

**SUMMARY J. T. M. REPORT  
OF  
OPERATION AND MAINTENANCE  
OF  
PERUMTEL**

**( From May 1980 To May 1982 )**

**THIS REPORT HAS BEEN PREPARED  
BY  
JAPAN TELECOMMUNICATIONS MISSION (JTM)  
FOR PERUMTEL, INDONESIA**

**MAY 1982**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

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PART I INTRODUCTION

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## 1. Background

Technical cooperation with Perumtel by JTM (Japan Telecommunications Mission) was initially commenced in April 1977 under the Colombo Plan Agreement by the request of Indonesian Government to Japanese Government in accordance with Project PTA-75/A/JAPAN-AID.

Aim of the project is to assist Perumtel to establish steady running of uniform procedures and management systems in the field of Operation and Maintenance. Under PTA-75A, the JTM is termed as Advisory Team For Telecommunication Operations.

The first phase JTM project was carried out by seven JICA experts and completed in August 1979. Upon the completion, it was agreed between Indonesian and Japanese Governments that the project should be extended for further period of two years. Accordingly, new JTM team consisting of five JICA experts commenced the cooperation activities in May 1980 at Bandung with the duration of two year period until May 1982. The experts assigned for the second phase JTM project which cover the engineering areas of outside plant, transmission, telephone switching and traffic operation are shown in the Table below.

Table 1. Team composition and assignment period

Name	Organization(belonging to)	Period
Toru MIYACHI	Nippon Telegraph and Telephone Public Corporation	May 1980 ~ May 1982
Hiroshi HANASHIMA	-Ditto-	August 1977 ~ May 1982
Motonori ANDO	-Ditto-	May 1980 ~ May 1982
Tetsuo TAKAHASHI	-Ditto-	-Ditto-
Satoru HASHIMOTO	-Ditto-	-Ditto-

## 2. Scope of Work

As stated in a letter 'MTA-75A; Advisory Team for Telecommunication Operations' No.2871/Set.Kab/LN/P/1979 dated 15 May 1979, the JTM is to advise the Board of Director of PERUM-TEL, on necessary measures in order to establish efficient operation and maintenance system for sophisticated telecommunication network integrated by new techniques, assisting the implementation of an effective Operation and Maintenance Management System and unified O and M procedure.

The scope of work given in the letter is:

- 1) Assist in the implementation of unified standard procedures of operation and maintenance,
- 2) Assist in the implementation of SLJJ network operation management system,
- 3) Assist in the implementation of reporting system and operation and maintenance management system,
- 4) Advise to solve the technical problems which are disclosed through the above management.

## 3. Outline of Project Progress

During the past two years, the project has shown smooth and steady progress in close cooperation with Perumtel engineers concerned. Major findings, observations, proposals and recommendations of the second JTM project are summarized in the following chapters of this summary report.

Technical reports submitted to Perumtel during the past two years are 74 in total, which include draft procedures and instructions in various speciality of technical works and management system as well as advices to solve the technical problems which were disclosed through our activities.

Table 2. Technical Reports submitted to Perumtel

Outside Plant	16	Switching	13	Total 74
Transmission	31	Traffic	11	
—	—	Others	3	

Now, we think, the project has progressed fairly well, though not sufficient, as far as procedures necessary for basic O and M management system are concerned. However, in order to achieve more reasonable services in telecommunication and in particular to work out sophisticated system meeting the technological advancements, further cooperation in this project is very desirable from the view point of technology transfer.

All of the JTM experts are very grateful for the constant rendered by Perumtel officers to conduct the duties. *assistance*

## PART II      OUTSIDE PLANT

### Summary Recommendations

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## Summary Recommendations

### 1. General Recommendations

The recommendations mentioned hereinafter are mainly based on our observation, study and the information obtained through JTM technical cooperation activities. It is, we believe, in the interests of Perumtel to mention that the present outside plant maintenance situation is not satisfactory and we request that Perumtel will pay urgent attention and positive thoughts on the subjects mentioned hereinafter.

We note that most of the subjects have already been taken up by Perumtel for serious examination. Therefore, the intention of the recommendations is to facilitate the problem-solving with concerted efforts and to maximize the efforts by all officers concerned.

Outside Plant is exposed to various environmental conditions in the open-air. It is affected by natural environmental conditions such as temperature, wind, moisture, sunlight, lightning, earthquake, geological and geographical condition, birds, insects, and social factors such as electric power lines, electric railways, polluted air from factories, and road traffic. It is impossible to keep outside plant in good condition for a long time without any maintenance work.

Therefore, adequate maintenance work is needed to maintain outside plant in perfect condition. Neglecting the maintenance of outside plant causes accelerated deterioration of plant, shortened plant life, degraded telecommunication service quality and unexpected breakdowns. These result in huge expenditures for restoration of plant, expenditures several times as large as the ordinary maintenance costs. Therefore, it is most important to keep the outside plant in the best possible conditions by adequate maintenance.

Since the largest number of faults occurs at outside plant, problems concerning the outside plant maintenance must be dealt with on sufficient emphasis.

### 1.1. Upgrading of practical skills

The present maintenance personnel skill levels concerning installation, fault location and fault clearance are rather discouraging. Also, it is doubtful whether contractor's work and its acceptance tests are performed in a thorough and workmanlike manner in accordance with laid-down standards.

Under this situation, it is recommendable to take urgent steps as follows:

- some accepted practices and standard instructions concerning outside plant maintenance works should be thoroughly reviewed for adequacy. Standard Instructions which are easily understandable even for unskilled maintenance staff should be prepared.
- the training by using such Instructions should be conducted to the staff. On-the-job training system should be established. Kepala Sektor and senior-technicians are the key persons who are responsible for grading-up technical skills of their staff through actual jobs being conducted every day.
- outside plant maintenance staff is astonishingly poor equipped with tools, measuring instruments and transportation means as well as the necessary instructions. Positive thought should be given to solve such problems.
- present specifications concerning contractor's work and the acceptance tests seem to be incomplete from the engineering point of view. This is partly attributed to the great changes that have been taken place in outside plant technologies in recent years. The inspectors, we think, require to undergo intensive training to be conversant with supervision and acceptance techniques.
- it is necessary to review the present Outside Plant design, construction standards and methods, and to improve the quality of constructive work; trouble-free jobs which will be the best protection to avoid faults when the plant is handed-over to maintenance stage.

## 1.2. Elimination of deteriorated plant

We have observed many deteriorated outside plant almost everywhere. They are caused not only by effects of age, but also by inadequate installation methods and poor workmanship as well as unsuitable designs and poor contractor capability.

It should be noted that even if daily maintenance activities have been carried out effectively and properly, the number of faults can not be reduced unless such deteriorated plants have been rectified or rehabilitated. The daily maintenance activities can not cover all such problems. Coordinated actions of design group, construction group and maintenance group must be initiated to solve the problems.

In this regard, it is suggested that:

- standard procedures to eliminate and to rehabilitate deteriorated plant should be laid down. The procedures will give the limits beyond which the plant will be treated as bad plant from the maintenance point of view.
- inspection should be initiated progressively and routinely to check for deterioration on the existing plants. The inspection should be focused on a priority basis on the plants which cause high fault incident such as drop-wire section, D.P. etc. And an adequate comprehensive implementation program should be worked out annually within their own available resources.
- the above implementation program should be executed in the following two ways in parallel:
  - (a) to incorporate the program in the development plan in such cases that outside plant re-arrangement is expected for a new exchange installation, or that a new cable is under planning for new connections,
  - (b) to initiate a special maintenance project for rehabilitation of deteriorated plant in such cases that there is no possibility for these plants to be included in the development plan mentioned in (a) above within five years.

### 1.3. Demand management system

We have frequently observed the facts that many additional small-pair cables on one route have been installed within few year period. This is short-sighted problem solving attitude, only to meet the immediate demands and indicates the lack of demand management ideas. This must be avoided because such practice is not justified in the light of the basic concept of cable design engineering and economic comparison studies. It should be that the fundamental outside plant must be designed in such a way as the capacity should be sufficient to cover a specific period, say 5 years demands for local cables, including possible deviation from the estimated figures at the stage of design. In Perumtel, it seems that this concept is not implemented in many field offices and that a demand management system is not established yet on a regular basis.

The system should include:

- to analyse telephone demand in each small unit area,
- to trace telephone demand in a time series format and estimate future demands,
- to compare estimated demands with actual results,
- to examine existing outside plant position based on data obtained,
- to determine outside plant construction work necessity and priority,
- to give necessary designing information such as capacity and size of the cable to be installed.

#### 1.4. Introduction of Quality Control System

One of the main problems we have observed is the lack of the quality control principle and the follow-up systems in maintenance activities in Perumtel. According to our observation, though it is very limited, it seems that the system is not effectively applied in maintenance operations except a few cases such as in Jakarta Witel-IV. In Jakarta, certain attempts have been made to reduce the number of subscriber complaints based on the quality control concepts. This movement should be extended to other Witel by means of an uniform standard instruction to be prepared. The instruction should cover all kinds of telecommunication plant.

It can also be mentioned that the maintenance practices prevailing in Perumtel is of the repair when broken category (corrective maintenance). Steps should be taken progressively to the category of to prevent breakage based on quality control principles (controlled maintenance).

The quality control system, as mentioned by CCITT, is essential for up-grading the maintenance levels. The system aims at ensuring that field maintenance routines are effectively carried out and that a firm control is exercised by the administrative staff over the field operations. We believe that with the rapid expansion of telecommunication networks in Indonesia there will be a pressing need to introduce such a system in immediate future.

The major points to be considered necessary for introduction of the system are suggested as follows:

- to revise the current practices on statistics so that they can be effectively utilized in the quality control system,
- to set up a control by objectives system on main telecommunication facilities and services,
- to authorize routine inspection/test items and the periodicity as well as the methods on all kinds of equipment to be maintained, taking into account their effectiveness and less manpower requirements.

