistent and predictable results – were not available. In any case, from within the individual exchange unit it is difficult to assess the value of changes of practice in preventive maintenance because the quality of service to customers is not immediately affected.

So in 1970 we started a thorough long-term review of Strowger maintenance aiming to use the results to help streamline our MRIs. With POEU co-operation a number of London exchanges were chosen as 'test beds' where a study could be carried

out under controlled conditions.

We found that conversational equipment will continue to give satisfactory service with a small amount of attention, closely specified and diligently applied, every three years. Actually, this interval was extended to four years in the test bed exchanges and the equipment still gave good service. For short holding equipment we confirmed that its maintenance requirements are linked to its rate of use.

But with extended intervals between maintenance it is clear that the scheduling and execution of this work becomes even more crucial than before. So to ensure the required quality of service we will use block routines. For each type of equipment they combine preventive maintenance tasks into a single MRI, removing, where possible, the need to make judgements which may differ from those of someone else.

Each type of 2-motion selector will have its own block routine which, in addition to covering wipers, banks and lubrication, will include an inspection of pulsing relays. With other relays sample checks before the three-year routine cycle is started will determine the extent of further work.

Unfortunately the pre-2000 and 4000 types of mechanism require bank cleaning to be done more frequently than every three years. We have had to schedule this at one year for the pre-2000 type and 1½ years for the 4000 type equipment.

Subscribers' uniselectors will generally function satisfactorily with regular cleaning and lubrication. This is covered by a simple block routine which includes only cleaning, lubrication and a functional test as previously detailed in R172. So normally we won't need a full block routine for this work unless the uniselector fails the functional test or difficult situations are encountered such as 'that rack just inside the door'.

Short holding equipment is subjected to considerably more wear and tear than conversational equipment and requires more frequent attention. The best approach in such cases is to apply the block routine at intervals dependent on the rate of use. Where call count meters (CCMs) are fitted this is easily done, but such equipment – Directors and local registers for example – is relatively thinly spread. So for items with no CCM we have had to adopt a criteria based on the highest usage rate for determining when the block routine is necessary.

Certain elements of short holding equipment, such as send switches and pulsing relays, require regular maintenance over and above that given to the remainder of the item. For these we will need to apply a shortened form of MRI – the partial block routine – at intervals between the full one.

Examples of block routines for short holding equipment are :

Directors :	Full block routine every 500,000 operations Partial block routine every 100,000 operations
ND Controlling Registers :	Full block routine – yearly Partial block routine – 13 weekly

We are confident that block routines will improve the organising of preventive maintenance. They reduce the routine work to a minimum which, nevertheless, will enable us to get good service from Strowger equipment while it is still with us.

Sv6.5.5 (01-432 1348)

Automatic Callmakers

by **Roy Domville,** Sv5.3.2

Customers who make calls regularly to the same group of numbers can use an autodial to remember and dial. To call other numbers the normal dial is used. At present there are three types of autodial, each giving standard loop/disconnect pulsing with the necessary inter-train pause between digits. They are all mains-powered. Here is a brief description of them and how they are maintained.

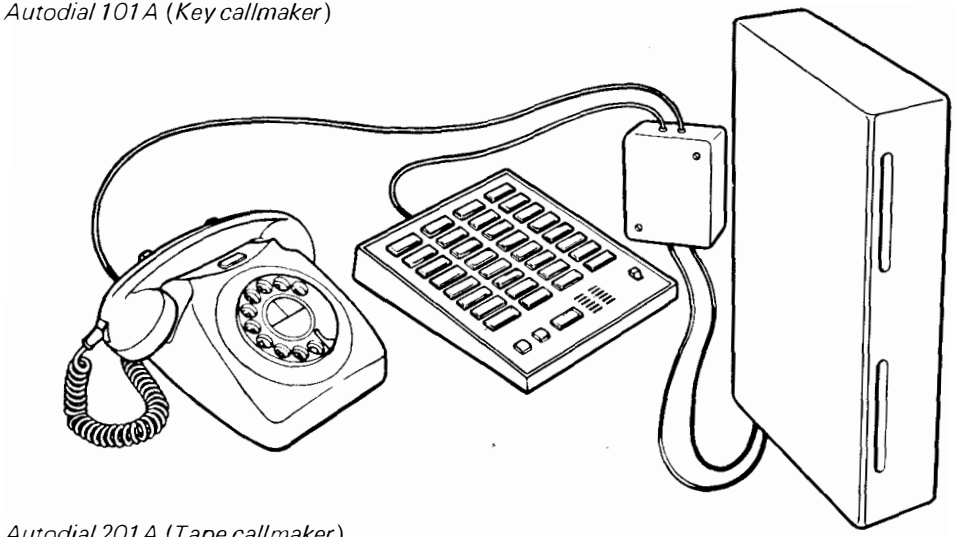
Key Callmaker (Autodial 101A)

This machine can call any one of 32 telephone numbers, each up to 16 digits long, using a separate pre-programmed button for each. The PABX access digit or ISD access code 010 can be included if required.

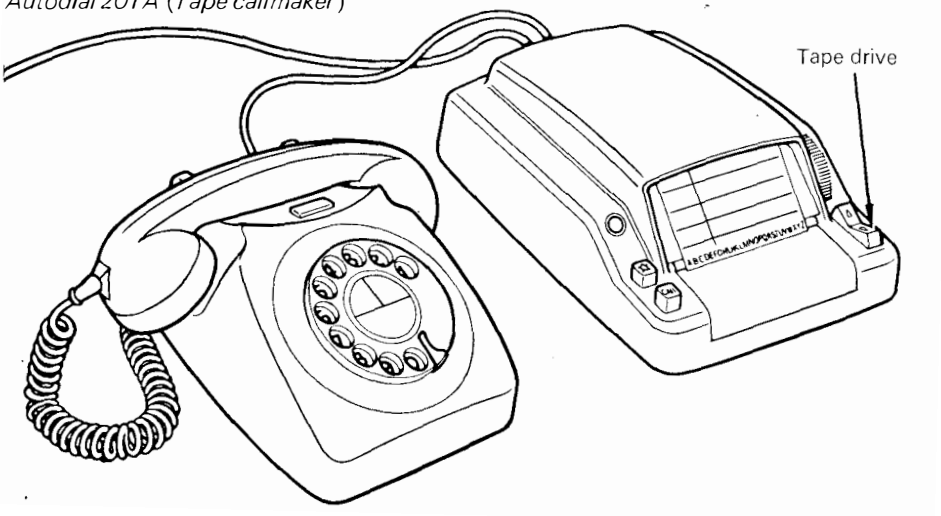
The autodial consists of three units – key unit, translator and power unit. Customers are encouraged to make their own changes to stored numbers by changing connector cords in the translator.

