



GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

INDIAN RAILWAY TRACK MACHINE MANUAL

**DISCLAIMER : THIS COMPILATION IS FOR REFERENCE ONLY.
FOR DETAILS PLEASE REFER CORRECTION SLIPS ISSUED BY
RAILWAY BOARD**

**Embodying all correction slips up to number 17
ACS from 12 to 17 highlighted in yellow**

March 2000

PREFACE

Track Machines were introduced on Indian Railways during the early sixties. The use of the machines both for maintenance as well as track laying increased with the introduction of heavy track structures. For working of these machines, instructions had been issued by the Railway Board and Zonal Railways from time to time. However, no manual as such was issued on track machines. Under these circumstances, Railway Board vide their letter no.96/Track-III/TK/44 dated 11-12-96 appointed a committee, for preparation of the manual, of Director/IRICEN Executive Director(TM)/RDSO, Executive Director Track (MC)/Railway Board and Chief Track Engineers (MC) of Northern, Southern & South Central railways. The following officers participated in the committee from time to time: -

Designation	Name
Director, IRICEN(Chairman)	Shri Vinod Kumar
Executive Director(TM) / RDSO	S/Shri i) A.P.Mishra ii) O.P. Agrawal, iii) Dham Singh
Executive Director Track (MC)/ Rly Board	S/Shri i) R.N.Verma. ii) V.K. Agrawal
Chief Track Engineer(MC)/ N.Rly.	S/Shri i) S.K. V1J ii) A.P.Mishra iii) Harjinder Singh
Chief Track Engineer(MC)/S.C.Rly	S/Shri i) N.Ramasubramanian ii) P.N. Ram
Chief Track Engineer (MC)/S. Rly	S/Shri i) A.N.Parakalan ii) S.Parameshwara Iyer iii) K.J.S.Naidu

The Committee held its first meeting -on 10-04-97 at IRICEN/Pune. The subject matter of various chapters of the manual was discussed by the committee during subsequent sittings and draft of the manual finalised.and circulated to zonal Railways for suggestions. Vide Railway Board's letter no. 96/Track-III/TK/44 dated 08-06-98. In the light of comments /suggestions received from Railways,original draft was finalized with modifications as considered necessary.The prevailing instructions in regards to working of track machines over different railways, instructions issued by the Rly. Board, provisions in the IRPWM. Indian Railways

General Rules other relevant codes / manuals and circulars issued by RDSO, had also been kept in view while writing this manual.

While every effort has been made to cover all aspects of track machine working Chief Engineers of Zonal Railways may issue such supplementary instructions as necessary to suit local conditions on the railways. Such instructions, however, should not contravene any of the provision in this manual and other codes.

The Committee was rendered valuable assistance and contribution by S/Shri C.P.Tayal, Sr. Professor /IRICEN, Hitesh Khanna, Director Track(M C)/Railway Board and J.S. Mahrok, Director (TM)/RDSO, during deliberations and preparation of this manual.

Though every care has been taken in preparing this manual, any error or omission may be brought to the notice of Railway Board. Suggestions for further improvement in this manual will be welcome.

This manual has been issued in consultation with Finance and Traffic Directorates of Railway Board.

March 10, 2000

N.C. Bindlish

Additional Member/Civil Engg.
Railway Board, New Delhi.

INDEX

CHAPTER	1	ORGANISATION AND DUTIES OF OFFICERS AND STAFF
	1.1	Track Machine organisation
	1.2	Duties of Assistant Engineer/Track Machines
	1.2.1	General
	1.2.2	Important duties
	1.2.3	Knowledge of rules and regulations
	1.2.4	Inspection by higher officers
	1.2.5	Inspection of machines by Assistant Engineer
	1.2.6	Execution of works
	1.3	Duties of (Senior) Section Engineer/Track Machines
	1.4	Duties of Machine operators
	1.5	Duties of Track Machine Fitters/ Mechanics
CHAPTER	2	FEATURES AND WORKING PRINCIPLES
	2.1	Types of machines
	2.1.1	Tamping machines
	2.1.2	Dynamic track stabilizer (DTS)
	2.1.3	Ballast handling machines
	2.1.4	Track laying machines
	2.1.5	Special purpose machines
	2.2	Tamping machines
	2.2.1	General
	2.2.2	Alignment of track
	2.2.2.1	Two chord lining system
		(i) smoothening mode
		(ii) Precision/design mode
	2.2.2.2	Single chord lining system
		i) 4 point lining method
		ii) 3-point lining method
	2.2.3	Levelling of track
		i) levelling in automatic mode (smoothening mode)
		ii) levelling in design mode
	2.2.4	Optional equipments
		i) Radio control system
		ii) Laser beam system
		iii) Geometry value assessment (GVA)
		iv) Packing/tamping system
	2.2.5	Important assemblies of tamping machines
		i) Engine
		ii) Tamping units
	2.3	Dynamic track stabilizer (DTS)
	2.3.1	General
	2.3.2	Working principle
	2.3.3	General data
	2.4	Ballast handling machines
	2.4.1	General
	2.4.2	Plain track BCM (RM-80)

- 2.4.3 Points & crossing BCM (RM-76)
- 2.4.4 Shoulder ballast cleaning machine
- 2.4.5 Ballast regulating machine (BRM)
- 2.5 Track relaying machines
- 2.5.1 Plasser's quick relaying system (PQRS)
- 2.5.2 Track relaying train (TRT)
- 2.5.3 Points and crossing changing machine (T-28)
- 2.6 Special purpose machines
- 2.6.1 Mobile flash butt welding plant K-355 APT
- 2.6.2 Rail grinding machine

CHAPTER 3 WORKS REQUIRED BEFORE, DURING AND AFTER DEPLOYMENT OF TRACK MACHINES

- 3.0 General
- 3.1 The tamping machines
 - 3.1.1 Pre requisites for introduction of tamping machines
 - 3.1.2 Pre tamping operations
 - 3.1.3 Operations during tamping
 - 3.1.4 Post tamping operations
- 3.2 Tamping machine for points & crossing (Unimat)
 - 3.2.1 Pre tamping operations
 - 3.2.2 Operations during tamping
 - 3.2.3 Post tamping operations
- 3.3 Ballast cleaning machine (BCM)
 - 3.3.1 Pre requisites for working of BCM
 - 3.3.2 Operations prior to deployment of machine
 - 3.3.3 Operations during traffic block
 - 3.3.4 Operations after deployment of machine
- 3.4 Shoulder ballast cleaning machine
 - 3.4.1 Operations prior to deployment of machine
 - 3.4.2 Operations during block
- 3.5 Portal cranes (PQRS)
 - 3.5.1 General
 - 3.5.2 Pre requisites
 - 3.5.3 Pre relaying operations
 - 3.5.4 Post relaying operations
- 3.6 Track relaying train (TRT)
 - 3.6.1 Operations prior to deployment of machine
 - 3.6.2 Manual operations during block
 - 3.6.3 Post block operations
 - 3.6.4 Precautions
- 3.7 Points and crossing changing machine (T28)
 - 3.7.1 Pre block operations
 - 3.7.2 Operations during block
 - 3.7.3 Post block operations
 - 3.7.4 Miscellaneous

CHAPTER 4 RULES FOR MOVEMENT AND WORKING OF TRACK MACHINES

- 4.1 General

- 4.2 Incharge of machine
- 4.3 Competency of operator
- 4.4 Safety equipments
- 4.5 Rules for operation
 - 4.5.1 General
 - 4.5.2 Single line section - work and proceed
 - 4.5.3 Single line section - work and return
 - i) with token tablet instruments
 - ii) with tokenless block instruments
 - 4.5.4 Double line section - work and proceed
 - i) via right direction
 - ii) via wrong direction
 - 4.5.5 Double line section - work and return
 - i) via right direction
 - ii) via wrong direction
- 4.6 Precautions
- 4.7 Failure of track machines in mid-section
- 4.8 Permissible speed
- 4.9 Procedure for introduction of new type of machine on open line
- 4.10 Infringements

CHAPTER 5 PLANNING, OPERATION AND MONITORING OF TRACKMACHINES

- 5.1 Planning
 - 5.1.1 General
 - 5.1.2 Project works (coordination and special guidelines)
 - 5.1.3 Inter railways deployment
- 5.2 Line block, stipulated corridors and monitoring
 - i) on single line section
 - ii) on double line section
- 5.3 Track machine organisation
 - 5.3.1 General
 - 5.3.2 Inspection schedules for track machine officers
 - 5.3.3 Inspection by open line officers
 - 5.3.4 Important items to be inspected
 - 5.3.5 Operation of machine
- 5.4 Working of tamping machines in design mode
- 5.5 Specific guidelines in respect of various machines
 - 5.5.1 Tie tamping machine
 - 5.5.2 Points and crossing tamping machine
 - 5.5.3 Ballast cleaning machine
 - 5.5.4 Ballast regulating machine
 - 5.5.5 Dynamic track stabilizer
- 5.6 Special precautions while working machines in ghat section
- 5.7 Performance monitoring
 - 5.7.1 Track machine control
 - 5.7.2 Functions of track machine control
 - 5.7.3 Reports and documents
 - I. TM organisation's reports
 - II. Divisional reports

	5.7.4	Monitoring systems
	5.7.5	Store depot for spares
CHAPTER	6	PERIODICAL REPAIR AND MAINTENANCE OF MACHINES
	6.1	General
	6.2	Types of maintenance schedules
	6.3	Types of workshops
	6.3.1	Types of workshops
	6.3.2	Intermediate overhauling workshop/zonal base depot
	6.3.3	Satellite depot
	6.3.4	Mobile workshop-cum-transport van
	6.3.5	Camp coach workshop
CHAPTER	7	DUTIES OF DIVISIONAL OFFICERS AND STAFF INCHARGE OF P.WAY
	7.1	Duties of incharge SSE/SE/JE(P.Way)
	7.2	Duties of assistant Engineer (OL)
	7.3	Duties of SR. DEN/DEN
CHAPTER	8	STAFF REQUIREMENT AND OTHER INFRASTRUCTURAL FACILITIES
	8.1	Introduction
	8.2	Requirement of staff for machine working
	8.3	Training of track machine personnel
	8.4	Other infrastructural facilities
	8.4.1	Storage and carriage facilities for fuel and oil
	8.4.2	Transport of spare parts/assemblies
	8.4.3	Communication facilities
	8.4.4	Repair and stabling facilities for machines
	8.4.5	Resting facilities for staff
	8.4.6	Cash imprest
CHAPTER	9	STORES
	9.1	Store depot
	9.2	Inventory control
	9.2.1	Pricing of items and consumption
	9.2.2	Estimated annual requirements
	9.2.3	Inactive items
	9.2.4	Control over consumptions
	9.2.5	Fast moving items
	9.2.6	Recoupment of stock
	9.3	Procedure for procurement of materials
	9.4	Procedure regarding approved suppliers of indigenous spares
	9.5	Procedure for inspection and acceptance of materials
	9.6	Cash imprest
	9.7	Emergency purchase
	9.8	Purchase of items for which DG S&D rate contract exists

- 9.9 Purchase of items through running rate contract
- 9.10 Annual maintenance contracts
- 9.11 Other modes of repairs through contracts
- 9.12 Inventory management

LIST OF ABBREVIATIONS

CHAPTER 1

ORGANISATION AND DUTIES OF OFFICERS AND STAFF

1.1 Track machine Organisation

The organisation shall be under the overall charge of Chief Track Engineer (Machines) of the Railway who shall be reporting to the Chief Engineer through Chief Track Engineer. The organisation shall be responsible for the following functions: -

- i) Field Operation of Track Machines.
- (ii) Repair and Maintenance of Machines.
- (iii) Supervision and technical services including training and
- (iv) Planning and deployment of machines.

To carry out each of the above functions, Chief Track Engineer (Machines) shall be assisted by one or more Deputy Chief Engineer(s)/Senior Engineer(s) depending upon the convenience and geographical area to be served by the Track Machines. Deputy Chief Engineer(s)/Senior Engineer(s) in charge of machines in the field shall inspect the machines frequently, especially where a group of machines such as tamping, ballast cleaning machines are deployed, with the objective of monitoring the health of machines and to ensure that the officials concerned are carrying out their duties satisfactorily.

A group of machines will be under the charge of an Assistant Engineer who will be assisted by (Senior) Sectional Engineer(s). Each machine will be manned by Sr. Operator, Operators, Technicians/ Mechanics and semi-skilled/unskilled staff. Scale of staff shall be as per para 8.2 of chapter 8 of this manual. Each Railway having machines shall have a zonal base depot and/or satellite depots headed by Assistant Engineer/Senior Engineer for carrying out heavy repairs and intermediate overhauling.

1.2 Duties of Assistant Engineer/Track machines

1.2.1 General

The Assistant Engineer is responsible for the maintenance and efficient working of all the track machines in his charge.

1.2.2 Important Duties: -Duties of the Assistant Engineer have been laid down in Chapter 1 of IRPWM. They shall apply "mutatis-mutandis" to the Assistant Engineer/Track Machines. Some of the important duties are detailed in the following paragraphs.

The assistant Engineer shall carry out the following: -

- (i) Inspection and maintenance of all machines in a satisfactory, efficient and effective working condition.
- (ii) Ensure adherence to stipulated maintenance schedules.
- (iii) Ensure availability of necessary staff for the operation and optimum utilisation of machines during track possessions/line blocks.
- (iv) Ensure achievement of stipulated targets in respect of both the quantity and quality of output.
- (v) Ensure adequate availability of all the consumables and spares of fast wearing components and unit replacement assemblies of required quality.
- (vi) Initiate proposals and plan for major schedules, ensure their execution and submit completion reports for all such works.
- (vii) Ensure coordination with other units of Engineering Department as well as those of other departments as necessary.
- (viii) Verification of stores held by the field units, once a year. He should ensure that the scraps and obsolete stores are returned to the base/disposed off.
- (ix) Ensuring maintenance of various records and submission of various returns pertaining to machines from the field units.
- (x) Ensure availability of tools/gadgets for inspection of the machines.
- (xi) **Training of Probationers** - The Assistant Engineer shall take interest in training of all probationers sent to him and see that training is given according to the specified programme. He should periodically examine the notes made by them.
- (xii) **Staff matters** - The Assistant Engineer shall ensure that -
 - (a) Strict discipline is maintained within the framework of the rules.
 - (b) Service and leave records are maintained correctly and up-to-date.
 - (c) Appeals and representations are dealt with promptly and welfare to staff looked after.
 - (d) Selection to various skilled and semi-skilled posts are made in time and the posts are promptly filled up.
 - (e) All the Section Engineers and other staff working under him receive proper training in maintenance practices, safety and protection rules at the appropriate stage.
- (xiii) **Witnessing Payment to Staff** - The Assistant Engineer should witness payment to workmen (labour) under one or more Sectional Engineer(s) each month.

(xiv) Ensure adoption of safe operation and maintenance practices and check availability and functioning of safety devices provided on the machines.

(xv) Ensure proper operation of Service Agreements in force.

(xvi) Counselling of machine staff for immediate action to be taken in case of failure.

1.23 Knowledge of Rules and Regulation

He shall ensure observance of rules, regulations and procedures laid down in this Manual, G&S Rules, IRPW Manual, Engineering Code and other departmental codes, extant orders and circulars issued from time to time. He shall ensure that the staff under him are acquainted with the relevant rules of operation and maintenance procedures/stipulations connected with their duties and they perform their allotted duties.

1.24 Inspection by Higher Officers

The Assistant Engineer shall accompany during inspections by the higher officers. Following records shall be made available during inspections:

(i) History register of the engine and the machine.

(ii) Failure Analysis register.

(iii) Progress Bar Charts and analysis.

(iv) Unit cost statement.

(v) Maintenance schedule register.

(vi) Inspection Notes of higher officers and Compliance Report duly updated.

(vii) Operation and maintenance manuals of the machines.

(viii) Programme of deployment of machines.

1.25 Inspection of machines by Assistant Engineer

(i) The Assistant Engineer shall inspect the machines in his charge as per the schedule specified in Chapter 5. He shall also inspect working of the machine(s) during traffic block. He shall record the results of his inspection and ensure compliance within a reasonable time. Immediate action shall be initiated in respect of areas where the condition of machine is alarming and needs urgent action. He shall submit a report to the next higher authority at the end of every month indicating inspections carried out, deficiencies noticed and remedial action taken.

(ii) Checklist of Inspection

Inspection of machines by the Assistant Engineer shall be carried out in detail covering necessarily the following aspects and keeping in view the Check List/Maintenance Schedule issued by RDSO for a particular machine: -

- a) Health of the engine,
- b) Condition of hydraulic, pneumatic and electrical/electronic systems.
- c) Condition of transmission/brake systems.
- d) Condition of functional systems/sub-assemblies.
- e) Adherence to schedules.
- f) Condition of gauges and safety devices.
- g) Availability of spares with the machine.
- h) Availability of tools and plants.
- i) Performance of the machine.
- j) Staff accommodation/facilities.
- k) Records of the machine in failure report.
- l) Follow up action on Service Engineer's report.
- m) Verification of competency certificates and medical fitness of staff.

1.2.6 Execution of Works

- (i) The Assistant Engineer shall ensure that operation and maintenance works are carried out by the staff in stipulated manner and the best maintenance practices are followed.
- (ii) The important/major repairs shall be personally supervised by him.
- (iii) Breakdown repairs shall be organized by him so as to ensure completion within the shortest possible time.

1.3 Duties of (Senior) Sectional Engineer/Track Machine

1.3.1 The (Senior) Sectional Engineer/Track Machine shall be responsible for the satisfactory operation, maintenance and productivity of the machines under his charge and quality of work. He shall inspect the machine(s) under his charge, as per schedule laid down in Chapter 5 and take remedial measures. He shall submit the report of inspection to his superior authority. He shall be able to work/operate the machine(s) under his charge when needed and shall be in possession of the relevant competency certificate. He shall also ensure that the machine operators working under him have valid competency and medical certificates.

1.3.2 He shall be well acquainted with the working systems, operating instructions, maintenance schedules, specifications of the oils/lubricants to be used, critical components etc. of machine(s) under his charge. He shall have thorough knowledge of the instructions given in the Manuals supplied by the manufacturers of the machine.

1.3.3 He shall have thorough knowledge of the rules and regulations and procedures concerning his work and duties as laid down in this Manual, G&S Rules, IRPWM, Engineering Code and other departmental codes, extant orders and circulars issued from time to time. He shall cooperate and coordinate with the other departmental staff (Permanent Way, Signal, Electrical, OHE, Traffic etc.) connected with the safe working of the machine and its effective utilisation. He shall train all the staff working under him in faultless Operation and efficient maintenance practices pertaining to the machines in his overall charge and educate them in rules and regulations. He shall ensure that the staff perform their duties efficiently.

1.3.4 He shall have in his possession up-to-date-copies of the rule books/documents/manuals pertaining to the safe, efficient and trouble free working of the machines and also other codes and books applicable and needed for the day to- working.

1.3.5 He shall maintain the records pertaining to the machines under his charge and submit the prescribed returns regularly. He shall periodically verify the physical condition and quantities of stock in his charge and arrange to submit periodical returns/requisitions of Tools & Plant, spares, consumables and other stores, carry out verification of all stores including spares held by him, assist in stock verification by Stock Verifiers, ensure compliance of Account/Audit Reports etc.

1.3.6 He shall ensure discipline amongst the staff working under him within the framework of rules and endeavour to keep their morale high and look after their welfare.

1.3.7 He shall ensure proper handing over of the charge when transfer/change of portfolio is affected.

1.3.8 He shall plan and ensure timely execution of the maintenance schedules of the machines within the specified time.

1.3.9 He shall keep himself abreast of the various methods and techniques of reconditioning of components and availability status of spares at the Base Depot for efficient recommissioning of the machine during break-downs. He shall render technical assistance to the higher authorities in developmental activities /import substitution and indigenisation activities.

1.3.10 He shall investigate major failure of the machine critically for corrective actions/remedial measures and for fixing responsibilities in case of failures occurring due to lapses of staff. He shall obtain the first information reports during breakdowns, inspect the machines and take action for expeditious repairs.

1.3.11 He shall be conversant with the provisions in various Service Agreement/ Contracts and organise the visits of Service Engineers (Scheduled or breakdown). Effective utilisation of expert advice and follow-up action on "Service Report Observations" shall form part of his duties.

1.4 Duties of Machine Operators

1.4.1 Each machine shall be under the direct charge of Section Engineer/Junior Engineer hereinafter called the **Operator**. The Operator shall be in possession of Competency Certificate for working the machine. He shall ensure the following:

- (i) Operation and maintenance of the machine.
- (ii) Carrying out pre-block maintenance and making the machine fit for working
- (iii) Initial setting out for the block working and closing the work of the machine including ramping in/ramping out of general lift to the track as in case of tie-tamping machine.
- (iv) Proper functioning of all the systems and components and keeping a watch on the controls/indicators/gauges.
- (v) Taking precautions for special Design Mode operations such as curve slewing etc. in case of tamping machines.
- (vi) Posting of fitters/khalasis at the respective places around the machine for monitoring the work of various systems, carrying out during block maintenance (greasing, oiling, tightening of bolts etc.) and also to attract attention of the main cabin operator and assist him in the event of a problem of malfunctioning of the machine or due to track obstructions.
- (vii) He shall ensure safe working of the machine and staff.

1.4.2 Where there are more than one Operators on the machine, the senior-most Operator shall be the **Machine Incharge**. In addition to his normal work as an Operator as detailed in para 1.4.1 above, he shall be responsible for the following functions in which he will be assisted by other Operator(s) /staff posted on the machine: -

- (i) Carrying out the prescribed schedule of maintenance and keeping proper records of the same.
- (ii) Safe custody, accountal and replacement of the spares, Tools & Plants and consumables issued for the machine and returning of the released spares to base depot for reclamation/condemnation.
- (iii) Keeping systems of the machine in working condition and ensuring the targeted output, duly maintaining quality.
- (iv) Maintaining log books and other records, sending daily and other periodical reports/statements using appropriate fastest mode of communication.
- (v) Liaisoning with Divisional officials for the efficient working of his unit, coordination with the Permanent Way staff and planning daily programme of machine work and interacting with the Permanent Way staff for working in design mode, slewing of curve, etc.
- (vi) Actively associating during visit of firm's Service Engineer, furnishing of such information as may be needed for proper examination of the machine and taking necessary follow up action.

1.5 Duties of Track machine Fitters / mechanics

1.5.1 The Track Machine fitters/mechanics attached with the machine(s) and the zonal/sub-zonal depots shall assist the machine incharge in operation and maintenance of various Track Machines.

1.5.2 The main functions of Track Machine Fitters/Mechanics are: -

- (i) to attend to the daily and weekly maintenance schedules of the machine and record the compliance in the log books.
- (ii) to extend help during other maintenance schedules/service checks by the Service Engineers.
- (iii) keep in his custody the various tools and equipment necessary to attend repairs and ensure their working condition.
- (iv) to guide and supervise the semi-skilled/unskilled staff in attending to the maintenance/repairs.
- (v) to remain vigilant during movement and working of machine and to inform the operator of any abnormalities.
- (vi) to ensure safety of the machine and men from approaching trains on adjacent lines.
- (vii) any other work assigned to him by the machine incharge who is defined in the para 1.4.2.