## 2. Project Proposal on Establishment of Outside Plant Maintenance Centre

Purpose of maintenance is to keep telecommunication facilities in a state of high performance to ensure good services to subscribers at all times. In other words, the purpose of maintenance is to prevent faults, to locate and clear faults quickly and reliably, and to achieve higher productivity in the activities.

Looking into the present maintenance service levels and field practices in outside plant sector of Perumtel, we notice that:

- maintenance technology and management system applied in outside plant sector fall much behind those in exchange and transmission maintenance sectors of Perumtel,
- present fault rate appears to be around 8 to 9 faults/100 tlp.-sets/month in average, which is still very high as compared with the ones in many industrial countries where the average rate is around 4 to 5. (Japan=0.55)
- outside plant faults represent by far the largest number of faults occurred in the telecommunication networks, accounting for more than 90% of all reported faults,
- faults being carried over for more than 6 days is considerably high. In industrial countries, 80 to 90 percent of the complaint faults is cleared within the end of the next working day (48 hours), and the faults being carried over more than 6 days is virtually 0%,
- average number of faults repaired per lineman per day is around 1 to 2 faults, which means very low productivity. Usually one lineman should clear 5 faults in average.

For details concerning the present service levels and maintenance practices, please refer to JTM study report, "Report of Study of Outside Plant Maintenance of Bandung Telephone Office -- Part I and Part II", issued on February and March 1982.

To improve the present conditions in outside plant maintenance, it is necessary among others:

- to intensify on-the-job training on practical skills for linemen and for supervisors,
- to improve fault location techniques by use of measuring instruments,
- to introduce modern management techniques concerning plant-record, fault statistics and analysis, maintenance material control etc.,
- to promote mechanization of the work force by using functionalized vehicles etc.

In order to realize the above objectives, it is recommended that Outside Plant Maintenance Centre will be established in all major cities in Indonesia. In this regard, we have submitted JTM project proposal, "Project Proposal on Establishment of Outside Plant Maintenance Centre under Colombo Plan Cooperation", issued on February 1982.

It is requested that Perumtel will thoroughly examine our proposal and take further steps necessary to obtain a Technical Aid under the Colombo Plan Cooperation.

We firmly believe that establishment of a functionalized Outside Plant Maintenance Centre is considered to be one of the most productive and effective measures for bringing about the substantial improvement. We are also of the opinion that with implementation of this project great benefits will be obtained by Perumtel because Perumtel could evaluate effectiveness of the Centre and formulate the future pattern of maintenance technology which would be applied throughout Indonesia.

### 3. Improvement programs of the current maintenance activities in Bandung

The experts have carried out a comprehensive survey and an overall study on the current maintenance activities in outside plant section in Bandung Telephone Office in co-operation with Tekjar. The objectives are to identify the problems of which improvement are required and to find solutions for the problems.

As a result of the survey, the experts have observed a number of problems awaiting the improvement for up-grading the maintenance service levels. And the experts have submitted JTM study report, "Report of Study of Outside Plant Maintenance of Bandung Telephone Office -- Part I and Part II", in which the experts have made a series of recommendations for consideration by Perumtel's officials concerned. The report presents the result of the study and proposes some countermeasures and/or suggestions to be taken up for improving the present maintenance performance.

The report mentions in particular the followings and the recommendations:

- a. Outside Plant faults represent 93.5% of all reported faults and the number of reported faults per 100 tlp.-sets per month is 7.36.
- b. 13.5% of faults is carried over more than 7 days.
- c. The number of faults repaired by one lineman is 1.17 in average.
- d. Regarding UG-DP and Pole-DP, methods of take-in wire and sleeve connection are often improper. Inspection is required for all DP.
- e. Regarding Drop-wire, methods of wire-connection, sleeve-jointing, hanging are often improper. Use of SD-wire is recommendable.
- f. Regarding RK and PCP, methods of jumper-wire termination, running and forming, terminal soldering and fixing etc. are often improper. Also we noticed that many obsolete terminal boards are still in use.



- g. Regarding In-house wire, methods of protection, places of wiring and jointing of wires are often improper.
- h. Regarding Rosette and Telephone-set, most of Rosette are not fixed on the wall, the pillar, the desk or furniture etc.
- i. Regarding Underground Cables;
  - very old deteriorated cables are still in use in many places,
  - faults due to civil works such as road digging are many,
  - fault location techniques are very poor, causing considerable delay of service restoration.
- j. Measuring instruments are provided only in very limited number and also in variety.
- k. Each lineman is not equipped with proper tools such as pliers, screw-drivers and nippers.
- l. Linemen carry no maintenance materials when they go out for fault repairs and they tend to repair on a temporary method without using materials.
- m. Vehicles provided in Bandung are very insufficient not only in number but also in outfitting.
- n. Storage and procurement procedures and storage facilities of maintenance materials require thorough review.
- o. Plant record available is incomplete and not up-to-date.
- p. Fault reporting and statistic system require sophistication based on quality control principles.
- q. On-the-job training system is not well established.

Since outside plant faults account for more than 90% of total reported faults in Bandung local network, we believe the problems concerning the outside plant maintenance must be dealt with on the first priority basis.

The recommendations made in this report are mainly directed to problems being considered to be urgent and to be effective as immediate relief actions without drastic changes from the present circumstances. In other words, the recommendations are only the first stage for improvement of outside plant maintenance activities.

And it is our opinion that there are a lot of more actions to be done in future, such as modernization of the activities and introduction of sophisticated control systems.

For details of the findings and the recommendations, please refer to JTM study report, "Report of Study of Outside Plant Maintenance of Bandung Telephone Office -- Part I and Part II", issued on February and March 1982.

#### 4. Production of Fault Repair Instruction

To encourage the field staff that they are conducting their jobs in conformity with Perumtel's Standard Techniques, it is very necessary for Perumtel to issue the Standard Instructions for all specialities of technical works on the construction and fault repair methods to be performed by field staff and contractors.

In this regard, the experts recommend that the first-phase program to produce the Standard Instructions should be concentrated on technical works related to the section between D.P. and telephone-set, because this section account for 50% of total faults occurred in outside plant.

For this objective, the experts have submitted a proposal "Technical Instruction Manual for the Fault Repairing between D.P. and Telephone-set". In this proposal draft, how to detect the faulty point and how to repair it are indicated only with easily understandable flow-charts and illustrations, without unnecessarily complicated explanation, so as to be practiced by field staff. The experts believe that such standard Instructions to be used by linemen, who are mostly less-educated, should be presented by photographs or illustrations as much as possible to help them easily understand proper methods of installations and maintenance works.

The experts hope that the "Standard Instruction" is distributed to all field staff after translated in Bahasa Indonesia as a Perumtel Standard Instruction. This proposal is now under examination and translation in Bahasa Indonesia by Tekjar to finalize as a Standard Instruction.

For details, please refer to JTM technical paper, "Technical Instruction Manual for the Fault Repairing between D.P. and Telephone-set", issued on 26 January 1981.

## 5. Upgrading of Cable Fault Location Techniques

When a cable trouble has broken out, it often takes much time to detect the exact point of fault, especially in underground cables. To take an instance in Bandung Telephone Office, it took often one week or so to locate the faults in a buried cable. And the experts strongly feel that appropriate and effective measuring instruments for the cable fault location should be urgently introduced in order to detect line faults speedily and accurately, and to shorten the period of service interruption.

In this regard, it is recommendable that at least the following measuring instruments be provided with in major exchange offices:

- Insulation Tester
- Pulse Echo Locator
- Wheatstone Bridge
- BW Tester
- Cable Fault Detector
- Cable Tracer
- Small Circuit Meter
- Pesawat Tlp. Test

In order to get the field maintenance staff familiar with fault location techniques by using appropriate measuring-instruments, the experts brought from Japan to Bandung several measuring instruments which have been widely used in NTT Japan.

They are:

Name of Instruments	Quantity
1. Insulation Tester (Tr-type 500V-1000M $\Omega$ ) .....	1
2. Insulation Tester (Tr-type 250V-50M $\Omega$ ) .....	1
3. No.3 Portable Line Fault Localizer .....	2
4. Pulse Echo Locator (MW32C) .....	1
Ni-Cd Battery Pack (MZ78A) .....	1
Battery Charger for Ni-Cd Battery (MZ81A) .....	1
5. No.20-F Oscillator .....	1
6. No.3 Searching Tone Amplifier .....	1
7. SD-Wire Fault Detector .....	1
8. Buried Cable Locator and Depth Measuring Equipment .....	1
9. Portable Generator (Model EX500-T) (AC Output:200V, DC Output:12V) .....	1

These instruments are of the donation by Japanese Government through JICA to Indonesia Government (Perumtel) for technical cooperation purposes.

The experts have made Instruction Manuals on these measuring instruments. The manuals instruct on how to detect the line faults, how to measure the distance to the faulty point and how to handle the instruments. In the course of Manual preparation, the greatest care has been paid that the Instruction Manuals are easily understandable and practicable by field staff without any difficulties.

Based on these Manuals, the experts have taken on a training on how to use the Instruments for field staff of mainly Bandung Telephone Office in cooperation with Tekjar. During the course, the experts were impressed that all the participants showed very keen interests to acquire not only the prearranged subjects for this course but also the broader knowledge on how to improve the present poor practices.

As a result of observations through the training course, the experts have found that:

- The participants lack the basic theoretical background to handle the instruments properly and to work out the exact answer from the measurements,
- Having a proper comprehension in theory for the measurements, the measuring instruments can be applied to be of wide application in accordance with the condition of faults and 100% utilization of each instrument can be expected.

In this connection, the experts recommend that:

- The key staff like supervisors participated in this training course should be given the advanced training courses at the Training Centre or other places, so that they can properly apply such instruments and can conduct on-the-job training for all the staff personnel.
- All kinds of measuring instruments for line fault location have been developed and currently used in the world. It is necessary to examine that the most suitable instruments from among these should be introduced to Perumtel, taking into consideration the environmental conditions in Indonesia, and these instruments should be arranged to all fields of maintenance sector.