This equipment is complex and on-site maintenance is therefore restricted. Lamps no 41B may be changed in the key unit, power unit faults being restricted to fuse changing. Otherwise, the complete unit is changed.

Autodial 101A (Key callmaker)



Autodial 201A (Tape callmaker)



Most of the electronic components in the translator are enclosed and cannot be maintained in the field. If the four corner screws are removed access is obtained to the cable terminations and four variable resistors :

- RV1 turned anticlockwise lengthens the inter-digit pause.
- RV2 and RV3 together effect the speed and ratio of pulsing and must *not* be adjusted.
- RV5 adjusts the length of the time out from the end of dialling to automatic clear down if the called customer does not answer in approx 60 seconds.

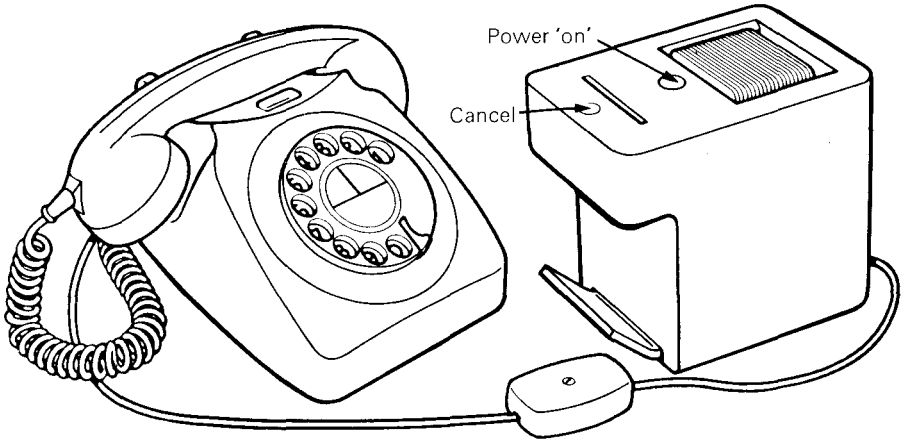
Tape Callmaker (Autodial 201A)

This autodial can store up to 400 numbers, each up to 16 digits long, on magnetic tape.

Numbers can be quickly found by using a motorised tape drive to scan the tape with the final selection being made by hand. The name of the person to be called will appear between guide lines of the window.

To record the numbers a separate plug-in dial is inserted into the rear of the desk unit. As each digit is dialled the tape magnetic field is changed. At the end of the pulse train the tape motor continues to drive for 600ms so as to give an inter-digit pause.

On playback of a stored number, when the call button is pressed, the record/playback head is moved to the extreme left hand side of the tape. When the button is released the tape head motor drives the head from left to right so that the tape is scanned. As each change in magnetic field on the tape is detected, a disconnection pulse is sent to line. One second after the stored number has ended, the tape-head drive cuts out if no



Autodial 301A/302A (Card callmaker)

further changes of magnetic field are found. Off normal contacts serve the same function as in a normal telephone – they stop receiver clicks, transmitter damage, bell tinkle and provide a spark quench.

Again, maintenance is limited to the changing of complete units except cords, lamps, fuses and tapes. The tape is housed in a tape cassette. When changing a desk unit the original cassette is retained for use in the replacement callmaker so that the customer does not have to make a new recording.

Card Callmaker (Autodial 301A/302A)
A separate plastic card is used for each number, up to 16 digits long. To store a number the customer punches holes in the card using a special jig. When the card is inserted into the slot in the autodial light shines through the punched hole onto photo-cells. These photo-cells signal to the pulse generator to pulse the required number. As each digit is sent the card drops to a position so that the next row of punched holes aligns with the photo-cells. This is repeated for each digit until the card drops from the slot. Autodial 302A is used for telex.

Maintenance is again limited to checking fuses and lamps. It is important that the lamp (Lamp no 54A) is fitted correctly otherwise uneven light may reach the photo-cells and wrong numbers could be sent.

Maintenance guide notes covering all types of autodials are available for field staff. These are usually obtainable from area training officers.
Sv5.3.2 (01-432 1383)

Asbestos -PO takes action

by **Roy Tharby,** OP2.2

The publicity given in recent times to the health risk associated with asbestos dust may lead readers to wonder what, for its part, the PO is doing about it.

The Experimental Changes of Practice Committee (ECOPC1) has formed an Asbestos Products Working Party with both staff and official sides represented. It is identifying all uses of asbestos in the PO to establish safe alternatives or safe working practices. At the same time the working party will maintain a constant watch on research into health hazards and legal obligations.

Asbestos is a material which has been very widely used, sometimes in well known spheres such as thermal insulation, fire-fighting equipment and fire protection and sometimes less obviously as in paint binders, building materials and plastics. In its solid or undisturbed state a material containing asbestos presents little hazard provided that the surface is sealed. A health risk occurs only when deterioration or abrasion causes dust to be released.

There are four main types of asbestos – amosite, chrysotile, anthophyllite and crocidolite, the latter being commonly known as blue asbestos which is considered to present the greatest hazard. However, the more stringent provisions of the Asbestos Regulations Act (1969) which relate to blue

asbestos now form the standard of protection applied in the PO to all of them.

The working party is revising all TIs and Postal EIs concerning asbestos. Among the diverse topics being covered are protective gear – including clothing and vacuum cleaners - motor transport, postal machinery and customers' premises.

Alternatives are being sought for asbestos cloths, blankets and curtains and improved designs of respirators are being introduced.

Asbestos plugging materials have already been banned and existing stocks scrapped. Asbestos based materials have been banned for all new building work except in restricted circumstances. In existing buildings, where asbestos is known to have been used but can be declared to be in a safe condition, notices will be strategically placed warning against cutting or drilling.

The working party will continue in being until the dangers have been fully investigated and remedies have been provided.

OP2.2 (01-739 3464 x400)

Correction

Gordon Bays, author of the article on cable pressurisation in the last issue, has asked me to point out a printing error which appeared in the section headed 'Desiccation' on p24. The property of a material for holding water vapour to its surface by capillary attraction is called *adsorption*.

Editor

The statistics of power maintenance

by **Derek Knight,** Sv5.4.2

An article in MN2 gave our targets for power system reliability and outlined the maintenance policy for achieving them at the lowest cost. We gave some examples of what was then being done but here we emphasise the role of field data in the drive for continuous improvement in power plant maintenance and development.

Statistics can be a dry subject and the processes involved in such work can be a drag. Filling in forms and dockets is a nuisance and evaluating them at the receiving end is not very stimulating either. It is therefore not surprising that in some cases only about 40 per cent of defects on telecommunications power plants are properly reported although, understandably, faults which cause service interruptions come to light more readily. But what are the effects of insufficient or inaccurate information being sent from the field?