CHAPTER - 2

FEATURES AND WORKING PRINCIPLES

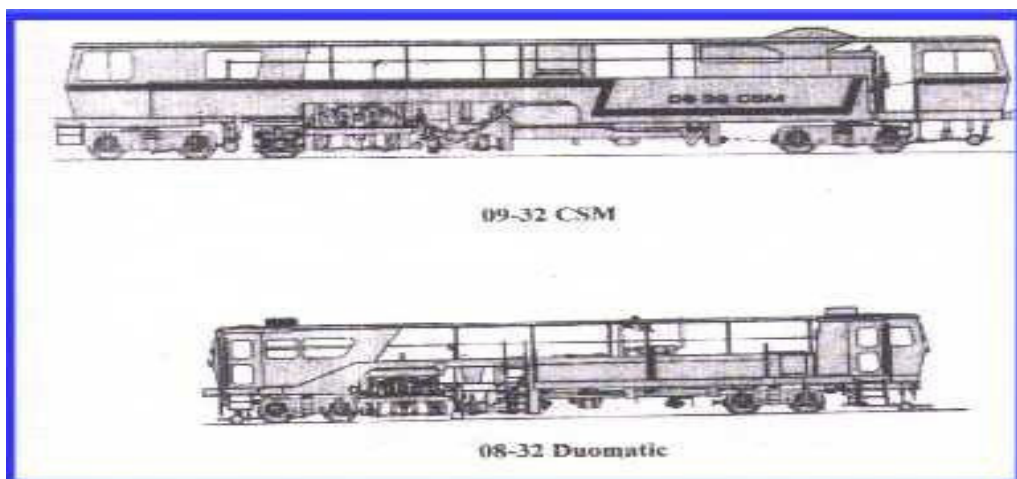
2.1 Types of Machines

Following major on-track machines, which are in use on Indian Railways at present are discussed in this chapter:-

2.1.1 Tamping Machines

(i) Plain Track Tamping Machines

- a) 06-16 Universal Tamping machine (UT)
- b) 08-16 Unomatic
- c) 08-32 Duomatic
- d) 09-32 Continuous Action Tamping Machine (CSM)
- e) 09-3x Tamping Express



(ii) Points and Crossing Tamping Machines

- a) 08-275 Unimat
- b) 08-275-3S Unimat

(iii) Multi-purpose Tamper (MPT)

2.1.2 Dynamic Track Stabilizer (DTS)

2.1.3 Ballast Handling Machines

(i) Ballast Cleaning Machines

- a. RM -80 for plain track
- b. RM -76 for points and crossing

(ii) Shoulder Ballast Cleaning Machines

- a. FRM -80 Plasser Make
- b. KSC-600 Kershaw Make

(iii) Ballast Regulators

2.1.4 Track Laying Machines

- i. Plasser Quick Relaying System (PQRS)
- ii. Track Relaying Train (TRT)
- iii. Points & Crossing Changing Machine T-28 (AMECA-Make)
- iv. Sleeper Exchanger and Crane

2.1.5 Special Purpose Machines

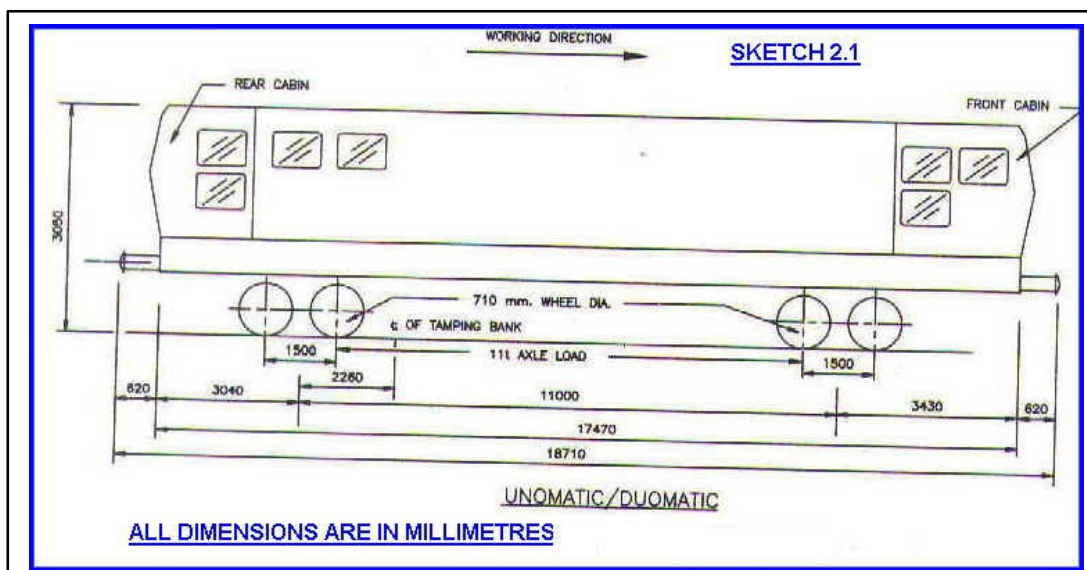
- i. Mobile Flash Butt Welding Plant K-355 APT (Plasser and Theurer make)
- ii. Rail Grinding Machine (Loram)

The salient features and working principle of these machines are described in the following paragraphs.

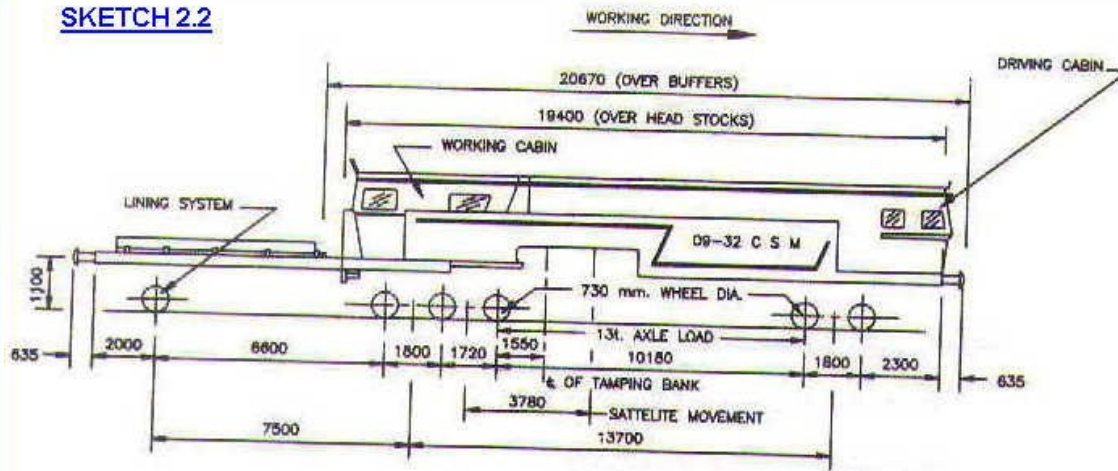
2.2 Tamping Machines

2.2.1 General

At present, Tamping Machines available on Indian Railways are of M/s Plasser make. The important assemblies and dimensions of these machine are shown in **sketch Nos. 2.1 to 2.6**. The main functions of tamping machines are:



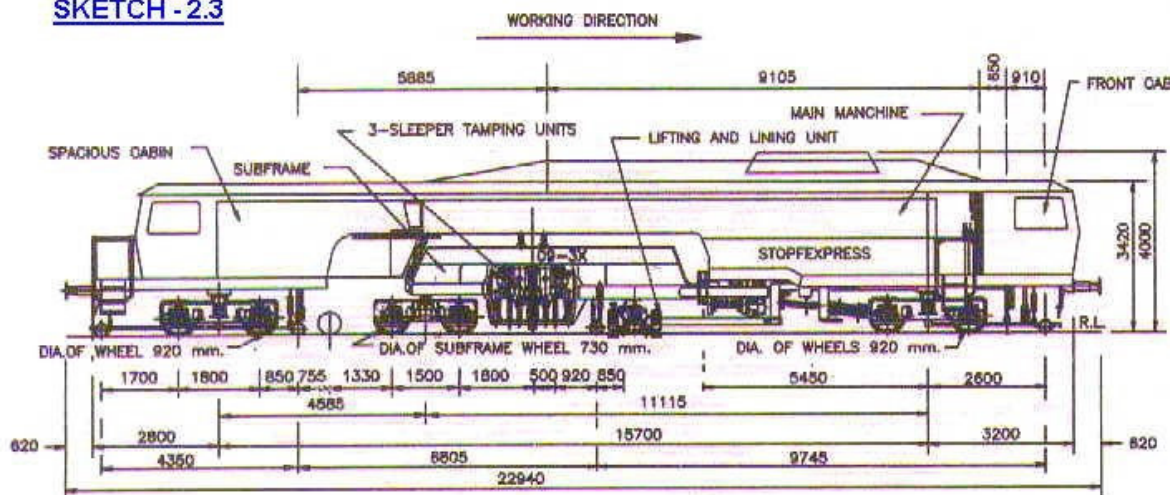
SKETCH 2.2



CONTINUOUS ACTION TAMPING MACHINE

ALL DIMENSIONS ARE IN MILLIMETRES C.S.M. -09-32

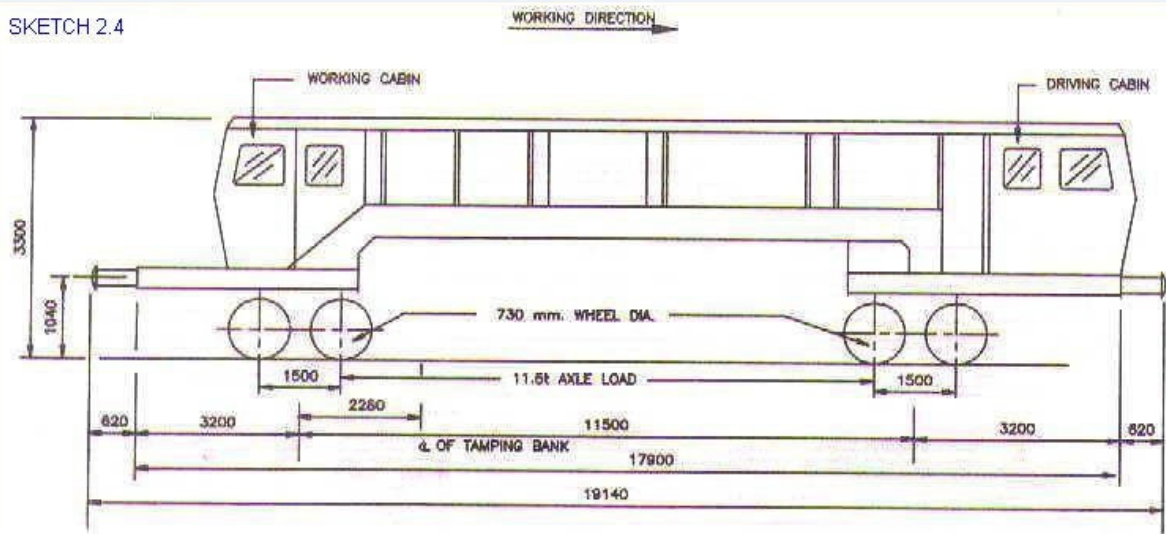
SKETCH -2.3



TAMPING EXPRESS

ALL DIMENSIONS ARE IN MILLIMETRES 09-3X

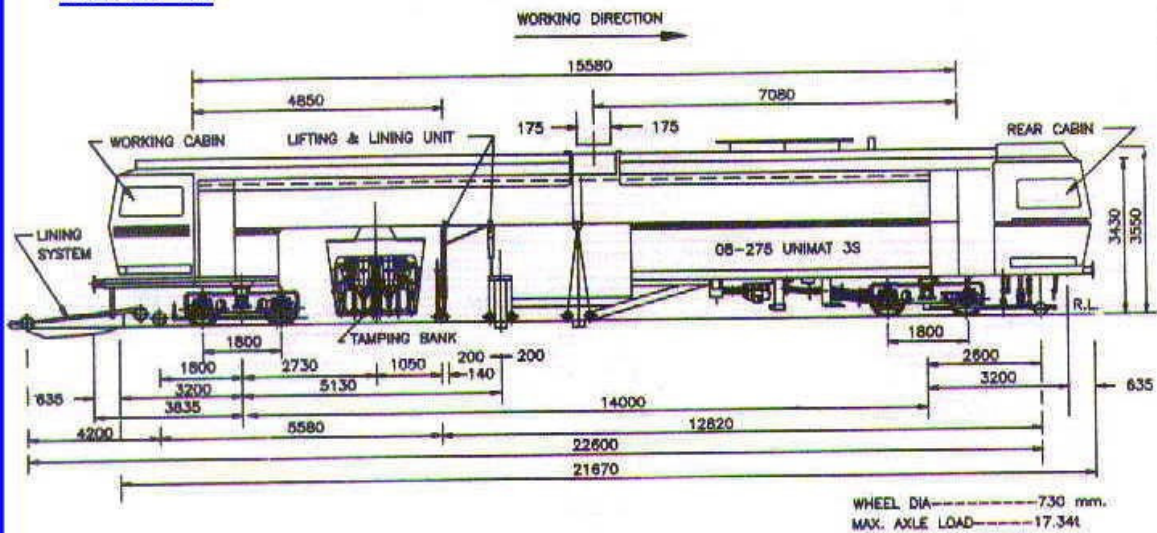
SKETCH 2.4



P & C TAMPING MACHINE
OB-275 UNIMAT

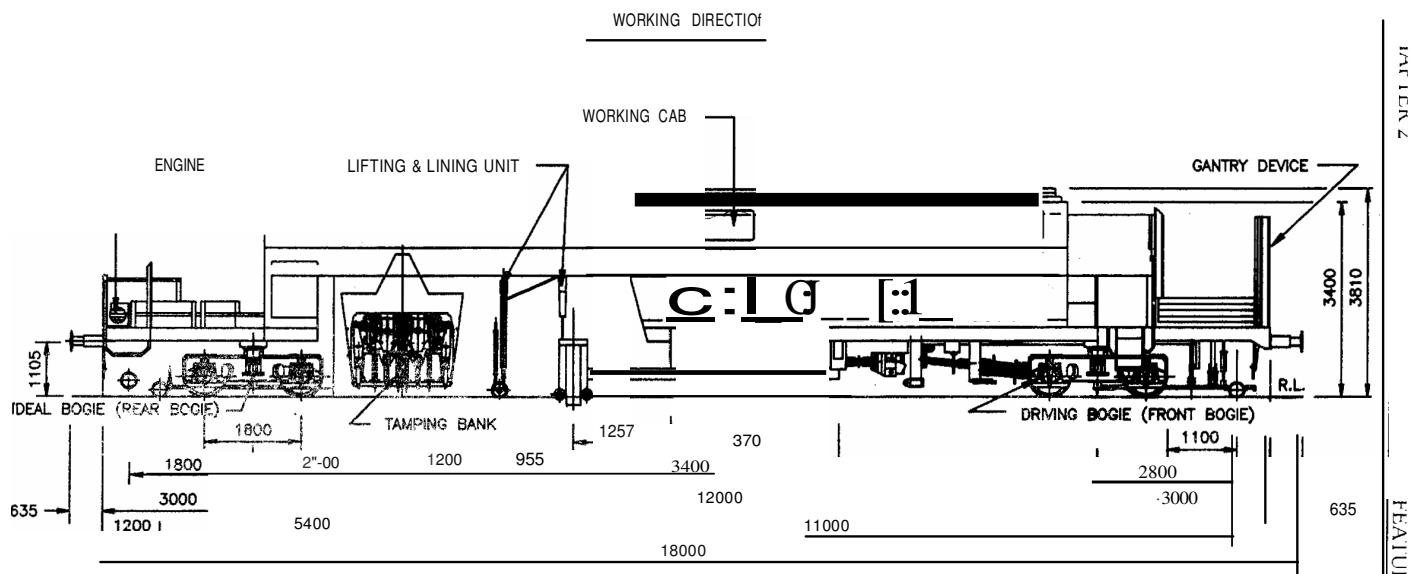
ALL DIMENSIONS ARE IN MILLIMETRES

SKETCH - 2.5



P & C TAMPING MACHINE
UNIMAT OB-275 3S

WHEEL DIA-----730 mm.
MAX. AXLE LOAD-----17.34t



MULTIPURPOSE TAMPING
MACHINE

WHEEL DIA-----730 mm.
MAX. AXUE LOAD----- 11.5t:

- i. Correction of alignment
- ii. Correction of longitudinal and cross levels, and
- iii. Packing under the sleepers

Some of the machines have provision for ballast consolidation and automatic precision mode working also.

2.2.2 Alignment of Track

The machine can be worked in smoothing mode or design mode. Two types of aligning systems are in use:

- i. Two Chord Lining System
- ii. Single Chord Lining System

In 06-16 Universal tamping machine, two chord system of lining is used while in other tamping machine, single chord lining system is used.

2.2.2.1 Two Chord Lining System

i) Smoothing mode

a) Curved Track

In a circle, the versine measurement on a sub-chord of half the length of full chord is approximately 1/3rd of the ordinate at quarter point of the full chord as shown in the **fig. 2.1** In the machine, the measure point need not necessarily be the be the quarter point of the chord. However, the ratio of the versine on sub-chord to ordinate on the full chord is fixed for a particular machine.

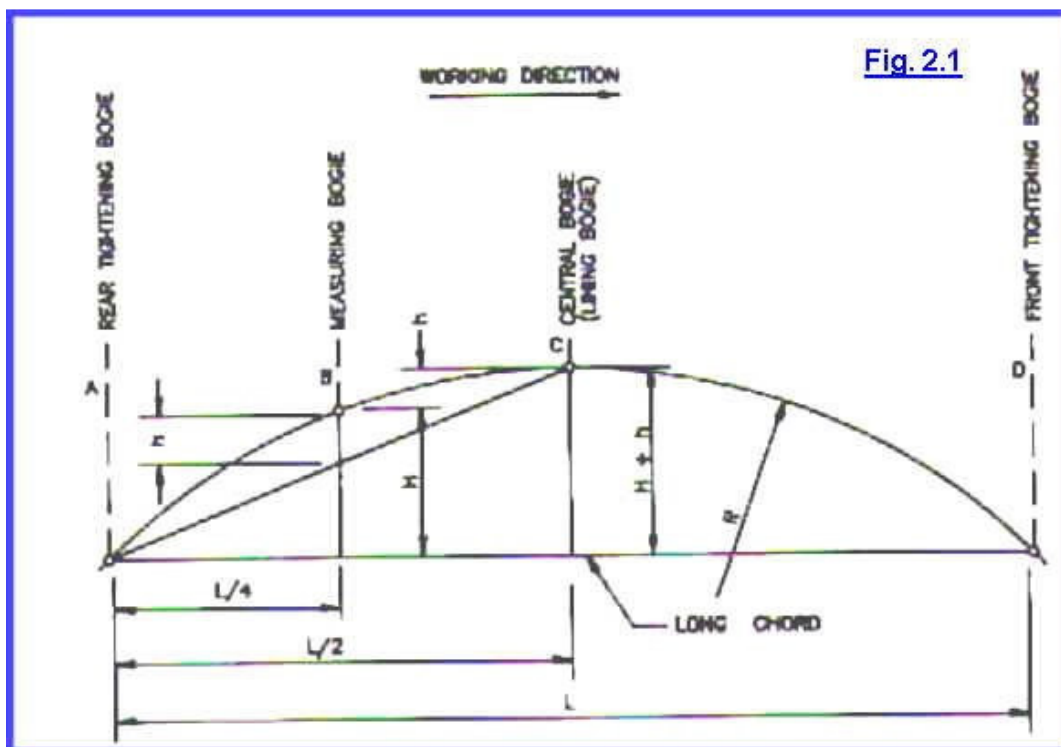


Fig. 2.1

The machine carries out these measurement on the curve and slews the track until the correct ratio is established between the versine and ordinate. The procedure is termed as smooth lining. The correction is continued as the machine moves along the track.

b) Transition Portion

In transition portion, the curvature is changing constantly throughout its length. The machine, therefore, has to vary versines progressively based on the length of the transition and radius of the circular curve. This information must be made available to the operator by the P. Way staff. The operator shall consult a set of tables provided on the machines for making the necessary adjustment at the front tower.

c) Straight Track

The machine works on the same principle as explained earlier for the circular curve portion.

ii) Precision /Design Mode

In this mode, precise track geometry data must be known before work commences. Correct track geometry data should be input at the front tower as even small error will have a cumulative effects on the slews produced by the machine.

a) Curved Track

Versine survey of the curve is to be carried out, then slews are worked out and made available to the operator for feeding to the front tower.

b) Transition position

The correct location of transition and its location in relation to run up or down is essential. The actual sleeper at the start and end of the transition should be indicated to the operator. With this information, the length of transition can be ascertained and the tabulated values applied to the control of the machine at the front tower. The details of Precision Method are explained in **Annexure 5.3**

c) Straight Track

There is a possibility of a long straight track being made up of a series of smaller zig-zag straight lengths. Therefore, the theodolite should be used to establish straight line along the length of track to be corrected.

2.2.2.2 Single Chord Lining System

This system is provided on all the tamping machines except UT machines and is controlled electronically. The system has arrangement both for 4- point and 3-point lining.

i) 4- Point Lining Method

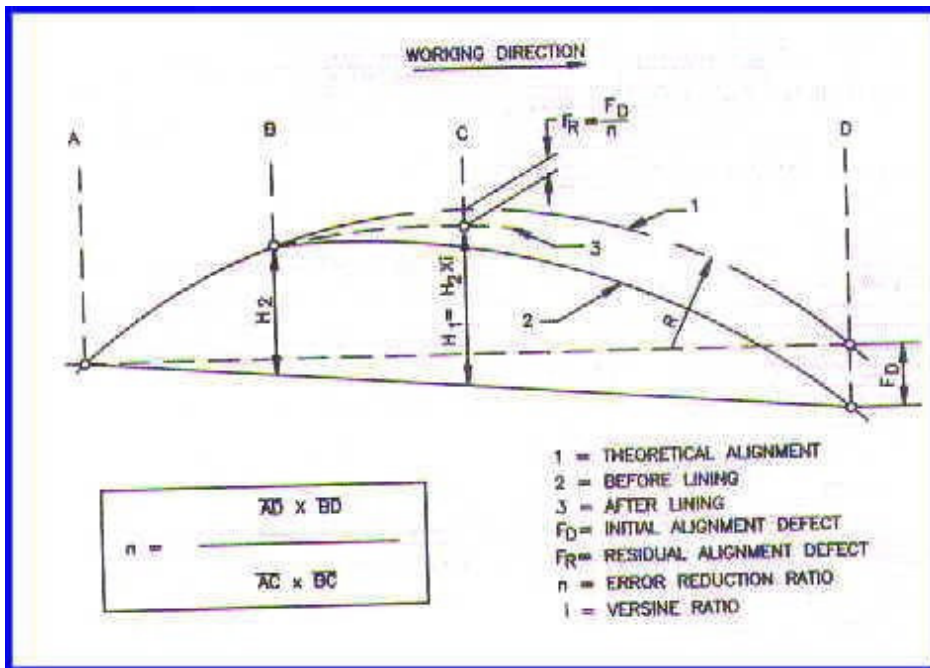


Figure 2.2

Trolleys at A, B, C and D are pneumatically pressed against the rail selected for line measurement, usually the high rail of a curve. The wire chord stretched between A and D represents the 'Reference Line' and the transmitting potentiometer (Transducer) which are fixed to the measuring trolley B and lining trolley C are connected to this wire by means of Forks and the wire drives.