For details, please refer to the following JTM technical papers:

1. Technical Instruction Manual for Cable Fault Location (Outside Plant Measurement) -- Part 1  
    (1) Tr-type Insulation Tester  
    (2) No.3 Portable Line Fault Localizer  
    issued on 26 February 1981.
2. Technical Instruction Manual for Cable Fault Location (Outside Plant Measurement) -- Part 2  
    Pulse Echo Locator  
    issued on March 1981.
3. Technical Instruction Manual for Cable Fault Location (Outside Plant Measurement) -- Part 3  
    SD-Wire Fault Detector  
    issued on April 1981.
4. Technical Instruction Manual for Cable Fault Location (Outside Plant Measurement) -- Part 4  
    Buried Cable Locator  
    issued on May 1981.

## 6. Relief measures for High-loss Subscriber Lines

In order to attain economically the transmission loss improvement for high-loss subscribers located far from their Telephone Exchange, the experts recommended the use of "Subscriber Line Loading System" as the most effective and economical means to be applied in Indonesia.

And as a result of discussions with Ka. Tekjar, it was decided that the proposal should be put into practice on a trial basis in Bandung area. (PATAL Textile Factory in Ujungberung)

According to calculation for a high-loss subscriber, it is expected that the transmission loss can be reduced by approx. 5~6 dB from the existing loss (13.2 dB), when this system is applied.

The necessary materials for this trial, such as subscriber loading coils, fitting devices and new telephone-set for high-loss subscribers, were obtained by the experts under Japanese Government contribution.

On 27 March 1982, the field trial has been put into practice in cooperation with Tekjar and Bandung Telephone Office, in compliance with JTM technical paper "Technical Instruction for Coil Loading for High-loss Subscriber Lines". This field trial is now under examination by Tekjar.

We hope that through further discussions based on this trial, Perumtel Standard Countermeasures for high-loss subscribers will be developed.

For details, please refer to JTM technical papers:

1. Techniques for High-loss Subscriber Lines, issued on 8 August 1980.
2. Technical Instruction for Coil loading for High-loss Subscriber Lines, issued on December 1981.

## Other Contributions

### 1. Technical Standard on Transmission Loss Assignment and Cable Jointing

In response to an inquiry about the jointing method of junction cable, including transmission loss assignment and transmission characteristics, the experts submitted a technical standard and reference data relevant to the subject.

For details, please refer to JTM technical paper, "Transmission loss assignment and cable jointing", issued on 7 July 1980.

### 2. Transposition method for Open-Wire Lines

In response to an inquiry about the transposition method for open-wire lines, the experts submitted a technical paper which gave in brief the theoretical explanation and technical design methods together with transposition charts.

For details, please refer to JTM technical paper, "Transposition method for Open-Wire Lines", issued on 24 September 1980.

### 3. Messenger Wire Installation Method

In response to an inquiry made by Direktorat Muda, Maintenance Bureau, about the Overhead Cable Installation with messenger wire, the experts submitted a technical paper which suggested an idea and gave the design, calculation and installation methods.

This is for the purpose to avoid ugly appearance of the streets by hanging down many cables overhead and to rehabilitate such bad plant as a provisional relief needs. The technical paper suggests that such cables will be bound and fixed to a messenger wire on three points between poles.



For details, please refer to JTM technical papers:

1. Overhead Cable Installation with Messenger Wire, issued on 15 April 1981.
2. Messenger Wire Installation to combine several cables, issued on 24 April 1981.

4. Comments on Perumtel's transmission plan specified in the "Fundamental Plan 1981"

The experts have gone through the "Fundamental Plan 1981" for comments on the Chapter V - Transmission Plan, and submitted the comments to Dirmudpran with revised and enlarged edition. Among the comments, it may be worth noting here that further examination is needed on the following matters:

- PCM transmission specification,
- Stability of singing, near-singing and echo,
- Calculation methods of minimum transmission loss,
- Calculation methods of summing up the noise,
- Loss assignment for subscriber lines.

Through discussions, we have agreed that these subjects would be dealt with by relevant Engineering Instructions when time is matured.

For details, please refer to JTM technical papers:

1. Comments on Chapter V. Transmission Plan of Fundamental Plan 1981 for the Telephone Network in Indonesia, Perumtel, issued on September 1981.
2. Comments with revised and enlarged edition, prepared by JTM, issued on 12 October 1981.

List of JTM Technical Report submitted

1. Transmission Loss Assignment and Cable Jointing,  
to Tekjar on 7 July 1980
2. Techniques for High-loss Subscriber Lines,  
to Tekjar on 9 August 1980
3. Transposition method for Open-Wire Lines,  
to Tekjar, Witel X on 24 September 1980
4. Technical Instruction Manual for the Fault Repairing  
between D.P. and Telephone-set,  
to Tekjar on 26 January 1981
5. Technical Instruction Manual for Cable Fault Location  
(Outside Plant Measurement) - Part 1,  
to Tekjar on 26 February 1981
6. Technical Instruction Manual for Cable Fault Location.  
(Outside Plant Measurement) - Part 2,  
to Tekjar on March 1981
7. Technical Instruction Manual for Cable Fault Location  
(Outside Plant Measurement) - Part 3,  
to Tekjar on April 1981
8. Technical Instruction Manual for Cable Fault Location  
(Outside Plant Measurement) - Part 4,  
to Tekjar on May 1981
9. Overhead Cable Installation with Messenger Wire,  
to Direktur Muda (Maintenance) on 15 April 1981
10. Messenger Wire Installation to combine several cables,  
to Direktur Muda (Maintenance) on 24 April 1981
11. Comments on Chapter V. Transmission Plan of Fundamental  
Plan 1981 for the Telephone Network in Indonesia, Perumtel,  
to Dirmudpran on 25 September 1981
12. Comments with revised and enlarged edition on Chapter V.  
Transmission Plan of Fundamental Plan 1981,  
to Dirmudpran on 12 October 1981
13. Technical Instruction for "Coil Loading for High-loss  
Subscriber Lines",  
to Tekjar on December 1981
14. Report of Study of Outside Plant Maintenance of Bandung  
Telephone Office - Part I,  
to Direktur Utama, Tekjar on February 1982
15. Report of Study of Outside Plant Maintenance of Bandung  
Telephone Office - Part II,  
to Direktur Utama, Tekjar on March 1982
16. Project Proposal on Establishment of Outside Plant  
Maintenance Centre under Colombo Plan Cooperation,  
to Direktur Utama, Tekjar on February 1982

## PART III TRANSMISSION

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## Recommendations

### 1. Fault Statistic System of Transmission System

The purpose of fault statistic system is to ensure that the telecommunication plant provides satisfactory services to the subscribers. For this, the following principles should be considered as fundamental requirements.

#### At field station

- Record each fault on a standard fault docket
- Summarize the faults data on a standard fault summary sheet
- Submit the summary to WITEL/H.Q.

#### At WITEL/H.Q.

- Evaluate the achievements in comparison with fault control target
- Analyze the statistic data if these achievements are unsatisfactory and initiate corrective actions.
- Produce and circulate an annual maintenance performance report.

The existing fault statistic system of transmission system in Perumtel should be improved on the following aspects.

#### At field station

##### a. Fault record

It was observed at the field survey of Bandung station that a notebook was used to record fault informations such as date, time, fault circuit name, fault condition etc. In order to produce the monthly report, Model CM-06, field staff in charge of statistics sort out the fault records registered on the notebook to summarize the data. This method can be acceptable in a small station with few routes.

However, in a big station with many control routes and circuits, difficulties emerges for the fault summarization by means of the method.

To facilitate the fault summarization, we recommend to introduce a fault docket which JTM had proposed instead of the notebook. Please refer to our technical report "Enacting and revising fault record slips" dated on July '79 for the models of fault dockets.

b. Summarization of fault data

We believe that fault statistics should be prepared both for circuit faults and for equipment faults. At present, in Perumtel, no statistic for equipment faults is produced. Since the equipment fault statistics is very important to evaluate the equipment performance and to take an appropriate action on equipment with poor performance. We recommend to introduce a standardized summary format for equipment faults. In our technical report "Fault control targets for trunk circuit, carrier line and equipment" dated on 29 Dec. '80, you will find our suggestion on the standardized summary format.

c. Submission of fault summary to WITEL/H.Q.

We observed many such cases that there are duplications of fault statistics, i.e., one fault is counted in both terminal stations respectively and reported to WITEL/H.Q. Consequently, WITEL/H.Q. may consider there were two faults on the circuit. Under such conditions, it is not possible to produce accurate statistics. To rectify this situation, it is necessary to assign a circuit control station for each circuit in order to make clear the responsible station for fault reporting on each fault. Regarding our recommendation in this aspect, please refer to our technical report "Designation of circuit control stations" dated on 25 Nov. '80.

At WITEL/H.Q.

a. Fault control target and chronological comparison

H.Q. summarizes the fault data reported from field stations, but does not go further to evaluate the summarized data.

In this regard, we recommend to set up the fault control targets as is shown in our technical paper "Fault control targets for trunk circuit, carrier line and equipment" dated on 29 Dec. '81. The proposed target figures are specified based on NTT's engineering instructions. With the accumulation of the performance data of existing transmission system in Perumtel, these figures will be subject to change.

Chronological comparison of the summarized result is also important to evaluate the maintenance performances in time sequence and we proposed several formats for this purpose, in our technical paper "Fault summary for transmission circuits/equipment" dated on 25 July '80.

b. Application of computer for fault statistics

In order to promote the application of computer for microwave fault statistics in Perumtel, we have programmed the job process and experimented a computerized fault statistic system with the Personal Computer available in JTM office.

Result of the experiment was successful to meet the requirement. With this system, it is possible that necessary statistics can be produced by inputting the reported fault data of each field station and output statistic can be compared with CCIR recommended performance standards. For details, please refer our technical report "Operation Manual of 'Fault Statistics' on Personal Computer" dated on 9 May '81.

We propose that based on the JTM proposals Perumtel will develop and finalize its own system with its own computer.