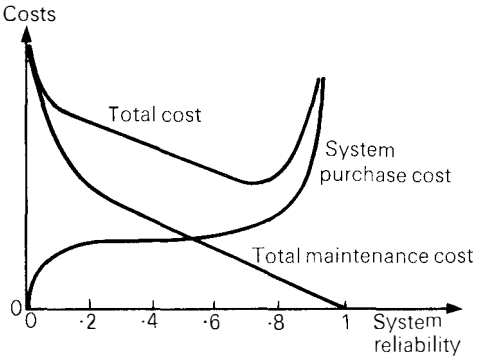
- In THQ priorities could be wrongly allocated, inappropriate maintenance TIs could be perpetuated and false information could be referred back to designers.
- In areas and regional headquarters unrealistic targets could be set for service and manpower.
- In the field there could be general frustration with management and too little time allowed for the job in hand.

All these could ultimately result in a declining service to the customer.

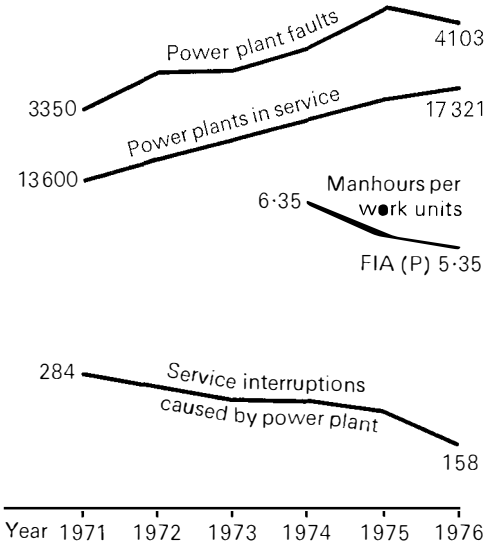
Design and experience

If faults and the need for routine maintenance could be designed out of power plants it would certainly remove the need for fault dockets.

Obviously with a well-designed plant the maintenance costs will be relatively low. But provisions made by the designer for derated components, redundancy and standby devices will all raise the purchase cost in such manner that, beyond a certain point, the system reliability will increase so little as to render the savings in maintenance costs negligible, while prohibitively raising the cost overall.



System purchase cost and total maintenance cost as a function of system reliability



Telecomms power statistics

So in a practical sense both 'system purchase cost' and 'total maintenance cost' are functions of system reliability. As the former increases the latter can be expected to decrease. But there is a point at which these functions combine to produce the most economic approach while keeping the system reliability high.

The collection and analysis of field data is an essential part in the process of getting to the minimum point on the 'total cost' curve. We must accept, for the time being at least, that faults will occur and some degree of routine maintenance will be necessary. But we can still aim to provide the best possible service at the smallest cost. The main channels for collecting the information we require are as follows :

The A237 form – 'telecommunications power plant fault docket' – is used for recording the details of all faults on telephone exchange, radio station, repeater station and telegraph power plants. By this means lists are compiled in THQ which, in conjunction with returns made for the numbers of plants of each type in service, provide information on the reliability of each type of plant and the reliability of individual components. National and regional summaries are produced and fed back to RHQs and THQ power development groups at quarterly intervals – *TI E12 A1051 refers.*

The FIA (P) sub-division of the engineering maintenance classes of work distinguishes the power element from other equipment maintenance manhours and enables us to relate the performance of power plants to the time spent on their maintenance.

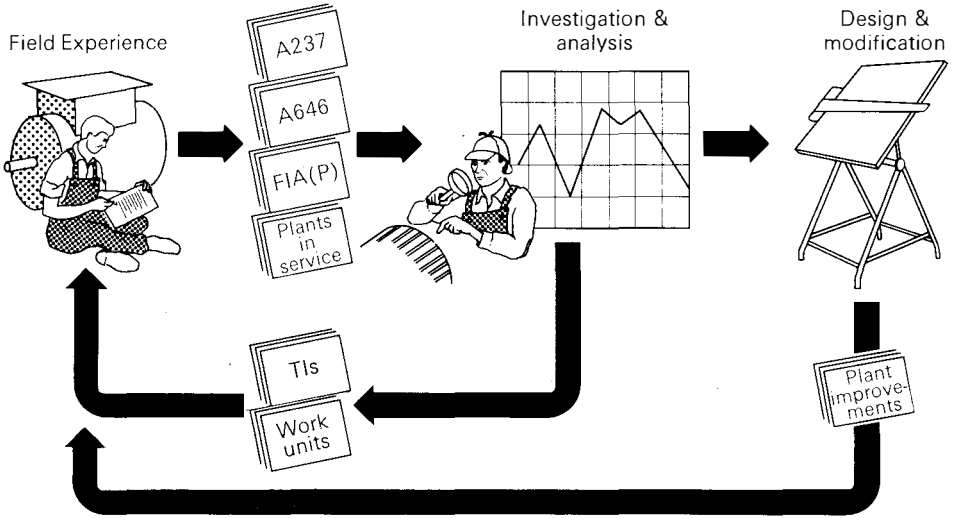
The A646 form – 'Notice of Unusual Difficulty' – draws direct attention to what could either be a design defect or an inappropriate or missing maintenance procedure – *TI E1 A0091 refers.*

In combination these sources of information form a valuable background for .

- ☐ Determining the frequency or necessity of particular maintenance tasks.
- ☐ Indicating the need for plant modifications.
- ☐ Arriving at realistic work unit allowances for each type of plant.

Trends and prospects

Our graphs show some recent power plant



statistics. Up to 1975 the number of faults each year has risen steadily but so has the number of plants installed. Overall the faults for each plant have been fairly constant although the most recent figures show an encouraging downward trend. In contrast to the fault rate we can show a steadily declining number of service interruptions due to power plant. This is attributable, in the main, to the planned recovery of obsolete dc plants. One more year should see this programme completed, so further improvements will depend on factors such as the increased reliability of plants now being installed.

FIA(P) has been used on time sheets since 1974. Since that time works units claimed for power maintenance have increased in step with the total number of plants in service but the average manhours worked for each unit claimed has decreased. On the face of it such a trend is encouraging since it represents an improvement in maintenance efficiency. But has this been achieved at the expense of omitting some of the scheduled maintenance? If so we may be storing-up problems for the sake of short-term savings. A full and accurate record of field experience will help reveal where the truth lies.
Sv5.4.2 (01-432 9041)

Electronic PABXs

by **Dave Stoate,** Sv5.3.1

***MN 11* carried a brief description of the important features of the IBM 3750 PABX. Here we mention some other newly designed, customer owned, electronic PABXs which British firms are offering to the PO for approval.**

Reed switched common control PABXs

Two common control PABXs which utilise reeds as the mode of switching instead of Crossbar or Code Switch crosspoints are the GEC REX 80 and the Plessey EPB 2000. Both are similar in principle to the public exchange TXE2 and they are also maintained in similar ways.

