GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

INDIAN RAILWAYS
SIGNAL ENGINEERING MANUAL
PART I

Madras

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FOREWORD

Signals are the silent sentinels providing safety in train operations. Procedures and practices in their maintenance and operation are therefore vital to provide the safety as designed.

The signaling systems are being continuously updated on the Indian Railways to meet the growing needs of traffic and hence new procedures are being evolved and implemented by supplementary instructions, corrections and modifications to the Signal Engineering Manual issued in 1955.

This revised Manual is an attempt to incorporate all the changes and update the original publication of 1955.

I do hope that this will serve to guide and instruct all the officers and staff of the Signaling and Telecommunication Department to discharge their duties effectively and efficiently.

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9-1-1988

PREFACE

Signal Engineering Manual was first issued in January, 1955. Since then much technological development has taken place in the field of railway signaling. A number of correction memos had to be issued during the last three decades. 25 kV. A. C. electrification has been taken up on the trunk and other important routes at an accelerated pace. Special instructions issued regarding signaling on A. C. electrified routes are, therefore, required to be incorporated in the Signal Engineering Manual. The use of electronics in Railway Signaling is increasing day by day and instructions regarding the same have also to be incorporated. The revision of Signal Engineering Manual had, therefore, become an urgent necessity. Accordingly, it was decided to revise the existing Signal Engineering Manual to make it up-to-date.

While revising the Signal Engineering Manual, a critical review was made regarding its organisation and the need to make it more self-sufficient and functional. It was considered desirable that unnecessary references to various other texts may be avoided. It was also found necessary to make it into two parts-Part I dealing with items of general nature, organisation of Signal and Tele communication department, duties and responsibilities of Officers and staff at various levels etc. Part II dealing with specific instructions regarding installation and maintenance of various signaling systems, sub-systems and equipments. Such an arrangement would be found more convenient for reference, by the staff in the field.

The work of revision of Signal Engineering Manual was initiated by Shri C. M. Joseph, C. S. T. E. (Retired) in 1980 and later taken over by Shri S. Narasimhan, O. S. D./Signal Engineering Manual (C. S. T. E./Southern Railway).

Draft Chapters have been thoroughly scrutinised and finalised after discussion with the C.S.T.Es. of all the Zonal Railways. A special sub-Committee consisting of C. S. T. Es. of Southern, Western South Eastern, Railway Electrification and Director (Tele-communication) R. D. S. O. was appointed to finalise the Chapter on special

requirements for signaling on A. C. electrified routes. Every effort has been made to make the instructions comprehensive. However, in a work of this type it is not possible to provide for every contingency that may arise in day to day working. C. S. T. Es. of Zonal Railways may, therefore, supplement, where necessary, the practices and procedures/orders as would suit local circumstances of their Railway. It is needless to point out that such instructions would not contravene any provisions of this Manual, the codes of various Departments of the Railways the General Rules or any statutory regulations in force.

Provisions in the Signal Engineering Manual will apply to all signaling works to be taken up in future. In the installations already existing or in progress, wherever the requirements of this Manual are not complied with, suitable works may be undertaken on a programmed basis to ensure compliance with this Manual.

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Executive Director (Signal and Tele communication

Date : 9th January, 1988.

Railway Board

Signal Engineering Manual (Vol-I)

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CHAPTER I

ORGANISATION OF THE SIGNAL AND TELECOMMUNICATION DEPARTMENT

SECTION ' A'

Officers

Signal and Telecommunication Department—An Overview

1.1. The efficient upkeep of Signal and Telecommunication assets of the Railways is the responsibility of the Open Line Organisation of the Signal and Telecommunication Engineering Department. The major construction activities of the Railways may be under the administrative control of a Chief Signal and Telecommunication Engineer (Construction) reporting directly to the General Manager of an Open Line or under the independent administrative control of a Chief Administrative Officer (Construction) or General Manager (Construction) reporting directly to the Railway Board.

Structure of Open Line Organisation

1.2. The Chief Signal and Telecommunication Engineer is the Administrative and Professional Head of the Signal and Telecommunication Department and is responsible to the General Manager for the efficient and economical working of the Department.

1.3. The Chief Signal and Telecommunication Engineer may be assisted in his work by one or more

Chief Signal Engineers and/or Chief Telecommunication Engineers. Wherever provided, the Chief Signal Engineer and Chief Telecommunication Engineer are in independent charge of their respective areas or control. Their work is, however, co-ordinate by the Chief Signal and Telecommunication Engineer who is responsible to the General Manager.

1.4.1. The Chief Signal and Telecommunication Engineer as well as the Chief Signal Engineer and the Chief Telecommunication Engineer, where provided, is assisted at the Headquarters by a team of Officers who may consist of Deputy Chief Signal and Telecommunication Engineers, Senior Signal and Telecommunication Engineers and Assistant Signal and Telecommunication Engineers.

1.4.2. The Chief Signal and Telecommunication Engineer will lay down the duties of each of the Officers of the Headquarters Organisation.

1.5. The expression " Chief Signal and Telecommunication Engineer " wherever used in this Manual includes Chief Signal Engineer, Chief Telecommunication Engineer and Chief Signal and Telecommunication Engineer (Construction) unless the contrary is clear from the context.

1.6. The Chief Signal and Telecommunication Engineer shall be in charge of staff cadre— gazetted and non-gazetted.

Construction Organisation

1.7. The Chief Signal and Telecommunication Engineer (Construction) shall provide necessary direction and control for the efficient and economical execution of all works under his charge.

1.8. The Chief Signal and Telecommunication Engineer (Construction) is assisted at the Headquarters by a team of Officers who may consist of Deputy Chief Signal and

Telecommunication Engineers, Senior Signal and Telecommunication Engineers and Assistant Signal and Telecommunication Engineers,

1.9. The Chief Signal and Telecommunication Engineer (Construction) shall maintain liaison with the Open Line Organisation and shall follow the general policies and procedure laid down for the execution of works. In cases where a different policy or procedure becomes necessary to be followed, he shall do so after due consultation with the Open Line Organisation to adopt an accepted policy or procedure.

1.10. The Chief Signal and Telecommunication Engineer (Construction) shall exercise necessary budgetary control within the allotment of funds at his disposal and shall co-ordinate with the Chief Signal and Telecommunication Engineer for compilation of budget at every budgetary stage.

1.11. The Chief Signal and Telecommunication Engineer (Construction) shall co-ordinate with the Chief Signal and Telecommunication Engineer with regards to the placement of personnel for the various assignments under his charge keeping in view the overall career development of such personnel.

1.12. In the case of certain major joint projects for Survey, or construction, the Signal and Telecommunication unit may be constituted as a self contained unit under the administrative control of the head of the Project. In such cases, the Head of the Signal and Telecommunication Branch shall be responsible for co-ordination with the Chief Signal and Telecommunication Engineer as mentioned in paragraphs 1.9 and 1.11.

Divisional Officers

1.13. A Signal and Telecommunication Engineer of appropriate grade is in charge of the Signaling and Telecommunication Branch on each Division. He is responsible to the Divisional Railway Manager for the maintenance as well as correct functioning of the installations under his charge.

He is under the technical control of the Chief Signal and Telecommunication Engineer to whom he is responsible for all technical matters. He may be assisted by a team of officers of the same grade or in lower grades. In case more than one officer, in the highest grade is available on a Division, one of them may be nominated as the coordinating officer. The Chief Signal and Telecommunication Engineer will lay down the duties of the various officers of the Signal and Telecommunication Branch on the Division.

1.14. The term "Divisional Signal and Telecommunication Engineer" includes Senior Divisional Signal and Telecommunication Engineer (Junior Administrative Grade) and Divisional Signal and Telecommunication Engineer (Senior Scale) holding charge of a division.

Extra Divisional Organisation

1.15. The following are the extra Divisional Organisations o f the Signal and Telecommunication Department on the Railways :—

(a) Signal and Telecommunication Workshops ;

(b) Signal and Telecommunication Training School ;

(c) Microwave Organisation ;

(d) Field Units of Construction Organisation ;

(e) Any other unit designated by the railway.

1.16. Each of these Organisations is under the control of an Officer of appropriate grade who is responsible for its efficient functioning to the Chief Signal and Telecommunication Engineer/Chief Signal and Telecommunication Engineers (Construction) directly or through an Officer of the Headquarters Office in the appropriate grade. The controlling Officer may be assisted by a team of officers in various grades as required.

SECTION 'B'

Strength of Officers

1.17. Strength of Officers in the Headquarters Office of Chief Signal and Telecommunication Engineer, Chief Signal and Telecommunication Engineer (Construction), Divisional Offices and in extra divisional organisations shall generally be in accordance with the studies conducted by the Efficiency Beereau of the Railway Beard.

SECTION ' C'

Technical Staff

1.18.1. The following are the technical staff of the Signal and Telecommunication Department for the purpose of this Manual.

(a) Signal Inspectors, artisan staff under their charge

(b) Drawing office staff ; and

(c) Supervisory and artisan staff of Signal and Telecommunication Workshop.

1. 18.2. The Signal Inspectors are classified as Sectional Signal Inspectors, Senior Signal inspectors, 'Chief Signal Inspectors and Technical Inspectors.

1.18.3. The Sectional Signal Inspectors are directly in charge of installation and maintenance of signalling on a section.

1.18.4. The Senior Signal Inspectors are directly in charge of installation and maintenance of more important sections.

1.18.5. The Chief Signal Inspectors supervise the work of one or more Sectional Signal Inspectors Senior Signal Inspectors and are responsible to the Divisional Signal and Telecommunication Engineer.

1.18.6. The Technical Inspectors are headquartered in the Office of the Chief Signal and Telecommunication Engineer/Divisional Signal and Telecommunication Engineer and assist him in discharging his technical duties.

1.19. **Staff under Inspectors :**

1 19.1. Each Sectional Signal Inspector shall be assisted by one or more maintainers and maintenance gangs.

1.19.2. Each Sectional/Chief Signal Inspector shall be provided with one or more special gang/ gangs for attending to maintenance requirements that may be considered normally beyond the

scope of maintenance.

1.19.3. Each Chief Signal Inspector shall be provided with office/stores clerks and stores khalasis depending on the quantum of office/stores work. Adequate number of chowkidars for guarding railway material in his custody shall also be provided where necessary.

1.19.4. Each Signal Inspector except Technical Inspector may be provided with a trolley or a motor trolley. Adequate number of trolleymen shall also be provided.

1.19 5. Each Senior Signal Inspector shall be assisted by appropriate staff as provided for a Sectional Signal Inspector.

SECTION ' D'

Strength, Charges, Designations

1.20. Strength and Charges of staff :

The strength and charges of Inspectors, Maintainers, Sectional gangs and office staff shall be generally in accordance with an approved yard stick framed by the Efficiency Bureau of the Railway Board. Where such a yard stick is not available, the Chief Signal and Telecommunication Engineer shall frame a suitable one with due consideration to the standard of signalling, type of installation, size of yards, density of train services and general importance of the section.

1.21. Designation and Code initials :

The designations and code initials of Officers, Inspectors and Maintainers shall be as under ::

1.21.1. Officers :

(a) Chief Signal and Telecommunication Engineer C. S. T. E.

(b) Chief Signal Engineer C. S. E.

(c) Chief Telecommunication Engineer C. C. E.

(d) Deputy Chief Signal and Telecommunication Engineer Dy. C. S. T. E.,

(e) Divisional Signal and Telecommunication Engineer D. S. T. E.

Note.—If the Divisional Officer is in Junior Administrative Grade, the Prefix Senior (Sr.) is added to D. S. T. E.

(f) Senior Signal and Telecommunication Engineer (in Headquarters and extra divisional organisations). S. S. T. E.

(g) Assistant Signal and Telecommunication Engineer. S. S. T. E.

1.21.2. Inspectors :

(a) Chief Signal Inspector C. S. I.

(b) Senior Signal Inspector S. S. I.

(c) Sectional Signal Inspector S. I.

(d) Technical Inspector T. I.

1.21.3. Maintainers

(a) Mechanical Signal Maintainers M. S. M.

(b) Electrical Signal Maintainer E. S. M.

CHAPTER II

DUTIES OF SIGNAL AND TELECOMMUNICATION ENGINEERS

SECTION ' A '

2.1 Duties of Signal and Telecommunication Engineer in charge of Maintenance or Construction

The Signal and Telecommunication Engineer in charge of Maintenance or Construction is generally responsible for

(a) The installation and maintenance of all signalling and telecommunication equipment under his charge in a satisfactory and safe condition.

(b) Observance of the rules and procedures laid down in the General and Subsidiary Rules, Rules for opening of a Railway, the Signal Engineering Manual, the Telecommunication Manual, relevant Rule books and Manuals and orders and circulars issued by the Chief Signal and Telecommunication

Engineer from time-to-time and ensuring that all staff under his charge are acquainted with relevant rules and working methods and efficiently perform their allotted duties.

(c) Preparation of plans and estimates and safe execution of works in his charge.

(d) Ensuring that all important inspection notes of higher authorities receive prompt action.

(e) Co-ordination with Engineering and other branches in case of combined works ; obtaining sanction of Commissioner of Railway Safety for new signalling works or alterations and additions to the existing signalling installations, either separately for purely signalling works or jointly with other Departmental officers in the case of combined works.

(f) Co-ordination with concerned branches in case of accidents for speedy restoration of traffic and for investigation into the causes of accidents.

(g) Co-ordination with officers and staff of other branches in all other matters to ensure smooth functioning of signalling and telecommunication system.

(h) Ensuring supply of approved quality materials and tools for the installation and maintenance of the equipment.

(i) Control over expenditure in relation to budget allotments and sanctioned estimates.

(j) Submission of proposals for Revenue and Works Budget, and for periodic reviews.

(k) Exercise of such powers as may be delegated to him in Establishment and other matters.

(1) Ensuring strict discipline amongst his staff within the frame work of the Rules.

(m) Dealing promptly with appeals and representations from and looking after the welfare of his staff.

(n) Issue of special and specific maintenance schedules for Inspectors and Maintainers as and when necessary.

2.2. Transfer of Charge :

2. 2. J. Instructions on "Transfer of Charge" are contained in Chapter I of Indian Railway Code for Engineering Department.

2.2.2. The Divisional/Senior Signal and Telecommunication Engineers handing over and taking over charge of a Division or of a work shall carry out joint inspection of such works or important sections as necessary.

2.2.3. The "Transfer of Charge" statement shall be prepared in adequate number of copies, signed by both and one copy sent to the Chief Signal and Telecommunication Engineer

2.3. **Applicability to other Signal and Telecommunication Engineers**

These instructions with suitable modifications will apply to the other Signal and Telecommunication Engineers posted to a Division or for executions of works.

SECTION ' B '

Additional duties of Signal and Telecommunication Engineer in charge of Maintenance

2.4. The Divisional Signal and Telecommunication Engineer is generally responsible for :

(a) Ensuring that no alteration to an installation is made, which is a deviation from the original approved plan diagram or specification, without the authority of the Chief Signal and Telecommunication Engineer.

(b) Periodical inspection of all Signalling and Telecommunication installations under his charge by a Signal Engineer, at least once in twelve months. The inspection shall be intensive with reference to the prescribed schedule of maintenance. A monthly report of inspections so made shall be submitted to the Headquarters Office.

(c) Inspection of Signals within his jurisdiction from footplate of a locomotive or a driving cab both by day and by night in both Up and Down direction once in a year, preferably jointly with officers of Mechanical /Electrical /Traffic branches.

(d) Having in his possession the under mentioned drawings and registers as required when called upon to accompany the inspection of superior officers like Divisional Railway Manager, Chief Signal and Tele-communication Engineer", General Manager, Commissioner of Railway Safety or an officer of the Railway Beard etc.

(i) Interlocking plans of the section ;

(ii) Foot plate/station inspection details ;

(iii) Previous inspection reports of the section by Chief Signal and Telecommunication Engineer.

General Manager, Commissioner of Railway Safety etc.,

(iv) Any other books/papers/documents as per instructions issued by the Headquarters office of the Zonal Railway.

(c) Inspection of office and stores of Inspectors once in a year. During the inspection a percentage check of some of the stores items, particularly those that are costly shall be made.

(f) Keeping watch on inspection of Signal and Telecommunication installations and foot plate inspection by the Inspectors under his control.

(g) Analysing the failures from the reports submitted by the inspectors and taking remedial measures to eliminate recurrence of failures. The reports may be examined in a meeting preferably jointly with all Chief Signal Inspectors of the division to improve the standard of maintenance.

Note.—Each Divisional Signal and Telecommunication Engineer must maintain a record showing the number of failures and number of trains detained every month over the jurisdiction of each Inspector.

(h) Drawing out a programme of overhauling and/or testing of interlocking frames, interlocking key boxes, Station Master's slide control frames, block instruments, relays, cables, point and signal machines, etc., as per instructions contained in Chapter XIII.

(i) Reviewing the position in regard to supply of stores on the Division periodically.

(j) Planning replacements of wornout installations and additional signalling inputs necessary to improve the working and submission of proposals for the same.

(k) (i) Reviewing the staff position periodically to ensure that the strength is neither in excess nor short of requirements.

(ii) Arranging to obtain timely sanction for additional maintenance staff before new works or additions/alterations to existing installations involving increased workload are commissioned.

(l) Ensuring sending periodical returns to Headquarters Office as well as replies to letters from Headquarters within the time specified.

Note.—The rules in Section' B 'will also apply to a Senior Signal and Telecommunication Engineer normally in charge of Construction, who is entrusted with the maintenance of any installation as for the time being.

SECTION C

Additional duties of Signal and Telecommunication Engineer in charge of Construction

2.5. The Signal and Telecommunication Engineer in charge of Construction is responsible for

(a) the accuracy, quality and progress of the works entrusted to him and for ensuring that "each work is efficiently organised and so programmed that it progresses speedily and is completed within the time specified.

(b) ensuring that all works are carried out strictly in accordance with the approved plans.,

standard drawings and specifications and conforming to the provisions of this Manual. Deviations, if any, shall have the prior approval of the Chief Signal and Telecommunication Engineer.

(c) (i) ensuring that traffic notices are issued in consultation with other Divisional officers before any existing installation is altered or any new installation is introduced which affects the safe working of any signal, points or interlocking :

(ii) ensuring issue of temporary working instructions for working of traffic, where necessary.

(d) Furnishing relevant information to the Operating department to help them in the preparation of working Rules and temporary working instructions.

(e) Arranging for obtaining the sanction of Commissioner of Railway Safety where required as per instructions' in paragraphs 9. 6 and 9.7.

(f) Advising Commissioner of Railway Safety by a message after bringing a new installation or modification to the existing installation into use and submission of a Safety Certificate as per instructions in Paragraph 9.8.

(g) Submitting progress reports on Form S. & T./PR1 (Annexure ' 1 ') to Headquarters every month.

(h) Periodical verification of the Materials-at-site as per Paragraph 6.14.

Note,.—The rules in Section ' C' will also apply to a Divisional Signal and Telecommunication

Engineer normally in change of maintenance, who is entrusted with the execution of certain specific works.

CHAPTER IV

BUDGET ESTIMATES, EXPENDITURE AND BUDGETARY CONTROL AND COMPLETION REPORTS

SECTION 'A'

Introduction

4.1. Budget Terms

4.1.1. Budget Estimates.—Every Railway Administration has to prepare estimates of expenditure expected to be incurred by it in a year and submit them on prescribed dates well in advance of the beginning of that year to the Railway Board for obtaining the sanction of the Parliament or the President. Such estimates are called '" Budget Estimates ".

4.1.2. Demands for Grants.—On the basis of the Budget Estimates received from the various Railway Administrations and other spending units, the Railway Board prepare their " Demand for Grants " and present them to the Parliament or the President, as the case may be, for sanction.

4.1.3. Grants and Appropriations.—The ' Demands for Grants ' as finally approved by the Parliament are called the Budget ' Grants ' and those sanctioned by the President without reference to the Parliament are called ' Appropriations '.

4.1.4. (i) Budget Orders and Allotments.—The Railway Grants and Appropriations for a year are distributed by the Railway Board to the various Railway Administrations and other spending units directly under the Railway Board through what are known as ' Budget Orders'. The Budget Orders are accompanied by the Budget Documents.

(ii) The Grants and Appropriations distributed to the various Divisions and spending units are called Budget ' Allotments '.

4.1.5. Budget Documents.—The complete Budget, is printed in the form of books as under :—

(i) Demands for Grants ;

(ii) Explanatory Memorandum showing the financial results of the year ;

(iii) Works, Machinery and Rolling Stock Programme of Railways.

4.1.6. Re-appropriation.—The transfer of funds originally assigned for expenditure on a specific object to supplement the funds sanctioned for another object is called " Re-appropriation ". The powers of the Railway Board and Railway Administration in respect of re-appropriation are detailed in Chapter III of the Indian Railway Financial Code Volume I (extracts at Annexure ' 11 ').

4.1.7. Review of Expenditure.—The sufficiency or otherwise of the sanctioned budget allotments shall be reviewed periodically by each Railway Administration on the basis of expenditure actually incurred upto the time of review and the anticipated expenditure during the remaining portion of the financial year. The detailed procedure in regard to review of Expenditure

is contained in Chapter III of the Indian Railway Financial Code, Volume I (extracts at Annexure ' 12 ').

4.2. Demands for Grants.—All revenue working expenses of the Railway are classified under 13 sub major heads with separate abstract for each sub major head. The sub major heads are divided into minor, sub and detailed heads as detailed in Volume II of the Indian Railway Financial Code (Minor, sub and detailed heads, relevant to Signalling and Telecommunication are at Annexure ' 13 ')

4.3. Revenue and Works Budgets.—Budget estimates of the Signal and Telecommunication Department comprise mainly of the following :—

(i) Estimates of Working Expenses.—These are based on the Working Expenses for the repairs and maintenance of Signaling, interlocking and Telecommunication Services and comprise estimates of expenditure against Demand Nos. 3, 7 and 8 referred to in para 4.2.

(ii) Works Budget.— Open Line Works Budget' otherwise known as ' Annual Works Programme ' comprises estimates of requirements for Works against Demand No. 16.

(iii) Plant and Machinery Programme comprises estimates of requirements for Machinery and Plant against Demand No. 16.