The measured ordinate at B is multiplied through the electronic circuit by the specified ratio and compared with ordinate at C. Then electronic signal is emitted which activates the hydraulic control of the lining mechanism to effect necessary correction.

When working on transition portion of curve, necessary adjustment can be applied by digital control on the front trolley. The method of applying adjustments is explained in the **Annexure 2.1**.

ii) 3Point Lining Method

The track is measured at three points B, C and D and lined according to specified theoretical versines. The chord at measuring position B is fixed by the Fork and the potentiometer is switched off.

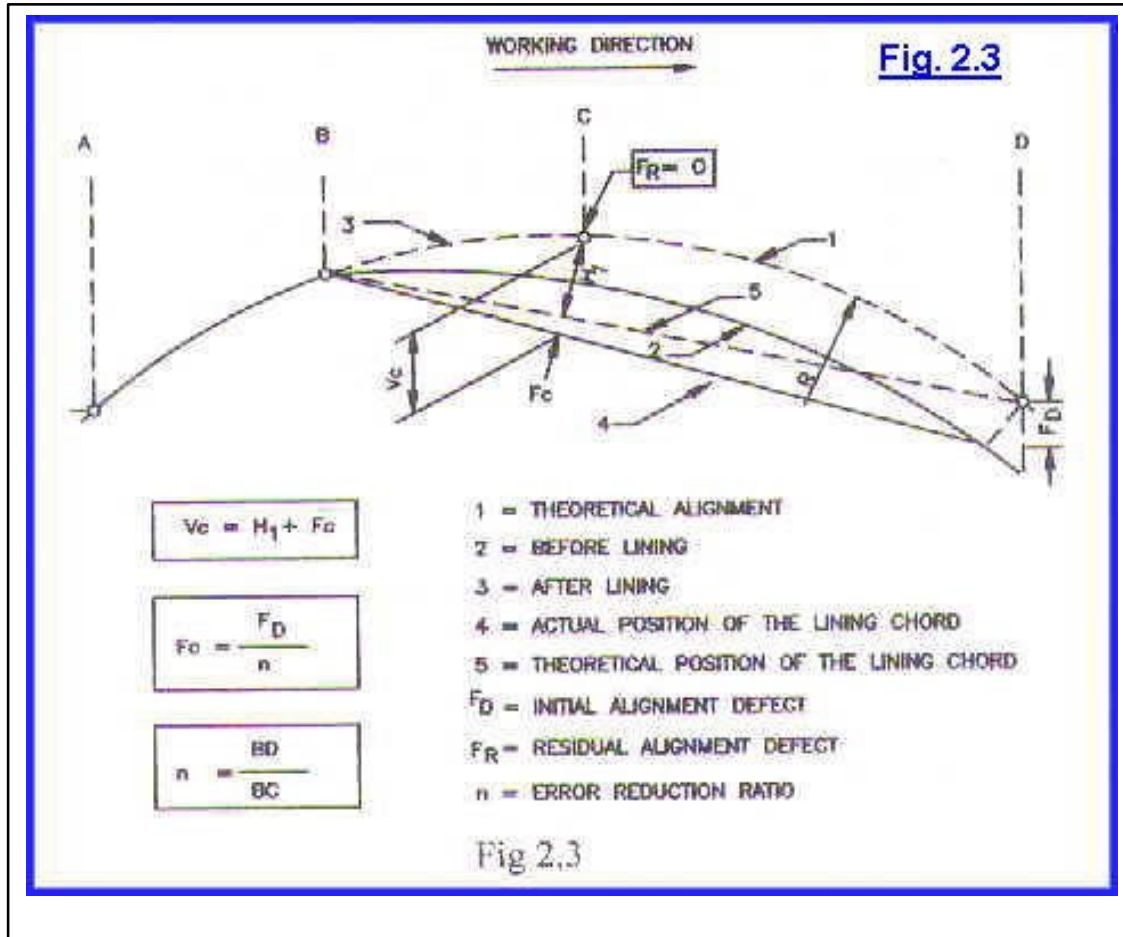


Figure 2.3

The ordinate at C only is measured on chord BD and compared with preset ordinate value. Any difference detected will activate the lining control to effect the necessary correction.

The 3-point method is mainly used if:

- The track is to be lined according to specified radii or versines
- The lining system is used in conjunction with a sighting device and remote control or a Laser.

2.2.3 Levelling of the Track

Longitudinal level of track is corrected by principle of proportional levelling as shown in Fig. 2.4.

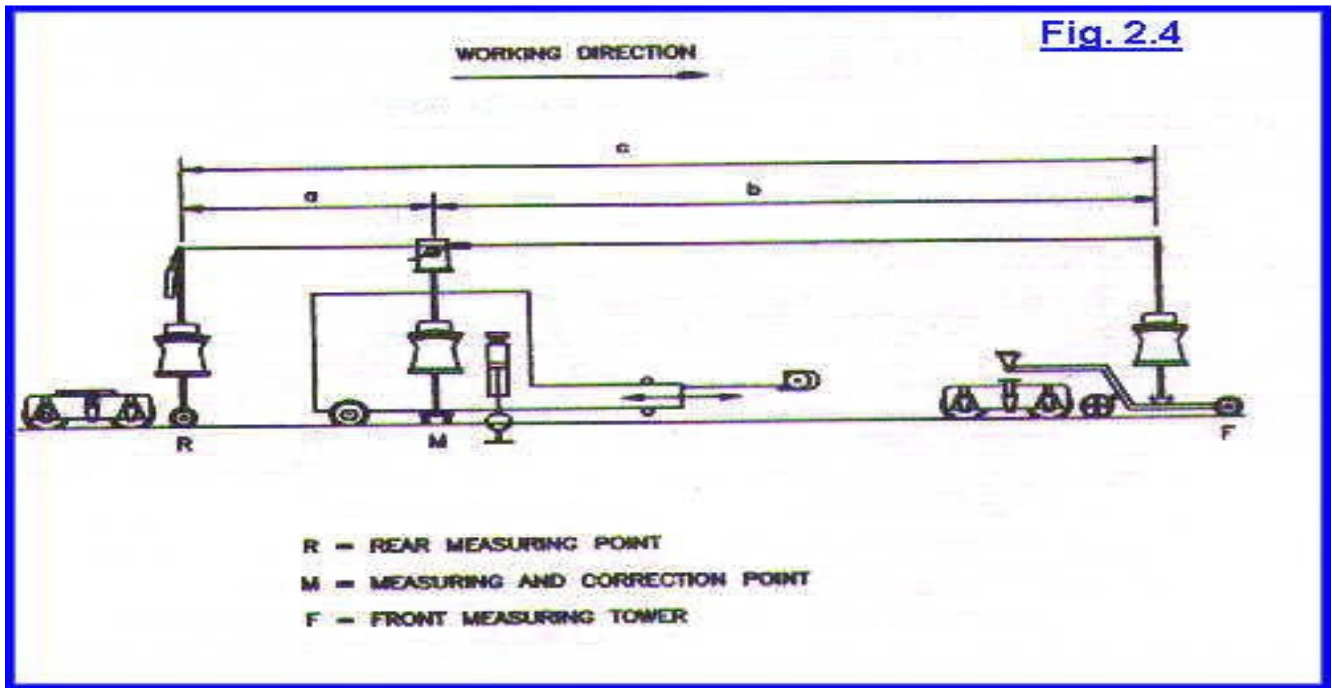


Figure 2.4

Different machines have different ratio(c/a) for lining as under.

Ratio (c/a)	Machine Type
4.3	UT
3.0	UNO, DUO, CSM, MPT
3.2	UNIM AT

i) Levelling in Automatic Mode (Smoothering Mode)

The amount of lift which is given to track while tamping to cover all undulations, is called **general lift**. It is decided on the magnitude of dips generally available in track.

The general lift should always be more than the largest of dips which shall be ascertained by Section Engineer (P. Way) in advance. In the beginning, run in ramp of 1 in 1000 and while closing the work run out ramp of 1 in 1000 is given for smooth transition. Levelling system consists of two chord wire, one for each rail which are stretched tightly from front tower to measuring bogie. Contact boards are mounted on feeler rollers which rest on track at the place where tamping is actually done. These contact boards are also lifted when the track is lifted.

In UT machines, as soon as the track is lifted to the required level, the contact board touches the chord wires cutting off the lifting process.

In Unomatic, Unimat, Duomatic and CSM tamping machine, instead of contact board, height transducers have been provided which cut-off lifting process as soon as required level of lifting is achieved.

On front tower, a pendulum is incorporated between the two chord wires through a PCB. If a general lift is given to datum rail chord wire, the other chord wire will automatically get lifted or lowered via the pendulum and PCB as to maintain correct cross level.

On UT, the wires move physically up or down, as per generated signal and total lift required at right/left rail at tamping zone is automatically achieved. But in case of other machines, the signal goes to microprocessor and wire does not move physically up or down. The microprocessor gives left/right rail required lift at tamping zone. The amount of lift is same as the wire would have moved up and down physically.

Levelling in Transition Portion of Curve

While working in transition curve, one part of the machine may be situated in the transition portion and the other part on the straight or fully canted track. To compensate for this, correction is applied at the front tower.

Limitation of Auto (Smoothing) mode of levelling

By this method, the errors in longitudinal level are not fully eliminated and the machine reduces the defects in longitudinal levels to an acceptable degree depending on its measuring base length.

ii) Levelling in Design Mode

Levels of a track section are recorded by using levelling instrument. Final level along with gradients and vertical curves are decided as per guide lines in **Annexure 5.3**. The required lifts are finally recorded on every alternate sleeper. Levelling is carried out by entering the lift values at the front tower.

By adopting design mode of levelling and lining desired track geometry can be achieved.

2.2.4 Optional Equipments

The use of optional equipment like Radio Control System, Laser Beam System and Geometry Value Assessment, simplifies implementation of design levelling and lining. These are briefly described below:-

i) Radio Control System

An optical Instrument is positioned on good point depending on the range of instrument by adding desired lift. The range is 200 to 250 metres under fair weather condition. The instrument is made to intercept zero point on central vertical as well as horizontal scale and fixed.

As soon as the machine moves forward, these positions get disturbed according to defects in the track. These are brought back to zero by using the transmitter and looking through the optical instrument. In doing so, the height of datum rail chord is changed to required level and also front end of lining chord is changed to get exact levels and alignment respectively.

ii) Laser Beam System

The system is similar to Radio Control System but in place of optical Instrument, laser beam is provided.

The fanned-out laser beam is received by a pair of photo cells. In case of unbalanced laser input to the photo cells, a corresponding differential signal activates an electric motor which moves the whole receiver assembly together with front end of the chord to the centre of the LASER beam. Thus, front tower end of chord is shifted by the amount of error to enable design lining and levelling.

iii) Geometry Value Assessment (GVA)

It is a small computer which eliminates the feeding of adjustment values from tables and marking on sleepers. The location of main points of curve i.e. starting of transition, end of transition, transition length, radius, super elevation, and vertical curve data etc. are fed in the computer.

The attention of operator is not distracted by adjustment operation, mistake in calculation is avoided and therefore, the higher progress is achieved with improved quality.

iv) Packing / Tamping System

Vibratory pressure tamping works according to non-synchronous even pressure principle. All tamping tools exert the same pressure on ballast, independent of their movement. This means that there is a perfect equilibrium of forces between the individual tool pairs and the specific surface pressure of all tools is equal. The movement of the tool pairs is completely independent, according to the resistance encountered from the ballast.

During tamping a resistance is built up in front of each pair of tools. Once the resistance reaches the pre selected pressure, the corresponding tool pair stops automatically. The other tools continue to work until they too encounter the same resistance in the ballast.

2.2.5 Important Assemblies of Tamping Machine

i) Engine

Diesel engine is the main source of power. The engine converts chemical energy of fuel into mechanical energy which is further converted into four types of power for the working of machine.

a) Mechanical Power through gear boxes

A part of mechanical power generated is used by means of gear boxes for travelling of tamping machine except in case of 06-16 UT where hydraulic power is used.

b) Hydraulic Power through Hydraulic pump

It provides power for operations during working through various hydraulic motors and cylinders.

c) Pneumatic Power through Compressor

It is used for brakes and locking system of assemblies, up and down movements of feelers, datum operation of lining bogies, horn etc.

d) Electrical Power through Alternator and Batteries

It is used to provide electrical power for sensing device, feedback of corrected parameters, signals to hydraulic units and directional valves for operations.

ii) Tamping Units

Two independent tamping units are provided, one for each rail. These are attached to the machine frame by means of vertical guiding columns. In case of 09-32 CSM, the tamping units are fitted to the satellite Frame.

The tamping units may be for tamping one sleeper or two sleepers or three sleepers at a time depending upon type/model of tamping machine. 16 tamping tools are provided for tamping each sleeper. The tools are arranged in pairs and each sleeper is tamped by 8 such pairs, on both side of each rail. The units are held by horizontal guiding column in order to slide sideways, which allows their automatic centering over the rails in curves.

The tools are vibrated by piston rods pivoted on eccentric shaft driven by hydraulic motors with following parameters

- a) Number of revolutions of vibratory shaft - 2100 rpm (approx.)
- b) Vibration frequency of tamping tools - 35 Hz. (approx.)
- c) Amplitude of oscillation of tamping tools - 10 mm

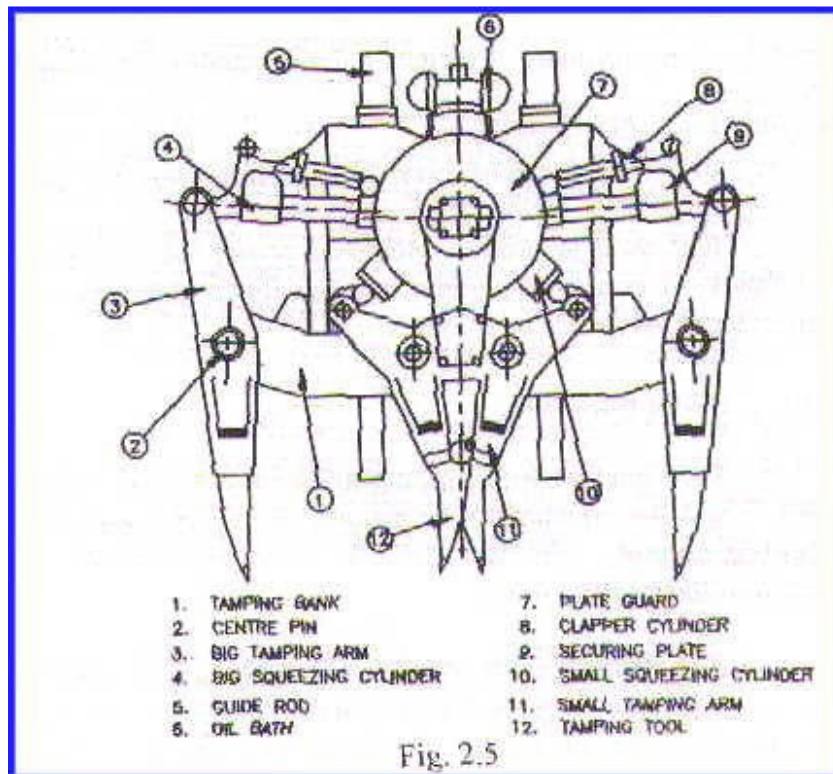


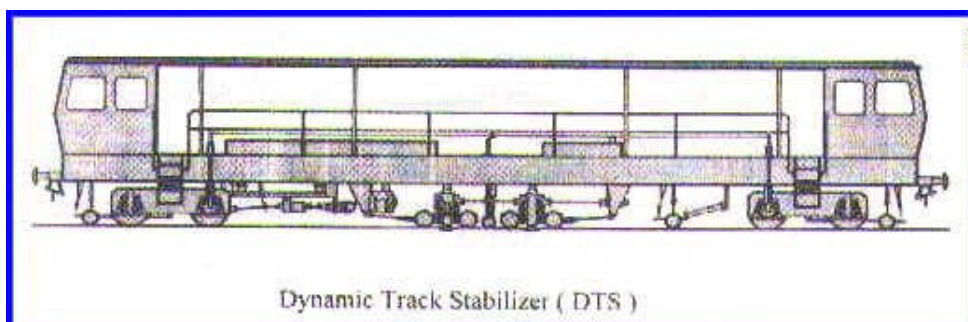
FIG. 2.5

The lifting and lowering of tamping units is achieved by means of a hydraulic tamping unit lifting/lowering cylinder. The insertion depth of tamping tools and squeezing pressure can be varied for different types of sleepers. In case of double sleepers, the opening width of tamping tools can be changed pneumatically by changing the clapper piece to suit the sleeper opening and by pneumatic operation of clapper cylinder for joints sleepers.

2.3 Dynamic Track Stabilizer (DTS)

2.3.1 General

During maintenance operations such as tamping, lifting, slewing, deep screening etc., the lateral resistance of track gets reduced which rebuilds gradually with passage of trains. This consolidation can also be achieved faster and more effectively by causing "controlled settlement" of track by means of a Dynamic Track Stabilizer.



The controlled settlement produced by DTS has the following major advantages:-

- i) Elimination of initial differential settlements which are caused by the impact of passing trains.
- ii) The track geometry achieved by tamping machines is retained for a longer duration.
- iii) Homogenous structure of ballast bed is built up.
- iv) Lateral track resistance increases resulting in enhanced safety against track buckling.
- v) Speed restrictions are relaxed faster.

2.3.2 Working Principle

Two heavy dynamic consolidating units are pressed firmly against both rails by hydraulic pressure. Fly-wheels produce a horizontal oscillation directed laterally to the track which together with a vertical load is transmitted into the track and subsequently into the ballast bed.

The dynamic effect of directional oscillation causes the sleepers to be "rubbed into" the ballast bed and produces a "flowing movement" of the ballast which settle closer by filling of the voids.

This compaction causes not only a controlled settlement of the track but also an enhanced friction between sleeper and compacted ballast bed, thus increasing lateral track resistance.

The oscillation frequency has a range of adjustment up to 45 Hz. For most common permanent way conditions, a frequency range of 32 to 37 Hz is adopted.

Not only the impact by the dynamic force but also a simultaneously applied static force is an important part of functioning of DTS. Hydraulic cylinders attached between the machine frame and the consolidating unit apply vertical static loads on both rails. The vertical load helps in maintaining firm contact between the consolidating units and the track for transmitting the oscillation.

The standard range of pressure variation is 40 to 100 bar which corresponds to effective loads from around 165 to 355 kN. For track maintenance operations, pressure range of 60 to 80 bar is used which give effective load of around 230 to 290 kN.

DTS is equipped with a levelling system which prevents the longitudinal and cross level values from varying appreciably due to differential settlement of various segments of track. The transducers of the longitudinal level and the cross level measuring system recognise the tendencies towards formation of faults of this kind and influence the load control with their measuring signal via the automatic governor, thus counteracting the tendency of propagation of the faults.

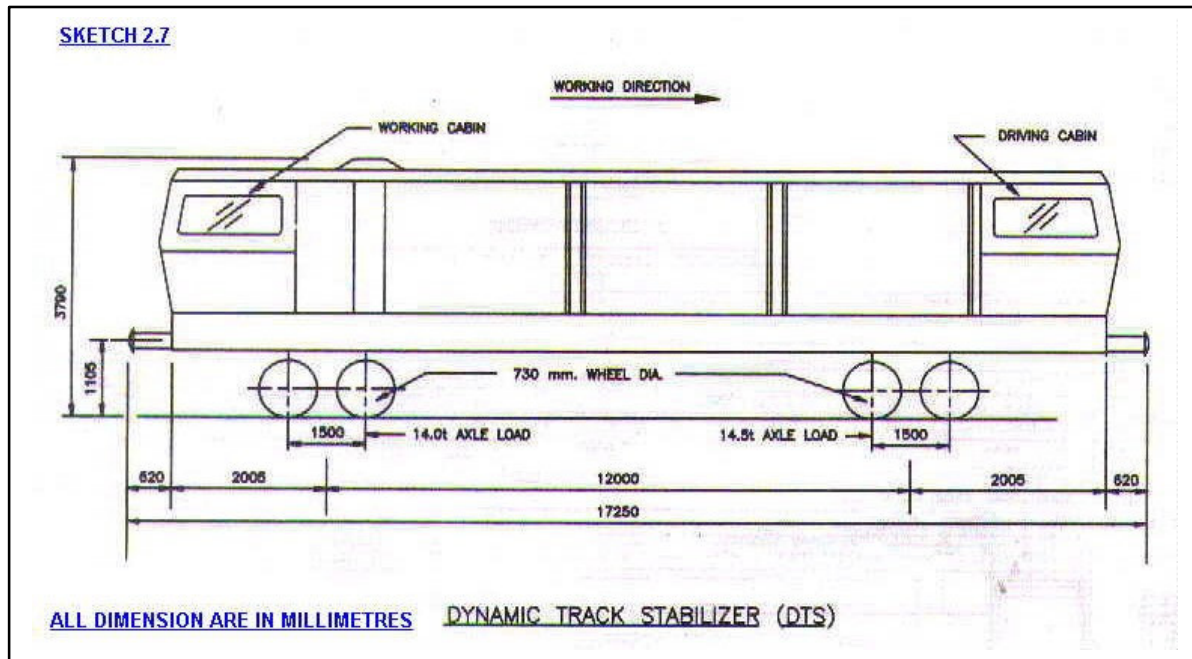
The speed of working can be controlled by an adjustable hydrostatic drive from 0 to 2.5 kmph. If the track geometry is corrected by several passes of the tamping machine, then a low speed of working of 0.5 kmph to 1.0 kmph is selected for first and second passes of the machine. For subsequent passes, higher working speed is selected. In one pass, the machine carries out stabilization equivalent to passage of one lakh tonnes of traffic. It is possible to permit speed of

40 kmph on freshly deep screened tack, if ballast is adequate and Dynamic track stabilizer has been used behind the tamping machine.

233 General Data

- Engine - Old stock Deutz-BF-12L-513C 460 BHP(Air cooled)
- New stock KTA- 1150L from KCL 473 BHP at 2200 RPM
- Length over buffer - 17250 mm
- Width - 2800 mm
- Height above rail - 3790 mm
- Bogie Pivot spacing - 12000 mm
- Bogie wheel base - 1500 mm
- Wheel diameter - 730 mm
- Weight - 57 tonne
- Axle load -
 - (i) Front axle load 14.5 tonne
 - (ii) Rear axle load 14.0 tonne
- Speed -
 - (i) self propelled 60 kmph
 - (ii) In train formation 50 kmph

The important assemblies and dimensions are shown in **Sketch 2.7**.