When the first attempt at setting up a call fails, this results in a printout of the individual items of equipment in use at the time of failure. Perusal of a number of printouts by the maintenance officer highlights the offending item of equipment which can be removed from service, faulted, corrected and then restored. Service meters, for use in conjunction with this means of diagnosis, also give a lead to the area of trouble.

Those who are already concerned with maintaining common control exchanges – TXE2 and TXK – must be used to these principles by now.

Both systems operate from a mains derived 50 volt dc supply with a standby battery. So far there are 8 REX 80s in service and 5 more are coming within the next few months. There is only one EPB 2000 working but two more are due in 1979.

New stored program control PABXs

Within the last year however, British firms have offered for approval four new types of PABX which, unlike the two mentioned above, operate on the stored program control principle. Here is a brief note on each of them.

Plessey PDX

The Plessey PDX is a processor controlled, digital PABX. It uses Stored Program Control (SPC) Pulse Coded Modulation (PCM) and Time Division Multiplex (TDM) techniques and was designed by the ROLM Corporation in America. Plessey are already manufacturing this system in the UK and their first production models will be in service in late 1977 or early 1978. However, three installations, manufactured in California, have been shipped to this country and installed in Manchester (1) and London (2). The Manchester installation is already in service and those in London will soon follow.

Being a TDM system, this exchange does not have switches as we have in space division systems such as Strowger or Crossbar. Instead, each calling number has two time-slots – one in which data is bussed

into the system (in PCM format) from the calling extension and another in which data is bussed out to the called extension.

The present design of this PABX caters for up to 800 extensions. At this size it has three cabinets with the appropriate number of operator consoles. Each cabinet occupies a space of 68″ × 52″ × 24″, which gives a good indication of the system's space saving potential. The PABX is powered from a battery backed —50V supply

For fault diagnosis communication with the processor is made by means of a teleprinter. The system runs its own 'on line' diagnostics – any equipment not being used to process a call will be automatically checked right down to the extension channel cards.

If a fault is found, the software has the capability of busying the offending equipment before it is taken into use on an active call. Once a fault is located by this self-test process it is logged in an error table and will bring up an alarm according to the category of the fault.

Various 'off line' diagnostics are available to enable the maintaining officer to check the exchange's memory, processor and controller.

GEC SLI

This system was originally developed by Northern Electric Ltd of Canada and will be developed and marketed in the UK by GEC Telecommunications Ltd. Like the Plessey PDX it is an SPC, PCM, TDM system. The original version used an electronic telephone set for its extensions which, in addition to the normal set of push buttons, also contained 13 additional facility keys. But GEC are currently adapting the system so that most of these facilities can be provided by the standard dial telephone with a recall button. The system caters for between 100 and 1500 extensions in its basic design but is capable of enlargement up to 7500 extensions. The 800 line version compares in size with the 800 line Plessey PDX.

The basic system is powered directly from the mains and has no battery.

Like most other SPC systems, the SLI has been designed with easy maintenance in mind and has all the usual means of fault detecting including self-checking routines. If a fault is detected an appropriate alarm is given. Most common equipment circuit pack faults will also be indicated by a LED situated on the board handle. Should the system become inoperative, a maintenance tape is available to test sequentially each circuit board on the bus until the defective unit is located.

The first trial sites should be working in mid-1979.

Philips EBX 8000

This has been designed by Philips of Holland and offered to us for approval in this country by Pye TMC. It is an SPC, space division, reed switched PABX, the reed switch being a Philips type with Ruthenium alloy contacts. It is a modular system catering for between 250 and 8000 extensions.

The system is designed to be powered from a —50V busbar and will always be supplied with a standby battery under mains failure conditions. One interesting feature is that in the event of a long duration mains failure the 50V battery will carry on supplying the system until a critical low voltage level is reached. When this occurs the complete system is shut down and the memory of one of the two processors is hibernated. As the hibernated processor draws approximately three amps the remaining energy stored in the battery will be sufficient to maintain this state for many hours. Upon restoration of the public mains, the system will immediately restore to service, the previously hibernated processor then dividing its time equally between call processing and updating the processor which is 'down'. In the event of a total system failure it will be necessary for the maintenance engineer to re-load the program, (contained on punched tape), using a tape reader.

Within the common control area are fault detection units and self-checking, software controlled routines which are continuously running. Upon detection of a piece of faulty equipment it is automatically removed from service and an alarm condition is displayed.

Diagnostic programs are permanently stored in the memory of the processor and are available at any time *via* the teleprinter provided on site.

The first trial installations will be brought into service during late 1978 and early 1979.

ITT Unimat 4080

The ITT Unimat 4080 is a stored program control, space switched, modular, double processor system. The mode of switching is solid state using NMOS crosspoints.

The ultimate growth of the PABX is 10,000 lines but initially the PO will be approving installations only up to 2,000 extensions.

In normal working the system derives its power from the mains which is converted to a —48 Volt, battery backed, dc supply.

As with the other PABX systems a great deal of thought has been put into the maintenance aspects. The capability to automatically detect, identify, alarm and record faults is inherent in the system. Diagnostic programs are used to 'talk' to the processor which result in printouts on a teleprinter. Together with the procedures in the maintenance manual these will enable the maintenance officer to localise a fault down to a single printed card or its equivalent.

The first trial installations will be coming into service in early 1978.

Other systems

Two manufacturers – Plessey and Thorn Ericsson – have introduced 'add-on' processor controlled units which can be added to an existing common control PABX to widen its facilities.

The Plessey 2150 is for the Plessey PB8000 crossbar PABX.

In the event of a failure of the 2150 the customer will fall back on the basic facilities offered by the PB8000. The first installation should be brought into service in October 1977.

The Thorn Ericsson AND 790 is a Programmable Number Group (PNG) unit which can be added on to an AKD 791 or AKD 792 PABX. The first installation should come into service early in 1978.

One of the main advantages of an add-on processor controlled unit is that it quickly utilises the customer's already invested capital. This enables him to gain most of the advantages of a 'stand alone' SPC PABX with considerable cost savings.

Customer facilities

Among the many extra facilities offered to customers with SPC systems is the capability of being able to easily :

- ☐ Change the class of service of extensions and
- ☐ Cease and/or provide any PABX connection.

Both these are provided by allowing the customer access to his software by means of a teleprinter. This innovation gives great flexibility to communication managers in large organisations.