## 2. Routine Test

### 2.1. Routine Test of Microwave System

Maintenance methods are classified into three categories, that is, preventive, corrective and control maintenances. In order to attain effective maintenance activities, these three methods must be well coordinated. For implementation of routine test of microwave system in Perumtel, the preventive maintenance method has been generally applied so far and the control maintenance method has not been applied yet. Usually, the preventive maintenance method claims bigger number of staff and greater amount of work load than the control maintenance method for implementation of routine tests. By the control maintenance method, the effectiveness of each routine test item should be assessed in relation to the number of faults found in the test and the time spent in performing the test. Based on a result of the assessment, a reduction or an increase in the frequencies should be made and also same philosophy should be applied for test items.

When we compare the items and frequencies of the routine tests being conducted in NTT Japan with Perumtel, we could say that Perumtel performs the routine tests four times as much as NTT Japan. The less man-power in NTT has been achieved mainly by the introduction of the control maintenance method.

It is recommended that routine test method should be reviewed toward the introduction of the control maintenance method which was also recommended by CCITT. Recommendations on this matter has been submitted to Perumtel.

They are:

- "Routine testing items and period" on 3 Sep. '80
- "Test items and frequencies of radio systems" on 13 Dec. '80

In the above reports, we also emphasized the needs of establishing the fault statistic based on the control maintenance method. The items of routine tests and frequencies will be adjusted from time to time in accordance with the analyzed result of the statistic system.

## 2.2 Routine test of digital radio system

Microwave digital system will be introduced in Perumtel's networks in near future. We will be left behind, we are afraid, unless we now start to work out the maintenance system.

As the first step, we proposed the test items to be used at the acceptance test and the routine test by a technical paper "Study of Digital Radio System" issued on 24 Dec, '81.

Main contents of this paper are:

- thirty three items to be tested
- normal periodicity to perform each test
- testing method for each test item
- measuring equipment to be prepared
- setting up method of measuring circuit for each test item
- formats to record test result etc.

We recommend that Perumtel will draft a standardized routine procedure based on the above proposal.



### 3. Circuit Control Station

Circuit control means to control and to direct the testing, repair and maintenance of toll transmission circuits. The detail recommendations in connection with 'circuit control' appears on CCITT Recommendations, Orange Book Volume IV.I 'Maintenance'. In Perumtel, however, these Recommendations have been neither observed so far nor applied to toll circuits throughout Indonesia. In order to implement the circuit control based on the CCITT Recommendations, we recommend that Perumtel authorized the circuit control stations throughout the nation-wide networks.

With-out the establishment of circuit control system, as in the case in Perumtel, difficulties emerges in the over-all management of toll transmission circuits; In particular:

- Production of exact fault statistics is not possible.
- Immediate notification of fault to an appropriate station is not possible, which leads to the delay of fault clearance.
- No command is available for dispatch and coordination necessary for fault repair, particularly in emergency faults.

JTM report "Designation of circuit control stations" issued on 25 Nov. 1980, proposed principles and methods on how to designate the circuit control stations in accordance with the existing network structure. In this report, a full list of circuit control stations is given for further examination by Perumtel officials concerned. We hope that Tektra will finalize the system in consultation with Tekpon and other bagians concerned as soon as possible.

#### 4. Transmission Plan

##### 4.1 Transmission Level

Aim of a transmission plan is to specify the quality of transmission in a network to realize the subscriber's satisfaction on the speech quality in most economical way. Among the objectives to be specified in the plan, loss and noise are most significant. The Perumtel's transmission plan was specified in 1972 and has been applied for planning and maintenance practices. However, we have noted such problems that:

- (1) For the long-distance transmission section, there are several different level setting practices being observed in field stations, which do not comply with the standard loss defined in the transmission plan 1972.
- (2) Regarding the minimum loss of 3 dB between PTC and STE/RTE, specified in the plan 1972, the 3 dB is not sufficient from the viewpoint of singing stability.
- (3) Regarding MFC-R2 signal transmission, the signal employs frequencies higher than the reference frequency of 800 Hz, for example 1980 Hz. The 1980 Hz signal receiving level at receiving end may not be sufficient to operate the signal receiver under such condition that non-load cable is used for the section between PTC and STE/RTE.
- (4) Regarding noise objectives, no specification is given in the transmission plan 1972.

We have tackled with the above problems to find solutions. As a result of our study, we have recommended that:

- (a) Regarding item (1) above, the following new level setting methods should be standardized.

-Pad in Multiplexer of transmission equipment should be adjusted at 9-11 dB, instead of 7.5-9.5 dB or 12-12 dB which are the current practices in field stations.

- Since switching pad function is no longer necessary in 4-wire switching SLJJ network, pad function should be eliminated from CIT and BTM-10C toll exchanges which will be installed in future.
- (b) Regarding item (2) above, the 3 dB minimum loss should be increased by 1 dB to 4 dB, so that the probability of near-singing can be improved to about 1 %.
- In addition, we suggest that a further study should be made in order to specify the probability of near-singing in the transmission plan 1972, based on the present performance factors of SLJJ network.
- (c) Regarding item (3) above, when non-load cable is used for trunk junction between a terminal exchange and a primary toll center, the design standard to be applied should be the one which was recommended in JICA report "Improvement of telephone network in the city of Jakarta, 1981". Or, as an alternative method, we suggest that a frequency of 1500 Hz should be used as a reference frequency for non-load cable loss design, instead of 800 Hz.

For details regarding above recommendation, please refer to our technical report "Report of study on transmission plan for SLJJ network in Indonesia" dated on 31 Aug. '81.

#### 4.2 Fundamental Transmission Plan

Regarding the Perumtel's new transmission plan specified in "Fundamental plan 1981", we noticed that there were several issues which would require further study.

They are:

- to re-examine SRE and RRE values
- to specify standards regarding the stability of singing, near-singing and echo in conjunction with CCITT Recommendations.
- to specify noise assignment
- to determine calculation methods regarding minimum transmission loss
- to specify the digital transmission standard

For detail, please refer to our comments "Comments on Chapter V Transmission Plan of Fundamental Plan 1981 for the Telephone Network in Indonesia; Perumtel" dated on 25 Sep. '81.

## 5. Spare Part Management

At present, the spare part management at Tektra is being made by manual operation. Many varieties of spare parts and panels used in the transmission equipment, computer application for the jobs is considered to be preferable so that efficient and quick management can be achieved.

In this regard, we have developed a program to calculate the required stock level for each type of panel, spare parts and components of microwave plant.

It is recommended that Perumtel will introduce a computerized spare part management system by applying this kind of programs for the actual jobs. The details of the program are shown in our technical report "Spare part management on microwave system" issued on 21 Sep. '81.

## 6. Lightning Protection

We are consulted with Tekdaya to assist them in solving the technical problems concerning protection method against lightning in microwave plant and coaxial plan in Indonesia.

In this regard, contributions were made as follows:

- Proposal on a protection method against lightning to be applied in a radio relay station. For details, please refer to our technical report "Protection methods against lightning in NTT" dated on 4 July '80.
- Proposal on a installation method of lightning arresters at the inlets of commercial power. For details, please refer to our technical report "Arrester Installation Method" dated on 27 Oct. '80.
- Proposal on a lightning protection method for coaxial cable. For details, please refer to our technical report "The lightning protection method for coaxial cable" issued on 25 Nov. '80.

## Other Contributions

### 1. Optical fiber transmission system

JTM's technical paper "Optical fiber transmission system" dated on 27 Sep. '80, was produced for Perumtel's engineers who are interested in optical fiber technology to get the latest informations such as; the latest achievement of NTT on the development, advantages & feature, system structure & application area, components such as light source, fiber cable, detector etc.

### 2. Digital transmission system

A study was conducted by JTM to make comparison between digital and analogue radio systems on economical and engineering aspects. The study result is summarized in our technical paper "Study of Digital Radio System" dated on 24 Dec. '81. The study reveals, in short, that a digital system will have cost advantage to analogue system in five years if distance of the system is less than 1,000 km in general. In Indonesia, 77.6 % of existing telephone circuits falls within 1,000 km, which presents a good economical justification of introducing digital radio systems in Indonesia.

### 3. Computerization

#### (1) Advice on organization plan of Bagian Computer

We have been consulted on organization plan of Bagian Computer as follows:

- organization of computer division
- scope of works and job description
- jobs suitable for computer application
- steps to be taken before a computer is installed
- outline of computerized management systems and its organization concepts being implemented in NTT Japan.

For details, please refer to our technical report "Study on organization matters of Bagian Computer" dated on Dec. '81.

(2) Training on the computer

In order to give fundamental knowledge on how to operate the computer and how to program the jobs, we held a training course for Perumtel's staff for several weeks. To meet the evergrowing need of efficient management on O&M activities, we beleive that mastering the computer is very urgent problem in Perumtel.

The names of trainees who participated in this computer course were:

Mr. HUDIONO, Tektra

Mr. MADE NASA, Tektra

Ir. WORYANTO S., Tekkomput

## List of Technical Reports

### (Radio)

1. Cost comparison between analogue and digital systems; on 30 June 1980
2. The example of digital radio transmission system design; on 7 Aug. 1980
3. Data transmission through microwave system; on Aug. 1980
4. Routine testing items and periods; On 3 Sep. 1980
5. Dispatch of maintenance staff to remote stations for testing and fault clearance; on 25 Nov. 1980
6. Observation and comments on allocation of maintenance staff between technical group and operation group; on 29 Nov. 1980

[More effective staffing of skilled technicians is important to attain effective organization. In this report, we defined the duties of each section, reorganized the sub-sections and specified the job responsibility.]

7. Tests items and frequencies of radio systems; on 13 Dec. 1980
8. Trouble shooting on microwave systems; on 27 Dec. 1980
9. Calibration of microwave system measuring instruments; on 9 Jan. 1981

[The calibration system is essential to maintain the performance of microwave network. In this regard, the working standard consisting of minimum measuring instruments for calibration should be established as the first stage within available fudgetary resources. In this report, the first stage working standard is suggested.]