2.4 Ballast Handling Machines

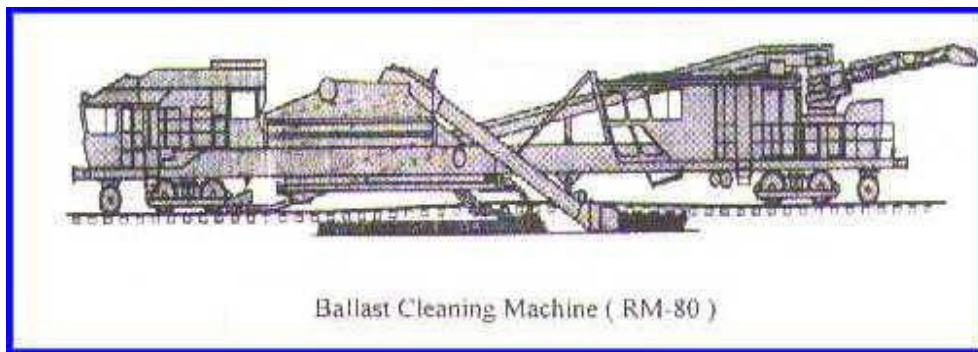
2.4.1 General

During maintenance of track, ballast is required to be handled in many ways. Ballast handling machines are categorised as under depending upon their functions:-

- i) Ballast Cleaning Machines.
- ii) Ballast Regulating Machines.

The function of ballast cleaning machine is to carry out cleaning of ballast by removing muck, thereby improving drainage of track and elasticity of the ballast bed. Basically, the machine excavates and picks up ballast by means of cutter chain and carries it to a set of vibrating screens where muck is separated and thrown out by a chute and clean ballast is transferred back to the track.

Ballast Cleaning Machines have following basic Units:-



- i) Excavating Unit
- ii) Screening Unit
- iii) Conveyer system for distribution of ballast and disposal of muck
- iv) Track lifting and slewing unit.
- v) Recording unit.

Three types of ballast cleaning machines are available:-

- i) Plain track ballast cleaning machine RM -80
- ii) Points and crossing ballast cleaning machine RM -76
- iii) Shoulder ballast cleaning machine (SBCM)

Ballast regulation and profiling becomes necessary primarily due to the following:

- i) After a maintenance operation such as tamping of track or screening of ballast.
- ii) After relaying of track
- iii) After training out ballast.

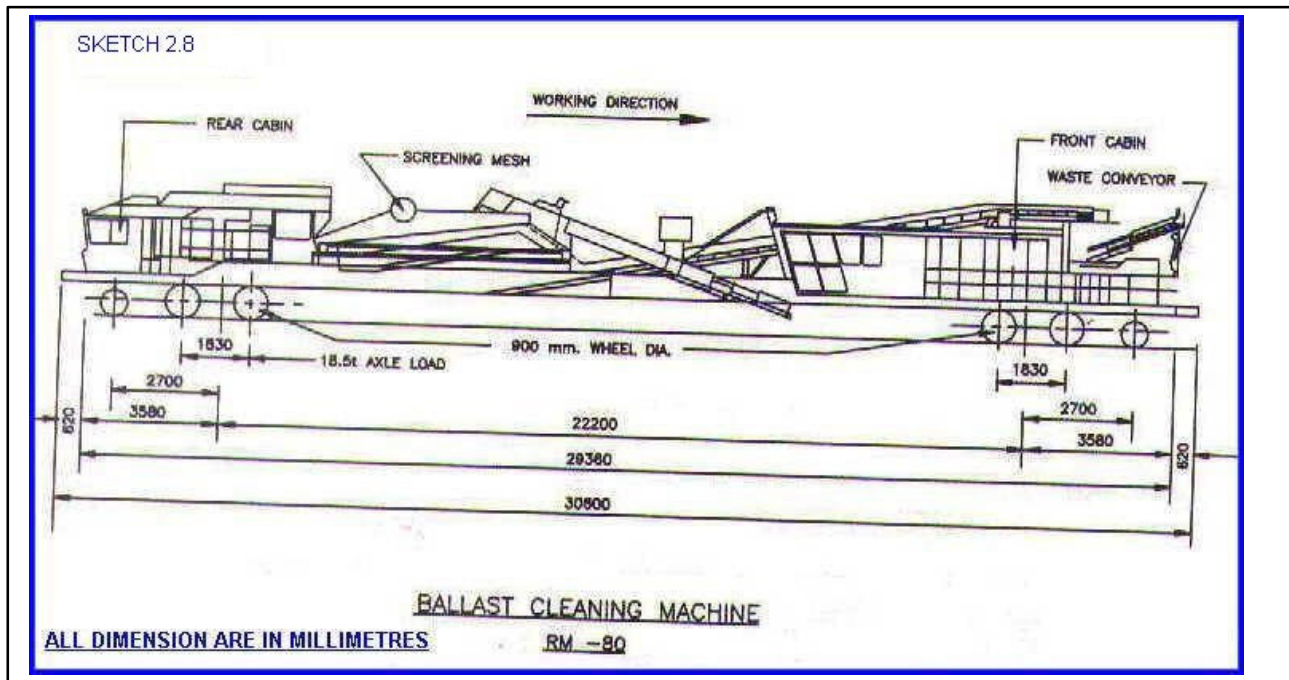
Ballast Regulators available on IR are of Kershaw make. These machines have their main application in ballast transfer, spreading and profiling operations. For this purpose, a front mounted one pass transfer plow, left and right ballast wings and a rear mounted track broom are provided as standard equipment. The machine can move ballast towards centre of track or away from centre of track transfer ballast across the track and transfer ballast from a surplus zone to deficient zone.

2.4.2 Plain Track BCM (RM - 80)

i) General Data:

• Engine	Deutz-BF 12L 513C 333kw (453 hp), 2 nos.
• Length over buffers	30600 mm
• Width (during transfer)	3050 mm
• Height above rail top	4015 mm
• Bogie pivots spacing	22200 mm
• Wheel base of bogies	1830 mm
• Diameter of wheels	
	(a) Power 900 mm
	(b) Idle 700 mm
• Speed	
	(a) Self Propelled 40 kmph
	(b) In train formation 30 kmph
• Total weight	91 tonnes
• Maximum axle load	18.5 tonnes

The important assemblies and dimensions are shown in **sketch 2.8**



ii) Description of machine

The machine is powered by two independent power units (total engine output: 666 kw) with air cooled Deutz Diesel engines type BF- 12 L 513C which drive the pump distribution gears via cardon shafts. The front engine powers the hydraulic pumps for all conveyor belt drives, lifting movements and the hydraulic propulsion, both in working and travelling mode. The rear engine provides power for hydraulic pumps for the excavation chain drive and the screen drive and also powers the hydraulic propulsion for travelling.

The chassis has sturdy welded construction. The frame and other units are joined by welding. The machine is equipped with buffers and drawbar on either end.

There are two powered bogies, each having two power axle. The powered axles of both bogies are driven by a hydraulic motor through a gear and a hydraulic multiple disc clutch. In working mode, the speed is variable from 0 to 1000 meter/hr. There is a driving cabin at the rear end of the machine having all controls necessary for travel. There is a working and driving cabin at the front end of the machine having all controls necessary for travel and work. This cabin is located right in front of the cutter bar which gives the operator a good view not only of controls and panels but also of the working units.

The machine is equipped with a pneumatic block brake acting on all powered wheels. There is hand operated braking valve for direct pneumatic braking. The machine also has a through brake pipeline to facilitate movement in train formation.

There is a 24V DC plant for lights, battery charging, electric control and monitoring systems of the diesel engines, and flood lights during night working.

For excavating the ballast, there is endless scraper chain located between the bogies and running under the track when working. The chain is basically composed of scraper blades with fingers, intermediate links and bolts. Chain speed is variable between 2.4 to 4.0 metres per second.

The excavation chain is guided in two slanted lateral channels and one horizontal channel. The top of the lateral guides are pivoted to the machine frame and hydraulically adjusted. The lower part of the chain guide is parallel to the machine body and is made of wear resistant steel. For protection against dust, noise and for safety reasons, the lateral guides are covered with solid rubber sheets which open by hinges.

At the beginning of work at a site, the cutter bar is inserted underneath the sleepers and connected to the lateral guides by quick action locks. Hydraulic hoists are provided for easy handling of the cutter bar. At the end of the work at a particular site, the cutter bar is removed.

The **screening unit** consists of three vibrating sieves of the following square mesh sizes:

Upper screen :80 mm
Middle screen :50 mm
Lower screen :36 mm

The vibrations are provided by hydraulically driven rotating fly weights. In super-elevated curves, the entire unit is hydraulically adjusted by the operator to keep it horizontal.

The **distributing conveyors** receive the cleaned ballast and distribute it evenly across the entire surface of track right behind the excavating chain.

From underneath the screening unit, the waste drops to the **conveyor belt** which carries it to a hydraulically adjustable belt controlled from the cabin. The waste can be discharged outside the track by means of the tilting waste conveyor.

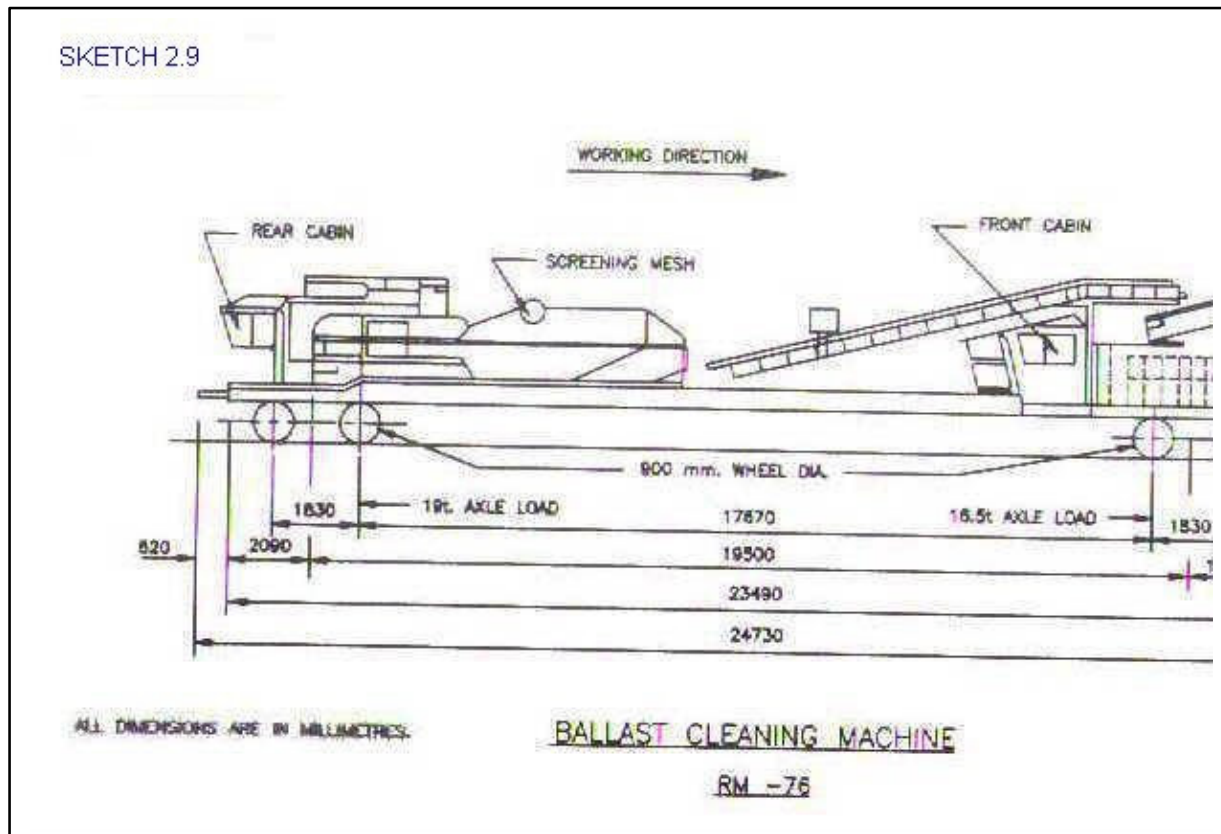
A **track lifting and slewing unit** is located next to the cutter bar for adjusting the excavation depth and for avoiding the obstacles.

2.4.3 Points and Crossings Ballast Cleaning Machine (RM-76)

i) General data:

• Engine	Deutz-BF12L 513C 291 KW (396 hp) and 163 kw (221 hp)
• Length over buffers	24730 mm
• Width	3130 mm
• Height above rail top	4015 mm
• Bogie pivot spacing	19500 mm
• Wheel dia	900 mm
• Maximum axle load	19 tonnes
• Bogie Wheel base	1830 mm
• Total weight	71 tonnes
• Speed:	
	(a) self propelled 40 kmph
	(b) train formation 30 kmph

The important assemblies and dimensions are shown in **Sketch 2.9**.



ii) Description of the machine

RM -76 Ballast Cleaning Machine is capable of carrying out deep screening of ballast on turnouts and also in plain track. The main features of this machine are similar to RM-80 in addition, it can perform the function of Ballast Cleaning of Points and Crossings without dismantling them. The cutter bar can be extended by adding intermediate links, each measuring 500 mm and a maximum of eight links can be used making the total excavation width as 7.72 metres.

The machine has Deutz make two diesel engine of 396 HP and 221 HP which give power for hydraulic and pneumatic systems, and electrical circuits.

Excavation unit consists of an excavating chain of 82 scraper shovels and 82 intermediate links. Scraper shovel is fixed with 2 scraping fingers.

Distributing unit consists of two ballast distributor belts on both sides of track to distribute clean ballast at desired locations.

Muck disposal unit throws away the muck outside track through waste conveyor belt.

Screening Unit consists of 3 sets of screens and the total screen area is 21 Square meters. The unit has three square meshes sizes of 80 mm, 50 mm, and 36 mm. The screens vibrate with Hydraulic power.

iii) Working Principle

The excavating chain designed in pentagon shape cuts the ballast bed and carries the ballast and muck through the chain-guides to the screening unit. The freely vibrating screen with linear vibration effects separation of ballast and muck. Underneath the vibrating screen, the muck falls on a conveyor belt which then carries this muck to a slewable conveyor belt (which can be folded also during travel). This slewable belt is called waste conveyor and it throws the muck outside the track. The cleaned ballast is led directly on to the distributor conveyor belts and from there it is distributed over the entire ballast profile.

iv) Capability of the Machine

It is capable of disposing off muck along cess at a distance of more than 7 meters from centre of track. Lifting of track upto 100 mm and slewing upto ± 300 mm can be achieved.

The machine can deep screen 1 in 12 turnout in 1 hr. 30 minutes and can deep screen plain track upto 140 -150 metres per effective hour.

2.4.4 Shoulder Ballast Cleaning Machines

The machine is used for cleaning of shoulder ballast to improve the drainage of track. Two types of Shoulder Ballast Cleaning Machines are available on Indian Railways. These are -

- i) Shoulder Ballast Cleaning Machine (Plasser make - FRM 80)
- ii) Shoulder Ballast Cleaning Machine (KERSHAW make - KSC 600)

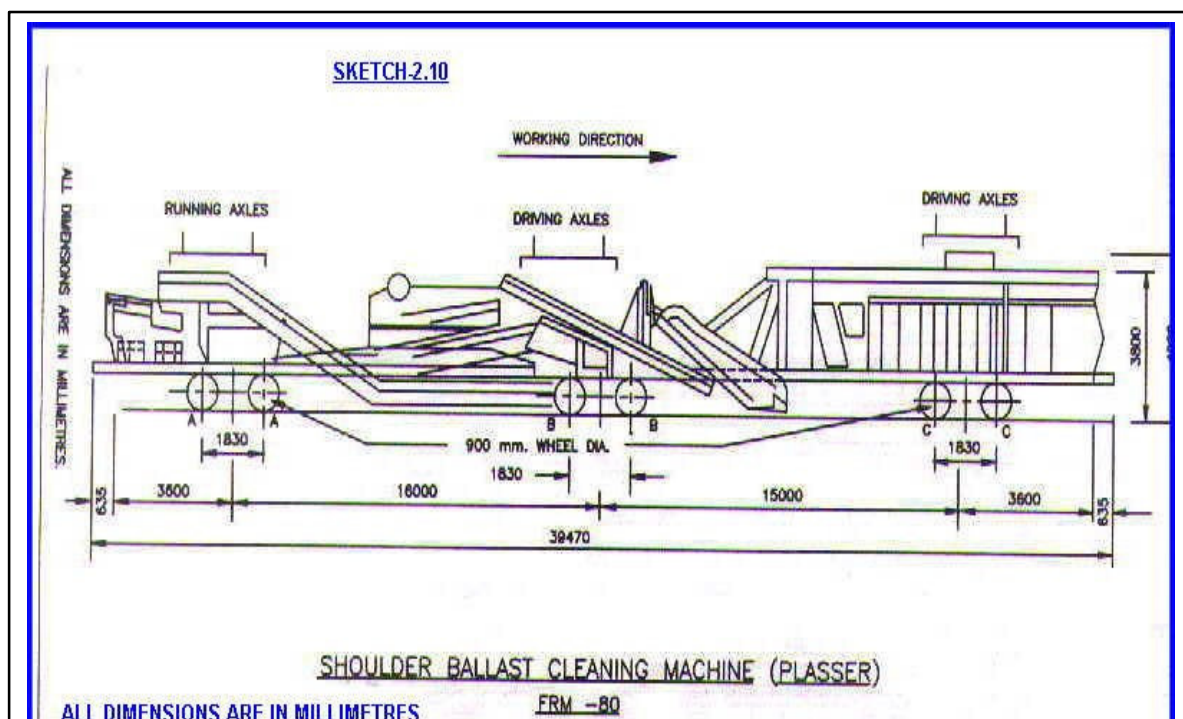
(i) Shoulder Ballast Cleaning Machine - FRM-80 (Plasser make)

The main features of this machine are similar to RM -80. The machine is provided with two excavating cutter chains, one on either side. Each chain excavates and picks up the shoulder ballast and directs it to a set of vibrating screens where muck is screened away and cleaned ballast is deposited on shoulders of the ballast profile.

General Data

Engine	Deutz TBD - 234-V-12
	470 hp
Length over buffers	39470 mm
Width	3135 mm
Height above rail top	4260mm
Bogie Pivots Spacing	
	(a) Front and Middle bogies 15000 mm
	(b) Middle and Rear bogies 16000 mm
Bogie Wheel Base	1830 mm
Wheel Diameter	900 mm
Max. Axle Load	20.0 tones
Total Weight	80 tonnes
Speed	(a) Self propelled 40 kmph
	(ii) In train formation 30 kmph

Different assemblies and dimensions are shown in **sketch 2.10**.

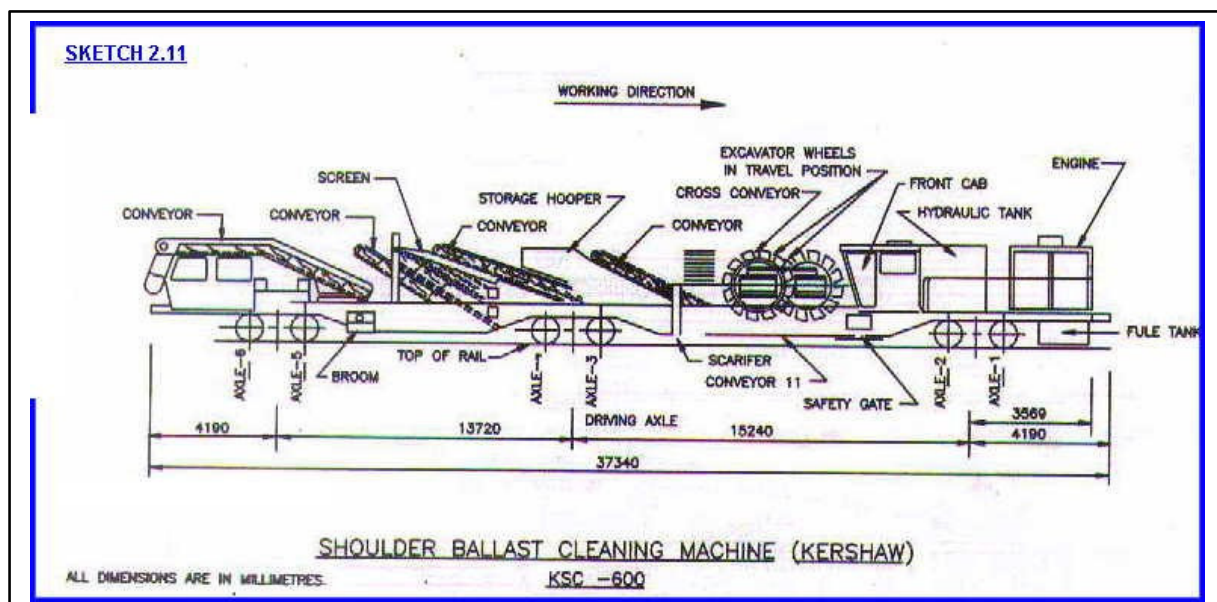


ii) Shoulder Ballast Cleaning Machine-KS C 600 (KERSHAW make)

General Data

Engine	-	Cummins Diesel engine VT 28-P, 800 hp
Length over buffers	-	37340 mm
Width	-	3081 mm
Height above rail top	-	3917 mm
Bogie pivot spacing	(a) Front and Middle bogies	15240 mm
	(b) Middle and Rear bogies	13720 mm
Wheel base	-	2000 mm
Wheel diameter	-	839. 8mm
Diameter of excavating wheel	-	2440 mm
Total weight	-	99.7 tonnes
Maximum axle load	-	19.93 tonne
Speed	-	-
	(a) self propelled	40 kmph
	(b) In train formation	30 kmph

The main assemblies and important dimensions are shown in **sketch 2.11**.



The machine has the following basic units:-

- Excavating wheel and scarifier
- Hopper assembly/bucket
- Screen drive assembly
- Broom assembly
- Conveyor system

Heavy duty Scarifier breaks up the mud pockets underneath the sleeper ends to allow the track to drain. The ballast is transferred to the screening unit by the **excavating wheel** having Hoppers/buckets. The reclaimed ballast is distributed back to shoulder area of the ballast profile. The machine completes the job by shaping the reclaimed ballast with the built-in Shoulder Regulator Wings and then finally sweeps the sleepers by broom.