Conclusions

I have attempted to outline the innovations which PABX maintenance staff will be meeting within the next few years. One thing is certain – we will be maintaining equipment which uses the most modern switching technology in the world. Although the maintenance facilities of each of the 'stand alone' SPC systems have been described separately, you can see that in principle they are practically identical. The skills of a PABX maintenance TO will now be almost entirely devoted to his manipulation of the diagnostic programs, so training will now be concentrated on becoming familiar with these and how to use flow charts. Comparisons of the relative maintainability of SPC PABXs will be made in terms of what percentage of faults in the PABX switching block are cleared by the diagnostic programs provided – 85 per cent ?, 90 per cent ?, 95 per cent ? 100 per cent ? ! ! We can look forward to a challenging and rewarding experience in the next few years.

Sv5.3.1 (01-432 9145)

60 MHz systems and their maintenance

by **Peter Garrick,** Sv7.2.1

The 60 MHz system is the latest development in frequency division multiplex techniques. By using the increased frequency range between four and 60 MHz a traffic carrying capacity of 10,800 telephone channels per coaxial pair is obtained – four times the capacity of existing 12 MHz equipment. Because of this large capacity, the 60 MHz equipment will be used only on those inter-city routes where growth is greatest. Equipment installation is about to start and the first system should be ready for service in August 1978 between Birmingham and Manchester. A London-High Wycombe system should follow in December 1978 and the following year should see the completion of systems between Birmingham-High Wycombe and High Wycombe-Reading. No further routes are planned at present.

System features

The 60 MHz terminal equipment includes special translating, frequency generating and line switching equipment.

The coaxial line equipment uses underground dependent repeaters spaced at 1,500 metre intervals. The dependent repeaters are energised from terminal and main intermediate surface power-feeding stations by a new power feeding arrangement comprising 2 series – aiding power-feed generators connected one at each end of the power-feeding section. The line current is 110 mA dc and for safety reasons it is essential that both generators should be working correctly. A control system is provided to ensure correct operation of the power-feeding system.

On each route the line sections carrying traffic are protected by a standby line section. In the event of a failure of a working line, the traffic path will be automatically switched at the terminals to the standby within 10 milliseconds.

Because of the higher carrier frequencies employed, the frequency accuracy of the 60 MHz generating equipment must be maintained to closer limits than until now. The accuracy now required is ± 4 parts in 10^9 – five times better than that required for existing 12 MHz systems. Manual adjustment within these limits would be impracticable so this is done automatically. An electric motor drives a variable capacitor until 60kHz derived from the master oscillator is in synchronism with the national 60 kHz standard frequency signal. The master oscillators will not be permanently locked to the national frequency standard but will be synchronised to it periodically.

Equipment construction

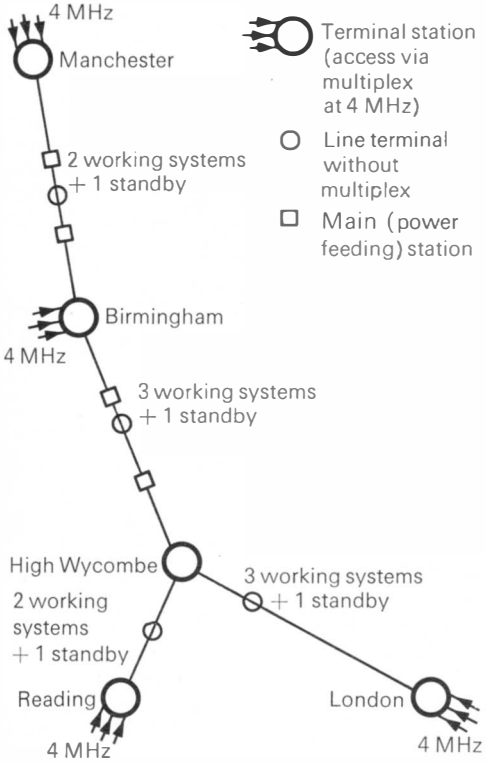
The equipment design is based on a proprietary form of construction known as *'Conclave'*. It comprises a rack frame which is capable of accommodating up to 24 sub-racks (analogous to 62-type shelves) and a range of modules which plug into the sub-rack.

Modules employed in the main transmission path are airtight and incorporate desiccators.

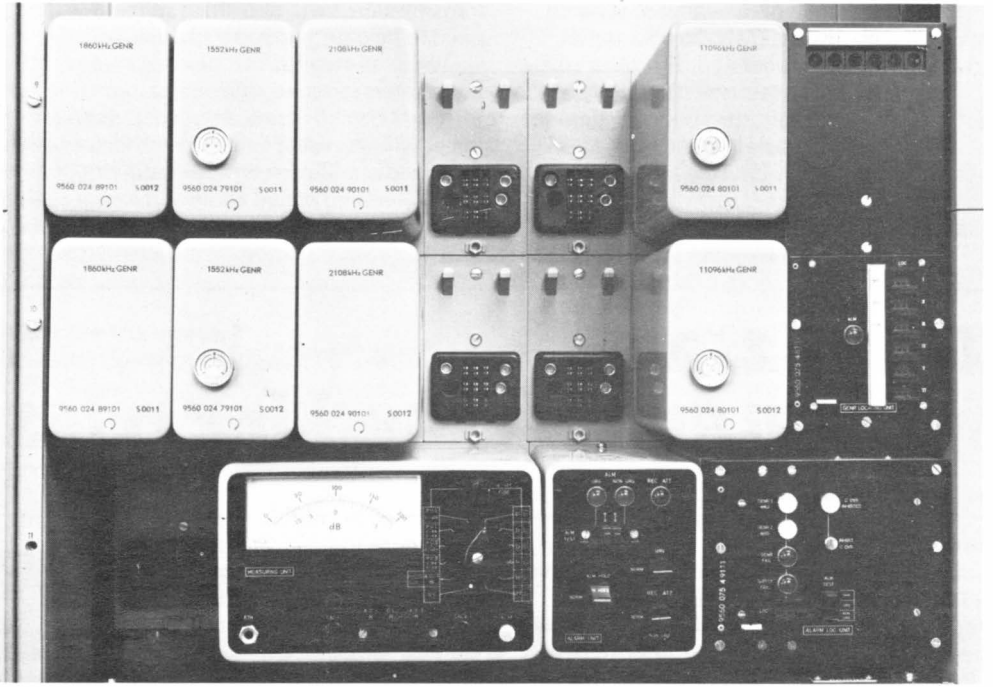
Standard electronic components are used, suitably derated for increased reliability. These are mounted on double-sided printed-wiring boards using plated through-hole techniques. The packing density of components is quite high and track spacing on printed wiring boards is somewhat less than with 62-type construction. An exception is the transistors in each repeater which together with coupling capacitors are mounted on an aluminium substrate within an encapsulation 14 mm dia and 6 mm high. This arrangement makes easier the short physical feedback path necessary in designs operating at such high frequencies.