10. Reporting system on microwave system; on 20 April 1981
11. Portable radio equipment for extraordinary failures on remote repeater station; on 20 April 1981
12. Availability on a microwave route having plural working channels; on 2 May 1981

[In this report, the concept of availability is explained in detail based on CCITT Recommendations on a microwave route like Jawa-Bali Microwave route which consists of more than one working radio channels and a stan-by channel.]

13. Operation Manual of "Fault Statistics" tape on Personal Computer; on 9 May 1981
14. Standard operation and maintenance procedures for maintenance management in transmission field; on 19 Sep. 1981

[In this report, a list which shows overall picture on how to formulate and systematize Standard Instructions necessary to be specified in transmission field.]

15. Spare part management on microwave system; on 21 Sep. 1981
16. Study of Digital Radio System; on 24 Dec. 1981

(Multiplexer & Carrier Line)

1. Fault summary for transmission circuits/equipment; on 25 July 1980
2. Designation of circuit control stations; on 25 Nov. 1980
3. Fault control targets for trunk circuit, carrier line and equipment; On 29 Dec. 1980
4. Alternative routing plan; on 31 March 1981
5. Work schedule for alternate routing system design; on 10 April 1981
6. Report of study on transmission plan for SLJJ network in Indonesia; on 31 Aug. 1981
7. Comments on Chapter V. Transmission Plan of Fundamental Plan 1981 for the Telephone Network in Indonesia, Perumtel; on 25 Sep. 1981

(Power)

1. Protection methods against lightning in NTT; on 4 July 1980
2. Arrester installation method; on 27 Oct. 1980
3. Lightning protection method for coaxial cable; on 25 Nov. 1980

(Computer)

1. Operation Manual of PC-8001 Personal Computer; on 20 May 1981
2. Study on Organization Matters of Bagian Computer; on 5 December 1981
3. Office Automation System in NTT Japan; on 2 Feb. 1982

(Others)

1. Report on Expert's Trip (Medan and Ujung Pandang Areas); on 1 Sep. 1980
2. Optical fiber transmission system; on 27 Sep. 1980



## PART IV TELEPHONE SWITCHING

### Summary Recommendations

1. Improvement of Subscriber Complaint Control System ..... IV- 1
2. Production of Maintenance Standard Instructions .. IV- 5
3. Establishment of SLJJ Network Management Structure ..... IV- 10

### Other Contributions

1. Calculation Method to determine Maximum Subscriber Accommodation in PRX Exchange ..... IV- 12
2. Qualification Standards of PABX Maintenance and Installation Contractor ..... IV- 13
3. Guideline of Traffic Measurement for XB Exchange.. IV- 13
4. Guideline to determine the Required Number of Maintenance Staff ..... IV- 14

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## Summary Recommendations

### 1. Improvement of Subscriber Complaint Control System

The purpose of a subscriber complaint control system is to ensure :

- that each complaint reported by a subscriber is given proper attention by Test Desk and Repair Staff,
- that the fault is located and cleared as quickly as possible,
- that a remedical action is effectively carried out, based on quality control principles, when the service offered to subscribers is found unsatisfactory.

Looking into the current practices in Perumtel from the above aspects, what is most lacking is the third subject ; i.e. establishment of a quality control system. The experts carried out a comprehensive survey and an overall study on the current activities being practised in Test Desks in Bandung and Jakarta areas in cooperation with Tekpon. As a result of the survey, the experts have submitted JTM study report, 'Reporting and control procedures on subscriber's complaint in local networks' dated on 15 Nov. '80. The report analyzes the Test Desk procedures for subscriber complaints and proposes certain measures to be taken up for improving the present procedures.

The report recommends among others the followings :

- a. To try clearing subscriber faults on the same day as reported.

One of the reasons which causes the delay is that the MU-4 issued by Test Desk is not handed over to the outside plant maintenance unit immediately, mostly on the next morning in Jakarta. In the case of faults due to exchange equipment, immediate notification is done by telex arrangement. We think a similar arrangement should be considered for the case of outside plant faults by means of a simplified faximili apparatus.

b. To pay more serious attention for a repeated faults.

In Jakarta, repeated fault control is partly observed in such a way that a faulty drop wire will be replaced if three faults occurred repeatedly on the same drop wire. We recommend that this kind of control should be extended to all repeated faults systematically. We suggest to establish the following steps :

- step 1 : when a complaint is received at the counter /test desk, history of the faults of the subscriber should be examined by TEL-18.
- step 2 : if it is found that three or more faults are recorded on TEL-18 within a period of the latest six months, this complaint should be treated as a repeated fault complaint.
- step 3 : in this case, special remarks should be recorded on the TD-1 by red colour and also the particulars of the past faults should be indicated on the TD-4.
- step 4 : in Dinas Luar/Dalam, the repair work of the fault should be allocated to a senior technician for special examination.

c. To specify performance targets in order to evaluate service performances in terms of subscriber complaints on a systematic and continuing basis.

Perumtel has already specified a target for this purpose as a part of MIS control system ; i.e. 8.0 faults/month/ 100 subscribers. However, this is not enough to initiate any action when the target is not met. Targets should be specified more elaborately so that the analysis can identify the weakest section/ exchanges where actions are urgently needed.

Our suggestions in this regard are as follows :

### Ordinary telephone

- i. The number of subscriber's fault complaint per 100 main telephones should not exceed 5 per month,
- ii. the break-down of the above target by plant is :

subscriber's installation	1.0
cable plant	3.0
central exchange	0.5
failure to detect the cause of fault	0.5

-----  
total 5.0

- iii. Special action should be initiated when three or more faults are reported on any ordinary telephone line within a period of 6 months.

### Public coin-box telephone

The number of fault complaints per set should not exceed 2 per month,

Note : This target can be applied to the auto-exchange office which has more than 20 public coin-box telephones.

### Leased circuit

The number of fault complaints per circuit should not exceed 1 per month,

Note : This target can be applied to the auto-exchange office which has more than 20 circuits.

### Carried over fault

The percentage of carried over faults should not exceed :

- 70 % of the total faults repaired within one day
- 90 % of " within 3 days
- 0 % of " more than 7 days

### Average repair hours

Average repair hours to clear a fault should be less than 3 hours

d. To hold Quality Control Meeting in every offices

Since the field manager is fully responsible for the quality control movement in his exchange area, it is recommended to hold a weekly or monthly meeting to discuss the problems related with the subscriber's fault complaint service. The meeting should be attended by all officers in charge of maintenance under his control. According to our observation, a beginning stage toward this end has already been initiated by Jakarta Witel IV. This movement should be encouraged and extended with great emphasis on establishment of a systematic quality control system. Because of the large number of subscriber's fault complaints together with accumulation of deteriorated outside plant being observed in most exchange areas, we believe there is a pressing need to introduce a quality control movement for the Perumtel maintenance activities at large and for the subscriber's fault complaints in particular.

e. To produce annual maintenance performance report at Head Quarters

In order to improve the service performances, it is important that incentive for improvement should be given to all exchanges in such<sup>a</sup> way that their achievements can be compared with other exchanges under a similar situation. Annual report should clearly indicate the performance levels of all exchanges to enable the field managers to compare their efforts.

For details concerning the above recommendations, please refer to JTM report ' Reporting and control procedures on subscriber's complaint in local network' submitted to Perumtel on 15 Nov. '80.

## 2. Production of Maintenance Standard Instructions

Purpose of producing maintenance standard instructions is to specify standard methods on engineering practices and procedures for each particular job. If a person assigned were always experienced and competent to the job, there would be no problem. But in reality, this is not the case. In order to operate and run all necessary jobs in an organized and orderly manner, the standard instructions will have to be produced.

In Perumtel, efforts have been made for production of complete series of standard instructions. However, as far as we observed in exchange offices, we could not find such manuals. When the maintenance staff encounter difficulties to conduct their duty, they tend to find the solutions referring to manufacturers' manuals which are also not easily accessible for the staff.

In this regard, we recommend primarily for Perumtel to formulate a philosophy and fundamental procedures on production of standard instructions. The philosophy and fundamental procedures may be as follows :

- a. Objectives : to provide all maintenance personnel with clearly defined methods on relevant practices and procedures.
- b. Subjects to be taken up
  - Maintenance principles.
  - Maintenance control system to follow up the above principles.
  - Fault recording and statistic system.
  - Programming of maintenance routines in preventive, corrective and quality control methods.
  - Techniques and practical skills for testing, fault tracing, fault repair and handling of measuring instrument.
- c. Type of standard instructions :
  - to be classified into two types ;
  - Maintenance administration instructions
  - Maintenance routine instructions which specify such methods as testing, fault repairing, measurement etc.

- d. Numbering scheme : for example four digit coding  
is shown in Table 1 on next page.
- e. Distribution : to establish distribution codes and methods so that all relevant staff can obtain relevant instructions necessary to perform their jobs.
- f. Amendments and re-issues : to specify the methods & rules to replace one or several pages, or to revise a complete instruction on a specific subject.
- g. Filing : to have a good storage of instructions, durably.

In order to facilitate the production of standard instructions by Perumtel, the experts have contributed as follows :

a. Maintenance instructions for SPC exchange equipment

The experts have been requested to cooperate with Tekpon to produce maintenance standard instructions on PRX and MC-100. For this purpose, the experts have submitted the following technical papers which describe current practices and standard maintenance methods being applied for SPC exchanges in NTT Japan.