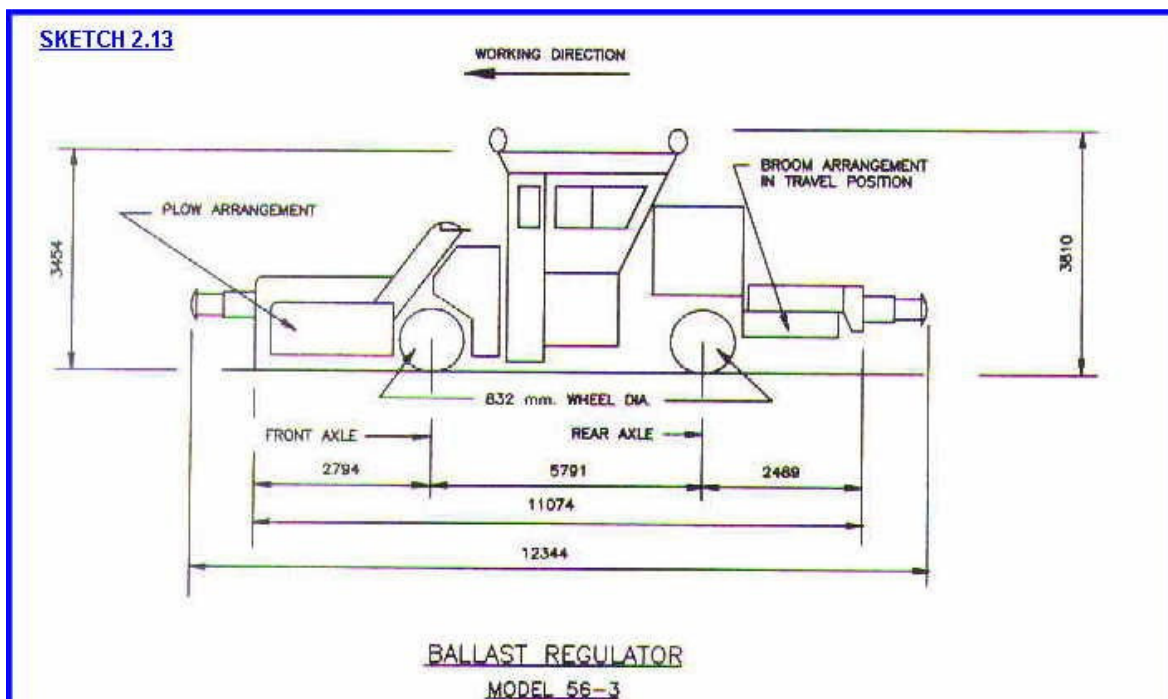
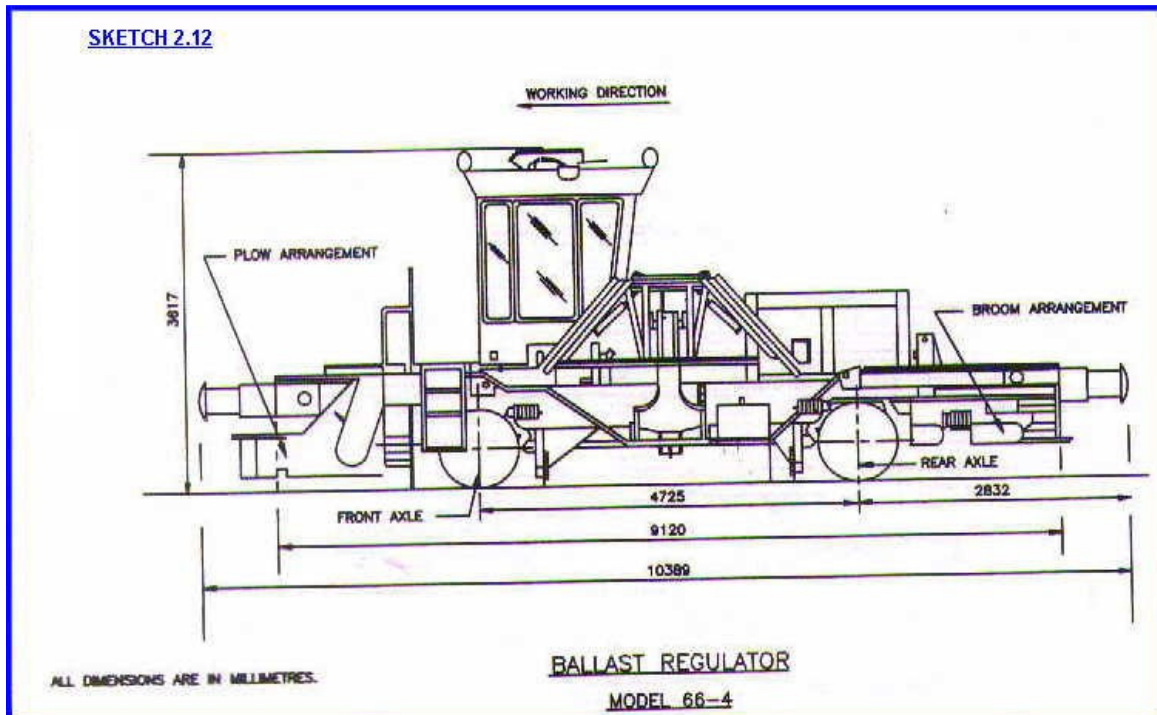
24.5 Ballast Regulating Machine (BRM)

General Data:

	Model 66-4	Model 56-3
• Engine	Cummins model NTA 743P Diesel Engine, 265HP at 1800 rpm	Cummins model NTA 743C Diesel Engine 250 HP at 1800 rpm
• Length over buffers	10389 mm	12344 mm
• Width	3136 mm	3122 mm
• Height above railtop	3617 mm	3810 mm
• Wheel base	4725 mm	5791 mm
• Wheel dia	8382 mm	832.0 mm
• Axle load	10.66 tonnes	12.97 tonnes
• Speed		

- | | | |
|------------------------|---------|---------|
| (a) Self propelled | 50 kmph | 60 kmph |
| (b) In train formation | 40 kmph | 40 kmph |

The important assemblies and dimensions of models 66-4 and 56-3 are shown in **sketches 2.12 and 2.13** respectively.



Power is supplied for driving the machine and its various attachments by a Cummins Diesel engine. To propel the machine, a closed circuit high pressure hydrostatic transmission powers the final drive. Both the rear and the front axles can be driven simultaneously for improved tractive effort. The machine is equipped with clasp air brakes on all the four wheels.

The horn, brakes, plow locks and broom locks are operated pneumatically. The system is governed to regulate the pressure in air tank between 110-120 psi.

The electrical system is of 24 volts. The system has a 30 Ampere alternator and two 205 Ampere-hour batteries wired in series. Protection is provided by circuit breakers.

The **one pass transfer plow (ballast plow)** has two blades which are pivoted on a common shaft in the centre of the plow frame. The plow can be positioned from the operator's cab to plow out, plow in or to transfer ballast to either side of the track with the machine travelling either forward or backward.

The **ballast wings** attached to the sides of the machine are hydraulically operated and controlled from the cab. The machine can be equipped with standard fixed width ballast wings or optional variable width ballast wings for better profile shaping.

The **broom** is mounted at the rear of the ballast regulator. It is used for track dressing operations to remove ballast from tops of sleepers, to fill empty cribs and to place excess ballast on the shoulders for final regulating and dressing.

2.5 Track Relaying Machines

Following system of mechanised track relaying are available on Indian Railways:

- i) Plasser's Quick Relaying System (PQRS).
- ii) Track Relaying Train (TRT)

2.5.1 Plasser's Quick Relaying System (PQRS)

It is essentially a semi-mechanised system of track renewal. PQRS consists of self propelled cranes which move on an auxiliary track of 3400 mm gauge having the same centre line as that of track to be relayed. These portal cranes are capable of self loading and unloading from BFRs. PQRS has following components as shown in figure 2.6.

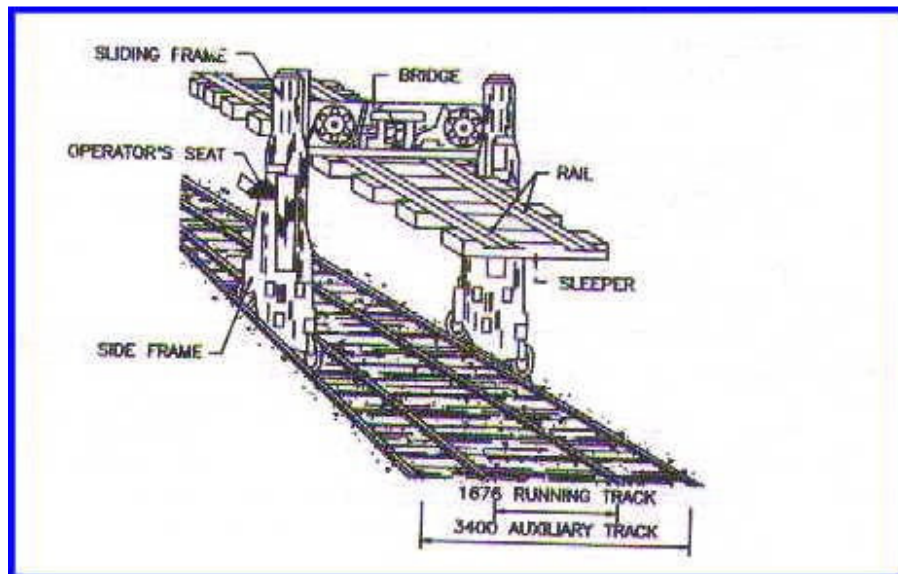


Figure 2.6

i) Side Frames:- The machine contains two vertical side frames that house two vertical sliding frames.

ii) Bridge:- Sliding frames are joined together with horizontal cross frame known as bridge. The Motive Power, hydraulic and electrical assemblies are installed over the bridge. The whole bridge is raised/lowered to facilitate lifting of panels.

iii) Sleeper Gripper:- On the underside of the bridge, grippers to pickup sleepers is provided. Gripping of sleepers by its end is done by two angles welded to the grippers.

iv) Rail Clamps:- On the end side of the frame scissors type clamps are provided to hold the rails/panels.

(v) Turn Table:- To facilitate turning of portal cranes for placing it on the BFR and off tracking in mid section, a turntable is provided. On the BFR a wooden platform is provided to support the turn table.

Earlier, Portal cranes of model PQRS 2000-I has capacity of lifting maximum 5 t load. Maximum length of only 9 meter of prefabricated panel with PRC sleepers can be lifted by one portal crane. The later model PQRS 201 has capacity of lifting upto 9 t. One such portal crane can lift 13 m long prefabricated panel with PRC sleepers.

i) General Data

	PQRS -2000-I	PORS -201
Engine	Deutz . M ake 4 Cylinder 44 HP diesel engine	Kirlosker M ake air cooled HA-694, 75 HP
Drive	Hydraulic	Hydraulic
Speed	10 kmph	14 kmph
Lifting capacity	5 tonnes	9 tonnes
Overall length	2914 mm	3050 mm
Overall width	3860 mm	3860 mm
Overall height above rail top	4400 mm	4390 mm
Wheel base	2400 mm	2400 mm
Wheel dia	450 mm	450 mm
Weight	10 tonnes	12 tonnes

Briefly the sequence of operation for relaying with PQRS is as under:

- Panels are fabricated with new sleepers and service rails in a Base Depot. These panels are loaded on BFRs in 3 or 4 layers.
- The existing rails in track are cut in lengths of 13 m.
- Auxiliary track is laid to proper line and level with the new rail panels, if rail renewal is also to be carried out as part of track renewal. Otherwise, service rails are used for making auxiliary track.
- PQRS rake is brought to site of relaying after getting proper traffic and OHE block.
- Following three methods of laying of new panels are used depending upon site conditions:

- Pulling the PQRS rake

- Pushing the PQRS rake

- Parting the PQRS rake

- Portals are unloaded on the Auxiliary track.
- Old panels are removed and loaded on PQRS rake, ballast bed is scarified manually and new panels are laid at site by using portal cranes.
- Proper ramp is provided at the beginning and at the end of the day's work .

2.5.2 Track Relaying Train (TRT)

TRT is a system for complete mechanisation of Track renewal process. The important assemblies and dimensions of Track Relaying Train are shown in sketch 2.14. It does the following jobs:

- i) Threads out old rails from track.
- ii) Removes old sleepers.
- iii) Levels and compacts ballast bed.
- iv) Places new sleepers.
- v) Threads in new rails into track.

TRT consists of the following:-

i) Beam Car (22.34 m long):

The beam car is hinged with handling car and has one common bogie and one independent bogie. Below this car all the working units like old sleeper pickup, dynamic plow, sleeper flipper, indexing wheel, new tie conveyor, self guiding roller for guiding in and guiding out rails, are provided. If sleeper spacing is to be changed, this can be achieved by changing the indexing wheel. Sled is hung from this car when not in use.

ii) Handling Car (21.05 m long):

This car has one independent bogie and one common bogie with beam car. All the conveyors are provided on this car.

iii) Power Car (14.81 m long):

This is a four axle vehicle. TRT power unit is provided on half the length of this car and remaining half is utilised for loading of sleepers. Power unit is Cummins NTA-855 turbo-charged, 6 cylinder diesel engine, maximum rating 360 HP at 2100 RPM, continuous rating 295 HP at 1800 RPM.

Salient Features:

- i) There is no need to prefabricate panels.
- ii) No Auxiliary track is to be laid.
- iii) Concrete sleepers loaded on modified BRHs are directly taken to site and relayed one by one.
- iv) New rails unloaded at site on shoulders and duly paired or fishplated are exchanged with old rails along with sleeper renewals

The quality of track produced by TRT is very good and the traffic is allowed at 40 kmph just after relaying. After first & second tamping, speed is raised to 60 & 80 kmph respectively and after third tamping the speed is raised to normal. It normally takes 10 days to bring speed to normal. At sites where DTS is used, the speed can be raised to normal in six days. After first packing and application of DTS, the speed is raised to 60 kmph and after ballasting and 2nd packing with application of DTS the speed is raised to normal.

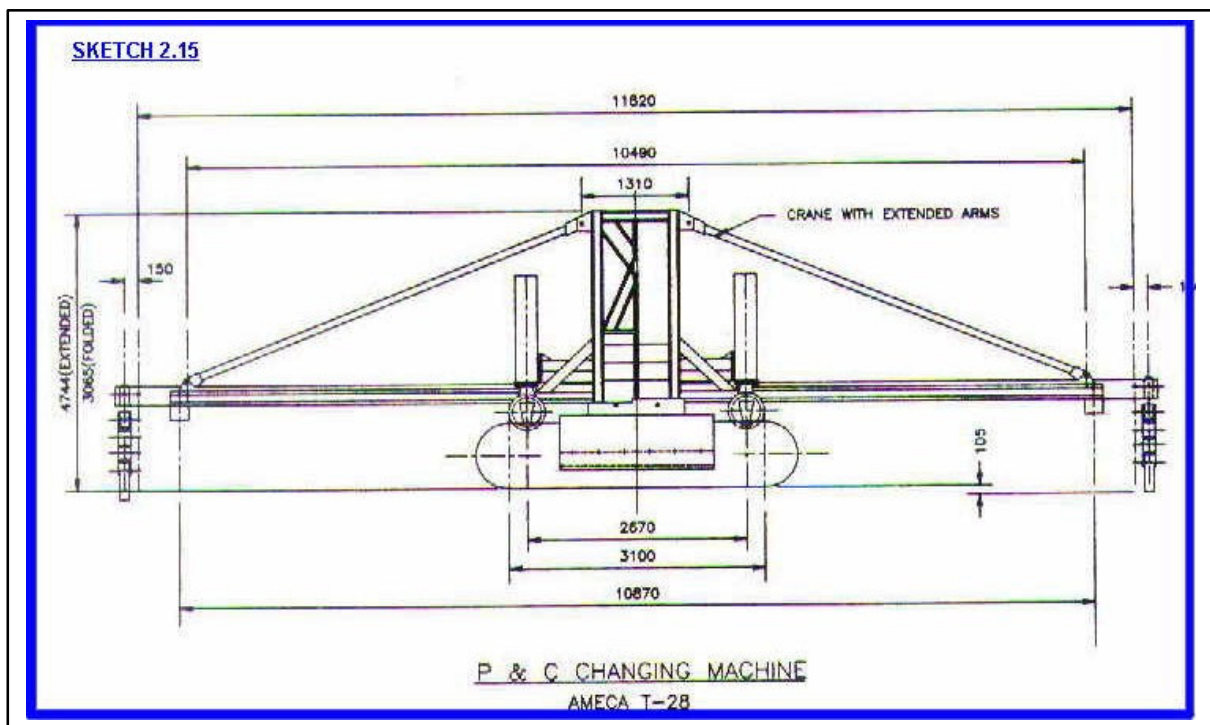
2.5.3 Points and Crossing Changing Machine (T-28)

The machine available on IR is manufactured by M/s AMECA of Italy and is used for relaying of turnouts on PRC sleepers.

It consists of the following:-

- i) Self propelled portal crane
- ii) Motorised rail trolley
- iii) Non-Motorised rail trolley.
- iv) Jib crane.

The important assemblies and dimensions of AMECA T-28 are shown in **sketch 2.15**.



i) Portal crane

The portal crane permits adjustment of span and height and is equipped both with circular and flanged wheels. A set of two cranes can lift and handle a complete turnout. It can also be used to handle normal track. When working with a set of two portal cranes, the connection is provided by the turnout or track portion, which is being handled.

General Data:

Engine	SUN/6105I 125 kw (170 hp) at 2400 rpm.
Wheel diameter	400 mm
Wheel base	2670 mm
Load capacity (Max.)	30 tonnes
Speed with full load (Max.)	0.8 kmph
Speed with no load	10 kmph
Max. lift with full load	2300 mm
Height in closed position	3065 mm
Height in lifted position	4744 mm
Crawler width	360 mm
Crawler lateral clearance	2066 mm (Min.) 6116 mm (Max.)
Moving width	3066 mm (Min.) 7110 mm (Max.)
Max. axle load	6.0 tonnes
Total weight	24.0 tonnes

ii) Trolleys:

The trolleys are used to transport the turnout assembly on track. The motorised trolleys have the facility to move laterally by 300 mm on either side and lift vertically by 300 mm. One such trolley is placed below each of the crossing portion and switch portion and is used for shifting the turnout laterally or vertically for clearing any obstructions. e.g. signal post, OHE mast, platform etc. while transporting the turnout.

General Data of Motorised Trolley:

- Width 1680 mm
- Height 510mm
- Lateral Shift ± 300 mm
- Upper table rotation $\pm 10^\circ$
- Vertical lift 300 mm
- Weight 950 kg
- Capacity 25 tonnes

iii) Jib Crane

Pre stressed concrete (PSC) sleepers for turnouts require careful handling to avoid damages during loading /unloading assembling and laying , the sleepers loaded on BFRs are unloaded either at assembly depot or in yards near the site of laying .Thereafter the PSC sleepers have to be spread at proper spacing for linking of turn out assembly . The Jib crane is used for loading and placement of PSC sleepers.

The salient features and dimensions of Jib crane are shown in sketch 2.16 .It has the following systems .

- a) Liftingsystem
- b) Hydraulic system
- c) Electrical system
- d) Brakingsystem
- e) Self-loading system

General Data

Engine	Diesel engine DIN 6271 93KW (125 hp)
Length over buffers	6687mm
Width	2794mm
Height over rail top	3154mm
Bogie Wheel base	2500 mm
Wheel diameter	400 mm
Axle load	11.1 tonnes
Weight	18.0 tonnes

Speed 30 kmph

2.6 Special Purpose Machines

2.6.1 Mobile Flash Butt Welding Plant K -355 APT (Plasser & Theurer Make):

Flash butt welding processes gives reliable and economical weld. No foreign matter is used in the welding process. This machine is used for in-situ flash butt welding of rails. The machine can weld rail in the centre of track, on the shoulder, cess and in the track on which it is standing.

The machine consist of following eight major units:-

- i) Prime-mov er
- ii) Three phase alternator
- iii) Rail weldinghead
- iv) Hydraulic and electric unit
- v) Telescopic Crane
- vi) Cooling plant
- vii) Shearing Knives
- viii)Weld recorder

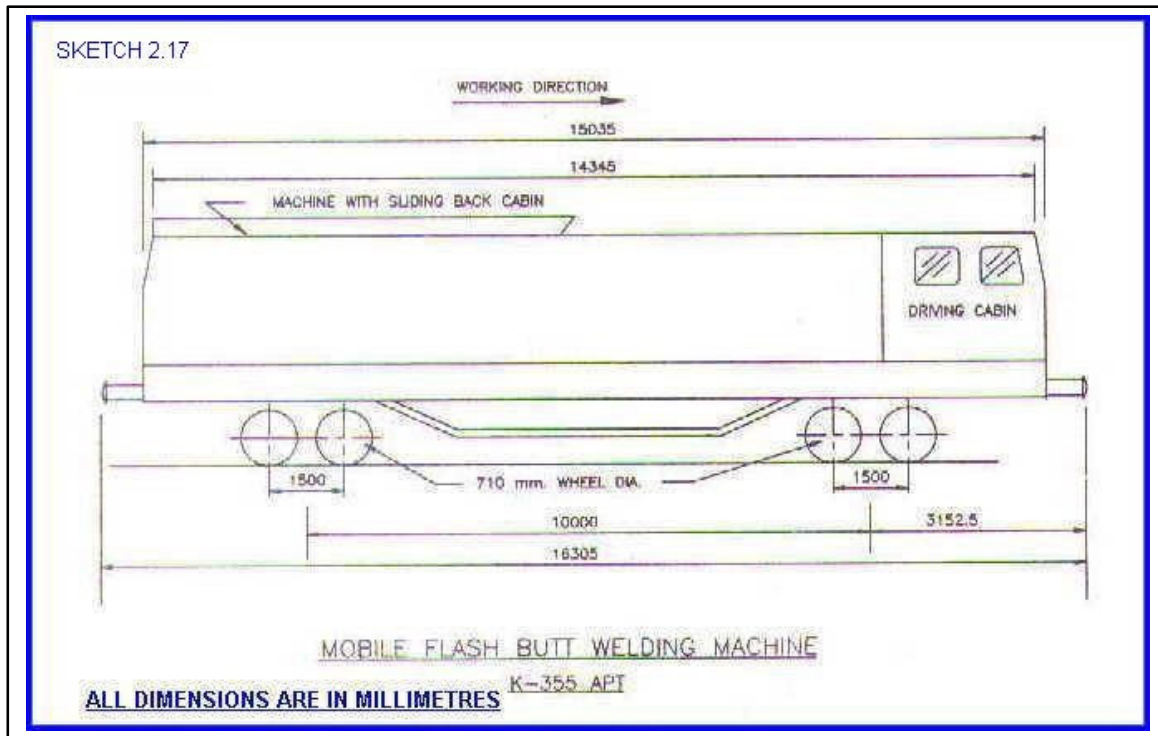
Rail web and face are cleaned properly for good conductivity. Welding head is fixed in position and after clamping, the rails are checked for alignment on top and the sides of rail head. Initially, gap of 3 mm is provided. Welding operation is switched on and the joint is welded as per preset parameters on the machine. Due to flashing and butting, rails are shortened by 32 mm to 35 mm as such rails have to be pulled from front for further weldingfor which the machine has pulling arrangement.