Accommodation

Segregated accommodation has been provided at terminal stations where each 60 MHz installation has its own 50V dc power plant. The terminals will be fed with traffic over conventional 4 MHz line links, there being no direct access for blocks of circuits below hypergroup level (900



The 60 MHz network



channel blocks). New routes have been selected for the 60 MHz cables and as a result four new main intermediate power-feeding stations have been built.

Dependent repeaters are sited in manholes and are housed in a new design of case constructed from silicon-aluminium alloy coated with nylon. Each case has an ultimate capacity for 18 repeaters. High reliability will be an intrinsic feature of the 60 MHz transmission equipment design. With more reliable equipment, the effect of working party faults assumes even greater significance. This special accommodation will assist in preventing inadvertent interference. Routine maintenance operations will also be kept to a minimum.

Dealing with faults

The equipment is provided with in-built alarm and supervisory facilities which will enable faults to be traced to a particular unit.

☐ A crystal oscillator is provided in each repeater, the signal from which is monitored at the terminal stations.

☐ The amount of gain regulation applied to each line-section is compared with that applied to adjacent systems on the same route. Any discrepancy initiates an alarm.

☐ The multiplex equipment incorporates a scanner which monitors the level of the

1552 kHz reference pilot received on each working hypergroup. (MN2 contained an article on reference pilots.)

Service affecting faults will need to be put right within the shortest possible time so terminal and intermediate stations will be geared to deal with them by changing complete units. Spare units will be held for all those whose failure could affect transmission. When a unit is faulted it will need to be plugged into a special jig.

Terminal stations will be equipped with precision measuring equipment operating up to 100 MHz and a new compact pulse-echo tester will be available at each surface station to enable discontinuities in the power-feeding path – cable and repeaters – to be located to the nearest repeater section.

The existence of the standby line should also mean that the more elusive or unusual line faults can be tackled in a calm and thorough manner.

The October 1973 issue of IPOEE Journal gave a detailed account of the system. Also, an article on 60 MHz cable maintenance appeared in MN6.

Sv7.2.1 (01-432 1366)

Tester 219A- for coin and fee checking relay sets

by **Brian Meyer,** Sv6.5.6

Coin and fee checking (CFC) relay sets have been standard equipment in exchanges since the introduction of STD. They incorporate the many facilities required to control the operation of pay-on-answer coin box (PACB) telephone and coin pulsing mechanisms. As their numbers have increased it has become increasingly difficult to keep up with maintenance. But now a new tester has appeared. Designed originally in LTR it should provide an answer to this problem.

Although testers used on CFC relay sets have developed in their design over the years they have not provided the facility for fully automatic testing and they have either been too slow in operation or have not provided sufficient facilities. The build-up of public call office business and the corresponding increase in the numbers of CFC relay sets in exchanges has caused us to fall behind generally with testing resulting in an increasing fault liability to an extent which has forced us to take specific action.

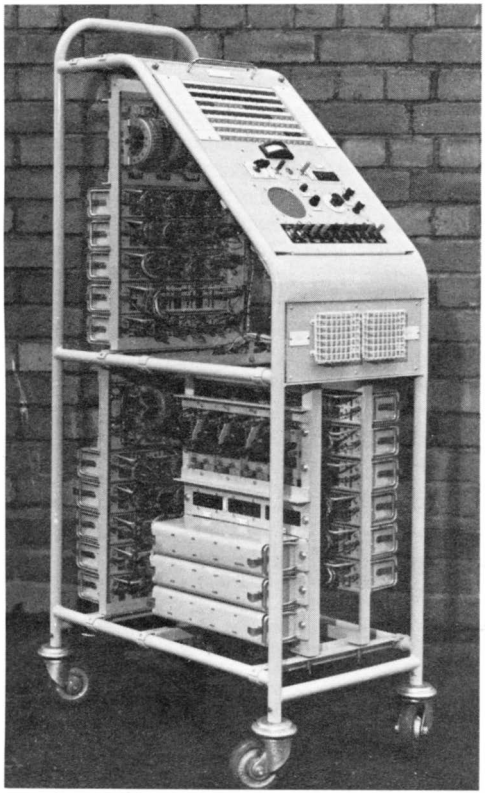
If exchange equipment is to give call office users a quality of service comparable with that given to other telephone customers, undetected CFC relay set faults need to be picked up at the same rate as other switching equipment – within 12 hours – and this implies that we need to test on a daily basis. But we are considering large and relatively complicated items requiring testing equipment of a similar complexity.

THQ were faced with the problem that a fully automatic routiner, having facilities for comprehensive testing, would take too long to produce and would probably be too costly to provide at exchanges with fewer than, say, 42 CFCs.

However, with exploratory work still going on in THQ, LTR Service Division also gave thought to the matter and came up with their own design of tester. It's transportable, automatic and while it may not be the perfect answer to our problems, has advantages which have led us to adopt it for national use in preference to other alternatives.

What the new tester does

Tester 219A has access to all relay sets during the nightly routine programme and automatically passes a test call through each one in turn to a test number circuit. This tests all functions whose failure would result in loss of automatic service to customers. The tester also has access to the fault recorder control circuit so as to give a printout of all faults which are registered during the



Tester No. 219A

process.

☐ It reduces considerably the time previously spent on testing and ensures that the program is carried out.

☐ It does not require special rack space (except for the access uniselectors which can be mounted in spare space on the relay set racks).

☐ It can be used on all types of CFC.

☐ It should result in a considerable improvement in the quality of service given to PACB customers because maintenance staff will be able to get directly to grips with faults as they are revealed. There should be a reducing number of them as well. It's too early to give an accurate assessment, but there are indications that the numbers of faults reported from coinboxes may fall by up to 25 per cent.

What are the snags?

The tester does not check all CFC relay set facilities. For successful testing it depends on other exchange equipment working normally. And the exchange has to be provided with a test number circuit.

Existing testers – TRT122, TRT197, TRT172 – will still be needed to carry out full facility tests although we can now afford to do them less frequently than before. In this respect the periodicity of MRIs R226 and R228 will be changed from two weekly intervals to 26 weekly. Our earliest tester, TRT60, together with the associated MRI R223, will be kept on for the time being but forthcoming modifications to relay sets conforming to diagram AT5716 will mean that the tester will be unusable thereafter – unless it too is modified. This would be an extensive job and, bearing in mind that the other testers will themselves be updated, cannot be justified on economic grounds. Sv6.5.6 (01-432 1347)

What use is your traffic recorder?

by **Matt Murphy,** NIPTB

If we put this question to our hard pressed maintenance staff in the field they could react with either uncertainty or outright hostility. Perhaps the parentage of Mr Erlang and all his formulae would be called into question. However, if we analyse the benefits which accrue from the proper use of the traffic recorder we might consider renaming it the *terrific recorder*. The benefits apply in all fields of telecommunications work – maintenance, trunking and grading, traffic planning and design – to mention a few. Here, for example, are some ways in which traffic recorder returns, A854 forms, can be used to improve efficiency in the exchange maintenance and grade of service fields.