- i. D-10 type exchange routine tests (14 Jan. '81)
- ii. The main objective of introducing D-10 system into NTT network (20 Jan. '81)
- iii. Acceptance inspection standard in SPC system in NTT. (11 Feb. '81)

b. Maintenance instructions for PABX

Upon request by Tekpon of producing standard maintenance instructions for PABX, the experts have submitted the following technical papers which describe outline of standard maintenance methods on small size XB PABX installed and maintained by NTT Japan. ' Maintenance control for PABX' dated on 9 Sep. '80 .

c. Maintenance instructions for public coin-box telephone

Upon request by Tekpon of producing standard maintenance instructions for public coin-box telephone, the experts have submitted the

Table 1. Numbering Scheme

1st digit	2nd digit	3rd digit	4th digit
0	0 Manual exchange	0 C1	0 Routing testing
1	1 Step by Step exchange	1 C2	1 Adjustment
2	2 Crossbar exchange	2 Rural	2 Traffic equipment maintenance
3 Telephone Switching	3 Analogue SPC (local)	3 C400	3 Fault tracing
4	4 Digital SPC (local)	4 C45	4 Acceptance test
5	5 Toll trunk exchange	5 C460	-
6	6 (spare)	6 C9	-
7	7 Test desk	7 Centrex	-
8	8 Power plant	8 (spare)	-
9	9 General (Administration)	9 General	-
			0 Fault reporting
			1 Fault statistics
			2 Fault analysis
			3 Test programming
			4 Reporting
			5 Actions
			6 - 9 -



technical papers which describe main features of standard maintenance instructions of NTT Japan for the maintenance of booth-type public coin box telephone instrument. It is recommended that Perumtel will produce a similar pattern of instructions. As far as we observed in field exchanges, no technical literature or manual is available to the repairmen. The details, please refer to 'Maintenance control for public coin-box telephones' dated on 22 Sept. '80.

d. Maintenance instructions for NEC/HITACHI crossbar exchange equipment

Upon request by Tekpon of producing standard maintenance instructions for NEC/HITACHI crossbar exchange equipment, the experts have submitted the draft instruction which focusses on routine test methods and the routine frequencies. The report is 'NEC/HITACHI exchange routine test instruction' dated on 26 Mar. '81. The experts worked out a draft of the instructions and submitted it to Perumtel. The draft specifies :

- routine test methods
- routine test frequencies
- minimum stock level of spareparts to be held at each exchange
- list of maintenance tools to be kept at each exchange
- list of measuring sets to be kept at each exchange and at the parent exchange

Through the course of working out the draft, the experts experienced difficulties due to lack of information because of incomplete description of manufacturer's manuals to make the draft practicable and easily understandable for field technicians who are normally less-educated. We have the opinions that the manufacturer's manuals are generally too complicated and lengthy to be maintenance standard instructions.

e. Maintenance instructions for technical inspection on exchange maintenance activities

Upon request by Tekpon of producing a standard method on how to inspect and evaluate exchange maintenance performances which will be carried out by Head Quarters or Witels, the experts worked out a draft instruction, 'Check points of technical inspection on exchange maintenance activities' dated on 24 Nov. '80. The draft listed the checking items for switching equipment, power plant, test desk and administrative activities as well as personal skill level.

f. Maintenance instructions for plant control values of switching equipment for performance evaluation

In order to make comparison in equipment performances among many similar type of exchange offices throughout Indonesia, it is essential to specify an acceptable performance value, by which the performance of each exchange equipment can be measured and an action will be initiated if the actual performance is not satisfied with the control values. In this regard, a suggestion has been made by the experts in our technical report 'Plant control values of exchange equipment' dated on 17 Dec. '80. The report indicates the plant control values being specified in NTT for switching equipment used in Japan.

### 3. Establishment of SLJJ Network Management Structure

In Perumtel, needs of establishing a functionalized SLJJ network management are well recognized but we observe that the present situation is still far from the establishment. This is partly because the SLJJ management structure to be organized requires unique approaches different from local network maintenance structures.

The structures to be established for SLJJ network management can be classified into two categories .

#### a. SLJJ network maintenance structure

The SLJJ network is constituted with such transmission means as satellite, micro-wave, coaxial cable etc. and there are 4-wire trunk switching units such as MC-10C, Janus, ARM and combined PC-1000C in use. Since various maintenance units of transmission and exchanges positioned in various places through Indonesia are involved for the maintenance activities, the maintenance structure requires arrangements for close and systematic coordination on their activities.

In this regard, we recommend to establish Trunk Test Positions and Circuit Control Stations at appropriate trunk exchanges and transmission stations respectively. For the detail proposals on this matter, please refer to our proposal ' Establishment of SLJJ Network Management Structure ' dated on 6 May. '82.

#### b. SLJJ network management structures

The structure aims at making SLJJ network operate efficiently under any traffic overload condition and any faulty condition.

As is well known from our experience in the past, the network is forced to operate very poorly far below its maximum capacities if a proper network management structure is not organized. In this regard, we recommend to establish SLJJ network control centre in all Tertiary trunk exchanges. For the detail proposal on this matter, please refer to our proposal, 'Establishment of SLJJ Network Management Structure' dated on 6 May. '82.

In the above proposal report, we also suggested the measures to be taken in creating a disaster - proof SLJJ network which will be strong enough against service disruptions caused by such as earthquakes, typhoons or serious damages of telecommunications facilities.

## Other Contributions

### 1. Calculation Method to determine Maximum Subscriber Accommodation in PRX exchange

In response to an inquiry by Tekpon, a study was made on a standard calculation method to determine maximum number of subscribers to be accommodated in a PRX unit and the experts proposed an appropriate method, details of which are described in JTM technical paper, 'How to determine the effective capacity for D-10 SPC system' dated on 25 Apr. '81.

The proposed formula for the calculation is :

$$\text{effective capacity} = \frac{95 - \text{BHL}}{(\text{BHL} - \text{NTL})(1+Y)(1+1.8\text{CV})} \times \begin{matrix} \text{number of} \\ \text{working lines} \end{matrix} + \text{number of working lines}$$

where :

BHL is busy hour load of CPU

NTL is non-traffic load of CPU

Y is a time variable (usually  $Y \approx 0.1$ )

CV is a seasonal variation coefficient and can be represented by the following formula. (in ordinary cases for large city local exchanges in Japan,  $\text{CV} = 0.1$ )

$$\text{CV} = \frac{1}{\bar{a}} \frac{\sqrt{\sum_{i=1}^n (a_i - \bar{a})^2}}{12}$$

$a_i$  = calling rate measured monthly

$\bar{a}$  = annual average of  $a_i$

In connection with this subject, we have also proposed to introduce the concept of Mean Busy Hour Traffic defined in CCITT Recommendation for traffic calculation to determine the maximum number of subscribers accommodation in PRX unit.

For details of the concept, please refer to JTM technical report 'Mean busy hour traffic' dated on 17 May. '81.

## 2. Qualification Standards of PABX Maintenance and Installation Contractor

In response to an inquiry by Telkpon regarding an effective way to ensure good quality in contractors' works for PBX installation and maintenance, the experts proposed :

- to hold an authorized examination to qualify the persons who will engage in the contracted PBX works,
- to establish a procedure to qualify the contractors who will undertake the PBX works,
- to stipulate technical requirements on certain technical conditions desired in customer-provided PBX equipment in order to prevent damage or interference with the various services offered by Perumtel.

Details of the above proposals are given in JTM technical report 'Qualification for PBX maintenance and installation' dated on 3 Feb. '81. In this report, we have also given suggestions on what kind of subjects and questions should be taken up for the qualification examination, based on instances of the examinations held in Japan.

## 3. Guideline of Traffic Measurement for XB Exchange

In order to produce the Perumtel's guideline book 'Pedoman Pelaksanaan Manajemen Traffic Sentral Telepon Otomat' dated on April '81, the experts were requested to provide technical information regarding traffic measurement for NEC/HITACHI XB exchanges. Based on certain studies on the actual situation in Indonesia on the subject, the experts submitted a technical report 'Traffic measurement for NEC/HITACHI XB exchanges' dated on 7 May, '81.

Through the studies, the experts noted that

- no body in the XB exchanges knows the methods to operate the traffic measuring equipment installed,
- manufacturers' manuals are very incomplete as far as the description on how to operate the measuring equipment is concerned,
- no proper acceptance test for the equipment was likely conducted at the time of installation.

#### 4. Guideline to determine the Required Number of Maintenance Staff

In response to an inquiry concerning a calculation method to determine the required number of staff in Perumtel's field organizations for maintenance works, the experts submitted JTM technical report 'Staff standards' dated on 2 Nov, '81. This report was prepared mainly based on the staff standards of NTT Japan, and covered the maintenance areas of local exchange, toll exchange, local tandem exchange, test desk, power plant, PBX, outside plant and transmission plant.

List of JTM Technical Reports submitted

1. Maintenance Control of Private Automatic Branch Exchange (PABX) to Tekpon on 22 September 1980
2. Maintenance Control of Public Coin Telephone to Tekpon on 22 September 1980
3. Technical Information on SLJJ Charging System, SLJJ Public Coin Box Telephone and 'Centrex' in NTT to Pransen on 22 October 1980
4. Reporting and Control Procedure on Subscriber's Complaint in Local Network to Tekpon on 15 November 1980
5. Check Points of Technical Inspection on Exchange Maintenance Method to Tekpon on 24 November 1980
6. Plant Control Values of Exchange Equipment to Tekpon on 17 December 1980
7. Technical Instruction Drafts on SPC type Exchange Maintenance Method (refer to 'Note' on this page) to Tekpon on Jan. to May 1981
8. NEC/HITACHI Exchange Routine Test Instruction to Tekpon on 26 March 1981
9. Qualification for PBX Maintenance and Instration to Tekpon on 3 February 1981
10. Telephone Set for High Loss Subscriber Line to Tekpon on 6 May 1981
11. Traffic Measurement for NEC/HITACHI XB Exchange to Tekpon on 7 May 1981
12. Application of a Personal Computer for Spare Part Management at the DTM-100 Maintenance Center to Tekpon on 30 September 1981
13. Comments on 'Numbering Plan' of Fundamental Plan 1981, for the Telephone Network in Perumtel to Dirmudpran on 1 October 1981
14. Comments on 'Signalling Plan' of Fundamental Plan 1981, for the Telephone Network in Perumtel to Dirmudpran on 6 October 1981
15. Staff Standards to Dirmudtek on 2 November 1981
16. Establishment of SLJJ Network Management Structure to Diretur Utama on 6 May 1982

Note: Details of 7. Technical Instruction Drafts on SPC type Exchange Maintenance Method are as follows

- a. D-10 type exchange routine tests
- b. The main objectives of introducing D-10 system into NTT network
- c. Acceptance inspection standard in SPC system in NTT



## PART V      TRAFFIC

### 1. General

- 1.1. Introduction ..... V- 1
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## 1. General

### 1.1. Introduction

The traffic expert has performed his duty from the first phase of JTM through the second phase for five years continuously.