General Data:

Engine	Cummins diesel engine KT 1150L 330 kw (450 hp)
Length over buffers	16305 mm
Width	2990 mm
Height above rail top	3695 mm
Bogie pivot distance	10000 mm
Wheel diameter	710 mm
Bogie wheel base	1500 mm
Max. axle load	11.5 tonnes
Total weight	42 tonnes
Speed	

- (a) Self propelled 60 kmph
- (b) In train formation 50 kmph

The important assemblies and dimensions of the model K-355 APT are shown in sketch 2.17.



2.62 Rail Grinding Machine (Loram Make)

Rail Grinding helps in controlling the contact points between rail and wheel to reduced wear and tear of both rail and rolling stock. One rail grinding machine available on the Indian Railways is manufactured by M/s Loram. Eight grinding modules (stones) are located on each rail. Both the rails can be ground simultaneously. Microprocessor controlled hydraulic system raise and lower each of the sixteen grinding stones in sequence at a specific point on the rail head.

The machine removes metal from rail head according to a specified grinding pattern. All required patterns can be stored and recalled. Pattern changes can be made very quickly.

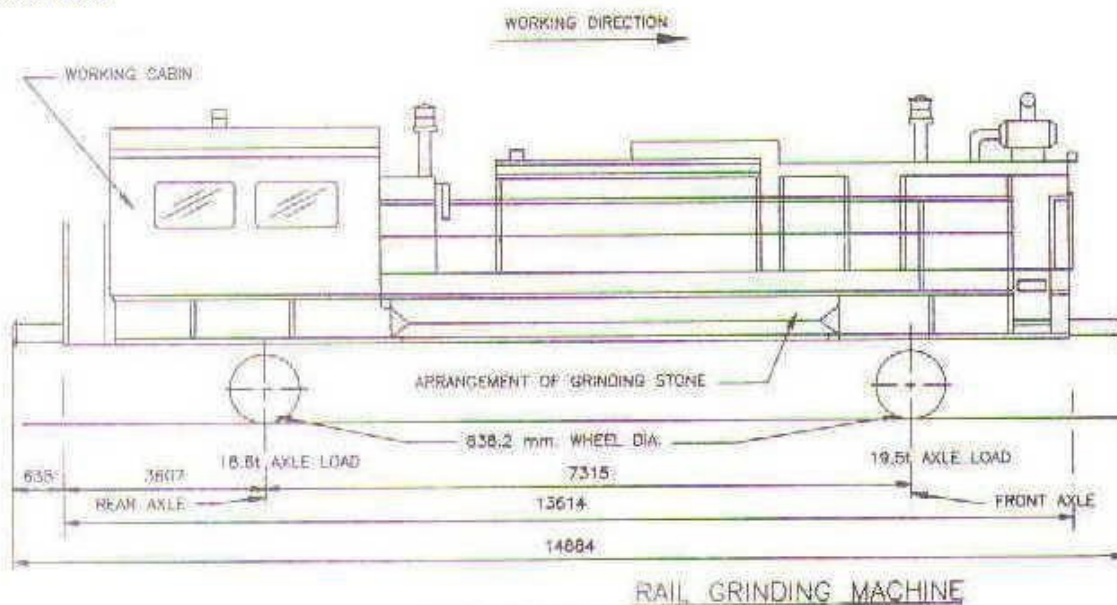
It removes long and short wave corrugations efficiently while minimising rail head loss.

General Data:

Engine	Cummins diesel engine KTTA 700 hp at 1975 rpm
Length over buffers	14884 mm
Width	2718 mm
Height above rail top	3924 mm
Bogie wheel base	7315 mm
Wheel diameter	838.2 mm
Max. axle load	19.5 tonnes
Weight	41.72 tonnes
Speed	(a) Self propelled 60 kmph (b) In train formation 40 kmph
Working speed	1 to 4 kmph
Grinding Horse power	16 grinding modules @ 20 hp
Grinding angle	Infinitely adjustable 60° gauge side to 45° cess side.

The important assemblies and dimensions of the Rail Grinding Machine are shown in **sketch 2.18.**

SKETCH 2.18

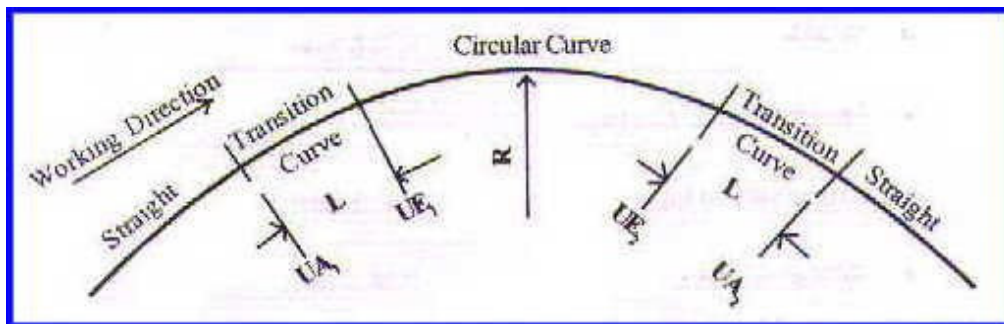


ALL DIMENSIONS ARE IN MILLIMETRES

Annexure 2.1

Method of Applying Adjustment at Front Tower of Tamping Machine on Curve

When the front tower of the tamping machine enters the curve, the rear tightening bogie is still on straight. Therefore, it experiences error because of the curvature and certain adjustments have to be applied at the front bogie to compensate the error due to curvature. Similar adjustments are also required when the tamping machine leaves the curve at other end.



The procedure for applying these adjustments as the machine enters or leaves the curves is explained below: -

- (i) For a particular curve having length of transition 'L' and radius of circular curve 'R', pick up the maximum adjustment value 'Vm' from Table 1.
 - (ii) Then from Table 2, pick up the adjustment value 'V' for different positions of the front tower corresponding to the value 'Vm' as obtained in Para (i) above.
 - (iii) As the front tower of the machine enters the curve at UA₁ and negotiate along the transition curve, apply the adjustments equal to the value 'V' as obtained in Para (ii) above, value varies from zero at UA₁ to Vm at 20 metres distance from UA₁.
 - (iv) For remaining length of the transition curve i.e. 20 metres beyond UA₁, till the front tower reaches location UE₁, uniform adjustment value equal to 'Vm' will be applied at the front tower.
 - (v) As soon as the front tower of the machine enters the circular curve at UE₁, apply adjustment of value 'V' obtained from the Table 2, ranging from Vm at location UE₁ to zero at location of 20 metres distance beyond point UE₁.
- The adjustments explained in para (ii) to (v) above are to be applied in direction of outer rail of the curve, as indicated in Table 2.
- (vi) For remaining length of the circular curve, the adjustment value will remain zero till the front tower reaches location UE₂.

(vii) As the front tower enters the transition curve at location UE_2 , apply adjustment value 'V' ranging from zero at UE_2 , to V_m at 20 metres distance beyond UE_2 , as obtained from Table 3.

(viii) For remaining length of the transition curve at location 20 metres beyond UE_2 , till the front tower reaches location UA_2 , adjustment of value V_m will be applied.

(ix) When the front tower enters the straight track at location UA_2 ; apply adjustment 'V', ranging from V_m at UA_2 , to zero at 20 metres distance from UA_2 , as obtained from Table 3. The adjustments explained in para (vii) to (ix) above are to be applied in direction of inner rail of the curve as indicated in Table 3.

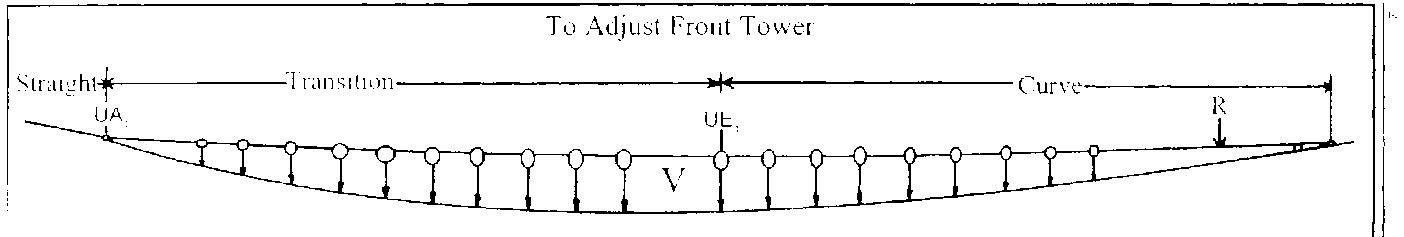
The adjustment explained in para (vii) to (ix) above are to be applied in direction of inner rail of the curve as indicated in Table 3.

850	5	4	3	3	2	2	2	2	2	1	1	1	1	1	1	1	1	1	0	0	0
900	5	4	3	3	2	2	2	2	2	1	1	1	1	1	1	1	1	1	0	0	0
1000	4	3	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1	0	0	0	0
1500	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	0	0	0	0
2000	2	2	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0
3000	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3500	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4000	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4500	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5000	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6000	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7000	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8000	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Vm = Maximum adjustment value (in mm)

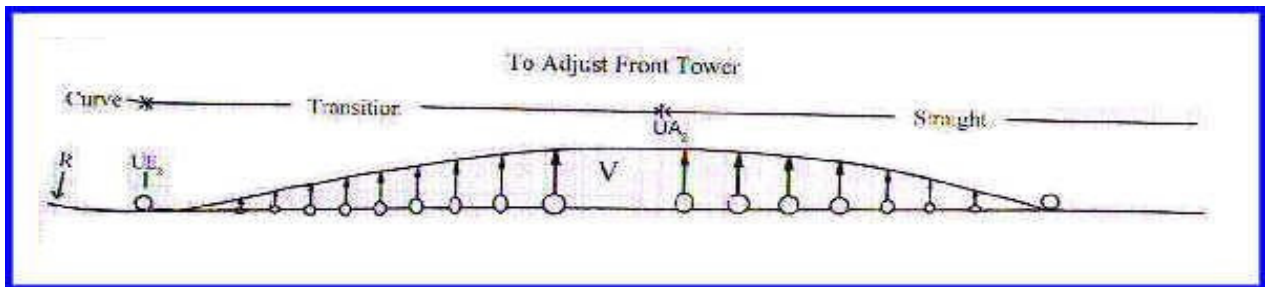
R = Radius of curvature (in mm)

L = Transition length (in mm)



Adjust after UA ₁												V-VALUE ADJUSTMENT	Adjust after UE ₁											
Sleeper	0	11	14	16	17	18	20	21	23	25	32		0	11	14	16	17	18	20	21	23	25	32	
Metres	0	6.6	8.4	9.6	10.6	11.5	12.4	13.2	14.2	15.5	20		0	6.6	8.4	9.6	10.6	11.5	12.4	13.2	14.2	15.5	20	
V _m	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		1.0	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0.0	
2	0	0	0	1	1	1	1	1	2	2	2		2	2	2	1	1	1	1	1	0	0	0	
4	0	0	1	1	2	2	2	3	3	4	4		4	4	3	3	2	2	2	1	1	0	0	
6	0	1	1	2	2	3	4	4	5	5	6		6	5	5	4	4	3	2	2	1	1	0	
8	0	1	2	2	3	4	5	6	6	7	8		8	7	6	6	5	4	3	2	2	1	0	
10	0	1	2	3	4	5	6	7	8	9	10		10	9	8	7	6	5	4	3	2	1	0	
12	0	1	2	4	5	6	7	8	10	11	12		12	11	10	8	7	6	5	4	2	1	0	
14	0	1	3	4	6	7	8	10	11	13	14		14	13	11	10	8	7	6	4	3	1	0	
16	0	2	3	5	6	8	10	12	13	14	16		16	14	13	12	10	8	6	5	3	2	0	
18	0	2	4	5	7	9	11	13	14	16	18		18	16	14	13	11	9	7	5	4	2	0	
20	0	2	4	6	8	10	12	14	16	18	20		20	18	16	14	12	10	8	6	4	2	0	
22	0	2	4	7	9	11	13	15	18	20	22		22	20	18	15	13	11	9	7	4	2	0	
24	0	2	5	7	10	12	14	17	19	22	24		24	22	19	17	14	12	10	7	5	2	0	
26	0	3	5	8	10	13	16	18	21	23	26		26	23	21	18	16	13	10	8	5	3	0	
28	0	3	6	8	11	14	17	20	22	25	28		28	25	22	20	17	14	11	8	6	3	0	
30	0	3	6	9	12	15	18	21	24	27	30		30	27	24	21	18	15	12	9	6	3	0	
32	0	3	6	10	13	16	19	23	26	29	32		32	29	26	23	19	16	13	10	6	3	0	
34	0	3	7	10	14	17	20	24	27	31	34	34	31	27	24	20	17	14	10	7	3	0		
36	0	4	7	11	14	18	22	25	29	32	36	36	32	29	25	22	18	14	11	7	4	0		
38	0	4	8	11	15	19	23	27	30	34	38	38	34	30	27	23	19	15	11	8	4	0		
40	0	4	8	12	16	20	24	28	32	36	40	40	36	32	28	24	20	16	12	8	4	0		
42	0	4	8	13	17	21	25	28	34	38	42	42	38	34	29	25	21	17	13	8	4	0		
44	0	4	9	13	18	22	26	31	35	40	44	44	40	35	31	26	22	18	13	9	4	0		
46	0	5	9	14	18	23	28	32	37	41	46	46	41	37	32	28	23	18	14	9	5	0		
48	0	5	9	14	19	24	29	34	38	43	48	48	43	38	34	29	24	19	14	10	5	0		
50	0	5	10	15	20	25	30	35	40	45	50	50	45	40	35	30	25	20	15	10	5	0		

V-VALUE
ADJUSTMENT



Adjust after UE ₂													V-VALUE ADJUSTMENT	Adjust after UA ₂												
Sleeper	0	11	14	16	17	18	20	21	23	25	32	0		11	14	16	17	18	20	21	23	25	32			
Metres	0	6.6	8.4	9.6	10.6	11.5	12.4	13.2	14.2	15.5	20	0		6.6	8.4	9.6	10.6	11.5	12.4	13.2	14.2	15.5	20			
V _m	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.0	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0.0				
2	0	0	0	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1	1	0	0	0				
4	0	0	1	1	2	2	2	3	3	4	4	4	4	3	3	2	2	2	1	1	0	0				
6	0	1	1	2	2	3	4	4	5	5	6	6	5	5	4	4	3	2	2	1	1	0				
8	0	1	2	2	3	4	5	6	6	7	8	8	7	6	6	5	4	3	2	2	1	0				
10	0	1	2	3	4	5	6	7	8	9	10	10	9	8	7	6	5	4	3	2	1	0				
12	0	1	2	4	5	6	7	8	10	11	12	12	11	10	8	7	6	5	4	2	1	0				
14	0	1	3	4	6	7	8	10	11	13	14	14	13	11	10	8	7	6	4	3	1	0				
16	0	2	3	5	6	8	10	12	13	14	16	16	14	13	12	10	8	6	5	3	2	0				
18	0	2	4	5	7	9	11	13	14	16	18	18	16	14	13	11	9	7	5	4	2	0				
20	0	2	4	6	8	10	12	14	16	18	20	20	18	16	14	12	10	8	6	4	2	0				
22	0	2	4	7	9	11	13	15	18	20	22	22	20	18	15	13	11	9	7	4	2	0				
24	0	2	5	7	10	12	14	17	19	22	24	24	22	19	17	14	12	10	7	5	2	0				
26	0	3	5	8	10	13	16	18	21	23	26	26	23	21	18	16	13	10	8	5	3	0				
28	0	3	6	8	11	14	17	20	22	25	28	28	25	22	20	17	14	11	8	6	3	0				
30	0	3	6	9	12	15	18	21	24	27	30	30	27	24	21	18	15	12	9	6	3	0				
32	0	3	6	10	13	16	19	23	26	29	32	32	29	26	23	19	16	13	10	6	3	0				
34	0	3	7	10	14	17	20	24	27	31	34	34	31	27	24	20	17	14	10	7	3	0				
36	0	4	7	11	14	18	22	25	29	32	36	36	32	29	25	22	18	14	11	7	4	0				
38	0	4	8	11	15	19	23	27	30	34	38	38	34	30	27	23	19	15	11	8	4	0				
40	0	4	8	12	16	20	24	28	32	36	40	40	36	32	28	24	20	16	12	8	4	0				
42	0	4	8	13	17	21	25	28	34	38	42	42	38	34	29	25	21	17	13	8	4	0				
44	0	4	9	13	18	22	26	31	35	40	44	44	40	35	31	26	22	18	13	9	4	0				
46	0	5	9	14	18	23	28	32	37	41	46	46	41	37	32	28	23	18	14	9	5	0				
48	0	5	9	14	19	24	29	34	38	43	48	48	43	38	34	29	24	19	14	10	5	0				
50	0	5	10	15	20	25	30	35	40	45	50	50	45	40	35	30	25	20	15	10	5	0				

V-VALUE
ADJUSTMENT

CHAPTER 3

WORKS REQUIRED BEFORE, DURING AND AFTER DEPLOYMENT OF TRACK MACHINES

3.0 General

This chapter deals with activities/works to be done before, during and after deployment of different on-track machines. In addition to the above, areas needing special care in respect of various machines are also brought out.

3.1 Tie Tamping Machines

3.1.1 Pre-Requisites For Introduction of Tamping Machines

i) A minimum cushion of 150 mm of clean ballast is recommended for the proper functioning of the machine. Adequate ballast should be available in shoulders and cribs to allow for required lift (about 20 mm in each tamping operation) and retention of packing after tamping.

For this purpose, planning and execution of deep screening of ballast, as well as training out of ballast should be done well in advance.

ii) Sanction of Commissioner of Railway Safety for working of the concerned tamping machine shall be available.

iii) Traffic blocks of adequate duration shall be planned. (See para 5.2.)

iv) The sleepers shall be uniformly spaced.

3.1.2 Pre-Tamping Operations

The following preparatory works shall be completed before undertaking tamping of track:-

i) Field survey should be carried out to determine existing profile of track and to decide the general lift. In case of design mode working, the survey should be done as per guidelines in **Annexure 5.3**.

ii) The beginning and the end of curve/transition curves should be marked on sleepers. Super-elevation and slew should be marked on alternate sleeper to act as guide for the operator.

iii) Ballast shall be heaped up in the tamping zone to ensure effective packing. However, sleeper top should be visible to the operator and the ballast should not obstruct the lifting rollers.

- (iv) Hogged, battered and low joints shall be attended.
- (v) Low cess should be made up.
- (vi) Track drainage should be improved for better retentivity of packing, Pumping locations should be attended. Rounded ballast should be replaced with clean and angular ballast.
- vii) Deficient fittings and fastenings should be made good and all fittings and fastenings like fish bolts, keys, cotters, loose jaws, elastic rail clips, pads etc should be properly tightened. Worn out fittings should be replaced.
- viii) Broken and damaged sleepers shall be replaced.
- (ix) Sleepers should be squared, correctly spaced and gauge corrected.
- (x) Destressing of rails, adjustment of creep, expansion gaps in joints, buffer rails and SEJs etc., if necessary shall be carried out.
- (xi) Guards rails at the approach of bridges and check rail shall be removed temporarily.
- (xii) All obstructions such as rail lubricators, signal rods, cable pipes, which are likely to obstruct the tamping tools should be clearly marked and made known to the operator before the start of the work.
- (xiii) Wooden blocks and jogged fish plates shall be removed temporarily ahead of tamping.
- (xiv) In electrified sections, the earthing; bond should either be removed or properly adjusted for tamping

3.13 Operations During Tamping

The following points should be observed by the machine operator and the Section Engineer (P Way):-

- i) The gap between top edge of the tamping blade and the bottom edge of the sleeper in closed position of the tamping tool should be adjusted depending upon the type of rail and sleepers. The gap for different types of sleepers will be as under:
 - a) Metal sleeper : 22-25mm
 - b) Flat bottom sleeper : 10-12mm
- ii) The tamping (Squeezing) pressure should be adjusted according to the type of sleeper as under:
 - a) CST-9 sleeper : 90 - 100 kg/sq.cm
 - b) ST or wooden sleeper : 100 - 110 kg/sq.cm

c) PSC sleeper : 110 - 120 kg/sq.cm

iii) Care should be taken to ensure that tamping tools are inserted centrally between the sleepers into the ballast to avoid damage to sleepers. The number of insertions of the tamping tool per sleeper varies with the type of sleeper and the amount of track lift to be given. While tamping, following guidelines should be adopted:-

a) CST-9 sleepers and steel trough sleepers may require double insertion before passing on to the next sleeper.

b) Wooden sleepers, require one insertion up to 20 mm lift and two insertions for lifts above 20mm.

c) One additional insertion for joint sleepers will also be required.

d) Concrete sleepers require one insertion upto 30 mm lift. Two insertions may be required for lifts above 30mm.

iv) For maintenance packing, squeezing time of 0.4 second to 0.6 seconds should normally be adequate. Higher squeezing time may be required for track with caked up ballast.

v) The machine should have full complement of tamping tools. The tamping tools should not be loose or worn out. The wear on the tool blade should not be more than 20% of its sectional area.

vi) A ramp of 1 in 1000 shall be given before dosing the day's work and obligatory point. The next day's work shall begin from the point of commencement of previous day's ramp.

vii) If work is to be done during night, sufficient lighting at work site should be ensured.

viii) Care shall be taken to provide for Slew and lift compensation as necessary. Heavy slewing or lifting should normally be done in steps of not more than 50 mm. For LWR/CWR track, the relevant provisions of LWR manual shall be adhered to.

ix) During tamping, the parameters of tamped track should be checked immediately after tamping for cross level and alignment and necessary corrective action should be taken.

3.14 Post Tamping Operations

The Section Engineer (P. Way) shall pay attention to the following items:-

i) Checking and tightening of loose fittings.

ii) Replacement of broken fittings.

iii) The ballast shall be dressed neatly. Proper consolidation of ballast between the sleepers shall be done.

iv) Final track parameters should be recorded with the help of recorders provided in the tamping machine. A copy of this record should be kept with the Section Engineer (P. Way) and the recorded values should not exceed the following limits:

TABLE 3.1

<i>Parameter</i>	<i>Not more than 10 peaks per km to exceed this value</i>	<i>Any peak exceeding this value</i>
Alignment	± 4 mm	± 6 mm
Cross level	± 6mm	-
Unevenness	6 mm	10 mm

If the recorder is not available, then track parameter of at least four stretches of 25 sleepers each per kilometre of tamped track should be recorded. In addition, the versines and super-elevation of curves shall be recorded for at least ten stations at a specified cord length.

(v) While working in LWR territory, the provision of **Manual of Instructions on Long Welded Rail - 1996** should be followed.

(vi) The fixtures like check rails removed during pre-tamping operation should be restored.

3.2 Tamping Machine For Points & Crossing (Unimat)

Tamping of turnouts shall be planned to cover sufficient length of approach track taking into account the special track features on either side. In case of the turnout leading to loop line, the turn in-curve shall also be tamped. In addition to provisions contained in **para 3.1** for plain track tamper, the following aspects shall be taken care of.