☐ Busied or faulty equipment and wiring, which may not be apparent under normal maintenance examination, may be identified by special records taken between the hours of midnight and six am.

☐ Imbalance in gradings and early indications of developing congestion or maintenance problems can be highlighted.

☐ Equipment and line plant quantities can be forecast together with designs for new exchanges and extensions to existing exchanges.

Traffic recorder readings are now processed by computer – Partially Mechanised Traffic Recording (PMTR). From a national standpoint it has resulted in three main benefits.

☐ Individual exchange files have been set up – giving both up-to-date and historical information.

☐ A Planning and Forecasting Information Library (PAFIL) has been established which in the future will contain all data and calculations associated with these duties.

☐ Asset Utilisation Factors (AUFs), which are a measure of how efficiently we are using our equipment and line plant, can be calculated.

$$AUF = \frac{Critical\ traffic}{Measured\ traffic}$$

This figure should tend towards 1 – a higher figure indicates a measure of over-provision and inefficiency.

So we can see that area, regional and national requirements in the grade of service, planning and forecasting fields are very much dependent on information produced by our traffic recorders. In the not too distant future FMTR, (Fully Mechanised Traffic Recording), will be introduced. This means that traffic recorders will be feeding information directly into a centralised computer. It will then be easy for the PO to establish its equipment requirements and translate these into orders quickly and efficiently. In turn, manufacturers will be able to programme their production lines more precisely.

Having said this, we must not lose sight of the fact that our little recorder is only *terrific* when it works accurately. It needs to be correctly jumpered and strapped and we need to be assured that it is recording on all groups and routes. Otherwise it is worse than useless. Proper maintenance is vital. So perhaps we could take our term PMTR again and apply the words – 'perceptive maintenance men take records'. Then, the answer to our original question would be a resounding – 'very useful'.

NIPTB/Sv2.3 (0232 33540)

Mercury-wetted relays in telegraph transmission equipment - an occasional problem

by **Benny Goodman,** Sv6.4.2

As the means of transmitting signalling current to operate customers' teleprinters there can be no doubt that mercury-wetted relays have been proved more reliable than the earlier polarised relays they replaced some years ago. The MCVF (multi-channel voice-frequency) channel cards on which they are mounted have an overall MTBF (mean time between failure) of between 20 to 50 years. But a relatively high proportion of the card faults which do occur are classified as FNF (fault not found) and we have been looking into why this is so.

What is a mercury-wetted relay ? A pressurised glass bulb containing a small amount of mercury encloses a reed armature which moves between two fixed contacts. Attached to the glass bulb is a small biassing magnet – the relay is a bi-stable device. The bulb and magnet are held inside the former of a surrounding coil and the whole assembly is housed in a protecting metal box. From a small pool capillary action draws the mercury along channels in the reed armature until it reaches the contacts. This is called 'wetting'. It provides for a clean 'make' and 'break' action and prevents the effects of contact bounce. A spark quench circuit consisting of a series CR network protects the contacts against the effect of reactive line impedance.

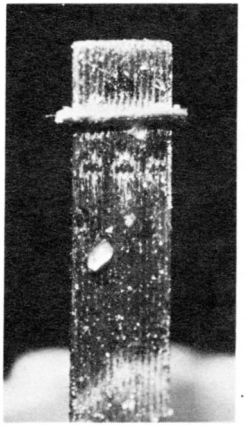
Where could the trouble lie ?

Our investigation led us to arrange for P&S Materials Section to carefully dismantle and examine some mercury wetted relays taken from channel cards on which FNF reports had been recorded. What they commonly found was that sparking damage had

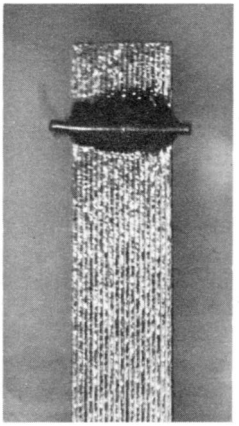
occurred not only on the contacts but also on the capillary channels, so that mercury was prevented from flowing.

The spark quench values are, of course, optimised. So they can't be equally effective against the full range of line characteristics. It appears that when sparking damage occurs the subsequent lack of wetting at the contacts causes them to stick or partially weld together. A slight tap or movement usually frees them and the relay seems to carry on working normally. But the evidence suggests that once such sticking has occurred it is liable to happen again.

To keep this matter in perspective we don't wish to suddenly label the mercury-wetted relay as a fault-prone item. (Bear in mind the overall MTBF mentioned earlier.)



Damaged capillary channels caused by sparking.



Undamaged capillary channels on reed armature.

The problem will have only a very small effect on service. What we recommend however is that MCVF channel cards which have faults that can't be attributed to other causes should be treated as if intermittent relay sticking is possible. Careful tapping may sometimes confirm this by bringing about an apparent solution. But it's not to be assumed that every FNF condition can be blamed on the relay. The rule should now be – when it's reasonable to suspect the relay, change it.

A final word of warning. Don't attempt to dismantle mercury-wetted relays. Mercury is poisonous and the relay bulbs are pressurised to several atmospheres. Disposal instructions are to be found in *TI E1 H1007.*
Sv6.4.2 (01-432 1316)

Letters

.....about face.

If Des Mason is to be believed, page 8 *MN 11,* my illusions about the setting of TIP targets have been shattered.

For many years I have fondly believed that, in collaboration with my EEs and AEEs, I have been setting the area's quality of service targets. These, having been agreed with my regional colleagues, have been used with those from other areas in the region to produce regional targets which the Director has agreed with MD/T.

Perhaps my 'transmit' and 'receive' are reversed.

L J Reece
Head of Maintenance Division
Plymouth Telephone Area

Of course, Mr Reece is correct. Target setting is an upward process, starting with individual units and building to national target figures. Discussion and, hopefully, agreement takes place at each stage.
Des Mason, Sv7.2.2

.....about keeping our energy conservationist out of the pub.

Mr Smith's article – page 3 *MN 11* made fascinating reading. But what about getting something done about it instead of voicing pious hopes ? Such a practice should be confined to 'saloon bar conservationists'.

Lutyens House, the building in which both Mr Smith and I work, would be a good start. Past complaints have failed to have any effect, but these were made in the cause of staff comfort, so perhaps the same points can be raised under the banner of the 'save it' campaign and get a better result.

☐ An archaic heating system distributes heat unevenly.

☐ The lighting is wired at right angles to the windows rather than parallel to them, so making it impossible to switch off the light nearest the windows without plunging colleagues into darkness.