Five years ago, there was virtually no traffic operation conducted in the field of automatic telephone exchanges of Perumtel. And with a series of network development plans and rapid increase of subscribers and traffic, traffic congestion had been aggravated in many exchanges, especially in fully accommodated exchanges.

Therefore, in order to introduce the basic systems of automatic telephone traffic operation and its management, JTM began by enhancing the understanding of why and how the traffic business is necessary, what each sector of Perumtel should do for that, etc.

We are now going to look back, in brief, to the fundamental concept of the traffic business and the essence of its management in the following.

### 1.2. Concept of traffic business

#### (1) Role of traffic business

In order to provide satisfactory service in an economical way, telecommunication networks should be developed taking into consideration the both requirements of actual cost and grade of service.

The operation standard of traffic and the engineering standard of switching network are essential. They must be decided on an international level. For example, Switching loss/service standard and loss probability as recognized internationally are shown in Fig.1 and Fig.2. However, in Perumtel the standards were not well established.

Classification	N.T.T.(SLJJ)		Perumtel(JKT-Bd)	
	Standard Rate	Result	Sampled Result	
Dial Tone Stage Busy	0.5 %	less	} @ 20 %	
Switching Stage Busy	10 %	5 - 10 %		
Called Line Busy	15 %	@ 10 %	20 - 30 %	
Others (= Sub. Misuse)	-	@ 15 %	20 - 30 % (Fault, Misuse)	
Overall Grade of Service	70 %	@ 72 %	@ 25 %	

Fig.1 Switching Loss/Service Standard and Result in N.T.T. and Perumtel

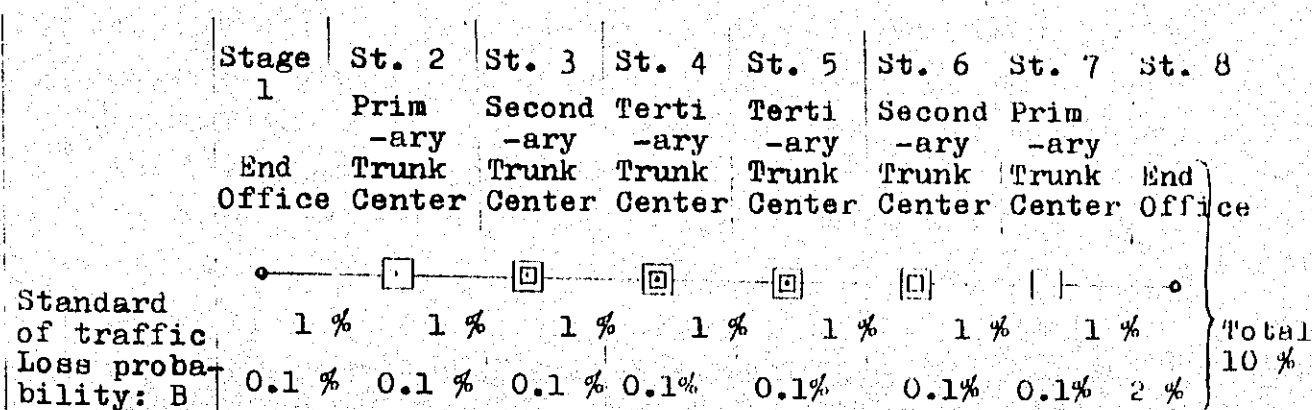


Fig.2 Loss Probability Assignment in SLJJ Final-Route

Management theory shows that the combination of three actions - Plan, Do, See - is the basis of good business performance. In telecommunication service, traffic operation (measurement and evaluation) corresponds to See, and reflection of traffic data to next expansion plan corresponds to Feed-back.

In spite of any attempt to make traffic forecast correctly, forecast errors in small traffic groups (routes, Ratusans) can not be avoided, which leads to some traffic imbalance or congestion in later years if this Feed-back of traffic operation result is not

applied to the network, because traffic often varies greatly in a range of years according to social development.

This is the reason why traffic operation is very important.

## (2) Two types of traffic measurements

There are two types in traffic measurements.

One is an analytical method, in which the amount of traffic is measured for each Stage of switching and for each traffic group. Then, based on the result of measurement, Loss Probability B (or Waiting Probability) is calculated. And if the loss probability does not meet the pre-specified standard, corrective action of network is taken for the Stage or traffic group in question.

The other is a method of overall observation, in which Successful Call Rate is counted by monitoring Subscriber calls or test calls. Then, overall service grade is evaluated statistically.

The latter method is used mainly for supervision and the former method is used mainly to take a concrete action of network correction.

## 1.3. Cooperation of JTM

At the starting point of the cooperation there was hardly basic traffic operation being conducted on automatic switching network and hardly enough understanding on the concept and technics of traffic business. Therefore, JTM has been endeavouring to penetrate Perumtel with the genuine traffic business, to establish the most appropriate technics and to improve the traffic operation through the On-the-Job-Training.

These efforts have started to ripen very recently,

and it is very delightful to see that regular traffic operation has been conducted on the routine bases. The operation includes analytical traffic measurement, underprovided facilities increase, subscribers removal for Ratusan traffic overload and actions for busy subscriber line.

The following chapters describe briefly of these systematic cooperations, including our proposals and recommendations.

## 2. Summary Recommendations

### 2.1. General Recommendations

#### (1) General traffic improvement plan (Aug. 1977)

A program to establish the basic traffic operation and management in Perumtel was proposed to Diroptektel. This program suggests formation of a pioneering task force to make a test and trial of traffic work in some pilot exchanges in Jakarta, etc. with a detailed plan of required manpower and skill levels and organizations.

This proposal did not make any immediate response. This seems, however, to give an incentive to the following project of Jakarta traffic measurement (see 2.2.(1)) and to movement of structuring effective traffic organization later year.

#### (2) Presentation of traffic and maintenance system with technical standards and results in NTT (Feb.1980)

This is a paper showing the main methods used in NTT and control values adopted in NTT. The needs of this kind of methods were gradually understood and agreed in Perumtel. And now this paper has repeatedly been referred to by Perumtel.

#### (3) Presentation of NTT traffic organization, job description and business flow surrounding Traffic Sector (April 1981)

In response to Perumtel's movement to build up proper traffic organization, this report suggests that an independent Bagian responsible for traffic operation exclusively is indispensable in HQ and Witel. The functions of Anedatel as an organization for traffic matters in Perumtel HQ should be enhanced so that all traffic data can be concentrated only to Anedatel, finalized by Anedatel and sent to planning sector for network designing. In this connection, traffic activities in Tekpon should be restricted only to technical matters concerning traffic measuring equipment.

Another important suggestion in this report is the flow chart of traffic management system, showing relationships with maintenance, construction, network planning, designing

and commercial sectors. Well-clarified job descriptions, which are provided in the paper, are one of the most important things to be implemented.

#### (4) Staffing Suggestion (Jan. 1982)

Requested by Anedatel to strengthen the present functions, JTM prepared a paper on staff standards. In this connection, Dirmudnitel have taken-up an action on training traffic staff, selected among those who graduated switching course in T.T.C. In order to upgrade quality of traffic operation, it is very effective that traffic training courses especially in T.T.C. are implemented for senior leaders of traffic sector. This program should be regularly conducted every year or so, and good training texts and lecturers should be prepared systematically.

### 2.2. Measurements and analysis of traffic in big cities

Traffic measurements and analysis were conducted in Jakarta and other big cities in Indonesia with the following intentions:

- to study and develop a standard method for traffic measurement and analysis in networks which consist of various types of switching system under circumstances where traffic meters are often not available,
- to examine and develop a standard traffic analysis method and a standard network planning technique to improve the services in local and STD networks, particularly in complicated multi-exchange local networks consisting of different types of switching system,
- to help the persons in control positions to understand the basic matters of traffic engineering so that they can initiate such actions as network correction or subscriber removal which require close coordination among traffic, maintenance, construction and commercial sectors.

Results of the traffic measurements and analysis are compiled in JTM reports as follows.

(1) Jakarta traffic measurement report (June 1978)

Perumtel's first and full-scale traffic measurement project was conducted in Jakarta to eliminate aggravating heavy traffic congestion. This big project of several weeks measurement by 50 to 70 people was itself very commendable and gave a great impact on people concerned. However, the calculation and evaluation work of the traffic data did not last long and stopped after making an interim report of junction traffic amount. Then, JTM expert alone went through to produce the final Jakarta traffic report with a recommendation of network correction.

During this work the following points were found:

- a. Jakarta junction network has a complicated features with EMD and PRX combination. This seems too difficult not only for traffic sector to evaluate traffic data on the network but also for planning sector to correctly design it. Design manual from PRX Co. seems to have some theoretical incorrectness.
- b. Considerable amount of errors in simple primary calculation of traffic data was found when I checked the measurement results.

(2) Recommendation on Jakarta network correction (Sept. 1978)

This report recommend that because of a lot of traffic imbalance, around 70 % of overload can be solved only by jumpering or subscriber transfer. Though there was no immediate response of the proposed network correction action at the time, this kind of action has gradually started since around last year in Witel of Jakarta.

(3) Traffic measurement reports in Medan (Ur49A), Solo (ARF-102), Surabaya (EMD), Ujung-pandang (HKS-442) and SKSD manual network

As a technical matter, it can be noted here that Waiting System for Registers and Markers should be used in Solo exchange for the measurement of their Holding Time.

In SKSD Interlocal system the problem of priority of selecting satellite circuits and terrestrial ones was studied. However, this problem is not solved theoretically. This should be further studied.



(4) Satgas traffic work (Jakarta) report (Oct. 1980)

Satgas (Satuan Tugas: Unified Task Force for telephone maintenance and operation improvement) was working since 1979 and asked JTM some technical help. JTM then analyzed and evaluated their data and pointed out some technical problems, especially the needs of urgent network correction in Jakarta.