SECTION ' B '

Estimates for Working Expenses or Revenue Budget

4.4. Compilation

4.4.1. The Revenue Budget or Estimate of Working Expenses is compiled in the prescribed forms in the Headquarters Office on the basis of proposals submitted by the Divisions/Extra Divisional Units in accordance with instructions contained in Chapter III of the Indian Railway Financial Code. Volume I (extracts at Annexure ' 14 ')

SECTION ' C'

Works, Machinery and Rolling Stock Budget

4.5. Detailed instructions for preparation and submission of Works, Machinery and Rolling Stock Budget are contained in Chapter III of Indian Railway Financial Code, Volume I (extracts at Annexure' 15 '). The classification of expenditure by primary units of expenditure are contained in Volume II of the Financial Code (Heads relevant to Signal and Telecommunication Department at Annexure ' 16 ').

4.6. **Compilation of Plant and Machinery Programme—**

4.6.1. The detailed instructions for the preparation and submission of the Plant and Machinery Programme are contained in Chapter XV of the Indian Railway Code for the Mechanical Department (Workshops).

4.6.2. The requirements of machinery in Signalling and Telecommunication Workshops shall be collected and shown in Plant and Machinery Programme. The description of machinery, number, allocation, cost etc., shall be shown on the prescribed forms and submitted along with the programme. This programme is submitted 15 months in advance of the financial year.

SECTION 'D'

Administering the Budget

4.7. Detailed instructions for administering the Budget are contained in Chapter III of the Indian Railway Financial Code (extracts at Annexure ' 17 ').

SECTION ' E'

Maintenance of Accounts

4.8. Code Rules.—Rules in regard to the maintenance of Open Line accounts are contained in Chapter XIV of the Indian Railway Code for the Engineering Department.

4.9. Accounting

4.9.1. The expenditure incurred is brought to account through various vouchers. Subject to such powers as may be delegated to him, the Divisional Signal and Telecommunication Engineer may incur expenditure on all ordinary maintenance works and establishments upto the limits of the provision in the Revenue Budget Estimates, sanctioned for his unit for the year.

4.9.2. All vouchers, such as debit notes for stores supplied, freight bills shall be carefully scrutinised before acceptance as to the reasonableness and propriety of the debits raised. Wherever necessary, such debits shall be correlated and checked with the initial records in the office, such as indents and work orders on Workshops, and necessary endorsements made thereon.

4.10. Departmental Registers on Extra-Divisional Units

4.10.1. Revenue Allocation Register.—The Divisional Signal and Telecommunication Engineer in charge of an Extra-Divisional Unit shall maintain a Register of Revenue expenditure, if any, incurred by him under the relevant grants in order to keep himself acquainted with the progress of expenditure in his unit as compared with the sanction in the Authorisation Rolls. The detailed instructions in regard to the maintenance of Revenue Allocation Register are contained in Para 1469 of Engineering Code (Annexure 18 ')

4.10.2. Register of Works.—The object of maintaining the Register of Works and Instructions in regard to maintenance of the same are contained in Paras 1472, 1473,1474 and 1475 of Engineering Code (Annexure ' 19 ')

4.10.3. Reconciliation of Registers.—The registers of the Divisional Office shall be sent monthly to the Accounts Office with a clerk on such dates as mutually agreed upon in order that the entries made therein may be reconciled with similar registers maintained in the Accounts Office.

4.11. Departmental Registers on Divisions.—On Divisions where the initial accounts are maintained by the Accounts Department, neither Allocation Register nor Register of Works need be maintained by the Departmental Officers. There will be only one set of registers and these will be maintained by the Accounts Officer both for his own use and for that of the other Departmental Officers, who will continue to be responsible for the efficient control of expenditure against estimates and allotments.

SECTION ' F '

Control over Expenditure

4.12. The manner in which the budgetary and expenditure control is to be exercised by the various units is indicated in Chapter V of the Indian Railway Financial Code (relevant extracts at Annexure ' 20 ')

413. Indents and Work Orders

4.13.1. When passing requisitions for materials and tools, for works or maintenance, and also while sanctioning temporary and seasonal labour, the Divisional Signal and Telecommunication Engineer shall ensure that the amounts involved are within the allotments and also within provision in the sanctioned estimates.

4.13.2. Before execution of agreements and work orders with contractors the Divisional Signal and Telecommunication Engineer shall ensure that these have been carefully checked in every respect. Rates allowed in bills received from firms shall be carefully scrutinised before they are passed for payments.

SECTION 'G'

Completion Reports

4.14. Code Rules.— Rules in regard to the preparation and submission of Completion Reports are contained in Chapter XVII of the Indian Railway Code for the Engineering Department (relevant extracts at Annexure ' 21 ')

CHAPTER V

PLANNING, ESTIMATING AND SURVEY

SECTION ' A '

Planning

5.1.1. The process of programming Works, Survey as well as Rolling Stock, Machinery and Plant in advance, deciding their relative priorities, preparing necessary justification and estimates, making available funds for their execution within the ceilings prescribed, and including them in the " Works, Machinery and Rolling Stock Programme " is termed Planning.

5.1.2. Initiation of Works Programme.—Detailed instructions for preparation and submission of Works Programme are contained in Chapter VI of the Indian Railway Code for Engineering Department (relevant extracts at Annexure ' 22 ').

5.1.3. Programme of Signalling and Telecommunication Works may be initiated as a result of proposals made by the Signal, Operating or other Departments for periodic replacement of worn out assets with or without improvements or for meeting operating requirements or for improving the safety of train operation or for provision of amenities to passengers.

5.1.4. Works may be initiated either on a Division or at the Railway Headquarters. Works initiated on the Division shall be first examined by the Divisional Officers. Where there is sufficient justification, the proposal after approval by the Divisional Railway Manager shall be forwarded to the Headquarters Office along with the remarks of the Accounts Branch for scrutiny and examination by the Heads of Departments concerned. If the work is approved by them and concurred in by the Financial Adviser and Chief Accounts Officer, it is noted for inclusion in the Works Programme of the ensuing year.

5.1.5. Works initiated by the Headquarters Office shall be sent to the Financial Adviser and Chief Accounts Officer for obtaining concurrence and thereafter included in the Works Programme. In case it is, however, desired to obtain the estimate from the Division, the Division may be asked to process the work in which case the procedure as in para 5.1.4 shall be followed.

5.1.6. A work should be considered as remunerative only if it satisfies the test of remunerative ness as contained in Para 204 of the Indian Railway Financial Code (Annexure ' 23 ')

SECTION 'B'

Estimates

5.2. Code Rules.—Instructions regarding the different kinds of estimates and their preparation are contained in Chapter VII of the Indian Railway Code for the Engineering Department (Relevant extracts-at Annexure ' 24 ')

5.3. General Instructions applicable to Estimates ;

5-3.1. While preparing the Abstract Estimate m accordance with the Code Rules, the expenditure for Stores may be grouped under Cabin Equipment, Point gear and connections, Signal fittings and connection, Cable and line wire, Track Circuits, Block Instruments, Station Master's Control Instrument, Control and Cabin telephones, etc., besides Labour, Tools and Plant, Establishment Charges, Freight and Contingencies, Works to be done by other Departments, e. g., construction of cabin and other buildings, construction of staff quarters, provision of wooden sleepers, power supply arrangements, etc., are to be included where necessary.

5.3.2. While preparing the detailed estimates in accordance with, the Code Rules, the following -

guidelines shall be observed :—

(i) Details of cost of cabin, staff quarters and other buildings, and electric power connections shall be included, by obtaining them from the Departments concerned and shall be provided for under separate sub works.

(ii) Establishment and Supervision charges, where necessary, shall be included. Additional "weightage for works to be done under traffic conditions should be provided.

(iii) Provision shall be made for additional quarters required for additional maintenance staff to be posted as a result of the scheme. Provision shall also be made for additional Stores/Office accommodation where necessary.

5.3.3. For preparing estimate for Line Capacity Work, the Operating Department will advice 'the Signal and Telecommunication Department of the detailed traffic requirements. If this involves preparation of a Plan or Sketch for estimating purposes, the Signal and Telecommunication Department will arrange to do so and detailed estimates shall be prepared only after the arrangements shown on the Plan or Sketch are agreed to by the Operating Department. In other cases,1 the estimates shall be prepared on the basis of requirements furnished by the Operating Department. In both cases, the justification for the proposed work will be furnished by the Operating Department together with the anticipated financial implications.

A similar procedure shall be followed for works to be executed for other departments, e. g., Electrical, Civil Engineering, etc.

5.3.4. In regard to grouping of Works, instructions contained in Para 750 of the Indian Railway

Code for Engineering Department and instructions contained in Para 776 of the Indian Railway Code for finance Department in regard to allocation of charges, shall be observed (relevant extracts at Annexure' 25 ').

5.3.5. Where works are customarily executed through the agency of contractors, each Divisional Office shall maintain the Schedule of Rates, issued under the authority of the Chief Signal and Telecommunication Engineer/Chief Signal and Telecommunication Engineer (Construction). The Schedule of Rates may be reviewed and revised by the Chief Signal and Telecommunication Engineer/Chief Signal and Telecommunication Engineer (Construction) every five years or at shorter intervals as considered necessary. No variation in the Schedule of Rates is permissible without the specific authority of the Chief Signal and Telecommunication Engineer/Chief Signal and Telecommunication Engineer (Construction).

5.3.6. Each Divisional Office shall maintain the Price Lists of Stores as issued by the Stores Department.

5.3.7. The Divisional Signal and Telecommunication Engineer shall be in possession of copies of "like authorised Scheduled of Rates and Price Lists of Stores and amendments advised to him from time-to-time.

5.4. Reports accompanying Estimates.—The reports shall generally include the following :

5.4.1. A clear description of the work to be carried out and the object to be gained by its execution together with such information as will enable the sanctioning authority to appreciate the necessity for the work.

5.4.2. Reasons for the adoption of the proposed lay out or design with special reference to any variations from usual practice and its special feature, if any.

5.4.3. When the Project is of a nature involving scientific points or other considerations of special character such as a new Signalling or Telecommunication System not tried out before, the reports shall contain a complete account of the basis on which every part of it has been framed, the various considerations in regard to Signalling and Telecommunication details, economy of construction, utility of the practical working of the Project when carried out and the method by which it is proposed to execute any portion of the work involving unusual difficulties of construction, if any.

5.4.4. In case of works of important nature like, Centralised Traffic Control. Automatic Signalling, ate, a complete account of the various considerations in regard to engineering details, economy of construction and utility of the Project shall be given. Any local considerations which may affect the Project shall also be fully "detailed.

SECTION 'C '

Surveys

5.5. Code Rules: —

5.5.1. General instructions for conducting surveys for Railway Projects are contained in Chapter IE of the Indian Railway Code for the Engineering Department.

5.5.2. The System of Signalling to be provided shall be as in Para 7.131.

5.6. Surveys for new lines, line capacity works, electrification, etc.—Engineering-cum-Traffic Surveys shall be carried out for new lines, Conversions, Doublings and other Line Capacity Works costing more than Rupees One Crore before the inclusion of such works in the Works Programme.

5.7. Survey for Signalling Works.—Field surveys shall be carried out for the following categories of Signal and Telecommunication works costing more than Rupees 50 lakhs each before inclusion in the Works Programme :—.

(i) Relay Interlocking of Major yards ;

(ii) Mechanisation of Marshalling Yards ;

(iii) Microwave, U. H. F. and other multi-channel communication systems ;

(iv) Extensive integrated telephone networks ;

(v) Sophisticated Signalling Schemes including Auxiliary Warning System, Centralised Traffic Control, etc.

5.8. Alternative proposals.—Where alternative proposals of importance have been examined and rejected, particulars shall be suitably indicated in the Plans or in the report and the reasons for rejecting the alternative shall be explained in the report.

5.9. Notes to be made in the field.— During the survey, careful notes with data shall be made at site, from personal enquiry and observation, regarding any information likely to be useful in working out the details of the Projects, and in determining the prospects of the proposals. The

following points shall receive special attention :—

(i) Availability of wooden/concrete sleepers ;

(ii) Availability of power supply at site or sites ;

(iii) Whether climatic condition will suit the type of equipment to be installed ;

(iv) Special problem like rocky soil, existence of wide rivers which may have to be traversed by cables or overhead lines, etc.

(v) Gradients on the section particularly if the Project is for provision of Automatic Signalling ;

(vi) Detention to trains that can be saved ; additional services that can be introduced.

5.10. Expenditure on Surveys:

5. 10.1. Railway. Administrations have no powers to undertake Surveys on their own. After a survey is included in the sanctioned Budget, the General Managers can sanction Survey Estimates costing upto Rs. 1 lakh.

5.10.2. If it is decided to undertake a Survey in connection with any proposal/modification in Signalling or Telecommunication System, an estimate of the cost of the proposed Survey shall be prepared, and the information collected in the course of the preliminary investigation, if any, shall be embodied in the report accompanying the Estimate of the Survey.

5.10.3. The proposal for Surveys shall be submitted to the Railway Board well in advance to enable

necessary provision being made in the Budget.

5.10.4. The Budget allotment for preliminary Survey of a work shall be charged under Demand No. 2 and when final estimate for that particular work is sanctioned, the amount charged under Demand No. 2 shall be transferred to the sanctioned Estimate of the Project.

5.11. Imprest Amount.—The official in-charge of Survey shall be provided with an adequate Imprest. He shall be responsible for maintaining all accounts with necessary vouchers.

5.12. Survey Teams:

5.12.1. A Signalling team shall be provided in Survey Estimates for Projects like Doublings, Remodeling, Conversions, New Lines, Railway Electrification including Techno-economic Surveys, Feasibility Studies, etc., to carefully study the needs of the Traffic and to make provision for Signalling equipment accordingly duly taking into account the age and condition of existing equipment, if any.

5.12.2. The period for which the Signalling team is to be catered for in the Survey Estimates shall be commensurate with the workload in each case and shall be decided by the Chief Signal and Telecommunication Engineer in consultation with the Financial Adviser and Chief Accounts Officer of the Railway concerned while finalising the Survey Estimate.

5.12.3. The requirements of the Signal Department shall be obtained from the Chief Signal and Telecommunication Engineer by the Chief Engineer while preparing the Survey Estimates for such Projects.

5.12.4. Similarly in Survey Estimates for Signal and Telecommunication Projects, suitable provision shall be made for other Departments, viz., Traffic, Engineering, Accounts, Electrical, etc., as found necessary.

5.13. Administrative Control on Survey Team.—.The Signalling Survey team shall work under the Administrative and Technical Control of the Chief Signal and Telecommunication Engineer or Chief Signal and Telecommunication Engineer (Construction), as the case may be, both for Surveys for Signalling works and for Signalling portion of the Surveys for Projects mentioned in Para 5.12.1.

5.14. Progress Reports on Surveys. —The Official-in-charge shall submit periodical reports of progress in prescribed forms as may be directed by the Chief Signal and Telecommunication Engineer.

5.15. Report.—At the conclusion of the Survey, a report should be formulated by the Officer-in-charge of the Survey. The details of the information collected, calculations and diagrams, shall be embodied in Tables as Annexure to the Report.

5.16. Covering Note.—The Survey Report and Annexures shall be submitted to the Railway Board under a covering note, which shrill have the authority of the Railway Administration submitting the Report. It should provide a summing up and should contain clear recommendation together with the views of the Financial Adviser and Chief Accounts Officer.

CHAPTER VI

SIGNALLING STORES AND THEIR ACCOUNTAL

6.1. Classification of Stores.—The Stores in the custody grouped under the following Stock Heads :—

(a) Imprest Stores—' Charged Off' to Revenue ;

(b) Tools and Plant ;

(c) Protective Clothing ;

(d) Books of Reference ;

(e) Office furniture ;

(f) Stationery and Forms ;

(g) Stores obtained for specific works.

SECTION ' A

Imprest Stores

6.2. Operation of Imprest.—The materials classified as Imprest Stores, their procurement and accountal are contained in Chapter XXVIII of Stores Code and XIV of Engineering Code (relevant extracts at Annexure ' 26').

6.3. Location and Scale of Imprest.- Imprest Stores shall be provided with each Supervisory Signal Inspector on a Division or such other Inspectors as may be nominated for the purpose. The

nature of items of Imprest Stores, location and the scale for each imprest holder shall be fixed by the Chief Signal and Telecommunication Engineer or any lower authority authorised for the purpose. The quantity of each item of imprest stores which each imprest holder may hold at a time shall be generally based on quarterly average consumption for normal maintenance and upkeep of equipment. Time for procurement in case of non-stock items and also time required for Stores Van movements in the case of stocked items may be taken into consideration for determining the quantity of imprest. The sanctioned scale shall not be increased or decreased without prior approval of the sanctioning authority.

SECTION 'B'

Tools and Plant

6.4. Scale.—A scale of Tools and Plant shall be fixed by the Chief Signal and Telecommunication Engineer for each Inspector. This scale will include Tools for each Maintainer and artisan besides a small reserve with the Inspector.

6.5. Accountal.—Instructions in regard to accountal of Tools and Plant are contained in Paras 1456 and 1457 of Engineering Code (extracts at Annexure ' 27').

SECTION ' C '

Protective Clothing

6. 6. Periodical requirements.—'The Supervisory Signal Inspector shall submit to his Divisional Signal and Telecommunication Engineer, the periodical requirements of protective clothing for all the staff eligible for the supply of the protective clothing in accordance with instructions issued from time-to-time.

6.7. Preparation of Indents.— Guidelines in regard to preparation of indents and accounting of protective clothing are contained in Annexure ' 28 '.

6.8. Accountal of protective clothing.—Accounts of protective clothing shall be maintained by the Supervisory Signal Inspectors on Ledgers similar to the Tools and Plant Ledgers.

SECTION 'D'

Books of Reference

6.9. Supply of Books of Reference.—The Supervisory Signal Inspector shall arrange to get copies of all Books of Reference, in accordance with instructions in Chapter VIII, for the use of his office, for himself and for the use of staff under him by submitting necessary indents to his Divisional Signal and Telecommunication Engineer.

6.10. Accountal.—Accounts of Books of Reference shall be maintained on Ledgers similar to the Tools and Plant Ledgers.

SECTION ' E '

Office Furniture

6.11. Acconntal and Replacement:

6.11.1. The Supervisory Signal Inspector shall maintain an account of all office furniture in his charge on Ledgers similar to the Tools and Plant Ledgers.

6.11.2. All replacements shall be made on return of unserviceable articles. For any additional item, prior approval of the Divisional Signal and Telecommunication Engineer shall be obtained before placing the indent.

SECTION 'F'

Stationery and Forms

6.12. Indents of Annual requirements:

6.12.1. The Inspectors shall submit the indents of their annual requirements of stationery to the Divisional Signal and Telecommunication Engineer in accordance with the scale for the supply of stationery.

6.12.2. The Divisional Signal and Telecommunication Engineer shall see that the sanctioned scale is not exceeded and the items for which no sanctioned scales have been fixed are essential and have necessarily to be supplied.

6.12.3. Accountal.—A numerical accountal of receipt and issue of all items shall be kept. The Divisional Signal and Telecommunication Engineer's Office shall make checks periodically to see that there is no accumulation of items of stationery and forms in the subordinate offices.

SECTION ' G'

Stores obtained for works including Special Revenue Works

6.13. Requisitioning :

6.13.1. Materials for specific works shall not ordinarily be requisitioned unless the estimate of the work has been sanctioned by the competent authority and funds have been allotted.

6.13.2. Requisitions for materials shall show the name and particulars of the estimate and sanctioning authority for the work.

6.13.3. Advance procurement of stores may be authorised by the Chief Signal and Telecommunication Engineer or Deputy Chief Signal and Telecommunication Engineer in charge of Works for long lead vital materials such as relays, cables, signal machines, point machines, block instruments, etc., which are required for the next three years, and which have to be specially arranged or have to be imported. In such cases, the indents may be placed as soon as a Work appears in the Final Works Programme. These indents shall be prepared on the basis of realistic estimate of quantities of materials and subject to prior scrutiny by Finance Branch in respect of reasonableness of the quantity of materials indented. The Chief Signal and Telecommunication Engineer or the Deputy Chief Signal and Telecommunication Engineer in charge of the work shall certify the quantities of materials indented for each work. Indents shall specify the delivery schedule for the next three years and funds shall be arranged according to the delivery schedules.

6.13.4. The materials on receipt shall be either utilised on the work or if this is not immediately possible stored carefully.

6.14. Materials-at-Site account.—The material received for Works detailed in Para 6.13.1 above, if not used up immediately, shall be kept at debit of a numerical account of Materials-at-site of the particular work. Detailed instructions in regard to maintenance of accounts for Works estimated to cost less than Rs. 1 lakh and more than Rs. 1 lakh are contained in Chapter XIV of Engineering Code (extracts at Annexure ' 29 ').

SECTION ' H '

The Daily Transactions

6.15. The Daily Transactions Register :—

6.15.1. A Daily Transaction Register shall be maintained by each Inspector, similar to Form No. No. S & T/DT. (Annexure ' 30 ')

6.15.2. All receipts and issue of Stores pending their transfer to their appropriate Ledgers, shall be entered in this Register.

6.15.3. The Register shall be written up daily. A line shall be drawn across both pages under the last entry of each date to prevent subsequent entries being made.

6.15.4. There shall be no direct posting of materials in Ledgers from Challan. All transactions shall first be shown in the Daily Transaction Register.

6.15.5. The dates shall be the same in both Ledger and the Register.

6.15.6. Issues of materials from outside stocks will be recorded by the Inspectors in their line note books first. These entries will then be transferred to the Daily Transaction Register. The date of entry, in the Daily Transaction Register shall be recorded on the note book.

6.15.7. The Inspectors are personally responsible for all the Stores in their custody and shall satisfy themselves that the Daily Transaction Register and the Ledgers are being correctly

posted. They shall initial the Daily Transaction Register at least once a week in token of having verified the entries thereof.

SECTION 'J'

Returned Stores

6.16. Instructions —.Instructions regarding returned stores are contained in Chapter XVI of the Indian Railway code for the Stores Department (relevant extracts at Annexure '31 ').

6. 17. Despatch of Spare, second band and scrap materials : —

6.17.1. Spare and second hand materials sent to Stores Depot shall be carefully loaded to avoid loss or breakage.

6.17.2. Material complete but having pins badly worn and not sufficiently good to be considered second hand, shall be entered up as serviceable scrap and their approximate weight shall be stated. If parts are missing, full details shall be given.