3.2.1 Pre Tamping Operations

- i) Layout including spacing of sleepers as per relevant drawings shall be ensured.
- ii) The nose of the crossing may get battered or worn or the sleepers below it may get warped or bent. In such cases, the crossing should be reconditioned or replaced and sleepers below the crossing should be attended.
- iii) High points on the turn out and approaches should be determined and general lift should be decided. General lift of minimum 10 mm must be given.

3.2.2 Operations During Tamping:

- i) For packing turnout, main line is to be tamped first. While tamping mainline, the additional lifting arrangement lifts the turnout side rail also. The lifted end of sleepers should be adequately supported on wooden wedges till it is packed/tamped.

- ii) The machine carries out correction of alignment and levels on main line portion. On the turnout side, only tamping without lifting and lining shall be done.
- iii) The squeezing pressure to be applied is as follows:
 - a) ST sleepers/wooden sleepers: 110-115/sq.cm
 - b) PSC sleepers: 135-140 kg/ sq. cm
- iv) In case there is hindrance to achieve adequate penetration of tool, penetration assistance system should be used to facilitate insertion of tools in ballast and to accelerate lowering of tamping units.
- v) During and before tamping, S&T and Electrical staff should also be associated to complete their portion of work

3.2.3 Post Tamping Operations

The post tamping operations shall be same as that of plain track tamping. Special care should be taken to tighten and complete the fittings. All S&T/Electrical connections removed before tamping shall be restored back.

3.3 Ballast Cleaning Machines (BCM)

Normally a tamping machine and preferably a DTS should also work along with Ballast Cleaning Machine

3.3.1 Pre-Requisites For Working of BCM

- i) The cutter bar will cut the formation and form channel under the track, if minimum 250 mm ballast cushion (caked and clean) is not available. If the availability of cushion is less, the track can be temporarily lifted up to 100 mm by BCM itself during working. If this temporary lifting is inadequate, the track shall be lifted up to desired level in consultation with Traction Distribution branch in electrified areas.
- ii) Since the cutter bar moves continuously below the track, the machine can not work if there is any lateral or vertical infringement. For such locations, either some special preparations are required or work has to be done manually.
- iii) Since the setting and closing time of the machine is longer, a block of at least four hours is necessary to effectively utilize the machine.
- iv) Adequate arrangements for supply and training out of ballast shall be ensured.
- v) While working in LWR territory, provisions of **Manual of Instructions on Long Welded Rails-1996** should be followed.

3.3.2 Operations Prior To Deployment of Machine

- i) Foot by foot survey of the section shall be conducted to see the condition of track components, ballast, cess width and availability of land for waste disposal.
- ii) Requisite survey shall be carried out and the longitudinal profile and alignment shall be finalised as per the relevant provisions in the **Indian Railways permanent Way Manual-1986** and **Schedule of Dimensions-1939**.
- iii) Depth of cutting/magnitude of track should be decided on the basis of proposed rail level. The longitudinal section showing formation level, existing and proposed rail levels should be plotted on a graph sheet. Otherwise, aid of computer along with suitable software may be taken. The final rail level shall be transferred on pegs or traction masts.
- iv) The pockets of the ballast beyond the reach of cutter chain shall be transferred in its cutting width before commencement of deep screening.
- v) It should be ensured that there is no obstruction in the width of 4100 mm to avoid infringement to cutter chain. Rail pegs of LWR, creep posts etc should be removed. Pucca drain walls, if infringing, should be dismantled, alternatively the track can be slewed temporarily.
- vi) In electrified section, distance of foundation of mast from track centre will have to be accurately measured to ensure free movement of cutting chain.
- vii) Any signal rodding or cable which is likely to interrupt the work should be temporarily removed.
- viii) Approaches to bridges which can not be screened by the machine should be screened manually in advance of the machine working.
- ix) Level crossings should be opened in advance so as to enable machine to work.
- x) Sleepers should have all the fittings intact so that no sleeper becomes loose and come in the way of cutter chain while the ballast is being excavated. Broken tie bar and ST sleepers should be replaced.
- xi) Gas cutting equipment should be available at site to cut any obstruction like rail pieces, pipes etc, which might get entangled with cutting chain.
- xii) Spoil disposal units should be attached with the machine while working in station yards, cuttings or multiple line section where dumping of the spoil along the cess is not feasible. If waste is to be disposed off across any adjacent track, the adjacent track shall also be blocked for traffic.
- xiii) A trench of 30 cm depth and one metre width should be made for lowering cutter-bar by removing one sleeper or re-spacing of sleepers.

3.3.3 Operations During Traffic Block

- (i) When the machine reaches site, the cutter bar should be lowered in the trench, both ends of cutter bar shall be connected to guides through links. For subsequent work, cutter bar is left under the track.
- (ii) When the machine starts working, cutter bar scarifies the ballast. Links of rotating chain push ballast in the inclined guides and lead the ballast to screening unit. One person on either side should move with the machine to watch for any obstruction to cutter chain, so as to arrange for stoppage of the machine immediately. Thereafter, the necessary corrective action should be taken.
- (iii) Screening should be stopped well before expiry of traffic block to permit proper closing of the work and packing before resumption of traffic.
- (iv) If the machine stops moving during work, it should be ensured that gates for clean ballast below screen are instantly closed. Otherwise, the screened ballast will get heaped up at one place.
- (v) Utmost caution should be observed while manipulating movement of waste conveyor to avoid hitting against electrical mast/signal post. Safety switch provided to sense the mast should, therefore, be kept 'ON'
- (vi) All the staff working with the machine should wear safety helmets and masks to avoid inhaling dust.

3.3.4 Operations after Deployment of Machine

- i) At the end of work, about five sleeper spaces are left without ballast. These should be filled manually with clean ballast.
- ii) The vertical and lateral clearances for OHE, signal post and any other structures should be checked and adjusted before cleaning the BCM block.
- iii) Ballast recoument activity should synchronise with deep screening activity so as to enable raising speed to normal after necessary packing.
- iv) One watchman should be posted at the location where cutter bar and chain are left whenever considered necessary.
- v) It is desirable that one round of tamping along with DTS should be carried out immediately after deep screening to resume traffic at a speed of 40 kmph.

The combining of BCMs, training out of ballast and DTS in the same block should be considered for opening of track at 40 kmph while clearing the block.

3.4 Shoulder Ballast Cleaning Machine

The working principles, preparations and operations of this machine are almost same as those of plain track ballast cleaning machines. In addition, following aspects should be given attention.

3.4.1 Operations Prior to Deployment of Machine

- i) Any obstruction existing in the shoulder area should be removed.
- ii) Excess ballast from centre of the track should be shifted to the shoulders so that along with shoulder ballast, it is also screened.

3.4.2 Operations During Block

After taking the machine to the site, the operator shall set the excavating units such that they do not touch the sleeper. The depth of excavating units is set hydraulically taking care to provide required cross slope. Thereafter, the conveyor belt is unlocked and turned to desired direction. Similarly plowing, grading units, conveyor belts and vibrating units are set as per the manual of the machine. It takes about five minutes for setting up the machine from drive mode to working mode. Other aspects to be watched are given below:-

- i) In case of single lines, full depth of the haunches should be excavated to ensure good drainage.
- ii) In case of double lines or multiple line sections, full depth of the haunches should be excavated on cess side. Between the track, the depth of haunch excavation should be just sufficient to provide continuity to drainage line of the cribs.

3.5 Portal Cranes (PQRS)

3.5.1. General

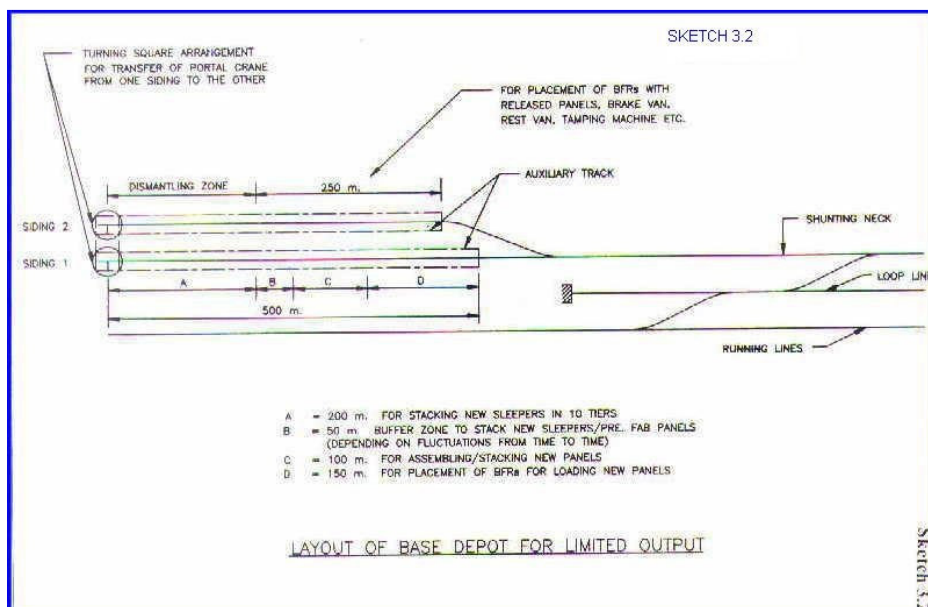
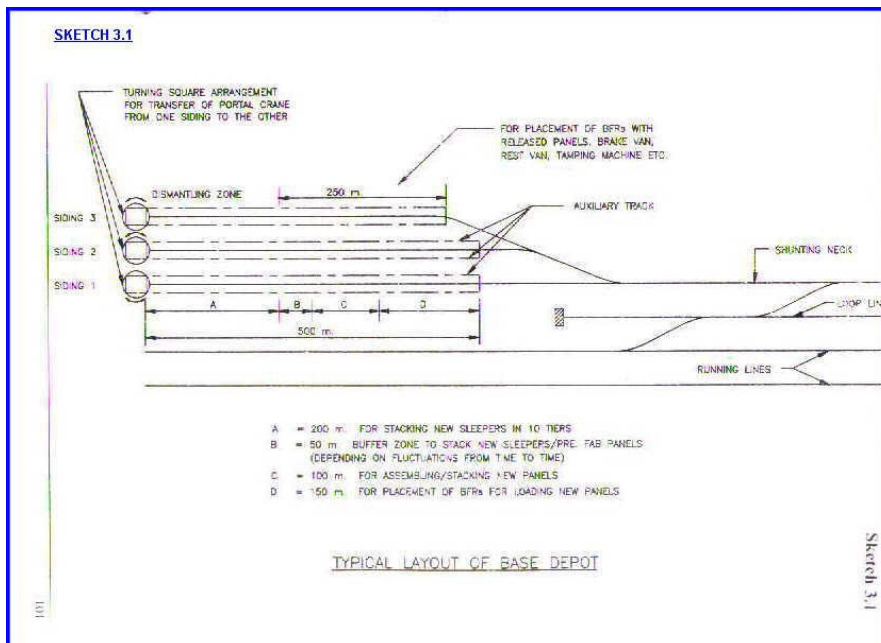
- i) Portal Cranes, commonly referred to as PQRS, are used for mechanised track renewals. These are loaded on BFRs' and hauled to the site. Normally two portal cranes are deployed for the relaying work at site, while the third one is utilised for pre-assembly of new track panels at the base depot. The third portal crane also acts as a standby in case of breakdown of the portals at site.
- ii) Tamping machine should be deployed behind the portal cranes for lifting and tamping of newly laid track.
- iii) Minimum block of 2 hours and 30 minutes duration should be arranged.
- iv) Adequate spares for working of all the machines (Portal Cranes and Tampers etc) should be arranged in advance and regular supply should be ensured.

3.5.2 Pre-requisites

Following are the pre-requisites for the relaying work with portal cranes:-

A well organised and properly laid out base depot is the back bone of relaying by portal cranes. A typical layout of the base depot is shown in **sketches 3.1, 3.2 and 3.3**. Smooth functioning of base depot will ultimately reflect in efficiency and productivity of the relaying work. The base depot is required to cater to the following activities:-

- a) Unloading of PSC sleepers from the rake and staking.
- b) Fabrication of new panels.
- c) Unloading of released panels.
- d) Dismantling of released panels.
- e) Loading of pre-fabricated new panels.
- f) Formation of PQRS rake.
- g) Maintenance of machines.
- h) Dispatch of released materials.
- i) Loading/unloading of ballast, if the base depot is also to be used as ballast depot.



- a) Unloading of PRC sleepers from the rake and stacking.
 - b) Fabrication of new panels.
 - c) Unloading of released panels from PQRS rake.
 - d) Dismantling of released panels.
- ii) It is desirable to locate the Base Depot at a central place such that the distance of remotest work site on either side does not exceed 60-70 kms. At the same time, the site selected should be accessible by road; there should be electric power supply and watering facilities. The base depot may have facility of entry and exit on both sides from the running line.
- iii) For smooth working the base depot should have at least three sidings of 500 metres each connected to a shunting neck of 350 metres. Of these, at least two sidings should be provided with auxiliary track for movement of portal cranes.
- iv) It is desirable to illuminate the base depot so that the activities listed in item (i) above can be undertaken safely at night.
- v) To strengthen depot working, it is desirable to install a few hand operated/motorised gantry cranes moving on auxiliary tracks in addition to the third portal crane in the depot. Some of these gantry cranes can be of 6.5 metres height from rail level to facilitate repair to portal cranes.

3.5.3 Pre-Relaying Operations

Following operations should be ensured before actual relaying:-

- i) The requisite survey shall be carried out and the longitudinal profile and alignment shall be finalised as per relevant provisions in the **Indian Railways Permanent Way Manual-1986** and **schedule of dimensions-1939**.
- ii) Track may be deep screened one or two days in advance of relaying. The ballast section should be built up to the bottom of sleepers to facilitate relaying. The balance quantity of screened ballast should be trained out after relaying.

- iii) Auxiliary track should be laid at 3400 mm gauge keeping the central line same as that of main line track, as shown in **Sketch 3.4**, CST-9 plates or wooden blocks of size 560 × 250 × 125 mm should be used at 1.5 to 2.0 metres distance for laying the auxiliary track. The length of auxiliary track should match with the daily progress of work.
- iv) The level of auxiliary track should be same as that of existing main line track and must have proper longitudinal and cross levels to avoid derailment of portal cranes. In no case, the auxiliary track should be more than 50mm higher than the existing track.
- v) Removal of ballast from the crib and shoulders up to the bottom level of the sleepers should be ensured.
- vi) Full fittings of the old sleepers should be ensured to avoid their falling off while lifting released panels.
- vii) Sleepers must be in single piece. All Broken sleepers should be removed or replaced in advance.
- viii) On girder bridges, the guard rails at the approaches on both ends should be removed temporarily.
- ix) In case a level crossing is to be encountered, it should be opened in advance.
- x) Proper planning and insertion of Switch Expansion Joints at correct locations should be ensured.
- xi) Cutting of LWR/SWR to single rails should be ensured for lifting released panels. Otherwise, replace the existing running rail by service rails for the stretches which are to be relaid during the next day.
- xii) Temporarily disconnect or remove any other permanent obstructions such as cables, signalling rods and any other installations like embedded rail pieces, tie bars etc. to allow unhindered progress of work.
- xiii) Availability of under noted equipments should be ensured at site:-
 - a) One set each of rail cutting and gas cutting equipment in good working condition.
 - b) Two sets of rail closures of the each rail section being laid, in various sizes from 0.5m to 3m lengths.
 - c) 4 sets of junction fish plates with bolts.
- xiv) Portable walkie-talkie sets should be provided at each relaying site for effective communication between the site of work and the adjoining stations.
- xv) Extra number of track panels should be fabricated in the base depot to maintain a buffer stock for one or two days of relaying work so that work at site does not suffer for want of depot working

3.5.4 Post Relaying Operations

Following post relaying operations should be ensured :-

- i) Clearance of track from any obstructions before removal of traffic block.
- ii) Complete track lifting including their correct positioning & tightness.
- iii) Proper lifting, packing, ballast regulating and compaction/stabilisation of track to raise the speed of the different stretches as per the **table II of para 308 of IRPWM**.
- iv) Training out of adequate quantity of ballast over the newly relayed track to full ballast section. Ballast recoument activity should be properly synchronised with the relaying activity so as to enable raising of speed to normal in three cycles of tamping by on-track tampers.
- v) Picking up of left over released materials.
- vi) Dismantling of auxiliary track and relaying the same in advance for the next day's work.
- vii) Restoration of cables and other fixtures e.g. guard rails on level crossing which were removed temporarily.
- viii) Tie tamping machines, BRM and Dynamic Track Stabiliser should be deployed to enable raising of speed to normal.
- ix) Provision of SEJ as per approved plan. In-situ welding of panels and destressing of LWR should be done after welding of panels.

3.6 Track Relaying Train (TRT)

3.6.1 Operations Prior to Development of Machine

i) Base Depot

- a) Ensure proper selection of Base Depot site. The base depot for TRT should be centrally located (30-40 kms. lead) in the area of working. It should have water, electricity and communication set up. Also, accommodation for machine and P. way staff should be available.
- b) Provide sufficient stock of new sleepers, elastic rail clips fastenings, liners and rail pads in the base depot.
- c) Ensure proper line and level of auxiliary track for 3400/3700 mm gauge portal working.
- d) 30 nos. BFR's should be modified for one set of TRT. 160 sleepers are loaded in one BFR and about 1500-2000 sleepers should be loaded as required during block. While loading PSC sleepers on special BFRs, wooden battens of 75 mm × 75 mm should be provided between different layers on the outer side of MCI inserts. This will enable gripper to function properly.
- e) Load rail fastening like elastic rail clips, liners and rail pads as required during block.

- ii) Condition of sleepers should be seen .All corroded and broken steel/CST-9 sleepers should be marked.
- iii) Foot by foot survey should be carried out to identify the locations having lateral or longitudinal infringements. There should be no infringement within one metre of sleeper ends.
- iv) Adequate ballast should be available before relaying operations start so that tamping and raising of speed is not delayed.
- v) Deep screening should be carried out in advance wherever feasible. Excess ballast should be removed and shoulders should be brought down wherever feasible to sleeper level. It should be ensured that the ballast bed is fully consolidated.
- vi) Check-rails of the level crossings falling in the range of work should be removed in advance.
- vii) All longer fish bolts and joggled fish-plates should be removed from the range of work.
- viii) New rails should be unloaded, paired, fishplated or welded in one piece (as required for a day's work) and set at about 1.5 metres from track centre. Rails should be kept on foot with adequate support so that they do not get shifted during working of the TRT.
- ix) All obstructions like creep posts, alignment posts etc. within 1 metre of sleeper end should be removed.
- x) All reverse jaw sleepers in case of CST-9 sleeper track should be removed. Alternatively, their lip may be cut by lip cutter so that rail removal is not obstructed.
- xi) All longer wooden sleepers from joints be either removed or cut to size in advance of TRT working
- xii) Interlaced sleepers of height different from remaining sleepers should be removed.
- xiii) Ensure that the fittings in old track are not jammed and can be removed while working. Loosen them if any problem is anticipated.
- xiv) In case of CST-9 sleepers, gauging should be done in advance to avoid hitting of sleepers by sled assembly during lifting of CST-9 sleepers.
- xv) Seven wooden sleepers should be laid in track at a location 5 sleepers behind the rail cut and ballast around them removed for easy placement of plow.
- xvi) The location of cut at new site of work should be so planned that it matches with the new rail end for threading at the start of work.
- xvii) At location where relaying is to start, two rail pieces of 7.3 metres length are cut and connected together using well greased fishbolts to enable quick opening during block.

- xviii) Plan the location of cut in the old track at the closing of work site so that it matches with the rail end of new rail panel. Some extra gap is preferable, as the new rail while threading in is likely to straighten and extend.
- xix) Walkie-talkie sets for communication should be available with engine driver, Junior/Section Engineer (P. way) machine staff and adjoining stations.
- xx) Ensure availability of S & T staff to connect- any wire/rodding disturbed during the block, and OHE staff (in electrified section) for opening of temporary bonds and bonding back after the work.
- xxi) Ensure removal of OHE bonds before the block. Temporary bonding of the OHE masts should be done by OHE staff while removing these bonds .
- xxii) Ensure earth bonding of new rail panels. There should be minimum 3 bonds in each panel length of 300 metres.
- xxiii) Ensure removal of alternate keys in case of CST-9 sleepers and inside alternate keys in case of ST sleepers. The remaining keys should be checked for easy removal.
- xxiv) Existing small nos. of PSC sleepers (2 rail lengths) should be replaced with wooden sleepers to avoid loss of time while working.
- xxv) High temperature destressing of the old track should be carried out as provided in **Manual of Instructions on Long welded rails-1996**.

3.6.2 Manual Operations During The Block

- i) Shield hydraulic pipes and other moving parts of the TRT so that in case of any mishap, these do not hit OHE mast.
- ii) Take OHE block, if staff is required to climb on top of the machine for repairs etc. in case of any break down.
- iii) Ensure proper track protection at the site of work, look-out men and hooter in good working order to give warning for train approaching on the other line.
- iv) Utmost caution should be taken while lowering and raising Clamp in order to avoid infringement to the adjacent line.

3.6.3 Post Block Operations

- i) Ballasting of the track should be done immediately after track relaying operation.
- ii) Then Ballast Regulator, Tie Tamping machine and Dynamic Track Stabiliser should be deployed to enable raising of speed to normal in shortest possible time.
- iii) In-situ welding of isolated joints should be done before restoration of speed to normal.

- iv) Switch Expansion Joints should be provided at locations as per approved LWR/CWR plans.
- v) Check rails should be provided at level crossing after final tamping of the track.
- vi) Destressing of LWR should be done immediately after welding the rail panels to long welded rails.

3.6.4 Precautions

The following precaution should be taken for TRT working :-

- i) It should be ensured that the ballast bed of newly deep screened track is fully consolidated and there is no fear of settlement of ballast bed during TRT working.
- ii) Do not unload excess ballast in advance as this causes excessive drag on the machine traction.
- iii) Do not open out all keys in advance. This should be opened up only as the machine rake approaches the planned site of renewal.
- iv) Do not stand close to the machine or modified BFRs and do not touch the gantry rails.
- v) Do not stand on the BFR while the gantry is moving over with new/old sleepers.
- vi) Do not allow the gantry to stand with its wheels on different BFRs.
- vii) Without work, do not sit on the rail seat meant for liner/rubber pad placement.
- viii) Do not climb to the top of TRT without OHE block in electrified section.

3.7 Points And Crossings Changing Machine (T-28)

3.7.1 Pre-Block Operations

Following preparations are to be made :-

- i) New turnout should be assembled using Jib Crane near the site of turnout to be replaced. The fittings of assembled turnout should be complete and properly tightened. If suitable location is not available near by, assembly may be done away from site and then transportation can be done with the help of trolleys. Infringements on the way should be checked and movement with slewing accordingly may be planned.
- ii) The assembled turnout should be loaded on trolleys for transportation.
- iii) Rails on either side of existing turnout should be of the same section as that of new turnout.
- iv) Deep screening of turnout portion should be done. Ensure required cushion and proper drainage. Rail levels should be taken for sufficient length on either side of turnout. Proposed rail profile should be plotted both for main line and loop line.