☐ Some rooms are prone to draughts.

Unfortunately, a further complaint can only be overcome by having a greater energy input. I refer to the need to achieve an acceptable atmosphere for non-smokers. Does Mr Smith consider that additional ventilation for this purpose is unnecessary or are there plans afoot to have us all kippered in the pursuit of economy ?
Mike Florey, NP2.1.1

It is not unknown for heating economy to have an adverse effect on telecommunications equipment. So, bearing in mind the cost of putting things right, could this sometimes be a false measure ?

About switching off lights, could Mr Smith tell us whether it is more economical overall to leave fluorescent fittings on all day or to turn them on and off say 20 times in the same period ?

Last, although energy saving is important, was it an error of omission not to mention that safety must not take second place to economy ?
Gerald Taylor, Epsom, Surrey

I suspect Mr Florey wants me to help grind his particular axe.

The guiding principle for the energy saving campaign is that its measures must be cost effective and, to this end, all the things we have done so far have shown a saving within three years. Of course, our people in OP6.3.2 have not carried out these tasks personally, so in this respect we must plead guilty to being 'saloon bar conservationists'. But our role is to investigate new methods and systems, looking for the most productive approach and advise regions accordingly.

The accommodation standards in Lutyens House are not a part of my job.

However, it is true that the building is getting rather old and its services do not meet modern standards. The heating is not zoned and local control has to be done by turning off radiators. But improvements would cost far more than could currently be justified on fuel economy grounds.

Criticism of the lighting is certainly valid and if ever re-wiring became necessary the switching would probably be improved. But until we are threatened with major faults rewiring would be uneconomic.

Draughts are a continual problem and, like the other points which have been raised, are not confined to Lutyens House. I cannot pretend we have a solution yet, however, work in this field is now being undertaken by the PO in combination with Newcastle University.

Florey and suggest that he read TI M4 B0032 *carefully and then see if he can get democracy to work in his favour.*

All things considered I think that Lutyens House is quite a pleasant building to work in, and if Mr Florey has never faired worse he has been lucky.

I wish to thank Mr Taylor for raising the point about safety. He is right. It must come before economy.

In anticipation of his point about faults caused by low temperature, I looked into this some while ago but could find no real evidence. Unless icing conditions occur, and even our unoccupied buildings are usually held above 5 °C, we are more in danger of equipment problems due to ambient temperatures being too high.

As for lamp life, much has been published recently on the effects of frequent switching. Taking into account the deterioration caused each time this happens and the consequent increased replacement costs, a breakeven point at which increased costs equal savings, occurs at about 7 minutes between each switching cycle. This is about the same for both filament and fluorescent lamps. I consider that a lamp should be switched off if it will not be needed for 10 minutes.
R Smith OP6.3.2

. . . . about what happens to work unit values

What happens to the quarterly returns made by areas to regional HQs on maintenance man-hours per work-unit ? (*TI EI E1013* para 6 refers).

If, let's say, an average figure of 10.1 is submitted on FIA DE (Strowger Director) and only 3.14 for FIA IV (Line transmission), does this mean :

■ There's a shortage of transmission staff and the equipment is not getting proper attention ?

☐ Transmission staff are working three times as hard as their auto colleagues ?

☐ The WU value given on the A484 form (repeater station equipment) is out of date ?

☐ No-one takes any notice of the returns because the statistics produced from them are rubbish ?
K. J. Turner, LTR/West Area

In both the exchange and transmission fields there is a TI which indicates why work-unit values such as those on the A484 form are not continuously revised. For Strowger

equipment there is E6 DOO11 para 8 and for repeater stations there is E9 AOO11 para 18. Both say very much the same thing. They give as a particular reason – 'the desire to observe trends in performance over a period'.

What this amounts to is that the system is run in such a way as to deliberately allow for area returns on man-hours per work units to show, in general, a downward trend. So although it's possible that Mr Turner's first suggestion could sometimes be true, in which case service would eventually deteriorate, his third alternative tends to be more realistic.

Improved equipment, increased maintenance efficiency or a combination of both are the main reasons why man-hours per work-unit figures can be expected to fall from the original value of 10 as time goes on. Indeed, if they didn't we might construe that something was wrong. So such trends are expected and are useful to management as a measure of overall plant and manpower performance.

It happens that the work-unit form for Strowger exchanges (A342) has been revised fairly recently and so a performance figure of 10.1 is near what can be expected for properly maintained equipment. The equivalent form for repeater stations (A484) was last revised some years ago and the present low figure for man-hours per work-unit is an indication of improvements attained since then. However, I am told that – 'the whole aspect of manpower and work-units for repeater stations is currently under review.'

One further point – the TIs I have mentioned take care to point out that – 'work unit values alone are not intended as a basis for assessing numbers of staff to be employed'.

D J Knight, Editor

. . . . about cable joints

Issue 10 carried an article on a particular method of making injection welded sheath closures which is used in Wales and the Marches. This is one of several techniques currently being studied and another method is on trial in several other regions.

Unfortunately it is not enough for a newly made joint to be leak free. The choice of material, excessive heating or a generally unsound technique can lead to an apparently good joint failing later. It is worth bearing in mind that when epoxy putty was introduced it was heralded as a breakthrough following our experiences with expanding plugs, but this in turn has been shown to have failings. There are general indications that putty may be slightly more reliable than lead plumbing, (some may remember cracked and porous wipes), but performance seems to vary.

As the article says, injection welding seems right for getting improved reliability from joints in polyethelene sheathed cables, but we must be sure that the method is applied properly.

R H Derbyshire
OP10.2.3

Send your contributions to...

If you have a contribution to offer to *Maintenance News* other than a letter to the Editor, please forward it through normal channels to the *Maintenance News* agent for your Region or Telecommunications Board. The list is shown here. The editor cannot publish anything to do with current awards suggestions.

EASTERN	Mr B A Pearce	S1.1.1	0206 89307
ETE	Mr R G Brown	ET10.1.2	01-236 4262 x630
LONDON	Mr F T Booth	Sv8.1	01-587 8000 x7489
MIDLAND	Mr D C M Coshan	SM4	021-262 4052
NORTH EAST	Mr J Yarborough	S1.3.1	0532 37808
N IRELAND	Mr W J McKinney	Sv2.1	0232 41322
NORTH WEST	Mr F Smith	S2.1	061-863 7458
SCOTLAND	Mr R L Logan	S1.4.1.1	31-222 2390
SOUTH EAST	Mr R Bayfield	SM3	0273 201477
SOUTH WEST	Mr P R L Evans	Sv1.3	0272 295337
WALES & MARCHES	Mr E H Francis	S3.2.2	0222 391340

Post Office Telecommunications

THQ:ICU 791 12/77

Printed by Camgate Litho Ltd.