6. 17. 3. In the case of Signals, height, type and condition of post and fittings shall be stated.

6.17.4. All cast iron, steel, brass, zinc, copper and lead scrap shall be collected from Sections regularly and sent to Stores Depot, with description and approximate weight.

6.17.5. Empties such as tins, drums kegs, barrels, and cement bags shall be accounted for along with the materials contained in them and shown in the Returns. They shall not be held longer than necessary and shall be returned to Stores Depot for disposal.

6.18. Credit for " Returned Stores ".—

6.18.1. The credit value allowed in the estimate for the returned Stores which are not likely to be required again shall be kept within the figure likely to be realised for it as an obsolete material or as scrap.

6. 18.2. For materials likely to be used again, after return credit value proportionate to its further life may, however, be provided in the estimate. The normal life of some of the Signalling equipments as laid down in para 219 of the Indian Railway Financial Code is as follows :—

(i) Signalling apparatus—both Mechanical and power	25 Years
(ii) Underground Cables	30 Years
(iii) Block token instruments	25 Years
(iv) Electrical power plant—Oil Engine driven	15 Years
(v) Motor Vehicles—Road and Rail Motor Trolley	10 Years

SECTION ' K '

Requisitions

6.19. Preparation of Requisitions.—The following instructions shall be observed in the preparation of requisitions :—

6.19. 1. Separate requisitions shall be prepared for each item of material. Requisition for stock items shall be prepared in Form No. S. 1313 and for Non-Stock items in Form No. S. 1302 (samples of Forms at Annexure ' 32 '.)

6.19.2. Nomenclature, price list Nos., and other references shall be correctly reproduced. In the case of special and non-standard items, description with complete specifications and drawings shall be given.

6.19.3. Blank space, if any, below the last item shall be crossed.

6.19.4. The designation of the consignee shall be written in full. No code abbreviations shall be given.

6.19. 5. The head chargeable shall be entered on all the requisitions.

6.19.6. The requisition for materials for different sanctioned works and revenue maintenance shall be distinguished by a mark or a code letter, as laid down by the Stores Department.

6.19.7. In the case of sanctioned works, the number of estimate and the reference of the sanctioning authority shall be given clearly.

6.19. 8. The quantity of each material shall be given in correct units in words and figures.

6.19.9. Corrections, if any, shall be initialled.

6.19. 10. Availability of funds shall be certified by the Divisional Signal and Tele-communication-

Engineer.

6.20. Requisitioning of Materials.—

6.20.1. All materials and equipment shall normally be indented in accordance with Indian Railways Standard Drawings and specification Where any such drawing or specification number is quoted, the latest alteration number as on the date of purchase will automatically apply. For items for which an I. R. S. specification does not exist, an appropriate specification shall be quoted.

6.20.2. No alteration or modification to or divergence from I. R. S. drawings shall be permitted without the specific sanctions in writing, of the Chief Signal and Telecommunication Engineer. In the case of deviations having been decided upon before the placing of an order, whether direct or through the Director-General, Supplies and Disposals, the indenting authority concerned shall quote such sanction in the order. When deviations are decided upon or desired after the placing of an order, the necessary sanction shall be obtained, in writing, by the Inspectorate concerned in consultation with the indenting authority.

SANCTION 'L'

General Instructions

6.21. Stores supplied by firms.—Receipt of Stores received direct from firms shall be promptly acknowledged. Discrepancy or defect, if any, shall be brought to the notice of the Divisional Signal and Telecommunication Engineer immediately.

6.22. Custody and Maintenance.—The Inspectors shall be responsible for the maintenance of all Stores and Tools and Plant in their charge in proper condition. Where Watchmen are necessary,

the Inspector shall approach the Divisional Signal and Telecommunication Engineer giving full justification. The guidelines laid down in Annexure ' 33 ' shall be followed as far as practicable.

CHAPTER VII

REQUIREMENTS OF SIGNALLING

SECTION ' A '

Signals, Generally

7.1. Location of Signals.—

7.1.1. Signals shall be so located and aligned as to

(a) display the best possible view of their aspects to Drivers o f approaching trains.

(b) to avoid, as far as possible the possibility of the aspect of one signal being mistaken for the aspect of another, and

(c) avoid confusion between the lights of running signals and the lights of subsidiary signals or and the lights.

7.1.2. Signals shall nominally be on the left of, or above the line to which they apply, unless authorised by special instructions to the contrary.

7.2. Size of Lenses. -The lenses of subsidiary signals shall be of smaller diameter than those of

running signals. Subsidiary signals shall not be brighter than running signals.

7.3. Number of Signals and height.—The number of signals and their height shall be limited to what is necessary for Safety and operational requirements.

7.4. Outside interference.—All apparatus shall be so designed, located and secured as to obviate, as far as possible, outside interference.

7.5. Signals controlled through slots or disengages.—Where a signal is controlled through slots or disengages, it shall not be possible to take ' off' a signal unless all the controls have been exercised by the controlling agencies. It shall be possible for any one of the controlling agencies to replace the signal to ' ON ' position by withdrawal of the control.

7.6. Standard and type of Signalling on a section.—It is desirable that the signalling at all block station and interlocked level crossings in the same section conform to the same standard and type.

7.7. Visibility.—The minimum visibility distance of various signals shall be as under —

Two Aspect Signals .—

7.7.1. Outer Signal.—1200 metres in sections where sectional speed is 100 Kilometres per hour and above. 800 metres where sectional speed is less than 100 Kilometres per hour. Where minimum visibility as above cannot be achieved, warner may be separated. With the Warner separated, minimum visibility of" outer shall not be less than 400 metres.

7.7.2. Warner Signal on a post by itself ... 400 Metres

7.7.3. Home Signal ... 400 Metres

7.7.4. Main Starter Signals ... 400 Metres

7.7.5. All other Signals ... 200 Metres

Note.— Where adequate visibility of Stop Signals cannot be provided, repeater or co-acting signals shall be provided to ensure the combined visibility or speed restrictors imposed.

Multiple Aspect Signals.—

7.7.6. Distant Signal.—400 Metres. An inner Distant Signal where provided, shall be visible from a minimum distance of 200 metres.

7.7.7. All Stop Signals.—200 metres. If it is not possible to ensure 200 metres continuous visibility of any stop Signal while approaching it, a suitable speed restriction shall be imposed.

SECTION ' B '

Semaphore Signals

7.8. Visibility of a Signal from the place of operation.—Where a Signal, due to its position is not visible to the Railway Servant operating the signals, the aspect of the Signal and the condition of its light shall be repeated at the place of operation. Repeaters for Home Signal and Last Stop Signal shall be provided in the Station Master's office also if all the following conditions are fulfilled:—

(a) The signals are not vissible from the platform outside his office ;

and

(b) The Station Master operates the Block Instruments ;

and

(c) Stations Master's Control is not provided on the relevant signals.

7.9. Visibility of front light.—Where the front light of a signal is not visible from the place of operation a back light or a repeater shall be provided. The back light shall show a white light in the 'ON position, and no light in any other position.

7.10. Fixed Green Light of Warner Signal.—The fixed green light above a Warner Signal on a post by itself shall be provided with a back light or it shall be repeated.

7.11. Unworked Warner Signal.—The position of the arm of an unworked Warner Signal which is not visible, need not be repeated. The condition of the light shall, however, be repeated.

7.12. Back lights for the ' Attention' aspect—The arrangement of back lights for a Signal capable of displaying the ' attention ' aspect shall be such that two lights are visible in the ' ON ' position and no light in any other position. However, only one back light of the Main Yellow aspect may be provided for electrically lit Distant Signals, if the arrangement is such that the bottom light is lit only when the arm is displaying the attention aspect.

7.13. Fixing Signal arms.—All signal arms shall be fixed on the left hand side of the post.

Two Aspect Lower Quardrant Signalling.—

7.14. Warner Signals —

7.14. 1. Semaphore Arm.—The semaphore arm of a Warner Signal shall be fish-tailed. The front of the arm shall be red with a fish-tailed white bar. The back of the arm shall be white with a fish-tailed black bar.

7. 14.2. Day and night indications.—By day, the arm of a Warner Signal shall be horizontal in the ' ON ' position and 45° to 60° below the horizontal in the ' OFF ' position. By night the Signal shall exhibit a red light in the ' ON ' position and a green light in the ' OFF ' position. When the Warner Signal is placed on a post by itself, a fixed green light shall be displayed 1.5 metres to 2 metres above it by night.

7.14.3. Conditions for taking ' OFF '.—A Warner Signal shall not be capable of being taken ' OFF ' for any line other than that over which the highest speed is permitted and not untill the levers of all relevant signals have been pulled and the relevant signals have assumed the ' OFF ' aspect.

7.14.4. Electric lighting.—On trunk routes and other main lines nominated by the Railway Board, warner signals shall be electrically lit.

7.14. 5. Placing of Warner Signal.—A warner Signal may be placed, either—

(a) on a post by itself with a fixed green light by night 1.5 metres to 2 metres above it at an adequate distance (not less than 1200 metres unless otherwise permitted by approved special instructions) outside the First Stop Signal or Gate Stop Signal ; or

(b) on the same post, but 1.5 metres to 2 metres below the arm of the outer Signal ; and

(c) on the same post as, but 1.5 metres to 2 metres below the Last Stop Signal of a station in rear.

7.14.6. Warner Signal below a Stop Signal.—When the Warner Signal is placed below a Stop Signal, the variable light of the Stop Signal shall take the place of the fixed green light of the Warner Signal and the the arrangements shall be such that the Warner Signal cannot be taken, ' OFF' while the Stop signal above it is ' ON '.

7.14.7. Warner Signal in rear of Gate Stop Signal.—When the Warner Signal applies to a Gate Stop Signal only, it shall not display the 'OFF' aspect unless there is a distance of at least 1200 metres between the Gate Stop Signal and the First Stop Signal of the Station ahead.

7.14.8. Where the distance between the Last Stop Signal of one station and the First Stop Signal of the Station ahead is less than 1200 metres the Warner Signal of the previous station shall be taken ' OFF ' only when the First Stop Signal of the Station ahead is in the' OFF ' position.

7.15. Stop Signals.—

7.15.1. Semaphore arm.—The Semaphore arm of a Stop Signal shall be square ended. The front of the arm shall be red with a white bar. The back of the arm shall be white with a black band. The bars shall be parallel to the end of the arm.

7.15.2. Day and night indications.—By day the arm of a Stop Signal shall be horizontal in the ' ON ' position and 45° to 60° below the horizontal in the ' OFF ' position. By night, the signal shall display a red light in the ' ON ' position and a green light in the ' OFF ' position.

7.15.3. On trunk routes and other main lilies nominated by the Railway Board, outer signals shall be electrically lit.

7.16. Stop Signals Location of :—

7.16.1. Outer Signals.—The outer signal where provided or the Home Signal, where an outer Signal is not provided, shall be placed not less than 400 metres in rear of the Points upto which the line may be obstructed after Line Clear has been given to the Station in rear.

7.16.2. Home Signals.—.The Home Signal shall be placed in rear of all connections, if any, on the line to which it refers.

7.16.3. Routing Signal.—A Routing Signal shall be placed in the rear of the Points, which it protects.

7.16.4. Starter Signals.—

(i) A starter Signal shall be placed at not less than 400 metres in advance of the Home Signal.

(ii) Where a Starter Signal is provided for each converging line, it shall be placed as to protect the adjacent running line or lines.

(iii) Where one starter Signal only is provided for two or more converging lines, it shall be placed outside the connections on the line to which it applies.

7.16.5. Intermediate Starter.—An Intermediate Starter Signal shall be placed clear of fouling marks in rear of the points, if any, which it protects.

7.16.6. Advanced Starter.—Unless approved under special instructions, an Advanced Starter Signal shall be placed outside all connections on the line to which it applies. It shall be placed at not less than 180 metres from outermost point in the case of Single Line section. This distance shall be reckoned from the Starter in the case of Double Line Section. If the Advanced Starter is placed at a distance more than 180 metres, the portion of track between the Starter and Advanced starter shall be track-circuited.

7.16. 7. Reduction of distance between Signals.—The distances laid down in paras 7.16.1,7.]6.4 and 7.16. 6 may be reduced under approved special instructions.

7.16.8. Combined Signals.—When, owing to their location, it is necessary to combine two Signals, e. g., an Advanced Starter, with an Outer Signal, one Stop Signal only suitably controlled from the points of operation of the two Signals may be provided, under approved special instructions.

7. 17. Distinction between Signals:—For Diverging lines. —

7.17.1. Unless otherwise permitted by approved special instructions, where two or more lines diverge, the signals shall be fixed on a bracket post or any route indicator of approved design shall be provided. In special circumstances or where the number of signals is considerable, they may be

fixed on separate posts or dolls carried on a signal bridge or gantry.

7.17.2. If permitted by approved special instructions, two or more signals may be placed on the same post. In such cases, the top arm shall apply to the extreme left hand diverging line and the second arm shall apply to the next line in order from the left, and so on.

7.17.3. Where Signals are carried on bracket posts or gantries, left hand signal in each case shall refer to the left hand line, the second signal from the left shall refer to the next line from the left and so on. The Signal for the main line shill be placed at a higher level than the signal or signals referring to the other running line or lines.

7.18. Distinction between Signals.—For converging lines.—When two or more lines converge, the signal shall be fixed on separate posts. Where signals are carried on brackets or bridges under approved special instructions, instructions given in Para 7. 17. 3 will apply.

Subsidiary Signals:

7.19. Calling-on Signals.—

7.19.1. Type and Function.—A Calling-on signal has no independent aspect in the ' ON ' position and shall be a Semaphore arm. A Calling-on signal when taken' OFF ' calls on the Driver of a train to draw ahead with caution, after the train has been brought to a stop even though the Stop Signal above it is at ' ON ". It indicates to the Driver that he should be prepared to Stop short of any obstruction.

7.19.2. Semaphore arm.—'The Semaphore arm of a Calling-on Signal shall be a short square

ended arm. The front of the arm shall be white with a red bar. The back of the arm shall be white with a black bar. The bars shall be parallel to the end of the arm.

7.19.3. Day indication—By day, the arm shall be—

(a) Horizontal in the ' ON ' position ;

(b) 45° to 60° below the horizontal in the ' OFF ' position.

7.19.4. Night indication—By night, the signal shall display—

(a) no light in the ' ON ' position ;

(b) A miniature yellow light in the ' OFF ' position.

7.19.5. Placing and working.—

(a) 'Calling-on Signal shall be placed below a Stop Signal governing the approach of a train. Under approved special instructions, a Calling-on Signal may be provided below any other Stop Signal except the ,last Stop Signal.

(b) The Calling-on Signal shall not be capable of being worked at the same time as the Stop Signal hove or shunt Signal below it, if any.

(c) It is desirable to provide track circuits at a suitable distance and a time delay circuit to ensure 'vat the Calling-on Signal is taken ' OFF ' only after the train has been brought to a stop.

(d) A Calling-on Signal shall detect all the Points in the route, which the main signal above it detects excluding overlap in double line section. On Single line section under approved special instructions, a Calling-on signal placed below the first Stop Signal may not detect points in the overlap.

(e) At stations where Station Master controls the reception and despatch of trains, such control shall be extended to Calling-on Signals also.

7.20. Shunt Signals:

7.20.1. Type—A shunt signal shall be either—

(a) a Disc Signal or

(b) a Position Light Signal.

Under special instructions, a shunt Signal may be a miniature Semaphore arm.

7.20.2. Disc Signals.—'The front of the disc shall be white with red bar. The back of the disc shall be white with a black bar. By day, the bar of a disc signal shall be horizontal in the ' ON ' position and 45° to 60° below the horizontal in the ' OFF ' position in the anti-clockwise position . By night, the signal shall display a red light in the 'ON' position and a green light in the 'OFF' position.

7.20.3. Position Light Signal.—Para 7.42.2 may be referred to.

7.20.4. Miniature Semaphore Signal.—(a) The Semaphore arm of a shunt Signal shall be square ended. The front of the arm shall be red with a white bar. The back of the arm shall be white with a black bar. The bars shall be parallel to the end of the arm.

(b) The day and night indications of a miniature semaphore shunt signal shall be as in Para 7.15.2.

7.20.5. Location.—(a) Shunt Signals may be separately located on posts or close to the ground or may be fixed below Stop Signals other than the First Stop Signal of a station.

(b) Where a Shunt Signal is required to be fitted on a Signal post on which a Calling-on signal is also fitted, the Shunt Signal shall be fitted below the Calling-on Signal.

(c) A Shunt Signal placed below a Stop Signal or a Calling-on Signal shall not be capable of being worked at the same time as the relative Stop Signal or Calling-on signal.

(d) Where a Shunt Signal is fixed below a Stop Signal it shall show no light in the ' ON ' position.

7.20.6. Diverging routes.—More than one shunt signal may be placed on the same post and when so placed, the top most Shunt Signal shall apply to the extreme left hand line and the second shunt signal from the top shall apply to the next line from the left and so on. One shunt Signal with or without a route indicator may also be provided for a number of diverging routes.

7.21. Repeating Signal—

7.21.1. A repeating signal is a signal placed in rear of a fixed signal for the purpose of repeating to

the driver of an approaching train aspects of the fixed signal in advance. It shall be provided with a marker consisting of a white-enameled disc with letter ' R ' in black.

7.21.2. A repeating signal shall be of—

(a) banner type, or

(b) a square ended Semaphore arm, or

(c) a colour tight signal. (Para 7.42. 3 may be referred to).

The 'ON ' position of the repenting signal indicates that the signal which it repeats is at ON ' while the OFF ' position indicates that the signal which it repeats is ' OFF'.

7.21.3. The front of the banner shall be white with two black bars and a yellow bar in between. The banner shall be horizontal in the ' ON ' position and 45° to 60' above the horizontal in the ' OFF ' position in the anti-clockwise direction.

7.21.4. (a) The arm of a semaphore repeating signal shall be square ended. The front of the arm shall be yellow with a black bar. The back of the arm shall be white with a black bar. The bars shall be parallel to the end of the arm.

(b) By day, the arm shall be horizontal in the ' ON ' position and 45° to 60° below the horizontal in the ' OFF ' position. By night the signal shall exhibit a yellow light in the ' ON ' position and a green Light in the ' OFF ' position.

7.22. Co-acting Signals.—Co-acting signals are duplicate signals fixed below Stop Signals and are

provided where, in consequence of the height of the signal post or of there being an over-bridge or other obstacle, the main arm or light is not in view of the Driver during the whole time that he is approaching it.

Co-acting signals shall be fitted at such a height that either the main arm or light or the co-acting arm or light, is always visible.

Modified Lower Quadrant Signalling

7.23. Provision.—Modified Lower Quadrant Signalling shall be provided only under special instructions issued by the Railway Board. Where the provision of such signalling is permitted, the requirements laid down in this section shall apply.

7.24. Distant Signals—

7.24.1. Semaphore arm.—The Semaphore arm of a Distant Signal shall be fish-tailed. The front of the arm shall be yellow with a fish-tailed black bar. The back of the arm shall be white with a fish-tailed black bar.

7.24.2. Day and night indications.—(i) By day, the arm of a Distant Signal shall be horizontal in the ' ON ' position displaying the ' caution' aspect. It shall be 45' to 60° below the horizontal in the ' OFF ' position displaying ' Proceed ' aspect.

(ii) By night, the signal shall display a yellow light in the ' ON ' position and a green light in the ' OFF ' position.

7.24.3. Electric lighting of Distant Signal.—On trunk routes and important main lines nominated

by the Railway Board, Distant Signals shall be electrically lit.

7.24.4. Location.—On both double and single lines, the Distant Signal shall be placed at an adequate distance in rear of the first Stop Signal, the adequate distance being not less than 1 kilometer-

7.25. Warner Signals—

7.25.1. Semaphore arm.—The Semaphore arm of a Warner Signal shall be as in Para 7.14. 1.

7.25.2. Day and night indications.—The day and night indication of a Warner Signal shall be as in Para 7.14.2.

7.25.3. Conditions for taking ' OFF ' —A Warner Signal shall not be capable of being taken 'OFF' for any line other than that over which the highest speed is permitted and not until the levers of all relevant signals have been pulled and the relevant signals have assumed the ' OFF ' aspect.

7.25.4. Placing.—Warner Signal shall be placed on the same post as but 1.5 meteres to 2 metres below the Main Home Signal. The arrangement shall be such that the Warner Signal cannot be taken ' OFF ' while the stop Signal above it is 'ON '.

7.26. Stop Signals.—The Semaphore arm of a Stop Signal and day and night indications shall be as indicated in paragraphs 7.15.1 and 7.15.2.

7.27. Stop Signals—Location of—

7.27.1. Home Signals.—The Home Signal shall be placed not less than 180 metres in rear of the points upto which the line may be obstructed after Line Clear has been granted to the station in rear.

7.27.2. Routing Signal.—A Routing Signal shall be placed as in Para 7.16.3.

7.27.3. Starter Signals.—When one Starter Signal is provided for each converging line, it shall be so placed as to protect the adjacent running line or lines.

1.27. A. Intermediate Starter Signal.—An Intermediate Starter Signal shall be placed as in Para 7.16.5.

7.27.5. Advanced Starter Signal.—'Unless approved under special instructions, an Advanced Starter Signal shall be placed outside all connections on the line to which it applies.

It shall be located at a distance of not less thanl20 meters from the outermost points in the case of Single Line section. This distance shall be reckoned from the starter in case of Double Line Section.

If the Advanced Starter is placed at a distance of more than 120 metres, the entire portion between the Starter and the Advanced Starter shall be track-circuited.

7.28. Distinction between Signals.—Requirements shall be the same as indicated in Paragraphs 7.17 and 7.18.

7.29. Subsidiary Signals.—Requirements shall be as in Paragraphs 7.19 to 7.22.

Multiple Aspect Semaphore Signalling

7.30.1. Semaphore arm.—The semaphore arm of a Distant Signal shall be as in Para 7.24.1.

7.30 2. Day and night indications.— (a) By day, the arm of a Distant Signal shall be horizontal in the ' ON ' position displaying the ' caution ' aspect. It shall be 40° to 45° above the horizontal in the ' OFF ' position displaying ' Attention ' aspect. It shall be 850 to 90° above the horizontal in the 'OFF ' position displaying the ' Proceed ' aspect.