(5) Contribution to upgrading "Successful Call Rate Campaign" in big cities (Dec. - Jan. 1982)

Perumtel has started since last year "Campaign of Successful Call Rate Improvement (from actual 25% to 40% target in one or two years)" under the instruction of Perumtel top.

JTM joined this project and made proposals for "Improving the rate in Bandung network". JTM traffic expert also joined Surabaya and Denpasar traffic measurement and action campaign. These are as follows:

a. Bandung network and SLJJ network (Dec. 1981)

JTM conducted a study which included analysis of Anadatel traffic report (Oct. 1981) and examination of Sofrecom's SLJJ traffic report (Aug. 1981) and also traffic measurement on Bandung local junction by JTM. The JTM reports pointed out, among others, as conclusional means of relieving heavy congestion in Bandung network, the following urgent actions:

- to increase some local junction and especially to separate SLJJ I/C junctions (actually via Centrum I/C switch) to direct ones to each exchange,
- to increase the number of lks in CIT Bandung, which is now very much underprovided,
- to increase SLJJ circuits between Bandung and Jakarta,
- to relieve highly busy subscriber lines and P. Ratusans (subscriber stage group).

As for SLJJ network in Java, introduction of Alternate Routing System is the most effective way of alleviating traffic congestion existing in main routes.

b. Surabaya and Denpasar traffic measurement

Though detailed evaluation is still underway by Anadatel, the measurement in April this year shows that many Ratusans in Surabaya Selatan, Darmo and Denpasar as well as Surabaya local junctions have big overload to be corrected.

As to SLJJ I/C junctions in Surabaya, JTM found a structural problem. That is, the trains from CIT to Sela-tan and to Darmo have two routes respectively, one is a direct route and the other is via Utara I/C GS for overflowed traffic. However, with such large amount of traffic on these direct routes, re-routing of overflowed traffic via Utara is not justified. Therefore, it is recommended to stop the re-routing function of CIT and to re-dimension the number of corresponding junctions.

### 3. Production of Standard Procedures of Traffic Operation and Action (Jan. and April 1982)

JTM prepared three most basic Technical and Operational Instructions on traffic measurement, traffic evaluation and subscriber stage traffic arrangement action. We believe that these are the most appropriate procedures in the current network here. These are as follows:

#### (1) Technical Instruction: traffic measurement - 1

This describes the Manual Count Method for traffic measurement in Step-by-Step system, and for circuits and Registers of crossbar system. This gives enough accurate traffic data in shorter days.

#### (2) Technical Instruction: traffic evaluation - 1

This is a traffic evaluation method which shows the calculation method by use of Traffic Evaluation Sheets. The sheets is designed in such a way to indicate, by itself the necessary traffic actions such as the number of junctions to be increased, the number of subscribers to be removed from Ratusans etc.

#### (3) Operation Instruction: Traffic Action - 1

This aims at establishing a standard procedure of actions to be taken at subscriber-stage. The actions include subscriber removal from overload Ratusans and Subscriber Allocation Control for new subscriber accommodation on Ratusans.

#### 4. Training at traffic operator course in T.T.C.

Along with the recent traffic campaign, an intensification program of traffic personnel has started at the Training Center. JTM gave a lecture to its first course by using the above three standard manuals. The students were, in fact, mostly leaders of switching and traffic group in exchanges or Witels.

By participating in the training course, the expert found that practicable texts like the JTM manuals are seldom available in Traffic and Switching Wings in T.T.C. So these JTM manuals should be utilized in the future training courses for traffic supervisors and senior engineers.

#### 5. Other Contributions

JTM has made several contributions concerning traffic matters as follows:

##### (1) Planning and engineering organization (Sept. 1981)

Requested by Dirmudpran, JTM prepared a proposal concerning organizational structure, functions and procedures of Planning and Engineering Sector in development wing of Perumtel.

This paper emphasizes the needs of strengthened activities in the following aspects:

- to establish regular demand and traffic forecast operation which is planning-oriented. This operation should be dealt with by a newly formed Bagian in Planning Sector, in close coordination with Anedatel,
- to strengthen planning activity for upgrading long and short-term plans, which will be dealt with by a newly founded group, not by the present designing group,
- to introduce "Project Initiation Order" procedures to provide basic design of a project, and to determine the most effective and economically sound scheme among possible schemes of a project,
- to strengthen the function of project programming and coordination.

(2) Proposal of introduction of SLJJ Alternate Routing System (Sept. 1981)

JTM studied the network situation and switching technology, and discussed with all concerned Bagians the feasibility of introducing the Alternate Routing System in SLJJ network. Consequently JTM proposed this to Perumtel as a most appropriate and profitable (about 10% network cost economy) technical project. This paper detailed the theoretical background, technical methods for the introduction and a work schedule for the implementation.

(3) Examination and comment on FTM report (June 1981)

At planning sector's request, JTM examined and commented on FTM report on "SLJJ network planning" and "Trans Java-Bali Second Route Plan" prepared by French Telecommunication Mission (FTM) 1980.

Among major items JTM commented, the followings are remarked in particular:

- to further sophisticate the demand and traffic forecast method,
- to upgrade the network theory used for junction calculation,
- to accumulate and file the past time-serial traffic data.

(4) Examination and comment on Fundamental Plan 1981 (Charging and Routing Plan) (Sept. 1981)

Regarding Perumtel's "new Fundamental Plan 1981", JTM submitted comments, in which further examination was pointed out as necessary on the following matters:

- to specify marginal standards of Grade of Service,
- to specify standards for application of Alternate Routing System,
- to standardize pulse charging methods used in Indonesian telephone network.

## 6. Supplementary Recommendation

Below are the supplementary items which are not recommended in the previous chapters but the expert think it is worth to note here.

### (1) Responsibility of marketing section for traffic problems

For the relief action of Busy Subscriber Lines and improving Subscriber Behaviour for smooth traffic flow, marketing sector's activities are needed to be intensified. At the same time, some telephone sales regulations should be revised to give favourable positions to additional or 'receive-only' telephones in order to improve traffic problems of overcongested subscriber lines.

### (2) Quick restoration of out-of-service facilities

Sometimes during traffic measurements, a high percentage of facilities were found out-of-order; for example, 10% of local junctions in some route of Surabaya was out-of-order. This is a very high percentage and aggravates traffic situation. Therefore, the maintenance sector is advised to take effective steps to lessen long-time unrepaired faults or careless man-made faults of switches or junctions.

### (3) Non-existence of competent traffic engineers

Importance of traffic operation has now been well recognized by most of Perumtel staff concerned and vigorous campaigns to tackle with traffic problems such as improvement of successful call ratio are now underway. To be successful in dealing with such problems, we must have certain number of competent indigenous traffic engineers on hand at HQ of Perumtel.

Our opinion on this matter is that unfortunately no competent traffic engineers are available yet though there are many excellent switching engineers working in HQ of Perumtel. It is hoped that Perumtel will work out concrete steps to bring up promising young switching engineers to be professional traffic engineers. For the time being, the number of the traffic engineers required will be two or three. And it will take at least five years to bring them up to be competent in traffic affairs.

The needs to have engineers specialized in traffic will be stronger than ever with the rapid expansion of complicated SLJJ and multi-exchange local networks and with the introduction of digital networks.

List of JTM Technical Report submitted

(General)

1. Work Plan on improvement of Traffic Operation in Perumtel; to Diroptektel on 16 August 1977
2. Call Completion Ratio and Maintenance Fault-Rate on traffic and maintenance management system in Japan; to Anedatel on 18 Feb. 1980
3. Traffic Administration System in Japan; to Anedatel, etc. on 30 April 1981
4. Traffic Personnel Staffing in N.T.T.; to Anedatel, etc. on 6 Feb. 1982

(Traffic Measurement)

1. Final Report on Jakarta Local Traffic Measurement; to Dirmudnitel on 29 June 1978
2. Supplement to Jakarta Traffic Measurement Report; to Dirmudnitel on 7 Oct. 1978
3. SKSD Manual Traffic Evaluation Report; to Operatel in Dec. 1978
4. Medan (UR-49A) Traffic Measurement Report; to Anedatel in Dec. 1978
5. Solo (ARF-101) Traffic Measurement Report; to Anedatel in Nov. 1979
6. Attention to Surabaya (EMD) Traffic Measurement and Network Correction Action; to Anedatel on 27 Mar. 1980
7. Ujung-Pandang (HKS-442) Traffic Measurement Report; to Anedatel on 1 Sep. 1980
8. Report on Satgas traffic work (for Jakarta traffic work improvement); to Dirmudnitel on 22 Oct. 1980
9. Traffic congestion in Bandung network (Proposal); to Dirutel on 1 Dec. 1981
10. Improvement of Successful Call Ratio in Bandung network; to Anedatel on 30 Nov. 1981
11. Traffic Measurement Program in Bandung network (Proposal); to Anedatel on 5 January 1982
12. Successful Call Test to evaluate the effect of Circuit Correction in Jakarta MC-10C I/C Trunks via SKSD (Technical suggestion); to Anedatel on 15 Mar. 1982

(Standard Procedures)

1. Technical Instruction : Traffic Measurement - 1; to Dirmudnitel on 18 Jan. 1982
2. Technical Instruction : Traffic Evaluation - 1; to Dirmudnitel on 28 Jan. 1982
3. Operation Instruction: Traffic Action - 1; "Subscriber Stage Arrangement"; to Dirmudnitel on 15 Apr. 1982

(Others)

1. Planning and engineering organization; to Dirutel on 28 Sep. 1981
2. SLJJ Alternate Routing System design; to Diroptektel on 28 Sep. 1981
3. Comment on the Report "SLJJ Network Planning" and "Trans Java-Bali Second Route Plan" by FTM 1980; to Dirmudpran on 18 June 1981
4. Comments on Chap. III Charging Plan and IV Routing Plan of "Fundamental Plan 1981 for the Telephone Network in Indonesia, Perumtel"; to Dirmudpran on 1 Oct. 1981
5. Subscriber complaints, checks and errors on domestic telephone charge in Japan; to Anedatel on 27 Dec. 1980