(b) By night, the signal shall display one yellow light for the ' Caution' aspect, two yellow lights in a vertical line 1.5 metres apart for the ' Attention ' aspect and one green light for the ' Proceed ' aspect.

7.30.3. Electric Lighting of Distant Signal.—Distant Signals shall be electrically lit on the trunk routes and important main lines nominated by the Railway Board.

7.30.4. Location.—On both double and single line sections, the Distant Signal shall be placed at an adequate distance in rear of the First Stop Signal, the adequate distance being not less than 1 kilometre.

7.31. Stop Signals :

7.31.1. Semaphore arm.—The semaphore arm of a Stop Signal shall be as in Para 7.15.1.

7.31.2. Day and night indications.—(a) By day, the arm of a Stop Signal shall be horizontal in the ' ON ' position displaying the ' STOP ' aspect. It shall be 40° to 45° above the horizontal in the ' OFF ' position displaying the ' Caution' aspect. It shall be 85° to 909 above the horizontal in the ' OFF ' position displaying the ' Proceed ' aspect.

7.32. Stop Signals—Location of—

7.32.1. Home Signal.—The Home Signal shall be placed in rear of all connections, if any, on the line to which it refers.

The Home Signal shall be placed not less than 180 metres in rear of the points upto which the line may be obstructed after line clear has been granted to the station in rear.

7.32 2. Routing Signal. -A Routing Signal shall be placed as in Para 7.16.3.

7.32.3. Starter Signal.—A Starter Signal shall be placed as in Para 7.27. 3.

7.32.4. intermediate Starter Signal.—An Intermediate Starter Signal shall be placed as in Para 7.16.5.

7.32. 5. Advanced Starter Signal.—An Advanced Starter Signal shall be placed as in Para 7.27.5.

7.33. Aspects—Sequence—

7.33.1. When a Signal is displaying the ' Stop ' aspect, the signal next in rear shall not display a less restrictive aspect than ' Caution '.

7.33.2. Every Multiple Aspect Signal, whether automatic, semi-automatic, or manually operated which, is required to display ' caution ' aspect to a train shall normally be placed at an adequate distance from the next signal in advance. This adequate distance shall not be less than 1 kilometre. Where the adequate distance cannot be provided and the 'caution ' aspect is being displayed, the next signal in rear shall display the ' attention '/ ' caution ' aspect.

7.33.3. If necessary, the ' Attention ' / ' Caution ' aspect shall be repeated back on successive signals. in rear until the adequate distance is obtained.

7.33.4. In all cases the signal next in rear of a Signal protecting diverging lines shall display ' Attention '/ ' Caution ' aspect in the ' OFF' position, when the points are set for any line other than the line over which the higher speed is permitted. When this signal cannot be placed sufficiently in rear of the ' STOP ' signal protecting the Points to permit the Driver of an approaching train to reduce to the sanctioned speed, the ' Attention '/ ' Caution ' aspect shall be repeated back on successive signals in rear until the required distance is obtained.

7.34. Combined Signals—When owing to their location, it is necessary to combine two signals, one Stop Signal only may be provided under approved special instructions, capable of displaying any or all the following aspects :—

(a) Danger.

(b) Caution.

(c) Attention.

(d) Clear.

7.35. Distinction between Signal.—For Diverging Lines.—Requirements shall be as in Para 7.17.1, to. 7.17.3.

7.36. Distinction between Signals—For Converging Lines.—Requirements shall be as in Para 7.18.

Subsidiary Signals

7.37. Calling on Signals—

7.37.1. The type and function of ' Calling on Signals ' shall be as in Para 7.19.1.

7.37- 2. The Semaphore arm of a Calling-on Signal shall be as in Para 7.19.2. By day, the Semaphore arm of a Calling-on Signal shall be—

(a) Horizontal in the ' ON ' position, and

(b) 40° to 45° above the horizontal in the ' OFF ' position.

By night, the signal shall display—

(i) No light in the ' ON ' position ; and

(ii) A miniature yellow light in the ' OFF ' position.

7.37.3. The placing and working of the Calling-on Signal shall be as in Para 7.19. 5.

7.38. Shunt Signals—

7.38.1. Type of Shunt Signals shall be as in Para 7. 20.1.

7.38.2. Disc Signal.—The front of the Disc Signal shall be white with a red bar and the back of the Disc Signal shall be white with a black bar. By day the bar of a Disc signal shall be—

(a) horizontal in the ' ON ' position, and

(b) 40° to 45° above the horizontal in the ' OFF ' position in the clock-wise direction.

By night, the signal shall exhibit a red light in the ' ON ' position and a yellow light in the ' OFF ' position. 7. 38.3. Position Light Shunt Signals.—Para 7.42.2 may be referred to.

7.38.4. Miniature Semaphore Shunt Signal.—(a) The arm of a miniature Semaphore shunt signal shall be as in Para 7.20.4 (a).

(b) By day the arm shall be horizontal in the ' ON ' position and 40° to 45° above the horizontal in the ' OFF ' position. By night, the signal shall exhibit a red light in the ' ON ' position and a yellow light in the ' OFF ' position.

7.38.5. Location — The location of the Shunt Signals shall be as in Para 7.20.5.

7. 38.6. Fixing of Shunt Signal below a Stop Signal.— Where a Shunt Signal is fixed below a Stop Signal, it shall show no light in the ' ON ' position.

SECTION ' C '

Colour Light Signals

7.39. General—

7.39.1. The signals shall be free from the possibility of phantom indication.

7.39.2. Colour Light signals shall normally be of multiple aspect type.

7.40. Aspects of Signals—

7.40.1. Warner Signal.—.The day and night aspects of a colour light Warner Signal shall conform to the night aspects of a semaphore Warner signal. The colour light Warner signal shall be provided with a marker consisting of a white-enameled disc with letter ' P' in black when the Warner is provided on a post by itself.

7.40.2. Distant Signal.—The day and night aspects of a colour light Distant Signal in modified lower quadrat/multiple aspect territories shall conform to the night aspects of a semaphore Distant Signal. The Colour Light Distant Signal shall be provided with a marker consisting of a white-enameled disc with letter ' P ' in black.

7.40.3. Stop Signal.—The day and night aspects of a Colour Light Stop Signal in two aspect/ modified lower quadrant/multiple aspect territory shall conform to the night aspects of a

semaphore Stop-Signal in the same territory.

7.41. Route Indicator :—

The type of Route Indicator to be provided instead of separate signals shall be as under —

(a) Two Aspect Colour Light Signalling Section : Any route indicator of approved design.

(b) Multiple Aspect Colour Light Signalling Section :

For speeds in excess of 15 km. p. h.—'Direction type Route Indicator.

For speeds not exceeding 15 km. p. h.—Any Route Indicator of approved design.

7.42. Subsidiary Signals —

7.42.1. Calling-on Signal.—A Colour Light Calling-on Signal shall display no light in the ' ON position and a miniature yellow light in the ' OFF ' position. The colour light Calling-on Signal shall be provided with a marker consisting of a white enameled disc with letter ' C ' in black.

7.42 2. Shunt Signal.—Shunt Signals shall be of the Position Light type. The lights of a Position Light Signal shall be white. By day and by night, the two lights of a Position Light signal shall be horizontal in the ' ON " position and 45° above the horizontal in the ' OFF ' position.

7.42.3. Repeating Signal :—A colour light type repeating signal shall exhibit a yellow light in the ' ON ' position and a green light in the OFF ' position. It shall be provided with a market which

shall show a white illuminated letter' R ' against a black background.

7.42.4. Starter Indicator :—Starter Indicators may be provided to repeat the aspect of the Starter as an aid to the Guard to enable him to know the aspect of the Starter. This repeater may be provided at a convenient place. The Starter Indicator shall exhibit no light when Starter is at ' ON ' and yellow light when it is ' OFF '.

SECTION 'D'

Gate Signals

7.43. A Gate Stop Signal shall be fixed at an adequate distance from the gate, this adequate distance not being less than the value stipulated in Para 7.45.1 and 7.45.2.

7.44. The Gate Stop Signal shall be provided with ' G ' marker except where prohibited under special instructions.

The ' G ' marker shall consist of letter ' G ' in black on yellow circular disc. The instructions in Para 7.168.2 shall apply to signals protecting level crossing gates in automatic block territory.

Interlocked Level Crossing gates outside station limits

7.45.1. On sections provided with two aspect lower Quadrant Signalling, a Stop Signal at 400 metres from the gate shall be provided. Where the section is otherwise provided with separate Warner signals, such a signal shall bf provided at a distance of not less than 1.2 km. from the Gate Stop Signal.

7.45.2. On Sections provided with multiple aspect/modified lower quadrant signalling, a Stop Signal

ft 180 metres from the gate and a Distant signal at 1 km. in rear of the Stop Signal shall be provided.

7.46. Interlocked Level crossing Gates inside station limits or in the vicinity :—

7.46.1. On sections provided with two aspect Lower Quadrant Signalling,

(a) The Outer Signal shall be located at a minimum distance of 400 metres from the gate ;

(b) Where the Outer Signal cannot be so located and the Outer Signal falls in between Home Signal and Gate, a separate Gate signal may be located at a distance of 400 metres in rear of the gate ;

(c) Where there is adequate visibility of the Outer Signal as prescribed in Para 7.7.1, the Gate Signal shall work independent of the Outer Signal ;

(d) Where the visibility of Outer Signal is not adequate, the Outer Signal shall be shifted and combined with the Gate Signal where feasible or inter-slotting arrangement shall be provided between the Outer Signal and the Gate Signal.

7.46.2. On sections provided with Multiple Aspect/Modified Lower Quadrant Signalling when the interlocked gates are situated between distant arid Home Signal—

(a) The Gate Signal shall be located at 180 metres in rear of the gate ;

(b) The Distant Signal shall be located at not less than one kilometre in rear of the Gate Signal and will function as Gate Distant as well.

SECTION ' E'

Warning Boards

7.47. A Warning Board to warn the driver of his approaching a Stop Signal shall be provided at a distance of 1.4 km. in rear of the First Stop Signal of a station and Gate Slop Signal. This distance may be increased suitably to cater for gradient.

7.48. On sections where emergency braking distance of more than 1.6 km. is to be catered for, a second approach signal shall be provided failing which suitable speed restriction imposed.

7.49. In cases where Gate Signals and station signals happen to be located close to each other, only one warning board shall be provided at a distance of not less than 1.4 km. from the First Stop Signal.

7 50. Where inter-signal distance between two signals is less than the distance required for warning Board, the signals in rear shall either be controlled by the signal in advance or they shall be combined.

7.51. Self reflecting sheets of approved type or reflectors shall be provided on the warning board as per approved drawings.

7.52. The warning board shall normally be on the left of the line to which it applies unless there are special reasons to the contrary.

SECTION ' F'

Indication Board

7.53. Indication Boards are provided to give warning to drivers about changes in type of signalling or type of Block Working.

7.54. Where a Block station, which is provided with two aspect signalling without a Warner signal in rear of the First Stop Signal, is approached from a section provided with Multiple Aspect Signalling or with two aspect signalling with a Warner signal in rear of the First Stop Signal, an Indication Board bearing alternate yellow and black diagonal stripe shall be fixed at not less than 1.4 km. in rear of the First Stop Signal. The Board shall have a legend " Approaching unwarned Stop Signal".

7.55. When a station provided with single line token block is approached from a Double Line of a Single Line section equipped with tokenless block working, an indication board with symbol " Entering Token Territory " shall be provided at the First Stop Signal of the station.

7.56. Where the block working at one end of a station is automatic and the other end is absolute, an indication board with suitable legend shall be provided at the First Stop Signal of the station.

The legend on the board shall be " Entering Absolute Block Territory " or " Entering Automatic Block Territory " as appropriate.

7.57. Shunting Limit Board—A Shunting Limit Board shall be provided at Class ' B ' stations over a single line section worked on Absolute Block System where shunting in the face of an approaching train is permitted and where an Advanced Starter is not provided. The Shunting Limit Board shall be fixed at a distance of not less than 400 metres in case of two aspect lower quadrant signalling

territory and 180 metres in case of multiple aspect and modified lower quadrant signalling territory in advance of the First Stop Signal.

7.58. Block Section Limit Board :—

7.58.1. At Class ' B ' stations worked on Double Line Absolute Block System with multiple aspect or modified lower quadrant signalling a Block Section Limit Board shall be provided where there are no points or the Outermost points are trailing.

7. 58.2. The Block section Limit Board shall be located at 180 metres in advance of the Home Signal and protecting the fouling mark of the trailing points, if any.

7.59. The Block section Limit Board or the Shunting Limit Board shall be so located that the legend is facing towards the station. They shall befitted with lamps showing white light in both directions during night.

Note.-Chapter XII may be referred to for the painting details.

SECTION ' G'

Points

7.60. All double wire worked Point and Lock mechanisms shall be provided with broken wire locks and electrical detection in addition to mechanical detection. In the case of Point mechanism, the broken wire lock shall function before the opening between the tongue rail and the stock rail exceeds 5 mm. at 150 mm. from the toe.

Note.—In all new installations. Points, Locks and Bars shall not be operated by wire but by rodding

or by electrical means.

7.61. Permissible Distances.—The distance at which Points may be worked by rodding must not exceed 320 metres except where the stroke at the lever tail is not less than 200 mm. in which case the above distance may be increased to 460 metres. For special type of switches, the Chief Signal and Telecommunication Engineer may stipulate the permissible distance.

Note, No new installation shall be commissioned with Points mechanically operated and locked by the same lever.

7.62. Obstruction test.—The insertion of a 5 mm. obstruction between the switch rail and the stock rail of a Facing Point, approximately 150 mm. from the toe of the switch shall prevent the Point from being locked and the relative signal or signals, where provided, being taken ' OFF ' for movements in the facing directions

7.63. Detection by Shunt Signals—

7.63.1. In all new installations, Points on a running line used in the facing direction for shunting movement shall be provided with a Facing Point Lock.

7.63.2. The Shunt Signal shall lock and detect all Points in the route in electrically interlocked installation, where required.

7.63.3. Single switch detection is permitted for shunt signals movement.

7.64. Operation of Facing Point lock.—The operation of the facing point lock shall depend on the

correct operation of the lock bar. This lock bar shall form a part of the transmission and be in series with it.

7.65. Length of Lock Bars.—The length of lock bar shall exceed the greatest distance between any two adjacent axles of any vehicle likely to be used on the section.

7.66. Point Indicators—

7. 66. 1. Type.—Point Indicators shall be of the target type.

7. 66.2. Provision.- (a) Point indicators shall be provided at all Points on running lines which are not interlocked with Signals, unless the position of Points is otherwise proved.

(b) Point Indicators shall be provided on interlocked facing points which are protected by only a single arm Home Signal instead of separate signals on a bracket post or a route indicator.

7. 66. 3. Indications.— (a) When the points are set for the straight line, the indicator shall display a white target by day and a white light by night, in each direction.

(b) When the points are set for the diverging line, the indicator shall display the edge of the disc by day and a green light by night, in each direction.

At Points where a green light would give a misleading indication to a Driver, a red light may be permitted under special instructions.

7.67. Trap Indicators.—

1.61 A. Type.—Trap indicators shall be of the target type.

7.62.2. Provision.—Trap indicators shall be provided at all trap Points on running lines which are hot interlocked with signals unless the position of trap points is otherwise proved.

Note.—Points leading to a short dead end and used solely for the purpose of trapping the riming line or sidings shall be treated as derailing switch.

7.67.3. Indications.— (a) When the Trap Points or derailing a witches are open, the Indicator snail display a red target by day and a red light by night in each direction.

(b) When the trap Points or derailing switches are closed, the indicator shall display the edge of the disc by day and a green light by night, in each direction.

At trap points where a green light would give a misleading indication to a Driver, a white light may be permitted to indicate trap " CLOSED " position only.

7. 68. Size of lights and placing.—Points and trap Indicators shall be provided with miniature lights and as a rule be placed as close to the ground as circumstances permit.

7.69. Shunting Permitted Indicator—

7.69.1. Type.— Shunting Permitted Indicator may be of the disc type or of the light type.

7.69.2. Provision.— Shunting Permitted indicator may be provided to permit uninterrupted to and

fro movements towards shunting neck or other connected lines.

7.69.3. Indications.—Day and night indications of the Shunting Permitted Indicator shall be as follows :

Type	Indication when shunting is permitted in the direction to which it refers		Indication when shunting is not permitted in the direction to which it refers	
	Day Indication	Night Indication	Day Indication	Night Indication
Disc Type	Black disc with a yellow cross painted on it.	Yellow cross light	Edge of disc	No light
Light type	Yellow cross light	Yellow cross light	No light	No light

7.69.4. Working.—Shunting permitted Indicator may be operated by a ground lever which works in conjunction with a Stop Signal so that either the shunting permitted indicator or the associated stop signal can be taken off at a time.

7.70. Spring Points—

7.70.1. Spring points shall be used only in exceptional cases where the same purpose cannot be achieved conveniently by other means.

7.70.2. Spring Points if used in the facing direction must be fitted with facing point locks. They may be operated from a Cabin or from a ground lever. In the latter case, the ground lever shall be of such a type that it will not move when the Points are being trailed through.

7.71. Movable Diamond Crossing.—.Movable Diamond Crossings on passenger lines shall be provided with complete facing point equipment of approved type.

7.72. Means of Isolation.—

7.72.1. Sand humps, trap points, or other approved means of isolation shall be provided on all goods lines and sidings at their junctions with passengers lines, the normal setting being such as to prevent the passenger lines from being fouled,

1.12.2. At interlocked layouts the means of isolation shall be interlocked with the relative signals.

7.72.3. In order to maintain safety for through running Points for trap sidings shall not be inserted in the main or through line.

An exception may, however be allowed under approved special instructions in cases where, owing to grades in or near stations, it is necessary to prevent—

(a) trains being brought to a stand at a Stop Signal on a rising grade, or

(b) vehicles running away from the station.

An exception may also be allowed under approved special instructions, where it is considered

necessary in the interest of working to receive trains from opposite directions at the same time.

At stations where trap siding are inserted on Main lines, through running shall be permitted only under approved special instructions.

7.73. Provision of Isolation—

7.73.1 At block stations where trains are permitted to run at speed in excess of 50 kilometres an hour, the line on which that speed is permitted, shall be isolated from all connected lines during the passage of the train.

7.73.2 Such isolation need not be provided at Block stations where trains are permitted to run at a speed of 50 km. an hour or below provided GR. 4.11(2) is complied with.

7.73. 3. The provisions of Para 7.73.1 do not apply to—

(a) junctions where two block section lines meet at the same end of a station and system of Block Working with adjacent stations on both lines is done by one of the approved means and the junction is equipped with full complement of signals.

At such junctions, the First Stop Signal on Single Line sections shall be placed at an adequate distance from the outermost facing point/fouling mark, the adequate distance not being less than the sum total of the adequate distances prescribed in GR. 8.01 in regard to condition for granting Line Clear and GR. 3.40 in regard to the condition for taking off the Home Signal. On Double Line section, the First Stop Signal shall be placed at an adequate distance from the outermost facing point/fouling mark, his distance not being less than the adequate distance prescribed in GR. 8.01 in regard to the conditions for granting Line Clear.

(b) Block stations where track circuits or other appliances have been provided to prove whether the connected non-isolated lines are clear or occupied and the signalling is such that a distinctive aspect is given to the Driver of a run through train, restricting the speed to 50 kilometre san hour when a connected in is occupied.

(c) Catch and Slip Sidings and Sidings provided for isolation purposes only.

7.74. Arrangements of Sidings.—Sidings shall be so arranged that shunting operations upon them involve the least possible use of, or obstruction, to running lines.

Siding Points on Passenger running lines outside station limits

7.75. Facing Points (Single Line).—

7.75.1. Where Siding Points take off a running line in a facing direction, the following minimum equipment shall be provided :—

(a) A gauge tie plate where steel sleepers are not provided ;

(b) A facing point lock, of equivalent mechanism the plunger of which shall lock each switch independently.

7. 75.2. The control of the points shall be made by means of a key or other suitable device which shall secure the bolting mechanism of the Points in the plunged or locked positions, i.e., when the Points are set and locked for the running line. The means for control of the Points shall be interlocked with the block system in force.

7.75.3. Where Siding Points are provided only with the minimum equipment specified in Para 7. 75. 1, an appropriate speed limit over the facing points shall be imposed for all trains passing over such Points in the facing direction only and an ' S ' marker at the Points and a speed indicator at not less than 30 metres from the Points shall be provided, neither of which, need be lighted. In addition., a caution and termination indicator shall also be provided as for open line speed restrictions. Where the sanctioned speed of the section does not exceed 50 kilometers per hour, the ' Marker ' at the points and the Indicators need not be provided.

7.76. Facing Points (Double Line).—The minimum equipment for Points taking off a running line in the facing direction on Double Line shall be in accordance with the provisions of Para 7.75.

7.77. Trailing Points (Double Line)—Where Points take off a running line in a trailing direction the following minimum equipment shall be provided for unrestricted speed :—

(i) A gauge tie plate where steel sleepers are not provided ;

(ii) A suitable type of key lock or equivalent mechanism, the key of which can only be extracted when the Points are set and locked for the running line. The points shall be controlled through the block system in force ;

(iii) An ' S ' Marker at the Points which need not be lighted.

SECTION 'H'

Signal Cabins and Interlocking

7.78. Location and elevation of cabins.—Signal cabins shall be so located, elevated and built as to provide the Operator with sufficient space and to enable him to have an adequate view of signals operated from the cabin as well as of the movements taking place in the portion of the yard controlled by him unless a substitute for direct vision is provided.

7.79. Cabin equipment :—All cabins shall be equipped with—

(a) A Cabin Diagram showing the location and normal position of all points. Facing point locks' Signals and Level Crossings, with their respective cabin lever numbers ;

(b) A lever pull chart suitably exhibited ;

(c) Lever collars ;

(d) A suitable staging with ladder for attending to interlocking frame ;

(e) Telephones, as necessary ;

(f) All equipments as required to be provided by concerned Departments including a clock, and

(g) A name board of sufficient size.

Note.—The lever pull chart, referred to in sub-Para (b) above, need not be provided in Cabins where the number of release ever concerned are indicated on the lever name plates to guide the Cabinman in following the correct sequence for pulling the levers.

7.80. Numbering of levers.—All levers, including spares, shall be numbered consecutively through the frame from left to right. Each lever shall be provided with a number plate. This will show the function in the order of operation which must precede to release when no lever description board is provided.

7.81. Signal and Interlocking apparatus— Installation.—Signal and interlocking apparatus shall be, as far as possible, so installed and the connections and circuits so arranged, that the relevant fixed signal shall remain at or return to its most restrictive aspect in the event of failure of any part of its connection and circuits.

7.82. Essentials of Interlocking.—Lever frames and other apparatus provided for the operation and control of signals, points, etc., shall be so interlocked and arranged as to comply with the following essentials :—

(i) It shall not be possible to take 'OFF' a running signal, unless all points including isolation are correctly set, all facing points are locked and all interlocked level crossing are closed and locked against public road for the line on which the train will travel including the overlap.

(ii) After the signal has been taken ' OFF ' it shall not be possible to move any points or lock on the route, including overlap and isolation, nor to release any interlocked gates until the signal is replaced to the ' ON ' position.

(iii) It shall not be possible to take ' OFF ' at the same time, any two fixed signals which can, lead to any conflicting movements.

(iv) Where feasible, points shall be so interlocked as to avoid any conflicting movements

7.83. Holding Route :—

7.83.1. Signals governing movements over Points shall be placed- as close as possible to the Points. Where a signal is more than 180 metres from the Facing points it controls, arrangements shall to made to keep the Points locked until the train has passed them. Similar arrangements shall also be made to hold consecutive Points should the distance between them be more han 180 metres.

7.83.2. At a station where trains run through at speeds more than 50kilometres per hour, such arrangements to hold the route are also required in case of trailing points situated more than 180 meters from the signal controlling them. However, such arrangements are not required if the Points are locked in either position by the signal in advance as stipulated in paragraph 7.84.

7.83.3. Route holding arrangements for facing or trailing points are, however, not necessary, if due to the manipulations required in the system of control, it is impossible under normal working conditions for the Points to be operated before the train has passed.

7.83.4. It is desirable to provide continuous track circuit for holding the route.

7.84. Locking trailing points by Signals in advance :—Levers operating Stop Signals which are next in advance of trailing points operated from the same cabin, shall when reversed, lock such point levers in either position unless route locking is provided or the distance between the Points and the signal is such that the locking interferes with traffic movement.

7.85. Clearance at Junction Point :—

7.85. I. Where it is difficult under normal conditions of visbility for a Cabinman to estimate clearance, bars or other approved devices shall be provided in order to define the fouling points of junctions, loops, siding connections, crossings etc.

Note.—It is desirable to provide such protection by track circuiting the Point Zone.

7.85.2. Where the movement of trains over the Points is not visible to the Cabinman operating the Points—

(a) Occupation of the track between Stop Signal reading over the Points upto the fouling mark ahead of such Points shall be electrically indicated at the place of operation ;

(b) In order to prevent the movement of Points while a train is passing over them, facing Points may be provided with track circuit locking of the Point lock lever or ground track lock.

7.86. Track Circuit Control of Signals.—Where continuous track circuiting is provided, the occupation by a vehicle of any track circuited section shall control the running signal or signals leading to the same line and shall also lock in either position, the Points on the section.

7.87. Slot Circuits.—Slot circuits for Home Signals leading to non-track: circuited reception lines shall be so arranged that a slot once given is effective for the reception of only one train and a fresh slot has to be given for a subsequent train.

7.88. Station Master's Control—

7.88.1. The Station Master shall be provided with interlocked mechanical or electrical control over

the Home and Last Stop Signals. Separate control on Warner and Calling-on Signal may be provided where required.

7.88.2. The Station Master's control over Home Signals can be dispensed with only if all the-following conditions are satisfied :—

(a) All reception lines are fully track-circuited from Home Signal to corresponding Last Stop Signal in double line and Home Signal to Home Signal in Single line ;

All reception lines are track-circuited from the fouling mark to fouling mark and the non-track circuited portion of the line from the fouling mark to the Home Signal is within the range of visibility of the Cabin Assistant Station Master/Leverman/Switchman.

(b) Station Master does not allot the line ; and

(c) Cabin Assistant Station Master/Switchman posted in the Cabins operates the block instruments and controls receptions/despatch signals.

7.89. Interlocking of Last Stop Signal and First Stop Signal with Block Instrument.—Where block instruments are in use

(a) The Last Stop Signal shall not be capable of being taken off until Line Clear has been obtained from the block station in advance ;

(b) It shall not be possible to close the line and grant or receive ' Line Clear ' unless the ' ON aspect of the relevant approach signals are proved.

7.90. Automatic replacement of Signals :

7.90. 1. On Double Line Sections where Double Line Block Instruments have been provided and on Single Line sections where tokenless block instruments have been provided, the Advanced Starter Signal as well as the Starter Signal shall be automatically replaced to ' ON ' position by the entry of a train into the block section.

7.90.2. On Single Line Sections where Token instruments are in use, it undesirable to provide such automatic replacement arrangement for the Last Stop Signal.

7.90.3. On Double Line Sections where Double Line Block Instruments have been provided and on Single Line sections where tokenless Block Instruments have been provided, the Home Signal shall be automatically replaced to ' ON ' position by the passage of a train in advance of the Home Signal.

SECTION ' I'

Interlocking of Catch Sidings and Slip Sidings

7.91. At stations where Catch and Slip Sidings are provided in accordance with the Rules for opening of-a Railway, interlocking arrangements and other safeguards in accordance with Paragraphs 7.92 to 7.97 shall be provided.

7.92. Reception of trains :

7.92.1. Either a minimum of two Stop Signals shall be provided in rear of the Catch Siding points or

the First Stop Signal shall be at an adequate distance equal to Block overlap from the catch siding points.

7.92.2. A train shall first be brought to a stop at the First Stop Signal, before the Catch Siding points are set for the main line and the reception signals taken ' OFF ' unless the following conditions are satisfied :—

(ii) The line on which the train is to be received is clear and the train is to be received on the main line.

(ii) The points leading to the Catch Siding as well as all the Points required for a run through train are set for the main line immediately after granting Line Clear to the Block station in rear.

(iii) Line clear has been obtained from the Block section in advance.

(iv) The gradients in the block section ahead are such that the train can be brought under control easily.

7.93. Setting of Catch Siding/Slip Siding :—The take off points of a Catch/Slip siding shall normally be set and locked for the siding and interlocking between the points and block instruments shall be provided as in Para 7; 94 and other safeguards as in paragraph 7.95 to 7.97.

7.94. Interlocking of Catch/Slip Siding points with Block Instruments.—The interlocking shall be such that the key required to set the siding points is released from the instruments in the " Train Going to " / " Train Coming from " position and once the key is removed from the block instruments, the instrument gets locked in the relevant position. The instrument can be normalised

only after the points are set for the the Slip Siding/Catch siding and the " Train Going To "/" Train Coming from " key is released from the Points and brought back to release the instrument. Where a Slip Siding is located at the departure end of a Double Line Station, the interlocking shall be such that the Points can be set towards the Block section only when the block instrument is set to " Line Clear ",

7.95. Audible Indication.—An audible indication shall be provided at the place of operation of Points as an aid to the Operating staff, indicating that the train has been received or despatched and that the points shall now be reset for the Catch Siding/Slip Siding. This indication would continue till the points are reset for the Catch Siding/Slip Siding.

7.96. Safeguards in working.—In all cases where interlocking arrangements stipulated in Para 7.94 are provided between the Slip/Catch Siding and the block instrument, the following safeguards shall also, inter allia be provided in the Station working Rules :—

(i) Shunting on non-isolated lines shall cease once Line Clear has been granted ;

(ii) Points shall remain set and locked for the Catch Siding until Home Signal has to be taken 'OFF'.

(iii) Before normalising the block instrument the Asistant Station Master/Cabinman shall verify the Complete arrival or despatch of the train, even if he is getting an audible warning, which can arise due to reception or despatch of a. complete train or part thereof.

7.97. Emergency Key.—An Emergency Key of the Catch/Slip Siding shall be kept in a sealed box under the custody of the Station Master. This is used for operating the Slip Siding/Catch Siding

points when either the block instruments have failed, or when the train is still in the Block section and a train is required to be despatched into the Block section.

SECTION ' J ' .

Operation of Points and Signals by Electrical Means

7.98. The points and Signals may be operated individually from a—

(i) Lever frame ; or mi nature power frame ; or

(ii) Control panel ; or

(iii) Station Master's Slide Control.

7.99. Locking and sealing arrangements.—Locking and sealing arrangements shall be provided for the covers of locking tray of lever frame/power frame, etc., to secure against unauthorized opening.

7.100. Lever frame/Power frames.—

7.100.1. Lever Frame locking tray and power frame mechanism shall be completely enclosed with removable covers giving free access to all parts.

7.100.2. All electric locks shall be be forcibly replaced to the locking position.

7.100.3. The interlocking frame shall be properly earthed and earth resistance shall not be more

than 10 ohms. Safeguards shall be provided to prevent injury to the operator in the event of a short circuit or other similar circumstances.

7.101. Operation of Signals by Electrical means - Where levers are used to operate signal by electrical means they shall be provided with " Normal" indication locks adapted directly to prevent the full return movement of they lever or the normal position unless the signal has returned to the ON position This rule does not apply to a mechanical interlocking frame if

(i) the signal is easily visible, or

(b) the position of the signal is repeated.

7.102. Operation of points by Electrical means.-Except where alternative electric locking is provided, the lever operating electrically worked points shall be provided with. " normal " and " reverse " indication lock adapted directly to prevent the full movement of the lever, unless the point mechanism has made the required movement and the points are set and locked in a position corresponding to that of the lever and in the case of facing points, they are securely locked

7.103 Visual indicators shall be provided to show the " normal " and "reverse" positions of all points the condition, of all track circuited sections, route setting and to repeat the indications of Colour Light Signals.

7.104 Track circuits as a means for detecting obstructed lines.—Adequate arrangements shall he made where necessary for reminding the Operator of vehicle., which are standing within his control. In case of passenger lines or where light engine crossing and shunt movements are frequent or where stop Signals are at a considerable distance from the Cabin, or where the view of the Operator is likely to be obstructed, the provision of track circuits or other automatic

device is desirable.

Note —Whenever the use of normally closed type of track circuit is specified in this Chapter, it shall automatically cover the use of axle counter in lieu of truck circuit.

7.105. Track Circuiting.—At Stations where points and signals are operated from an Assistant Station Master's Office at a central place, track circuiting of the entire station section including all lines where direct reception is provided shall be done.

7.106. Circuits.—

7.106 1 The circuits controlling the operation and indication of Points shall be so arranged that, as far as practice. be cross connection or a short circuit cannot operate the switch or give a false indication of the position of the points.

7.106 2 Circuits controlling the operation and indication of Signals shall be so arranged that, as far as practicable, a cross connection or a short circuit on any of the wires cannot give a false indication.

7.106 3 The battery or power supply for line circuits, as far as practicable, shall be arranged at the end of the circuit farthest from the operated unit.

7.106 4 Where the line supply volume normally exceeds 125 volts protection arrangements as laid down in the Indian Electricity Rules, 1956. shall be provided.

7.107. Crank Handle interlocking.—

7.107 1 At instillations with motor operated paints, crank handles shall be kept electrically locked and released for every operation requiring a crank handle. The interlocking systems shall be such that the when relevant signals are taken 'OFF' and once the crank 'Handles is released the relevant signals cannot be taken ' OFF ' until the crank handle in restored to its electric lock and gets locked therein.

7 107 2. In case of major stations, grouping of Points shall be resorted to and non-interchange-able crank handles provided for each group.

SECTION ' K '

Relay Interlocking Installations—Route Setting Type

7.108. Route setting shall be on the basis of " Entrance-Exit" principle. Facility for individual operation of points shall also be provided.

7. 109. Route setting, i. e., setting and locking of the route fend clearing of main signals include the following processes :—

(i) Prove that the route selected does not conflict with any other route which has already been set and locked;

(ii) Operate die points—in the route, overlap and those required fore isolation—to the required position, lock and detect them ;

(iii) lock the route including overlap and isolation ;

(iv) Prove that the tracks in the route and the overlap are dear ;

(v) Prove that all interlocked level crossing gates in the route including overlap are closed and locked against road traffic ;

(vi) prove the t the signals are controlled by the Block System in force as necessary ;

(vii) Prove that the relevant crank handles are electrically locked in ;

(viii) Clear the signals after the above conditions are satisfied.

7.110. The system shall be so designed that the points in a route once set shall remain in the last operated position until they are required to be operated for the setting up of another route or for individual operation except when stipulated otherwise.

7.111. The route shall ordinarily be released by the passage of the train over the route. Sectional Route Release may be provided where necessary. Emergency route release shall also be provided with appropriate time delay.

7.112. Approach locking and back locking shall be provided for all routes governed by main signals. Approach and back locking shall be continuously effective from the approach track which shall commence from an adequate distance in rear of the signal.

7.113. Point Operation :—

7.113.1. Tire points shall be operated by electric or electro-pneumatic or electro-hydraulic point

machines. Points leading to unsignalled lines or sidings may be manually operated with suitable electrical control

7.113.2. Where required, provision maybe made for emergency operation of points during track circuit failures. Each such individual operation shall be recorded on a suitable Electric Counter.

7.114. When, required, provision may be made for emergency sub-section route release. Where such release is provided, it shall be possible to release the sub-section only with the co-operation of both the Station Master and the Maintainer.

7.115. All running signals shall be colour light multi-unit type and shunt signals shall be of the Position Light type. Calling on signals may be provided in accordance with Para 7.19.

7.116. A signal in the 'OFF' position shall be replaced to 'ON' position automatically by the passage of a train It shall also be possible to replace a manually controlled signal in the ' OFF ' position to the ' ON ' position manually.

7.117. The Calling-on Signals shall lock and detect points in the Route and prove that the level crossing gates in the Route are closed and locked against road traffic.

7.118. Shunt movements shall, as far as possible, be controlled by Shunt Signals. The Shunt Signals shall lock and detect the points in the Route and prove that the tracks in the route excluding the berthing track are clear and that the level crossing gates in the Route are closed and locked against the road traffic.

7.119. Where local control panels are provided over a portion of the yard, the points and signals of

that portion of the yard shall be operated as follows :—

(a) directly from the main control panel ; or

(b) from the local control panel after obtaining release from the main control panel ; or

(c) from the local control panel after operation of an emergency switch. This emergency operation shall be suitably counted in a Counter.

7.120. Suitable indications shall be provided on the control panel for points, track sections, routes signals including Calling-on Signals, ' A' Markers, level crossings, train approach, power supply cancellation, slot and crank handle interlocking, etc., as required.

SECTION ' L'

Requirements of Signalling Circuits using Electronic Equipment

The following fail-safe principles shall be incorporated in the design of the equipment :—

7.121. Component failure shall be self-detecting by way of causing a signal to display a most restrictive aspect as far as practicable.

7.122. Failure of components which are not self-detecting shall not cause any unsafe failure of the equipment. Even simultaneous failures in different components which are not self-detecting shall not cause any unsafe failure of the equipment.

7.123. All fail-safe circuits shall work on continuous energisation principle such that open circuits

in wiring, relay contacts, etc., or loss of power supplies shall not cause unsafe conditions.

7.124. Common return shall not be used for vital circuits. In vital circuits, the final stage shall use fail-safe signalling relays. A transformer isolation shall be provided between the final stage fail-safe signalling relay and the electronic device preceding it. The D. G. power supply shall not have any galvanic connection with the coil of the final stage signalling relay.

7.125. All electronic equipment shall have a long Mean Time Between Failures (M. T. B. F.). Duplication of components and parts of equipment or modules may be resorted to for improvement of the reliability where necessary. Where components/parts modules are duplicated, it is desireable that provision may be made for cross checking the performance of one set by the other set and vice-versa

7.126. Due consideration shall be given to the effects of faults in fail-safe electronic equipment to allow open or short circuit or earthling conditions and variation in component values due to ageing, replacement of faulty component with new components of specified tolerance, etc. Safety shall not be impaired as a result of multi-terminal devices failing-either open circuit, short circuit or with partial short circuit between any pair of terminals or earthing.

7.127. Special care shall be taken in the design of amplifier circuit to eliminate the possibility of self-oscillation. It is desirable that loss of safety requirements is not caused should the amplifier go into self-oscillation due to any unforeseen contingency.

7.128. Where specific frequencies are used for safety circuits, particular care shall be taken to ensure that the frequency generating equipment is producing only the desired frequency signal. Verification shall be carried out using passive tuned filters in series with each frequency source.

7.129. The physical construction of fail-safe equipment shall be designed to eliminate the possibility of external objects causing short circuits between combinations of terminals in vital circuits. This may be achieved for example, by adequate separation of terminals, and by the fitting of protective shrouds where necessary.

7.130. For the consideration of the fail-safe feature of an electronic safety signalling device, failure of one component for all the modes of probable faults indicated in paragraph 7.126, one at a time shall be considered. If the failure of the component under examination is not self-detecting, then simultaneous failure of other associated components shall be considered.

SECTION ' M '

Standards of Signalling and Interlocking

7.131. Broad Gauge lines on Indian Railways have been classified into five categories and Metre Guage lines into four categories in terms of Paragraphs 210 and 211 of the Engineering Code. The complement of signalling equipment to be provided at stations on these routes is indicated in the Tables below :—

Broad Gauge

Broad Gauge

Details	'A'	'B'	'C'	'D'	'E'
	Above 130 Km. P. H. and upto 160 Km. P. H.	Above 100 Km. P. H. and upto 130 Km. P. H.	Suburban Section	Above 50 Km. P. H. and upto 100 Km. P. H.	@ 50 Km. P. H. and below
Point Fittings	Clamp type Direct Lock.	Approved type of Point Machine Clamp type Direct Lock desi able.	As required *	Plunger type Facing point Lock.	Hand Plunger Lock
Method of operation ...	Electrical operation of Points and Signals.	Electrical operation of Points and Signals.	Electrical operation of Points and Signals.	†† Mechanical Operation of Points and Signals.	Mechanical operation of Points and Signals.
Interlocking	Circuit Interlocking	Circuit Interlocking	Circuit Interlocking ..	Direct Mechanical Interlocking.	Key Interlocking..
Signalling	Multiple Aspect ..	Multiple Aspect ..	Multiple Aspect ..	Multiple Aspect ..	Two Aspect/Multiple Aspect.
Block Working ..	Block Working by track circuit.	† Block Working by track circuit.	Automatic Block ..	††† Single Line : Token working Double Line : Double line Block instrument. ††††	Token working.
Track circuiting ..	All reception lines and from Fouling Mark to Block Section Limit.	All reception lines and from Fouling Mark to Block Section Limit.	All reception lines ..	Run through lines ..	....
No. of Distant Signals ...	Two	Two	....	On sections where Goods trains have a braking distance of more than one kilometre, two distant Signals to be porovided.	One

BROAD GAUGE—concld.

Details	'A'	'B'	'C'	'D'	'E'
	Above 130 Km. P. H. and upto 160 Km. P. H.	Above 100 Km. P. H. and upto 130 Km. P. H.	Suburban Section	Above 50 Km. P. H. and upto 100 Km. P. H.	@ 50 Km. P. H. and below
Auxiliary warning Systen.	To be provided. Continuous Automatic Train protection desirable.	To be provided ..	To be provided ..	....	....
Colour Light Signals ...	To be provided ..	To be provided ..	To be provided ..	....	....
Detection	Electrical Detection with Lock Detection.	Electrical Detection with Lock Detection.	Electrical Detection with Lock Detection.	Mechanical/Electrical Detection with Lock Detection.	Mechanical Switch Detection.
Complement of Signals ..	Distant, Inner Distant, Home, Starters, Advanced Starter.	Distant, Inner Distant, Home, Starters, Advanced Starter.	....	Distant, Home, Starters, Advanced Starter.	Outer and Home in Case of Two Aspect Signalling or Distant and Home in case of Multiple Aspect Signalling.

* When the suburban section falls under Group 'A', 'B', or 'D', as the case may be, the requirements of that Group shall be applicable.

† On Single Line, when density is less than 20 trains each way, Tokenless Block Instruments may be provided. On Double Line, when density is less than 30 trains each way, Double Line Block Instruments may be provided.

†† If the traffic density is likely to exceed 18 trains each way on single line and 20 trains on double line, colour Light Signals may be provided.

††† If the traffic density is likely to exceed 18 trains each way, Tokenless Block Instruments shall be provided and if it exceeds 25 trains each way, Block working shall be by track circuit.

†††† If the traffic density is likely to exceed 30 trains each way, Block working shall be by track circuits.

@ On routes where speed is more than 50 Km. p. h., Signalling requirements as per Group 'D' shall apply.

Metre Gauge

Details	Q, R1	'B'	R2/R3	'S'
	Above 75 Km. P. H.—Trunk Line	Suburban Section	Above 50 Km. P. H. and upto 75 Km P. H. Main Line	50 Km. P. H. and below Branch Line
Point Fittings	Plunger type Facing Point Lock or approved type of Point Machine. Clamp type direct lock desirable.	* As required	Plunger type Facing Point Lock	Hand plunger lock.
Method of operation ..	Electrical operation of Points and Signals.	Electrical Operation of Points and Signals.	Mechanical operation of Points and Signals.	Mechanical operation of Points and Signals.
Interlocking	Circuit Interlocking	Circuit Interlocking ..	Direct mechanical Interlocking ..	Key Interlocking.
Signalling	Multiple Aspect	Multiple Aspect ..	Multiple Aspect	Two Aspect/Multiples Aspect.
Block working	Block working by track circuit ..	Automatic Block ..	Token instruments on Single line Tokenless instruments: Above 16 trains each way. Double line Block Instruments on Double line.	Token working.
Track Circuiting ..	All reception lines and from Fouling Mark to Block Section Limit.	All reception lines ..	Run through line only ..	....
No. of Distant Signals ..	Two	....	One	Nil/One.
Auxiliary Warning System	To be provided	To be provided ..	....	....
Colour Light Signals ..	To be provided	To be provided ..	....	....
Detection	Electerical edet ction with lock detectio	Electrical detection with lock detection.	Mechanical/Electrical detection with lock detection.	Mechanical Switch detection.
Complement of Signals ..	Distant, Inner Distant, Home Starters, Advanced Starter.	....	Distant, Home, Starters Advanced Starter.	Outer, Home in case of Two Aspect Signalling Distant, Home in case of Multiple Aspect Signalling.

* When the Suburban Section falls under Group Q, R1 or R2/R3, as the case may be, the requirements applicable to that Group shall be provided.

SECTION ' N'

BLOCK INSTRUMENTS

General requirements

7.132. Construction and Type:

7.132.1. All block instruments shall be of robust construction and of a type approved by the Commissioner of Railway Safety.

7.132.2. On sections where A. C. voltages are induced due to power line parallelism, suitable block instruments with appropriate protective measures shall be provided. The immunity limits of various types of block instruments are specified in Chapter XVIII.

7.132.3. Block instruments shall normally be worked on physical conductors. Under special instructions, block instruments may be worked on radio relay systems with appropriate security features.

7.133. Lightning Discharger.—All instruments shall be provided with lightning discharger to approved specification. Where a return line wire is used ,lightning discharger must be installed on both wires.

7.134. Prevention of irregular operations.—There shall not be any opening giving access to the interior of the instrument through which it is possible to operate the mechanism by any irregular means.

7.135. Locking and sealing facilities.—Facilities shall be provided for locking and sealing the instruments. The doors of the instruments giving access to the internal mechanism shall be

provided with a double lock, the key of one of which shall be in the custody of the Station Master on Duty and the key of the other will be with the Electrical Signal Maintainer in charge of the maintenance of Block Instruments. It shall not be possible to open the door of the Block Instruments without the co-operation of both the agencies.

7.136. Prevention of unauthorised operation.—A lock or other device shall be provided to enable the Station Master on duty to prevent unauthorised manipulation of the instrument during his absence.

7.137. Isolation of telephone circuit.—Telephone instrument shall be provided in conjunction with block instruments. It is desirable that the condenser or other means provided for isolating the telephone circuit from the instrument circuit is located within the instrument or in such a way as to be inaccessible for outside interference.

7.138. Bell push.—A Bell push button or a bell plunger shall be provided on the instrument for exchange of bell codes.

7.139. A separate battery shall be used for each Block instrument. This battery shall only feed the Block Instruments and not any other circuits. The battery housing shall be locked and sealed.

7.140. Tokenless Block Instruments worked on physical conductors shall be worked on metallic return circuits.

Special requirements of Single Line Block Instruments

7.141. Fixed Indications.—The instruments shall be provided with visual indication clearly giving the-following indications :—

(i) When the instruments are normal and there is no train in the block section, " Line Closed " at both the stations.

(ii) When Line Clear for a train to leave the Block station in rear has been given, " Train Coming From " at the receiving station.

(iii) When Line Clear for a train to leave a Block station has been received from the Block station, ahead, " Train Going To " at the sending station.

7.142. Current Indicator.—An indicator, indicating the polarity of current, shall be provided to indicate incoming and outgoing line currents.

7.143. Operation:

7.143.1. " Train Going To " and " Train Coming From "—The instruments shall be such that the co-operation of the Station Master at the other end of the section shall be necessary. Even with the co-operation of the Station Master at the other end, the Station Master has to go through one or more definite moving operations on the instrument in addition to working of bell plunger.—

(a) before he can grant Line Clear to the Station Master at the other end of the section to release a token, or

(b) before he can obtain Line Clear and extract a token.

7.143.2. " Line Closed "—Both the instruments shall be restored to normal before a further

operation of setting the instrument to " Train Going To "/" Train Coming From " can be carried out. It shall not be possible for the instruments at either end of the section to be restored to normal without the co-operative features indicated in Para 7.143.1.

7.144. Operation of " Line Clear " receiving and granting mechanism.—It shall not be possible for the mechanism which permits a " Line Clear " to be received and that which permits a " Line Clear " to be granted to be in operation at the same time.

7.145. The instruments that is set to " Train Going To " for initiating a train movement shall be the first one to be restored to " Line Closed " on complete arrival of the train at the receiving station.

7.146. Extraction of token.—It shall be possible to extract one token only when the instrument has been set to " Train Going To ". It shall not be possible to change the " Train Going To " condition until the token has been inserted in one of the instruments of the Block section.

7.147. Token instruments shall be so installed that a token of one block section cannot be placed in the instrument of an adjacent section and preferably such that if the token is over-carried, it cannot be placed in an instrument at the next station.

7.148. The tokens of each section shall be engraved with the code name of the stations at both ends of the block section and with a serial number.

Special requirements of Single Line Tokenless Block Instruments

7.149. Fixed Indications.—In addition to the fixed indications specified in paragraph 7.141 the instrument shall be provided with means to indicate " Train On Line " at both the sending and receiving stations when a train has entered the block section.

7.150. Immunity from extraneous currents.—Single Line tokenless block instruments shall work on coded impulse/frequency modulated current system so as to be immune from the effects of extraneous currents.

7.151. Operations—Handle type tokenless Block Instruments:

7.151.1. "Train Going To" and "Train Coming From "—The instrument shall be such that even with the co-operation of the Station Master at the other end of the section, the Station Master has to go through one or more definite moving operations on the instrument in addition to the working of bell plunger—

(a) before he sets his instrument to " Train Coming From ".

(b) before he sets his instrument to " Train Going To ".

7.151.2. "Train On Line "—Means shall be provided to ensure that the instruments are set to " Train On Line " automatically by the entry of the train into the block section and maintained in that position until the train has cleared the block section. This indication shall be in addition to the " Train Going To " or " Train Coming From " indications of the handle.

7.151.3. " Line Closed".—Both the instruments shall be restored to normal before a further operation of setting the instrument to " Train Going To " / " Train Coming From " can be carried out. It shall not be possible for the instruments at either end of the section to be restored to normal without the cooperative features enumerated in Para 7.151.1.

7.152. Operations—Push Button Tokenless Block Instruments :

7.152.1. "Train Going To " and "Train Coming From ".—The co-operation of the Station Master at the other end of the section may be dispensed with. The instrument shall be such that a button in addition to the bell button shall be operated for " Train Going To " position.

T.152.2. " Train On Line "—Means shall be provided to ensure that the instruments are set to" Train On Line " automatically by the entry of the train into the block section and maintained in that position until the train has cleared the block section. This indication shall be in addition to the " Train Going To " or " Train Coming From " indications.

7.152.3 Line Closed.—Both the instruments shall be restored to normal before a further operation of setting the instrument to " Train Going To "/" Train Coming From " can be carried out. The instrument shall be such that a button in addition to the bell button shall be operated by the receiving station for setting both the instruments to the " Line Closed " condition. This feature can be dispensed with where an automatic device of closing the Block section is provided.

7.153. Operation of " Line Clear " receiving and granting mechanism.—It shall not be possible for the mechanism which permits a " Line Clear " to be received and that which permits a " Line Clear " to be granted to be in operation at the same time.

7.154. Tokenless block instruments shall be provided with—

(i) Audible indicators to warn the receiving station—

(a) when the train enters the block section at the sending station ;

and

(b) when the train has passed the Home Signal at the receiving station.

(ii) Shunting key suitably interlocked with the Block instrument for use as an authority for shunting behind the Last Stop Signal and upto the opposing First Stop Signal.

Special requirements of Double Line Block instruments

7.155. Indicators for Up and Down Lines.—The Instruments shall be provided with Visual indicators separately for Up and Down Lines to show the following three conditions :—

(a) Line Closed

(b) Line Clear.

(c) Train On Line.

7.156. Current Indicator.—The indicators provided as per paragraph 7.155 may also serve as the current indicators.

7.157. Operation before granting or receiving Line Clear.—The instrument shall be such that the Station Master has to go through one or more definite moving operations on the instrument besides working the bell or plunger before he can grant Line Clear.

7.158. Audible Indicator.—Where required, the instruments may be provided with audible indicators—

(a) to warn the receiving station when the train has passed the Home Signal, and

(b) to warn the sending station when the train has passed the Last Stop Signal.

7.159. Non-Co-operative type instruments.—Non-Co-operative type double line block instruments shall work on a system of coded currents.

7.160. The requirements indicated in paragraphs 7.155 and 7.158 will apply to these instruments. In addition, the following shall be provided in these instruments :—

(i) Automatic "Train On Line".—Means to ensure the instruments are set to "Train On Line" position automatically by the entry of the train into the block section and maintained in that position until the train has passed the Home Signal at the receiving station and the instrument set to " Train Closed " condition.

(ii) Audible Indicator.—Audible Indicator to warn the receiving station when the train enters the block section at the sending station.

(iii) Shunting Keys—Two Shunting keys, one for each line, suitably interlocked with the block instruments for use as an authority for shunting in the block section.

7.161. Use of track circuits for proving block section to be clear.—On sections where use of track circuits for proving the block section to be clear is to be introduced, the following equipment shall be provided.—

(a) A track circuit or circuits extending from the Last Stop Signal of the block station at one end of the block section to the other end of the block section.

(b) An indicator in each block station to show whether the block section is occupied or not.

(c) A control to ensure that the Last Stop Signal of the block station in rear is automatically replaced to ' ON ' by the passage of a train and maintained in that position until the train has cleared the block section.

(d) A control to ensure that the First Stop Signal is automatically replaced to ' ON ' by the passage of the train.

(e) On single line, a control to ensure that the opposing Last Stop Signals of the Block section cannot be taken ' OFF ' at one and the same time.

SECTION ' P '

Automatic signalling

7.162. Automatic Block System on Double line.—Automatic Block is a system in which the movement of trains is controlled by Stop Signals which are operated automatically by the passage of trains past the Signals. No automatic signal shall assume ' OFF ' aspect unless the Line is clear not only upto the Stop Signal ahead bat also for an adequate distance beyond it. Except under approved special instructions, this adequate distance of overlap shall not be less than 120 metres.

7.163. Automatic and Semi-Automatic Stop Signals on Double Line :—

7.163.1. The automatic Stop Signal which governs entry into an Automatic Signalling section is a multiple aspect colour light signal which is not dependent upon manual operation but is controlled automatically by the passage of a train into, through and out of the Automatic Signalling section

which the Signal governs. This Signal shall normally display the 'OFF' aspect but shall automatically assume the ' ON ' aspect immediately a train enters the Signalling Section. The 'ON' aspect shall be maintained until the train passes clear of the section and its overlap when the Signal shall assume ' OFF ' aspect automatically.

7.163.2. Fixed Signals which require manual control each time they are taken ' OFF ' are called Manual Stop Signals. A fixed signal having both manual and track circuit controls and which is capable of being operated either as an Automatic Stop Signal or a Manual Stop Signal, as required, is called a Semi-Automatic Stop Signal. The Semi-Automatic Stop Signal when working as an Automatic Stop Signal shall conform to an Automatic Stop Signal in all matters relegating to its functioning including its normal aspect. Similarly, a Semi-Automatic Stop Signal when working as a Manual Stop Signal shall conform to Manual Stop Signals in all matters including its normal aspect. A control may be provided to make a Semi-Automatic Stop Signal to work either as an Automatic Stop Signal or as a Manual Stop Signal as required.

7.163.3. Signals shall be so spaced as to meet the operating requirements of the section. At the same time the distance between signals shall not be so great as to cause serious repercussions during failures or so small as to provide inadequate braking distance. If the distance between the caution and danger aspects in the case of three aspect signalling or attention and danger aspects in the case of four aspect signalling is less than the braking distance of a train, the speed of that train shall be so regulated as to bring the braking distance within the abovementioned signal spacing.

7.164. Automatic Block System on Single Line :

7.164.1. Automatic Block System on Single Line is a system in which the movement of trains is

controlled by fixed signals which may be Manual Stop Signals or Automatic Stop Signals or Semi-Automatic Stop Signals.

7.164.2. Manual Stop Signals shall be manually operated multiple aspect colour light signals which shall assume ' ON ' aspect automatically on the occupation of the section ahead but shall assume ' OFF' aspect only when on clearance of the relevant section they are operated manually.

7.164.3. Automatic Stop Signals which shall be multiple aspect colour light signals operate in the direction of traffic established. Such Automatic Stop Signals as are against the direction of traffic exhibit' ON ' aspect.

7.164.4. Semi-Automatic Stop Signals are capable of being operated either as Automatic Stop Signals or as Manual Stop Signals as required.

7.165. Manual and Automatic Stop Signals on Single Line :

7.165.1. The line between two adjacent crossing stations may be divided into a series of Signalling sections and entry into each signalling section shall be controlled by a Manual Stop Signal or an Automatic Stop Signal or a Semi-Automatic Stop Signal which must assume ' ON ' aspect on entry of a train into the section and be maintained in that position until the train has passed clear of the next Automatic Stop Signal in advance or, when the next Signal is a Manual Stop Signal, an adequate distance beyond it. The Signal that governs entry into the Block section shall be Manual or Semi-Automatic Stop Signal.

7.165.2. A Control shall be provided to establish direction of traffic and to ensure that conflicting signals cannot be taken off and a suitable indicator provided to indicate the direction established.

It shall not be possible to change the direction unless the entire line between two crossing stations and the overlap in the direction to be established are at ' ON ' at either end. The mechanism of the control shall, in addition, be suitably approach locked. Except under approved special instructions, the overlap shall not be less than 180 metres.

7.165.3. Signals shall be so spaced as to meet the operating requirements of the section. At the same time, the distance between signals shall not be so great as to cause serious repercussions during failures, or so small as to provide inadequate braking distance. If the distance between the caution and danger aspects in the case of three aspect signals or attention and danger aspects in the case of four aspect signals is less than the braking distance of a train, the speed of that train shall be so regulated as to bring the braking distance within the abovementioned signal spacing.

7.175.9. Code transmission lines may be either cables or line wires. In both cases, the attenuation shall be such as to ensure fully satisfactory operation of the code system. The overhead line wire system shall be designed so as to ensure satisfactory operation under all weather conditions. Carrier circuits may also be transmitted on V. H. F., U. H. F. or Microwave radio links.

7.176. Communication facilities:—

7.176.1. If the voice communication system is superimposed on the code line itself, the design of the system shall be such that speech communication and code system will not interfere with each other.

7.176.2. Where necessary, repeaters shall be provided to ensure satisfactory communication between the C. T. C. Operator and various telephone locations on the section.

7.176.3 In the control office, a suitable loudspeaker, microphone and amplifier shall be provided

for C. T. C. Operator. In addition, conventional type of head sets with plugs and jacks; shall also be provided.

7.176.4. In addition to the telephone at Station Master's Office, the telephones or jacks shall if required, be provided at the Signal posts and in the relay rooms at the stations and in the instrument cases in the section.

SECTION ' R' Additional Requirements in 25 kv. 50 cycles A. C. Electrified Sections

7.177. The Signalling and Telecommunication equipment in A. C. electrified areas is affected by the Electric Traction System in the following manner;—

(a) Physical obstructions to the visibility of Signals and to the Signal and Point transmission underground cables, etc., by overhead electrical masts and fittings.

(b) Induced voltages in Signalling equipment and circuits from high voltages and current in the catenary.

(c) Voltage developed in the rail by the flow of traction return current affecting equipment connected to the rails.

7.178. Detailed requirements in 25 kV. 50 cycles A. C. electrified areas are enumerated in part II.

Special requirements for Block Instruments

7.179. Block Instruments shall not be worked on overhead lines. They shall be connected to underground cables as per approved drawings.

7.180. A block filter of an approved design shall be installed between the Single or Double Line Block Instrument and the Cable Conductors.

7.181. When a block section originates at a station in electrified area and terminates at a station in non-electrified area, Block instruments at both ends of such block section shall be provided with block filter in accordance with approved instructions.

7.182. The block telephone of Single or Double Line Block instruments shall not be worked on the same cable conductor as the block instrument. It shall be worked on a separate pair of cable conductors.

7.183. Over single line sections, approved type of Token and Tokenless Block Instruments shall be used. If the length of parallelism does not exceed 1.5 kilometres, Push Button Tokenless Block Instruments may be used.

7.184. Over Double Line Sections, only approved type of Block Instruments with block filters shall be used. Details of the type of instruments to be used are enumerated in Part IT.

CHAPTER VIII

DRAWINGS, SPECIFICATIONS AND BOOKS OF REFERENCE

SECTION 'A'

Plan of New and working installations

8.1. Preparation—General Procedure :

8.1.1. All plans shall be prepared in accordance with the instructions issued by the Chief Signal and Telecommunication Engineer.

8.1.2. The names of the junction or terminal stations should be noted on plans, that on the left hand side being the one from which the kilometre progressively increases. The names of the adjacent block stations and mid-section sidings should also be indicated on the plans as also their respective distances from the center line of the station for which the plan is prepared.

8.1.3. Standard drawings shall not be departed from without the specific permission of the Chief Signal and Telecommunication Engineer.

8.1.4. The Signal and Telecommunication Engineer in charge should ensure that drawings submitted with an estimate for a work are complete and include all information necessary—

(i) For the proper understanding of the scheme, relevant notes being written on the drawings ; and

(ii) For proper check of the design and estimate.

When part of the work has to be done to a standard plan or to an existing drawing, the fact should be stated . Such drawings need not be reproduced. If part of the information necessary has to be supplied by another department, the officer-in-charge should obtain and incorporate the details on the drawing.

8.1.5. The north point should be shown on every signalling plan.

8.1.6. All drawings should be quoted by number in their proper place in the estimate and in the covering letter accompanying the estimate.

8.1.7. Tentative signalling plans prepared for estimating purposes should bear the legend : "Tentative—For estimating purposes only". Tentative signalling plans issued for tender purposes should bear the legend : " Tentative—For Tender purposes only". Tentative signalling plan sent to Divisions for comments should bear the legend : " Tentative—For comments only ". All tentative plans should be signed by at least a Senior Scale Officer.

8.2. Plans for other Departments :

8.2.1. The Divisional/Senior Signal and Telecommunication Engineer may at his discretion prepare sketches for officers of other Departments or for Deposit Works. No detailed plans for Deposit Works should be prepared except on receipt of orders from the Chief Signal and Telecommunication Engineer.

8.2.2. The Divisional/Senior Signal and Telecommunication Engineer should obtain complete details from officers of other Departments when preparing plans that affect those departments and embody their requirements on the plans, if considered necessary. He should arrange for the plans, to be signed by the representative of the department concerned in token of approval.

8.3. General practice and sizes of Drawings :

8.3.1. The code of Practice for General Engineering drawings and the standard sizes of drawings—IS. 696 shall be followed as far as practicable.

8.3.2. In preparing plans or making ferro prints, wastage of drawing paper, tracing paper, tracing cloth and ferro paper should be avoided.

8.3.3. The following considerations govern the size of a drawing—.

(i) Folding, approximately to foolscap size to accompany correspondence and reports,

(ii) The commercial size of drawings, tracing and ferro paper rolls and tracing cloth rolls.

8.3.4. The following sizes may be considered convenient, the tracing paper/cloth being cut to the outer dimensions shown:—

Size	I.S.I. standard	Measurement including Border	Border
'A' 'B' 'U' 'C' 'D' 'W'	A-4	210 mm. x 297 mm.	10 mm.
	A-3	297 mm. x 420 mm	10 mm.
	--	297 mm. x Any length	10 mm.
	A-2	420 mm. x 594 mm.	10 mm.
	A-1	594 mm. x 841 mm	10 mm.
	--	841 mm. x Any length	10 mm.

On left hand side of each drawing, an extra margin of 30 mm. should be allowed of binding.

Size ' A ' may be adopted for preparation of sketches. Size 'B' may be adopted for Locking Tables and Selection Tables. Size ' U ' may be adopted for Locking Diagrams. For Signalling plans, any size as convenient may be adopted.

8.3.5. Drawings for a large project should be bound together, each such drawing should be marked as sheet 1,2 and so on as also the total number of sheets (e.g., 1/3, 2/3, 3/3) and bear in the proper place, the separate numbers by which each is identified. These numbers should be entered in the Office Register of Drawings and should also be marked on the outside bindings.

8.4. Titles and numbering of Drawings:

8.4.1. The title and number may be placed at the bottom right hand corner of the plan, sufficient space being left for " Notes " to be entered as necessary.

8.4.2. Drawings pertaining to any station, viz., Signalling plans, Locking Tables/Selection Tables, Locking diagrams, wiring diagrams etc. shall bear the same number. ,

8.4.3. If more than one sheet is used for a particular work, each must be distinguished by the sheet number as indicated in Para 8.3.5 immediately following the drawing number. The title may be placed below the number. If the drawing cancels the previous one, a note to this effect and the number of the cancelled drawing should be recorded at the right hand top corner of the drawing

8.4.4 Every plan should bear in small letters at the lower left hand corner, the name and initials of the Technical Assistant or Superintendent, Drawing Office, Head Draftsman/Draftsman and

Tracer who prepared and checked the plan.

8.4.5. All signatures in tracings should be in indelible ink. All signature should be dated with date month and year.

8.5. Scale of Drawings.—It is desirable that signalling plans are prepared to the scales—

(i) 10 metres to a centimetre (1/1000) longitudinal;

(ii) 5 metres to a centimetre (1/500) transverse.

8.6. Details on Drawings :

8.6.1. All dimensions and distances shall be written carefully upon that part of the drawing to which they refer. The distance to be embraced by the figures shall be indicated by arrow heads. Figuring and descriptive matter should be so printed that without moving the plan, it can be read with ease.

8.6.2. The following information should invariably be shown on signalling plans:—

(i) Standard of interlocking and class of station,

(ii) Holding capacity of all running lines and sidings.

(iii) Direction of reception and despatch on running lines and description of sidings,

(iv) Restriction on dead-end sidings (e. g., No stabling) if any.

(v) All gradients within the station limits and upto 2.5 kilometres in rear of first stop signal,

(vi) Kilometrege and class of level crossings within the station limits, whether interlocked or not,

(vii) Type of Block Working with adjacent station and location of block Instruments,

(viii) Up and Down directions and names of important junctions on either side.

(ix) Reference to condonation of gradient infringements, CRS's dispensation for deviations from General Rules/Signal Engineering Manual, if any.

(x) Reference to approved Engineering plan on which the signalling plan is based.

(xi) Note regarding telephone communication provided between A. S. M./Cabinman and level crossings within and outside station limits.

(xii) Aspect sequence chart for colour light signals.

(xiii) Whether turnout is 1 in 8-1/2 or 1 in 12 or 1 in 16 etc.

(xiv) Details of Detection Table etc., which are not apparent in the plan.

(xv) Details of Track Circuits/Axle Counter/Treadles.

(xvi) Intestinal distances and distance between Warning Boards and Signals.

(xvii) Details of open bridges.

(xviii) Location of water column, ash pit/tray.

(xix) Signal overlap in big yards.

(xx) Custody of spare keys.

(xxi) Date of commissioning the installation.

8.7. Check and issue of Drawings :

8.7.1. Signalling Plans and Locking Tables/Selection Tables shall be checked in full by both Assistant Signal and Telecommunication Engineer and Senior Signal and Telecommunication Engineer before they are approved and signed by an officer in Junior Administrative grade or above, authorised by the Chief Signal and Telecommunication Engineer.

8.7.2. Locking Diagram for lever frames having more than 50 levers shall checked and approved as required in Para 8.7.1. Locking Diagram for lever frames having upto 50 levers, cable plans and power supply distribution diagrams shall be checked in full by Assistant Signal and Telecommunication Engineer before they are approved and signed by Divisional Signal and Telecommunication Engineer/Senior Signal and Telecommunication Engineer.

8.7.3. Circuit Diagrams for inter cabin control and automatic signalling shall be checked in full by Assistant Signal and Telecommunication Engineer and Senior Signal and Telecommunication

Engineer before they are approved and signed by Deputy Chief Signal and Telecommunication Engineer. Detailed wiring diagrams for individual stations prepared on the basis of these typical circuit diagrams should be checked in full by Assistant Signal and Telecommunication Engineer and Divisional Signal and Telecommunication Engineer or Senior Signal and Telecommunication Engineer who may approve and sign them.

8.7.4. For major signalling schemes, including power and electromechanical signalling.—

(i) Typical circuit diagrams for various circuit elements, such as route locking approach locking, sectional route release, point control, interlocking relay control, signal proving and lighting, etc., will be checked in full by both Divisional/Senior Signal and Telecommunication Engineer and Deputy Chief Signal and Telecommunication Engineer before they are approved and signed by Chief Signal and Telecommunication Engineer.

(ii) The detailed circuit and wiring diagrams, including those submitted by the Contractors or firms for individual schemes shall be checked in full by both Assistant Signal and Telecommunication Engineer and Divisional/Senior Signal and Telecommunication Engineer before they are approved and signed by an Officer in junior Administrative grade or above, authorised by the Chief Signal and Telecommunication Enginee..

8.8. Completion Drawings;

8.8.1. The Signal and Telecommunication Engineer-in-charge of Construction should submit signed ferro copies to the Chief Signal and Telecommunication Engineer for works completed. These should indicate the work as actually carried out including the dimensional details as actually measured at site, location of signals, details of cables laid, wiring diagram, locking diagram etc.

8.8.2. On receipt of these drawings, the original tracings will be amended in the Office of Chief Signal and Telecommunication Engineer and marked "Completion Drawing". Requested number of copies of the completion drawing will be sent to the office of Divisional Signal and Telecommunication Engineer.

8.9. Supply of Plans ;

8.9.1. Plans of working installations- In addition to the Standard drawings, each Divisional Signal and Telecommunication Engineer/Assistant Signal and Telecommunication Engineer shall have copies of the following diagrams and charts of working installations :

(i) Engineering/Plan and Signalling Plan for each interlocked station including interlocked level crossings situated outside station limits and interlocked mid-section sidings.

(ii) Working Rule diagram where issued for each station including interlocked level crossings outside station limits.

(iii) Locking Table and Locking diagrams of each interlocking frame, Station Master's slide control frame, interlocking key box, power frame with mechanical locking.

(iv) Selection Tables for each electromechanical/Relay interlocked station,

(v) Panel diagram

(vi) Diagrams of track circuits for each yard showing complete layout and diagrams of individual track circuit showing location of insulation joints, jumpers, relay and feed ends, polarity, length,

traction, bonds, etc.

(vii) Diagrams of connections at track, line and other relays, as necessary for each track circuited yard ;

(viii) Diagram; of electrical signalling and power signalling circuits for each yard.

(ix) Diagrams of single and double line block instrument circuits.

(x) Diagrams of Location/Junction boxes showing description of wires at terminals for each yard.

(xi) Arrangement of relays in relay racks and contact analysis sheet for Relay Interlocked stations ;

(xii) Diagrams showing connections of power supply panels for each power supply installation.

(xiii) Cable route plan showing disposition of underground cables for each yard.

(xiv) Disposition charts of overhead lines for control telephones, block instruments, administrative trunks, telegraph and other railway circuits.

(xv) Disposition charts of overhead lines for circuits such as electrical reverses, key transmitters and other circuits under the charge of each inspector.

8.9.2. Sectional Signal Inspectors and Supervisory Signal Inspectors shall be supplied with copies of the above mentioned Drawings and charts.

8.9.3. Ai stations provided with electro-mechanical signalling or centralised operation of points and signals, a set of signalling plans, locking/selection tables, locking diagrams and wiring diagram, cable route plan etc. may be kept at the station for reference by the maintenance staff.

8.9.4. While signalling plans, locking tables, selection tables and wiring diagrams shall be supplied by Headquarters Office, other plans mentioned in Para 8.9.1 shall be prepared by Divisional Signal and Telecommunication Engineer (Construction) or (Maintenance) as the case may be. Signalling plans for non-interlocked stations shall be prepared by Divisional Signal and Telecommunication Engineer (Construction) or (Maintenance) as the case may be.

8.10. Care and file of tracings.—

8.10.1. Tracings shall not be used for reference as they are apt to get lost or damaged. Required number of ferro-prints should be supplied to Officers and Inspectors. Each particular file should contain a ferro-print of the works relating to it.

8.10.2. Should it be necessary to send a tracing from one office to another, it shall be rolled and inserted in a cardboard cylinder.

8.10.3. Ferros should be folded concertina fashion and shall when folded measure approximately 210 mm x 300 mm. The folding should be arranged so as to make visible the title of the plan without unfolding the plan. When prints are rolled for despatch, they should be rolled with the working side outwards.

8.10.4. The Records section of each Drawing Branch may file every tracing and original drawing on the basis of the subject classification and the index card filing system. Each drawer of the index

card cabinet should be distinguished by a classification number: each card should be complete as regards title of the drawing, other connected drawings, file reference and the drawer number in which the original is stored.

8.10.5. The storage-drawers should have placards on the outside indicating the contents in each. The plans should be stored flat in shallow drawers of convenient dimensions. Probability of damage by moths or white ants should be guarded against.

SECTION' B '

Standard Drawings

8.11 Indian Railway Standard Drawings.

8. 11.1. Indian Railway Standard Drawings, designated by the code word I. R. S. have been issued by the Director-General, Research Designs and Standards Organisation, Ministry of Railways, Lucknow. The signal drawings are marked IRS. (S)—" S " stands for " Signal ". The particulars of the drawings and their reference numbers are detailed in an "Index of Indian Railway Standard Signalling and Interlocking Drawings—IRS. (S)". This index shows all the IRS. (S) drawings arranged alphabetically, as well as serially, in the order of their numbers. Each drawing number is either prefixed with letters ' SA ' or letter I S ' ' SA ' stands for a signal assembly and ' S ' stands for a part of a signal assembly.

8.11.2. New designs and drawings which are acceptttd for adoption as standards have the word " Advance " suffixed to their number e.g. S-8716 (Advance), pending their final adoption as Indian Railway Standard Drawings. For such drawings the manufacturers shall have a sample approved by the purchaser before undertaking the bulk manufacture.

8.12. Supply of Standard Drawings :

8.12.1. A set of all I. R. S. (S) drawings shall be supplied to the office of each Divisional Signal and Telecommunication Engineer, Assistant Signal and Telecommunication Engineer and to each Inspector as required.

8.12.2. I. R. S. drawings should not be traced by the Zonal Railway. Copies in reproduction tracings should be obtained from the Director General, Research, Designs and Standards Organization (Signal and Telecommunication), Ministry of Railways, Lucknow, whenever required.

SECTION ' C '

Specifications

8.13—Indian Railway Standard Specifications.—Specifications for materials used for signalling purpose have been drawn out by the Director, Research General, Designs and Standard Organisation, Ministry of Railways, Lucknow and are titled as " Indian Railways Standards Specifications". These specifications are issued under a fixed serial number e. g. S-12-54, the letter " S " denoting " Signals " the number " 12 " representing the serial number of the specifications and the final number " 54 " indicating the year of original adoption as standard, or in the case of revision, the year of last revision. A list of I. R. S. Signal specification is at Annexure " 34 ".

8.14.—Other Specifications.—-Specifications issued by the British Standards Institution, the Indian Standards Institution and the British Railway Board have also been adopted for items of equipment used for signaling purposes for which no I. R. S. specification exists. Some of these

specifications pertaining to items in common use are detailed in Annexure '' 35 "

8 15.—Supply of Specifications.—Each Divisional Signal and Telecommunication Engineer and Assistant Signal and Telecommunication Engineer should have a copy of all Indian Railway Standard (Signal) specifications in his office. Copies of such British Standard and Indian Standard specifications that are generally required may also be kept. He should also have a copy of all specifications issued by Chief Signal and Telecommunication Engineer for local use.

8.16.—Availability—

8.16.1. Indian Railway Standard Specifications are obtainable from the Manager of Publications, Civil Lines/Delhi-6.

8.16.2 Indian Standard Specifications are obtainable from the Indian Standards Institution, Manak Bhavan, Bhadur Shah Zafar Marg, New Delhi, or its branch offices at Bombay, Calcutta, Madras, Hyderabad, Kanpur and Bangalore.

8.16.3 British Standard Specifications may be purchased from Indian Standard Institution Offices at New Delhi, Bombay, Calcutta and Madras.

SECTION 'D'

Books of Reference

8.17 Books of Reference—Scale of.—Books of reference should be supplied to Officers, Inspectors and Maintainers for their personal use, as well as for use in their officers. A statement showing the various books and their distribution is at Annexure - 36 .

8.18 Reports of Signal Standards Committee, Technical papers and Journals.—Each Divisional Signal and Telecommunication Engineer should arrange to have the under mentioned technical literature in the Divisional Library.—

(i) Reports of the Signal Standards Committee.

(ii) Proceedings and Technical papers issued by the Institution of Railway Signal and Telecommunication Engineers, New Delhi.

(iii) I. R. S. specifications, British Standard specifications, Indian Standards specifications, specifications of the Association of American Rail Roads Signal section relating to Signalling and Telecommunication equipment as required.

(iv) Quarterly Technical Bulletin and other technical papers on Signalling and Telecommunication matters published by the Research, Designs and Standards Organization/Lucknow.

(v) Notes published by Indian Railways Institute of Signal, Engineering and Telecommunications, Secunderabad.

(vi) Technical books and journals of interest on Signalling and Telecommunication.

SECTION ' E '

Maintenance of Drawings, Specifications and Books of Reference

3.19 Folders.—Standard drawings, plans of working installations and specifications should be maintained in a book form separately bound in suitable folders.

8.20 Addenda and Corrigenda.

8.20.1 I. R. S. Drawings and Specifications.—A quarterly notification is issued by the Director General, Research, Designs and Standards Organization. It gives the details of the new Indian Railway Standard Specifications and drawings issued and also those which have either been modified or cancelled during the quarter covered by the notification.

8-20-2 British Standard Specifications.—British Standard Year Book is published by the British, Standards Institution, Victoria Street, London S. W. I. It contains a list of up-to-date British Standards in numerical order and also gives a brief description of each.

8.20.3. Indian Standards Specifications.—The I. S. I. Hand Book of Publications contains up to-date list of Indian Standards and is available from the Indian Standards Institution, Bahadur Shah Zafar Marg, New Delhi, or any of its branch offices at Bombay, Calcutta, Madras, Hyderabad, Kanpur and Bangalore.

8.20.4. Standard Drawings and Plans of working Installations.—Railway should publish lists of standard drawing as also lists of plans of working installations for the information of the staff. Addenda and Corrigenda slips should be issued to these lists regularly once in six months incorporating particulars of drawings and plans issued, modified or cancelled.

8.20.5. Books of reference.—Addenda and Corrigenda slips to the books of reference are issued from time to time by the Railway Board and the Railways, as the case may be.

8.21. Accountal.—All Indian Railway Standard drawings and Specifications, British Standard and Indian Standard Specifications as well as books of reference must be accounted for in the same way as tools and plant items ;

8.22. Responsibility.—

8.22.1. All officials to whom books of reference have been supplied shall be responsible for—

(i) their safe custody and good order ;

(ii) pasting all addenda and corrigenda slips promptly and seeing that these are up-to-date to the last slip as modified from time-to-time.

(iii) returning all books issued to them for personal use prior to retirement.

8.22.2. Each Inspector shall be responsible to see that—

(i) the standard drawings and plans of working installations are properly maintained and kept up-to-date in respect of new drawings issued and old ones cancelled;

(ii) the staff working under him understand and carry out work in accordance with standard drawings and plans of working installations . Any mistake in drawings and plans that may come to his notice should be promptly intimated to the Divisional Signal and Telecommunication Engineer for arranging correction; and

(iii) the staff under them maintain their books of reference up-to-date and in good order.

8.22.3. Each Divisional Signal and Telecommunication Engineer shall be responsible to see that—

(i) the standard drawings, plans and specifications in his custody are kept up-to-date and that the obsolete and cancelled ones are destroyed.

(ii) all inspectors keep their standard drawings and plans up-to-date.

(iii) the staff properly understand and carry out work in accordance with the standard drawings and plans.

(iv) Any mistake in the standard drawings, working plans and specifications, which comes to his notice, is promptly intimated to the Chief Signal and Telecommunication Engineer for arranging necessary correction.

(v) each Divisional Signal and Telecommunication Engineer shall make periodical check to see that Inspectors maintain their books of reference up-to-date and in good order, He should encourage his Inspectors and other staff to study reports, proceedings, papers and journals mentioned in Para 8.18 so as to enhance their knowledge and to keep themselves informed about the up-to-date developments, methods and technique in Railway Signalling and Telecommunications.

SECTION 'F'

Indian Railway Standard Equipment

8.23. Indian Railway Standard Designs.—Where Indian Railway Standard designs exist, they should invariably be followed for all new works and no modification of such designs should be

introduced without the previous approval of the Railway Board.

If any defect in standard designs is noticed under service conditions or if certain modifications to the design are considered desirable, the matter should be brought to the notice of the Director-General, Re-search, Designs and Standard Organisation Signal and Telecommunications for examination in consolation with the Signalling Standard Committee.

CHAPTER IX

GENERAL INSTRUCTIONS FOR INSTALLATION OF SIGNALLING EQUIPMENT

SECTION ' A '

General

9.1. Reference to Rules :

9.1. 1. The safety of the travelling public is ensured by the Rules laid down in—

(i) The Indian Railway Act.

(ii) The General Rules for all Open Line Railways.

(iii) The Rules for Opening of a Railway or section of a Railway for the public carriage of passengers.

(iv) The Indian Railway Schedule of Dimensions.

9.1. 2. The rules provide for the legal authorization that shall be obtained for any work which affects the running line, before the work is started or brought into use and before a new section of a line is opened for public traffic.

9.2. Notification to Railway officials before opening works.—No signalling work affecting the running of trains or working of traffic at a station shall be brought into use until staff of all concerned Departments have been notified by means of a circular issued by the Operating Department Timely intimation of the date of commencement of work, duration of work, arrangements for working of trains during the progress of the work, date of opening of work, etc., shall be given to the Operating Department, whenever any new or revised traffic working instructions are to be brought into use to enable operating Department to give the station and running staff due notice.

9 3. Approved plans, Drawings and Specifications.—All works shall be carried out strictly in accordance with the approved plans, standard drawings and specifications and should conform to the provisions of this manual where such are applicable. Deviations, if any, shall have the prior approval of the Chief Signal and Telecommunication Engineer. All deviations shall be marked on the completion drawings and forwarded to the Chief Signal and Telecommunication Engineer for correction of the tracings and issue of revised prints.

9.4. Responsibilities of Engineer-in-charge.

9.4. 1 The Engineer-in-Charge shall ensure that no work is commenced without—

(i) Proper men and materiel-:; being available for its execution.

(ii) Approved signalling plans, locking tables and diagrams, selection tables and circuits, standard

drawings and specifications.

(iii) Sanction of Commissioner of Railway Safety in the case of works on lines opened already for passenger traffic.

(iv) Station working Rules and temporary working instructions.

(v) Sanction to the detailed estimate for the work with necessary allotment of Funds. (This does not apply to works started on urgency Certificates).

9.4.2 The Engineer-in-Charge shall, besides authorising commencement of works—

(i) Be responsible for proper and efficient execution of works,

(ii) Make frequent inspections and issue detailed instructions to the Inspectors.

(iii) Sec that the progress of work is satisfactory and submit progress reports to the Chief Signal and Telecommunication Engineer.

(iv) Be responsible for correct booking and control over expenditure within the funds allotted.

(v) Assist the Operating Department in preparation of the Station working Rules.

(vi) Arrange for sighting of new Signals by sighting committee before commissioning the same.

(vii) Fix a date for opening jointly with other concerned officials and notify the same to all concerned.

(viii) Arrange to issue safely certificate and joint message to the Commissioner of Railway Safety

9.5. Responsibilities of the Inspector in charge—The Inspector in charge of the work shall, besides ensuring the conditions stipulated in Para 9.4.1. be responsible for ensuring that—

(i) a work is not started unless authorized by the concerned officer ;

(ii) all necessary steps are taken for the safety of trains movements during the execution of the work;

(iii) there is no avoidable detentions to trains and if any detentions do take place particulars are advised promptly to the Engineer-in-Charge ;

(iv) the station staff have received the necessary notice and Station working Rules ;

(v) the work is tested and found correct by him before requesting the Engineer-in-Charge to test and commission the work ;

(vi) all precautions are taken to prevent accidents to staff or damage to equipment ; and

(vii) all accidents are promptly reported.

SECTION ' B'

Works on Lines opened to Traffic

9. 6. Works requiring notice to and sanction of the Commissioner of Railway Safety.—Under Section 20 of the Indian Railways Act and Chapter VI of the " Rules for the Opening of a Railway or Section of a Railway for public Carriage of Passengers " the approval of Commissioner of Railway Safety is required for the execution of any work on the open line which will affect running of passenger train, and any temporary arrangement necessary, for carrying it out except in cases of emergency. The following signal and interlocking works, when they are connected with or form part of a Railway already opened for carriage of passengers require the sanction of Commissioner of Railway Safety before they arc commenced or opened-—

(i) Additions/extensions or alterations to existing Block, Signalling and Interlocking installations

(ii) New Block, Signalling and Interlocking installations.

(iii) New Stations temporary or permanent.

(iv) Interlocking of level crossing, catch siding slip sidings, etc.,

9.7. Application to the Commissioner of Railway Safety for sanction for works:

9.7.1. Applications to the Commissioner of Railway Safety for sanction for carrying out works listed in Para 9.6 shall be submitted in the following manner.—

(i) When the work is executed by the Divisional organization, the application shall be mad by the Divisional Railway Manager.

(ii) When the work is executed by an extra Divisional Organization e. g. Construction Organization, the application shall be made by an officer not below the rank of Deputy Chief Signal and

Telecommunication Engineer for signalling works. For joint works the application shall be made by an officer not below Junior Administrative grade of the department which controls the work.

(iii) Station Working Rules obtained from the Operating Department shall accompany the application.

(iv) The application shall be made on the prescribed form 1606/1 " Application of or Sanction " (Annexure ' 37 ') and shall be complete in respect of all documents mentioned therein.

(v) The application for sanction shall ordinarily be made at least fourteen days in advance of expected commencement of the work. When a sanctioned work is not taken on hand within twelve months of the date of sanction, a fresh sanction shall be obtained.

9.7.2. If any material deviation from the plan approved by the Commissioner of Railway Safety which affects the yard layout or signalling and interlocking arrangements or system of train working, is found necessary, his prior approval to such deviations shall be obtained with reference to application first made.

9-7.3. The Commissioner of Railway Safety in according his sanction may or may not propose to inspect the works.

9.7.4. If the Commissioner of Railway Safety decides to inspect the work prior to opening, he will, after inspection in the company of the officers concerned, communicate in writing his sanction to open the work.

9.8. Safety Certificate:

9.8.1. If the Commissioner of Railway Safety decides not to inspect the work prior to the opening, the Engineer in-Charge shall submit the Safety Certificate on the prescribed from (Annexure ' 38') signed by him prior to the opening of works and in case of joint works, signed also by Engineering-in-Charge of Civil Engineering portion.

9.8.2. Before signing the Safety Certificate the Engineer-in-Charge shall—

(i) Test the new works and see that the installation has been carried out correctly.

(ii) Fully satisfy himself, that the work can be opened for the public carriage of passengers without endangering the safety of the traveling public or of the employees of the Railway.

9.8. 3. After fully satisfying himself he shall bring the installation into use by issuing a message in the form given on the sanction Application (Annexure '37') to the Commissioner of Railway Safety with copy to all concerned.

In case of joint works the message shall also be signed by the Engineer-in-Charge of the Permanent Way portion of the work.

9.8.4 The Safety Certificate shall be countersigned by the Officer who applied for the sanction of Commissioner of Railway Safety. A certificate from Operating Department, stating that the necessary Station Working Rules have been issued and giving reference to sanction of deviations (if any) from General and Subsidiary Rules, shall also be attached.

9.8.5 Copies of the Safety Certificates shall be sent to the Divisional Railway Manager and the

Chief Signal and Telecommunication Engineer and also the Chief Engineer if the Engineering Department is involved in the work.

SECTION ' C '

NEW LINES AND ELECTRIFICATION

9.9. Application to the Commissioner of Railway Safety :

9.9. 1. In the case of new lines or electrification, prior sanction of the Commissioner of Railway Safety for commencement of the work is not necessary but when it is proposed to open the line for passenger traffic or to initiate electric traction on a line already opened, the following documents are to be furnished by the General Manager of Railway to the Commissioner of Railway Safety at least one month before the date by which the line is expected to be ready for opening. These documents collectively are termed the Opening Documents ;—

(i) Tabulated details,

(ii) Index plan and section of Railway,

(iii) Drawings of works.

(iv) List of questions and answers duly filled in.

(v) Certificates.

(vi) List of infringements of maximum and minimum dimensions,

(vii) Diagram of proposed testing train

(viii) Station working rules to be enforced at each station.

9.9. 2. Of the above only the following items concern signalling and interlocking ;—

(i) Tabulated details Form No. VIII of Rules for Opening of a Railway (Annexure ' 39').

(ii) Drawings of works, plans of station yard showing gradients, the layout of tracks and signals and interlocking including locking and selection tables.

(iii) List of Questions and Answers (Annexure ' 40').

(iv) Station working Rules (assisting the Operating Branch in their preparation).

(v) Certificate for introducing or extending electric traction (Annexure' 41 ').

9.9.3. The new line shall be opened for passenger traffic or electric traction shall be initiated only after the Commissioner of Railway Safety authorises the Railway to do so after his inspection.

Note.—If any part of the work relating to a new line or electrification affects any existing signalling or interlocking installation, prior sanction of the Commissioner of Railway Safety shall be obtained for that part of the work and the work executed on the basis of instructions contained in Section ' A ' of this Chapter.

SECTION ' D '

INTRODUCTION OF NEW TYPES OF LOCOMOTIVES OR ROLLING STOCK FOR

INCREASING SPEED

9.10. Sanction of the Commissioner of Railway Safety is necessary for the running of new types of locomotives or rolling stock or for increasing the maximum permissible speed on a specified section or of locomotives or rolling stock. The application for this purpose shall be made by the Chief Engineer and it shall be accompanied by the following document;:—

(i) Load diagram.

(ii) Certificate for Track strength.

(iii) Certificate for strength of girders.

(iv) Certificate of test runs (if required by the Commissioner of Railway Safety) obtained from Operating Department.

(v) Certificate on Form Annexure ' 42' signed jointly by the Chief Mechanical Engineer, Chief Engineer, Chief Signal and Telecommunication Engineer and Chief Operating Superintendent.

(vi) A statement (in Form XI of the " Rules for Opening of a Railway or section of a Railway for the Public carriage of passengers") detailing any " infringement of maximum and minimum dimensions" involved in running of the locomotive or rolling stock.

On receipt of such an application, the Commissioner of Railway safety if he so desires, will inspect and/or try out the new locomotives and/or rolling stock and the Railway Administration will afford him the necessary assistance to do so.

CHAPTER X

CONTRACTS AND MEASUREMENT FOR WORKS

SECTION 'A'

General

10.1. Code references for contracts.—The procedure and rules for the calling for tenders and entering into contracts for execution of works and supply of materials are contained in Chapter XII of the Indian Railway Code for the Engineering Department and Chapters III, IV and VII of the Indian Railway Code for the Stores Department.

10.2. Lists of approved contractors and Registration of applications :—

10.2.1. Lists of approved contractors shall be maintained in the offices of the Divisional Signal and Telecommunication Engineers for their Divisions and the Chief Signal and Telecommunication Engineer for the whole Railway. As per Para, 1216E. these lists shall be deemed to be confidential records and examined and revised periodically. They shall be maintained in manuscript form under the following categories of work:—

A. For works to be executed under Open line conditions affecting safety of running trains.—

(i) Provision of Mechanical Signalling.

(ii) Provision of Electrical Signalling,

(iii) Provision of Relay Interlocking, C. T. C. etc.

(iv) Laying of cables.

(v) Erection of overhead alignment by the side of the track,

(vi) Any other signalling work.

B. For works to be executed under Open Line conditions not involving safety of running train or on new lines or in areas away from track opened for traffic.—

(i) Provision of Mechanical Signalling,

(ii) Provision of Electrical Signalling,

(iii) Provision of Relay Interlocking, C. T. C, etc., (iv) Laying of Cables.

(v) Erection of overhead alignment by the side of track,

(vi) Any other signalling work,

(vii) Supply of sand, bricks, etc.

10.2.2. The Chief Signal and Telecommunication Engineer shall authorise the inclusion in the lists of approved contractors the names of applicants considered capable of executing works under one or more of the catagories in para 10.2.1 above. On receipt of an application from a contractor desirous of having his name included in the lists of approved contractors, the Divisional Signal and Telecommunication Engineer shall satisfy himself on the following points (as per para 1215-E.) and

forward the application with his remarks to the Chief Signal and Telecommunication Engineer:—

(i) His position as an independent contractor.

(ii) His capacity to undertake and carry out works satisfactorily, as vouched for by a responsible-official or (firm).

(iii) His previous experience on works similar to that to be contracted for, in proof of which original certificates or testimonials may be called for and their genuineness verified, if need be, by reference to the signatories thereof.

(iv) His knowledge from actual personal investigation of the resources of the division in which he offers to work.

(v) His ability to supervise the work personally or by competent and duly authorised agents. It shall be ensured that each application for registration is accompanied by—

(i) A certificate showing the financial standing of the applicant,

(ii) An authorised copy of the Income-tax Clearance certificate,

(iii) Original certificates (or authorised copies thereof) regarding past experience of works.

10.3. Basis for inviting tenders and entering into contracts:

10.3.1. The documents which form a contract are as follows:—

(i) Instructions to parties tendering.

(ii) Tender form, if any.

(iii) Specifications—Standard and special,

(iv) Schedule of items and quantities, rates, etc.

(v) Conditions of contract—Standard and Special,

(vi) Agreement Form.

Items (i) to (vi) above shall be comprehensive and explicit so that there is the least possibility of conflicting, even differing, interpretations being placed on the intentions of the contract.

10.3.2. Each Divisional Signal and Telecommunication Engineer shall be in possession of copies of items (i) to (vi) vide para 10.3.1. and acquaint himself with the provisions contained therein. Signal Inspectors may be supplied with copies of these where necessary.

10.3.3. Copies of items (i) to (vi) vide paras 10.3.1. shall be available in the Office of the Chief Signal and Telecommunication Engineer and the Divisional Signal and Telecommunication Engineer for sale to contractors who shall be advised to make themselves conversant with the provisions contained in items (i) to (vi) before tendering for works or supply of materials.

10.3.4. Amendments when considered necessary to any para, clause or items of the regulations for tenders and contract, the general conditions of contract, the specifications for materials and works and the schedule of rates shall be authorised solely by the Chief Signal and

Telecommunication Engineer and intimated to the Executive Officers and Inspectors who shall acknowledge receipt of the same.

SECTION ' B"

Tenders

10.4. Calling for tenders.—Tenders may be invited for any of the works listed in para 10.2 required to be carried out under contract. When calling for tenders for works, the provisions contained in para 121IE. shall be observed. Tenders may be invited by the Divisional Signal and Telecommunication Engineer, Deputy Chief Signal and Telecommunication Engineer/Construction, Divisional Railway Manager or the Chief Signal and Telecommunication Engineer depending on the contract value or works (s) according to the procedure that may be prescribed by the Administration for the purpose. The common methods of obtaining tenders are by advertisement (Open Tenders), by direct invitation to a limited number of contractors (Limited Tender) and in exceptional cases by invitation to one contractor (Single Tender).

10.5. Tender Notices:

10.5.1. Notice for inviting tenders shall be to the Form prescribed by the Administration and shall embody the stipulations contained in para 1239-E.

10.5.2. When limited tenders are invited, tender notices shall be issued to Contractors on the list of approved contractors and displayed on the notice boards of the offices of the Divisional Signal and Telecommunication Engineer and important stations on the Division concerned.

10.5.3. When open tenders are invited, Tender Notices shall be displayed on the Notice Boards of

the offices of the Divisional Railway Manager, Deputy Chief Signal and Telecommunication Engineer, Divisional Signal and Telecommunication Engineer, Signal Inspectors and important stations on the region concerned. In addition, if so prescribed by the Administration, tender notices shall be published in the newspapers on the approved list of the Government of India, it being left to the authority inviting enders to select the newspapers and the number of insertions for this purpose.

10 6. Tender Forms.— Tender forms shall embody the contents of the contract document either directly or by reference. Tender forms shall be issued on payment of the prescribed fees to the appropriate contractors on the list of approved contractors. Contractors not on the approved list of approved contractors will, on payment of the prescribed fees, be furnished with tender forms and shall be required to submit evidence regarding their financial status, previous experience and ability to execute the works and an authorised copy of the Income Tax Clearance Certificate without which their tenders shall not be considered.

10.7. Drawings and Specifications.

10.7.1. Unless otherwise agreed to specifically, the execution of works and supply of materials on contract shall be according to the Railway's Drawings and the Specifications.

10.7 .2. If no specification exists for any item of work or supply, a complete specification of the item and of the materials to be used shall be prepared and embodied in the contract documents or made available for reference by intending tenderers.

10.8. Earnest Money and Security Deposit.

10.8.1. The tenderer shall be required to deposit with the tender, earnest money at the rates prescribed by the Administration as initial security. In case of acceptance of the tender, the earnest money will be retained by the Railway as a part of the security for the due and faithful fulfilment of the contract 'and the balance to make up the security deposit at the rates stipulated by the Administration shell unless otherwise specified in the special condition if any, be deposited by the contractor in cash or in the form of Government Securities or will be recovered by percentage deductions from the Contractor "on account" bills. A guarantee from a Scheduled Commercial Bank in India may also be accepted as Security Deposit. The Government Security may be of the required monetary value in the form of approved Banker's bonds. Government security certificates, deposit receipts of scheduled Banks or Post Office Savings Bank pass books, duly pledged or hypothecated to the Accounts Officer of the Railway.

10 8.2. No cheque shall be accepted from a Contractor or firm as earnest money with a tender unless it is guaranteed by the Bank concerned.

10 8. 3. The earnest money of all unsuccessful tenderers shall be refunded as expeditiously as possible.

10.9. Tender committees.—The Administration will specify—

(i) The constitution and functions of Tender Committees for the purpose of opening of tenders and submitting recommendations to the competent authority. The convenor of a Tender committee meeting shall be the Chief Signal and Telecommunication Engineer, the Divisional Railway Manager, the Deputy Chief Signal and Telecommunication Engineer (Construction), Divisional Signal and Telecommunication Engineer as the case may be ; Wherever practicable, an Officer of the Accounts Department shall be deputed on the Tender Committee.

(ii) The powers that shall be exercised by the Chief Signal and Telecommunication Engineer, Divisional Railway Manager and Divisional Signal and Telecommunication Engineer respectively in the matters of acceptance of tenders and entering into contracts, and the signing of contract documents.

(iii) The conditions in regarding to acceptance of single tenders.

Note.—(i) When a single tender is received in response to a call for limited or open tenders, the urgency of the work may be the criterion for its acceptance, provided the tendered rates are considered reasonable.

(ii) If the rates in a single tender are considered inordinately high, negotiations may be carried out by the Tender Committee with the tenderer in the interest of work.

10.10. Opening of Tenders.—At the advertised time and place tenders received for a contract shall be opened by the Tender Committee and, where practicable, the names of tenderers and the rates tendered by them read out in the presence of such of the intending contractors or their agents as may attend. Each page and correction or stipulation (if any) of every tender shall be initialled with date by members of the Tender Committee.

10.11. Acceptance of Tenders.

10.11.1.—Tenders opened and duly initialled at the Tender Committee Meeting shall be valued in the office of the Chief Signal and Telecommunication Engineer, Divisional Railway Manager, Deputy Chief Signal and Telecommunication Engineer as the Divisional Signal and Telecommunication

Engineer as the case may be, the stipulations made, if any, being duly assessed and a comparative statement prepared. The comparative statement together with a note shall be sent to the Accounts Department for vetting. Based on the vetted comparative statement, the tenders will be adjudged by the Tender Committee and recommendations made to the authority empowered to accept the tender.

10.11.2. Ordinarily the lowest tender may be accepted by the Railway unless such acceptances would not be in the public interest. The acceptance or rejection of any tender is left entirely to the discretion of the authority empowered to deal with the matter and no explanation can be demanded by any tenderer as to the cause of rejection of his tender.

10.12. Entering into Contracts.—No contract shall be entered into unless authority exists for commencement of the work. No authority shall enter into a contract beyond its own powers of sanction.

10.13. Execution of contract documents.

10.13.1. The tenderer whose tender is accepted shall be required to appear at the office of the General Manager, Chief Signal and Telecommunication Engineer, Divisional Railway Manager or Divisional Signal and Telecommunication Engineer as the case may be, in person or if a firm or corporation, a duly authorised representative shall so appear, and execute the contract within seven days after notice that the contract has been a warded to him. Failure to do so shall constitute a breach of the agreement effected by the acceptance of the tender in which case the earnest money accompanying the tender may be forfeited.

10.13.2. In the event of any tenderer, whose tender is accepted, refusing to execute the contract

documents the authority may determine that such Tenderer has abandoned the contract and thereupon his tender and the acceptance thereof shall be null and void and the earnest money accompanying the tender shall be forfeited.

10.14. Form of Contract Documents.

10.14.1. Every contract shall be complete in respect of the documents it constitutes.

10.14.2. The contract agreement required to be executed by the successful tenderer shall be in the form prescribed by the Administration for the purpose. The draft of the contract agreement shall be vetted by the Accounts Department.

10.15. Copies of Contract documents.

10.15.1. Sufficient number of copies of the contract documents shall be available for use in the offices of the Divisional Signal and Telecommunication Engineer and the Signal Inspector. If materials are to be inspected by an agency other than the consignee, a copy of the contract documents shall be supplied to the inspecting agency also. No deviations in the contract documents shall be permitted with out the sanction of the competent authority.

10.15 .2. The executive Officers and Inspectors shall thoroughly study the contract documents for works to be carried out and shall adhere to the provisions contained therein.

10.16. Items of works not included in contract documents.

10.16.1. The Assistant Signal and Telecommunication Engineer and the Inspector in charge of the

work shall ensure that no item of work that is not included in the contract is carried out without the sanction of the competent authority.

10.16 .2. Items of work not included in a contract may, if deemed expedient, be executed under the contract at the rates mutually agreed on by the contracting parties.

10.17. Modifications to contract.—In the event of any of the provisions of the contract requiring to be modified after the contract documents have been signed, the modifications shall be made in writing and signed by the Railway and the contractor and no work shall proceed under such modifications until this has been done. Any verbal or written arrangement abandoning modifying, extending, reducing or supplementing the contract or any of the terms thereof shall be deemed conditional and shall not be binding on the Railway unless and until the same is incorporated in a formal instrument signed by the Railway and the contractor, and till then the Railway shall have the right to repudiate such arrangement.

10.18. **Issue of Departmental materials to contractors.**—When so specified in the contract, cables and other signalling materials shall be issued to contractor and receipts obtained for the same, It shall be ensured that the Contractors takes reasonable care of all materials made over to him and that on completion of the works the unused balance of the same are handed over by him in good order.

SECTION' C '

MEASUREMENTS AND MEASUREMENT BOOKS

10.19. Code References.—The rules regarding the recording of measurements in measurement books, care and custody of measurement books and the preparation of contract bills are embodied

in Para 1313 E.

10.20. Measurement Books.—

10.20.1. Each measurement book shall have .—

(i) instructions printed at the commencement,

(ii) An Index which should be posted up-to-date.

A form of measurement book is attached as Annexure ' 43'.

10.20.2. Measurement books shall be issued to the Assistant Signal and Telecommunication Engineer by the Divisional Signal and Telecommunication Engineer as required duly numbered thus M. B. No.....of 19 . As few books shall be issued as can conveniently meet the requirements.

10.20.3. A register of measurement books shall be maintained by the Divisional Signal and Telecommunication Engineer wherein the contents and the movement of each measurement book shall be indicated.

10.20-4. Measurement books shall be sent from one Office to another in the personal custody of a responsible person.

10.20.5. Completed measurement books and those not in use although not completely written up, shall if they are no longer required, be sent to the Divisional Signal and Telecommunication Engineer to be filed in his Office.

10.20.6 If a measurement book is lost, immediately the loss is discovered, the matter shall be reported to the Divisional Signal and Telecommunication Engineer, who will obtain sanction to write off the book from the registers of Measurement Books.

10.21 Recording Measurements.

10-21.1. Every entry in a measurement book shall be commenced with a Statement as to how it is to be billed. The instructions for recording measurements contained in Annexure ' 43' shall be followed.

10.20.2. The pages of every measurement book shall be machine numbered; no page on any account shall be torn out, nor shall any entry be erased or defaced so as to be illegible.

10.21.3. Entries shall be recorded continuously in the measurement book. No blank pages shall be left. Any page left blank inadvertently shall be cancelled by diagonal lines drawn across the pages, the cancellation being attested.

10.21.4. When any measurements are cancelled, the cancellation shall be supported by the initials with date of the Officer ordering the cancellation or by the Official who made the measurements. The reasons for cancellation shall be recorded.

10.21.5. Should it be found necessary to make any additions to measurements already taken owing to omission at the time of the measurements, such additions shall be detailed in a subsequent page of the book, giving reference to the page containing the original measurements and explaining the reasons for the same.

10.21.6. Entries of the measurements shall be made direct into the measurement book at the site of the work in the presence of the contractor or his agent. The copying of entries from a rough note book or other record is forbidden.

10.21.7. The Contractor or his authorised agent shall be present at the time of all on account and 'final' measurements and should sign the measurements recorded in the measurement book as acknowledgement of his acceptance of the accuracy of the measurements and the classification of materials. The contractor shall be given due notice of the time and date on which the measurements are to be taken. Failing his attendance, the work may be measured up in his absence and such measurements shall notwithstanding such absence, be binding upon him whether or not be shall have signed the measurement book provided hat any objection to any measurement that is made by him in writing within seven days of the date of such measurements shall be duly investigated and considered.

10.21.8 After the contractor's dated signature has been obtained, the official recording the measurements shall attest his full signature and designation at the end of the measurements.

10.22 ' **On Account' Measurements.**

10.22.1 For measurements against which on account bills are prepared and which arc subject to adjustment in final bills, the official in charge may use percentage measurements for the part the work completed.

10.22.2 Quantities for payment' on account' shall never exceed the estimated quantities of actual work done upto the time of payment. In order to ensure this, the following certificate shall be recorded by the official in charge in the measurement book for all' on account' measurements.

" I hereby certify that not less than the quantity of work paid for has actually been done and that the measurements are from plans/approximately estimated ".

10.23 Responsibility of the Assistant Signal and Telecommunication Engineer for measurements of works.

The Assistant Signal and Telecommunication Engineer shall be responsible for the correctness of the measurements for all works in his charge. He shall ensure that the measurements are made in the specified manner and shall cither record them himself or have them recorded by the Inspector in charge of the work.

10.24. Computation of quantities.

After measurements for a work are recorded, the quantities shall be computed and entered in the ' contents' column of the measurement book. This may be done by the official recording the measurements himself or in the office.

10.25. Preparation of abstracts in Measurements Books.

10-25.1. After the quantities are computed, an abstract shall be prepared in the measurement book in the Divisional Signal and Telecommunication Engineer's Office. The abstract shall be headed thus

"Abstract of pages.....to....."

The abstract shall show the correct description of the item, total quantity done up-to-date, rate and the total value for each item measured/checked, in connection with the work. The total of the

values of all the items will be the total value of the work done up-to-date.

10.25.2. In the case of a first and final bill this amount will not be subject to any deduction and will be paid in full to the contractor.

In the case of an 'on account' bill, the prescribed percentage of the value of the work done since the last certificate shall be deducted as security deposit towards the due fulfilment of the contract. The balance will be the amount payable to the Contractor and this amount must be written clearly in words as well as in figures.

10.25.3. On satisfactory completion of the work the security deposit will be refunded to the contractor after the final payment for the work is made. Part of the security deposit may be kept with the Railway in specified cases whenever it is necessary to witch the results of the work and to ensure that there will be no failure of the work for the period stipulated in the contract.

10 25.4. The abstract shall be signed and dated by the Assistant Signal and Telecommunication Engineer.

10.25.5. Each paragraph of the measurement book to which the abstract pertains shall be crossed in Red Ink diagonally thus.

See Abstract pages.....

10.25 6. At the foot of each abstract the relevant bill number and date of preparation of the bill shall be entered.

10.26. Submission of bills.

After the abstract is prepared in the measurement book, the bill shall be prepared in the Divisional Signal and Telecommunication Engineer's Office on the prescribed form.

10.27 Checking of bills in Divisional Signal and Telecommunication Engineer's Office.

10.27.1. The quantities in measurement books submitted by the Assistant Signal and Telecommunication Engineer shall be checked for arithmetical accuracy in the Divisional Signal and Telecommunication Engineer's Office where it will be verified that-

(i) the description of items is according to the contract schedule.

(ii) there are no delays in recording measurements,

(iii) the quantities executed are according to sanctioned plans and estimates,

(iv) where measurements are not recorded, correct reference to the standard measurements is clearly given, and

(v) the quantities recorded in the bill agree with those shown in the measurement book and rates higher than those sanctioned are not allowed.

10.27.2. An endorsement shall be made at the end of Assistant Signal and Telecommunication Engineer's abstract in the measurement book under the signature of Divisional Signal and Telecommunication Engineer giving reference to the particulars of the bill passed.

10 27.3. The Railway Administration may lay down a time schedule for preparation and checking of bills.

10.28. Bill Registers.—The Divisional Signal and Telecommunication Engineer's Office shall maintain Bill Registers in which all bills prepared in their office shall be recorded. The Register shall be kept up-to-date and complete information with reference to agreements, work orders, abstracts in measurement books and amounts.

10.29. Disputes with Contractors.

10.29.1. On the completion of every work, 'No claims certificate' shall be obtained from the Contractor according to the relevant clause or clauses in the condition of contract. Every month or when ' on account' bills are made out, the contractor shall be instructed to submit a list of outstanding claims, if any.

10.29.2. If there is any likelihood of a dispute with a contractor, all documents, measurements and letters bearing on the case shall be at once collected and stored in safe custody with the officer responsible for the case. In all such cases care shall be taken to commence all correspondence with the contractor with head line 'without prejudice'. The contractor shall be instructed to submit complete details of his claims in writing with a certificate to the effect that these are final.

10.29.3. Inspite of all reasonable efforts to effect agreement, if the contractor refuses to sign the final contract certificate, the final contract certificate shall be forwarded to the Accounts Officer to tender payment. The contractor may accept payment if he wishes under protest.

10.29.4. Disputes arising out of the contract for a work, between the contractor on the one hand and the Railway Administration on the other, shall be referred for arbitration in accordance with the relevant clause in the General Conditions of Contract.