- v) Point machines should be disengaged and turnout should be non-interlocked before taking up its replacement.
- vi) Ballast from crib and shoulder of sleepers should be removed up to sleeper bottom for full turnout length.
- vii) 60 wooden blocks, each approximately 60 cm long, should be kept ready for facilitating passage of crawler on the obstacles.
- viii) 4 nos. of rail pieces each 70 cm long should be kept ready for housing; below the rail wheels of the crane.
- ix) Jumpering of both ends of the turnout should be done by electrical staff before lifting and removing of existing turnout.
- x) Adequate arrangements should be made for protection of the line involved and adjacent lines while the machine is working.
- xi) Fish bolts should be lubricated and worked to facilitate easy removal during block.
- xii) Location where clamp of each crane will hold the crossing and switch portions for lifting should be marked on the assembled turnout.

3.7.2 Operations During Block

- i) Immediately after getting traffic block, the fish bolts of existing turnouts should be opened.
- ii) Both cranes should be traversed and brought in position for handling the existing turnout at the demarcated position.
- iii) Old turnout should be lifted by cranes and traversed to suitable location for further dismantling after the block.
- iv) The crane should be traversed to the pre-assembled concrete sleeper turnout and both the cranes should be taken to demarcated position on turnout.
- v) Simultaneously, the gangs should scarify the ballast from the location where the turnout has been removed. The ballast bed is lowered to accommodate extra height in case of concrete sleepers.
- vi) The crawler side frame of the cranes should be spread suitably in stages to accommodate the length of the turnout sleepers on their demarcated locations for each crane.
- vii) Pre-fabricated turnout should be held by the crane. The cranes with the turnout be traversed across in stages and brought to the location of laying. The turnout is laid in position and fish plates are bolted to the existing track.
- viii) One crane is traversed on the track and the second is utilised for final alignment of turnout. After placing the turnout, gangs should fill back the ballast manually.

3.7.3 Post Block Operations

- i) Ballast deficiency should be made good by putting additional ballast. Profiling and boxing of ballast should be done.
- ii) The turnout should be tamped with the help of UNIMAT machine. Both alignment and levels should be corrected while tamping the turnout.
- iii) The turnout may be interlocked and point machine engaged immediately after laying the turnout.
- iv) Damage to the cess during block operation should be made good.
- v) Provision of proper earthing points should be ensured by the Electrical staff.

3.7.4 Miscellaneous

- i) Because of small diameter of wheels (400mm) of the machine, fixed diamond crossing must be avoided in the section, where machine is required to run in service.
- ii) The maximum permissible speed of crane is 10 kmph when it runs on its own power.
- iii) Whenever travel is shorter (approximately 100 metres) and no major obstacles exist, travelling on crawlers is recommended. During traverse of crawlers with lifted turnout, cranes can turn around ± 5 degrees.
- iv) Motorised trolley is designed to perform 300 mm lateral shifting on both sides and this is to be used to correct the loading of crossing portion which is wider. By lateral shifting of the trolley platform, obstacles on the way may be avoided.

.....

CHAPTER 4

RULES FOR MOVEMENT AND WORKING OF TRACK MACHINES

4.1 General:

- (i) Track machines are self propelled machines, hereinafter referred to as **machines**. These machines shall be worked as a train except when attached in the rear of a train, they will be treated as part of that train. However, when self propelled, there is no need for a guard or a brake van. Hauling of another machine/coach/wagon which may be un-braked shall also be permitted. The machine operator should take adequate care to ensure safe running, especially in steep gradient sections.
- (ii) When more than one machines are required to work within the same block section, these machines may be allowed to move into the block section in a convoy under one authority as detailed in this chapter. In such situation all the track machines must leave and enter the section simultaneously one after another keeping adequate distance among them and with proper authority as detailed further in the following paras.
- (iii) In case of run through movement from one station to another station, up to three machines may be allowed under one authority to enter in a section with ruling gradient not steeper than 1 in 100. For gradient steeper than 1 in 100, only one machine shall be allowed at a time in the block section in case of run through movement.
- (iv) Whenever the track machines are working in an integrated traffic block where other railway agencies are also working, the relevant instructions for integrated block working should be followed.

4.2 Incharge of Machines

4.2.1 Each machine shall be under the direct charge of Section Engineer/Junior Engineer (machine) hereinafter called the '**Operator**'. Number of railway staff on driving cab of each machine shall not exceed five. The operator shall have valid competence as defined in **para 4.3**.

4.2.2 The track machine shall work under the direct supervision of an Engineering official, not below the rank of Section Engineer (P. Way), who will be responsible for taking the traffic block and for protection of the line while the work is in progress and also timely clearance of block after the completion of the work ensuring the safety of the track.

4.3 Competency of Operator

4.3.1.

The operator shall be fit in A-3 medical category. If wearing spectacles, he shall carry one extra pair while on duty.

Technicians and helpers working on Track Machines shall be fit in B-1 medical category.

(4.3.1 Revised as per correction slip no.7 dated 07.4.2004)

4.3.2 The operator shall undergo training in train working rules at the zonal training centre/ IRTMTC, Allahabad . On successful completion of training, he shall be examined and if found competent shall be issued a competency certificate by Dy. Chief engineer of machines which shall be valid for 3 years and shall be kept in personal custody of the operator . The certificate shall be produced promptly when required.

4.3.3.

“The operator shall apply to the Dy.Chief Engineer incharge of the machines well in advance of the date of expiry for renewal of the competency certificate. The officer shall renew the certificate for further period of three years at a time after holding a test. The operator shall, however, be required to go for a Refresher Course in Zonal Training Centre/IRTM TC, Allahabad, within a period of 3 (three) years.

(4.3.3 Revised as per correction slip no.6 dated 13.01.2004 para A)

4.4 Safety Equipments

4.4.1 The operator shall be responsible to ensure that the following equipments complete in all respects and in working condition are available on his track machine before the machine is put on a running line:-

- i) Two red and one green hand signal flags.
- ii) Two tri-colour hand signal lamps.
- iii) Two chains with padlocks.
- iv) Two Clamps with padlocks.
- v) Twelve Fog signals (detonators) in a tin case.
- vi) A copy of the working timetable of the section where the machine is working.
- vii) **G&SR** book with upto date amendment slips.
- viii) One 4 cells flasher light.
- ix) One portable field telephone.
- x) Two banner flags.
- xi) One first aids box.
- xii) Two Skids.
- xiii) Patromax/LPG lamp
- xiv) Safety helmets for all machine staff
- xv) Protective clothing, safety shoes and safety gloves
- xvi) Track Machine Manual
- xvii) Accident Manual

4.4.2 Head and Tail Lights

Each track machine must be equipped with prescribed head and tail lights, marker lights and flasher lights as per thereof. Each machine shall display LV board/tail lamp if moving alone. While moving in convoy, the LV board machine in the direction of movement.

4.4.3-The following equipments should be available on the machines during block working to meet the exigencies: **(CS15)**

(i)	Fire extinguisher:	One
(ii)	Hooter (manual):	Two
(iii)	Jack 50 t.	Two
(iv)	Wooden blocks	Four
(v)	Crow bars	Four
(vi)	Hydraulic hand pump	One
(vii)	Emergency pneumatic/hydraulic hose off sizes suiting to different machines (Complete with end fitting)	One
(viii)	Wire rope with close loops at both ends 2 meters and 9 metres for BCM	One each

4.5 Rules For Operation

4.5.1. General

- i) When the track machine(s) is/are stabled at a station, necessary precautions against rolling down such as pinning down hand brakes, chaining and provision of skids, shall be taken.
- ii) No track machine shall be moved between a running line and the siding/stabling line without the written permission of the Station Master on duty in the form of shunting order/shunt signals.
- iii) When the track machine is required to move from one block station to another block station, the operator(s) shall run the machine only with **proper authority to proceed**.

The track machine(s) shall work under line block only, The Junior Engineer/Section Engineer (P. Way) shall give the requisition for block in duplicate to Station Master on duty, indicating therein the number of track machine(s) that will work, the duration of block required and whether the machine(s) will proceed to the next station or return back to the starting station after the work. After the block is granted and the Station Master returns the copy of the requisition

endorsing the duration and other special instructions like work and proceed, work and return via right or wrong direction, the Junior Engineer/Section Engineer (P. Way) shall accompany the machine(s) to the work site.

Station Master will issue a special caution order indicating number of machines and other railway agencies permitted and their work in the block period. Special Caution Order will be got signed by the Junior Engineer/Section Engineer (P. Way), from the operators of track machines.

4.5.2 Single Line Sections - Work and Proceed

Station Master will obtain line clear, take off dispatch signals and issue special caution order indicating the number of machines permitted and the work in the block section. Junior Engineer/Section Engineer (P. Way) shall move thereafter with token if any, shunting key, OPT form etc., ensuring piloting if due. He shall travel in the last machine in case proceeding ahead.

On completion of the work, the machine(s) will be received by lowering reception signals, display of signal at the foot of first stop signal by station porter till the last machine enters the station.

At the station in advance, the token and the key etc. if any, shall be handed over after the last machine has cleared the block section. The Junior Engineer/Section Engineer (P. Way) shall certify the fitness of track then only the Station Master will clear the line for normal train operation subject to the observations of speed restriction.

4.5.3 Single Line Section-Work and Return

i) With Taken Tablet instrument

Station Master will obtain line clear from station in advance, lower last stop signal, issue special caution order indicating the number of track machine(s) permitted to work within the block section, the stations where they will return etc. The special caution order will be handed over to the Junior Engineer/Section Engineer (P. Way) along with token/tablet. Junior Engineer/Section Engineer (P. Way) shall travel on the first track machine.

On completion of the work, the machine(s) will be received by lowering reception signals. Station porter shall display green flag/signals at the foot of first stop signal till the last machine enters the station. Junior Engineer/Section Engineer (P. Way) shall hand over the token as well as special caution order to the Station Master on duty only when all the machines have cleared the block section, he will also issue a certificate to the Station Master that track is fit for train movement. Then only Station Master will cancel the line clear and normalise the block instrument.

Similar procedure shall be followed in case of block working through axle counters. However, no physical authority to proceed will be handed over to Junior Engineer/Section Engineer (P. Way).

i) With Tokenless Block Instrument

Station Master will block back the section, take out the shunting key, issue a special caution order indicating the number of track machine(s) permitted to work within the block section, the station where they will return etc. which will be signed by all the operators of track machines and will be handed over to the Junior Engineer/Section Engineer (P. Way) along with the shunting key. In addition to it, requisite written authority for passing signal at danger as prescribed will also be issued. Junior Engineer/Section Engineer (P. Way) Incharge shall travel on the first track machine.

On completion of the work, the machine(s) will be received by lowering reception signals. Station Porter shall display green flag/signals at the foot of first stop signal till the last machine enters the station.

Junior Engineer/Section Engineer (P. Way) shall hand over the shunting key as well as the special caution order to the Station Master on duty only when all the track machines have cleared the block section. He will also issue a certificate to the Station Master that the track is fit for train movement. Then only, Station Master will remove the 'Block Back'.

4.5.4 Double Line Section-Work and Proceed

i) Via Right Direction

Station Master will obtain **line clear** from station in advance, lower last stop signal, issue a special caution order indicating the number of track machine(s) permitted to work within the block section which will be signed by all the operators of track machines and will be handed over to the Junior Engineer/Section Engineer (P. Way). Junior Engineer/Section Engineer (P. Way) Incharge shall travel on the last track machine.

On completion of the work, the machines will be received by lowering reception signals, Station porter shall display green flag/signals at the foot of first stop signal till the last machine enters the station.

On reaching the station in advance, Junior Engineer/Section Engineer (P. Way) shall hand over the special caution order only when the last machine clears the block section. He will also certify that the track is fit for train movement. Then only, the Station Master will clear the block.

ii) Via Wrong Direction

Station Master will take the line clear from station in rear on block telephone indicating the number of track machines which will work from that station upto the next station, **prepare paper line clear ticket**, issue **special caution order** clearly indicating the number of track machines to the station to which the machines will go on completion of work. The paper line clear ticket and the special caution order shall be signed by all the operators and then shall be

handed over to the Junior Engineer/Section Engineer (P. Way) who shall travel on the last machine.

The machine(s) shall be piloted out of the station on a written authority issued by the Station Master after all the facing points have been correctly set and locked and trailing points correctly set over which the machine(s) will pass.

On approaching the next station after completion of the work, the operators shall bring their machines to stop opposite the first stop signal pertaining to the right line or at the last stop signal pertaining to the wrongline (on which they are running) whichever they come across first and wait and proceed as piloted or follow **GR 4.44**.

The Station Master at the other end of the block section shall depute a Railway staff in uniform at the foot of the signal (whichever the machines would encounter first) who shall stop the machines on danger hand signal and thereafter pilot them into the station on a written authority issued by the station Master.

If the operators find that no Railway servant in uniform has been deputed at the foot of the signal to pilot the train into the station **GR 4.44** shall be observed.

All the crossover points in the facing direction, over which the machines shall proceed, shall be clamped and pad locked.

On reaching the station at the other end of the block section, Junior Engineer/Section Engineer (P. Way) will handover the paper line clear ticket, special caution order to Station Master only when the last machine clears the block section. He will also certify that the track is fit for train movement. Then only the Station Master will close the line and normal train running can be resumed.

4.5.5 Double Line Section - Work and Return

i) Via Right Direction

Station Master will block forward the section and arrange to put the needle of the block instrument directly to "Train on Line", take out the shunting key in case of 'Daido' Double Line block Instrument, issue special caution order indicating the number of track machines permitted to work within the block section, station where they will return etc. which will be signed by all the operators and will be handed over to the Junior Engineer/Section Engineer (P. Way) along with the shunting key, if any, Junior Engineer/Section Engineer (P. Way) shall travel on the first track machine. In addition, requisite written authority will be issued for passing the last stop signal at danger.

On completion of the work, the operators shall bring their machine to stop opposite first stop signal pertaining to the right line or at the last stop signal pertaining to the line on which they are running whichever comes across first.

Station Master shall depute a railway servant in uniform at the foot of the signal (whichever the machine would encounter first) who shall stop the machine(s) on danger signals and thereafter pilot them into the station on a written authority issued by the Station Master.

If the operators find that no railway servant has been deputed to pilot the train, **GR 4.44** shall be observed.

All the crossover points in the facing direction over which the machines shall proceed, shall be clamped and pad locked.

On reaching the station, Junior Engineer/Section Engineer (P. Way) will hand over the special caution order to the Station Master only when the last machine clears the block section. He will also certify that the track is fit for train movement. Then only the Station Master will close the line and normal working can resume.

ii) Via Wrong Direction

Station Master will block back the section as per extant instructions, put the needle of the block instrument directly to "Train on Line" take out the shunting key in case of 'Daido' double line block instrument issue special caution order indicating the number of track machine(s), station where they will return etc. which will be signed by the operators and then will be handed over to the Junior Engineer/Section Engineer (P. Way) along with the shunting key, if any. Junior Engineer/Section Engineer (P. Way) will travel on the first track machine.

The machines shall be piloted out of the station on a written authority issued by the Station Master after all the facing points have been correctly set and locked and trailing points correctly set over which the machines will pass.

On completion of the work the machines will be received by lowering reception signals. Station porter shall display green flag/hand signal at the foot of first stop signal till the last machine enters the station.

Junior Engineer/Section Engineer (P. Way) shall hand over the shunting key, if any, as well as the special caution order to the Station Master on duty, only when all the track machines have cleared the block section. He will also issue a certificate that the track is fit for train movement then only the Station Master will remove the block back.

4.6 Precautions

4.6.1 The Junior Engineer/Section Engineer (P. Way) is responsible for protection of the site of work and also for protection of adjoining track(s) in case of infringement. He shall be conversant with the infringing conditions of the various machines. He shall also be responsible for safe condition of track before clearing the block after machine working.

4.6.2 Some machines tend to foul the adjacent line, while working on double line section or in the yard like BRM, T-28 etc. If any part of a machine is likely to foul the adjacent line(s) while working, the Junior Engineer/Section Engineer (P. Way) shall request Station Master in writing to block the line(s). Such work shall only be undertaken if blocking of such adjoining line(s) has been permitted by the control and the Station Master and such adjoining lines have been protected.

4.6.3 While exchanging private numbers with level crossings, the Station Master on either side shall inform all the level crossings equipped with telephones falling in the block section.

4.6.4 While the track machines are moving in the block section in convoy, it will be the responsibility of the operators of these machines to maintain a minimum safe distance of 120 mtrs. from each other. If any of the machines is required to slowdown or stop due to some reason, the machine operator should ensure that red hand signal is displayed by waving vigorously. Where visibility is poor such as curves and cuttings, appropriate speeds and safe distance should be maintained by the machine operators. While approaching the level crossings, operators of all track machines shall keep a vigil for any obstruction and whistle freely till the machine passes the level crossing.

4.6.5 When the machine is stabled, the operator shall ensure that it is clear of fouling marks and traps and not obstructing the adjacent line(s). He shall apply the hand brakes, skid etc., to prevent movement of the machine.

4.6.6 The concerned points shall be set against the line on which the track machine is stabled and such points shall be secured with clamps or cotter bolts and pad locks. The keys of such pad locks shall be kept in the personal custody of Station Master until the machine is ready to leave from siding or running line. The operator shall not relinquish charge until he has satisfied himself that the machine has been properly secured and protected as prescribed herein.

During shunting on a line occupied by track machines, no machine shall be shunted without the presence of competent machine staff.

4.6.7 Temporary buffers or skids shall be provided to prevent rolling of stabled machines.

4.6.8. Track machine working is likely to produce a dusty atmosphere and/or heavy noise pollution. Hence extra care is necessary at site to ensure safety of workers. For this, the following steps should be taken:

i) Hooters should be provided on the track machines. These hooters should preferably have remote control operation so that the Lookout man standing around 150m away from the track machine can operate the hooter to warn the staff working on/around the track machine about approaching train on adjoining track.

ii) Temporary Whistle Board should be fixed on the adjoining track, which can be moved along with track machine worksite.

iii) It is necessary that all trains passing on the adjoining track should be issued a caution order "OBSERVE HAND SIGNAL WHISTLE FREELY AND STOP IF REQUIRED". Such caution order on the adjoining track is necessary due to high noise level caused by track machine and large concentration of staff working around it.

(iv) "The vertical and lateral clearance for OHE, Signal post and any other structure should be checked and adjusted before clearing the block. It shall be insured by supervisor working with track machine that there should be no infringement to Signal post, OHE and any other Structure as per schedule of dimensions"

(as per correction slips no.3 and 4)

4.7 Failure Of Track Machines In Mid-section

4.7.1 In the event of break-down, the track machines shall be protected as per **GR 6.03** and SR thereto by the machine staff, as directed by machine incharge.

4.7.2 Failures in block sections of the track machines will be treated as accident under class 'H'. Accidents involving track machines shall be treated as train accidents under the appropriate class and action shall be taken as per the rules in force.

4.7.3 In case of failure of track machine in block section, the Junior Engineer/Section Engineer (P. Way) may decide to push the disabled unit to the nearest station provided the brake power is in good condition. Otherwise, intimation shall be sent to the nearest Station Master through a messenger and to the Control through portable telephone asking for a light engine to tow the unit.

In case, machine incharge feels clearance of section is going to take long time, the assistance of Accident Relief Train shall be asked for immediately. Meanwhile the machine incharge shall take necessary action to rectify the defect(s).

4.8 Permissible Speed

Each machine will run within the maximum permissible speed sanctioned for that type of machine on a particular section.

4.9 Procedure for Introduction of New Type of Machine on Open Line

Sanction of Commissioner of Railway Safety is required for introduction of new type of machine on the open line. Application to the Commissioner of Railway Safety for sanctioning the running of new type of machine or increasing the maximum permissible speed on specified section(s) should ordinarily be made by Chief Engineer one month in advance. Application should be accompanied by following documents:-

- i) Load diagram.
- ii) Certificates for track strength.
- iii) Certificates for strength of bridges.
- iv) Certificate on form (**Annexure 4.1**) signed jointly by Chief Engineer and Chief mechanical Engineer. The certificate should also be signed by the Chief Operating Manager and Chief Signal and Telecommunication Engineer of the Railway, where maximum permissible speed for machine is proposed to be raised.

v) Statement in form-XII (**Annexure 4.2**) of the "Rules for Opening of railway or sections of railway for the public carriage of passengers" detailing any infringement of maximum and minimum dimensions involved in the running of the track machine .

(vi) Speed certificate issued by RDSO. The maximum permissible speeds of various track machines is given in **Annexure 4.3**.

(vii) Report of the oscillation trials/speed runs, to be supplied from RDSO, if required by CRS.

On receipt of such application, the Commissioner of Railway of Safety will, if he so desires to inspect and try out new machine. Railway Administration will afford him necessary assistance to do so.

4.10 Infringements

Some of the track machines infringe various dimensions as given in **Schedule of Dimensions-1939**. Machine-wise details of such infringements are given in **Annexure 4.3**

.....

Annexure 4.1

Speed Restrictions

<i>S.No</i>	<i>Kilometre</i>		<i>Nature of speed restrictions</i>	<i>Brief reasons restrictions</i>
	<i>From</i>	<i>To</i>		

.....

CME

.....

CEE

.....

CSTE

.....

CE

.....

COM

- Note:-**i) When the speed of a loco/rolling stock is to be increased or increase in speed is contemplated over the maximum sanctioned speed for that category of train (Passenger or Goods) over a particular section, the COM and CSTE should be associated
 ii) CEE should also sign wherever electric traction is involved.

4.2

Infringement of Maximum and Minimum Dimensions

.....Railway
GAUGE : 1.676 m

[illegible]

Annexure 4.3

Infringements of Schedule of Dimensions -1939 of Various Track Machines in Use Over Indian Railways

S. No.	Name of the Machine	Infringement Description	Actual Dimension of Machine (mm)	Dimension as per S.O.D. (mm)	Speed in Kmph	
					Self propelled	In train formation
1.	Duomatic & Unomatic Tamping Machine	i) Min. dia. of new wheel tread measured at 63.5 mm from wheel gauge face.	710	914	60	50
		ii) Max. distance apart of bogie centres.	11000	14785		
		iii) Min. rigid wheel base.	1500	1830		
2.	Continuous Tamping Machine (09 - 32 CSM)	i) Min. dia. of new wheel tread measured at 63.5 mm from wheel gauge face.	730	914	60	40
		ii) Min. rigid wheel base.	1800	1830		
3.	Points & Crossing Tamping Machine (UNIMAT 08-275-3S)	i) Min. dia of new wheel tread measured at 63.5 mm from wheel gauge face.	730	914	60	40
		ii) Min. rigid wheel base.	1800	1830		
		iii) Max. distance between any two adjacent axles.	12200	11890		
4.	Light On -Track Tamper (Phooltas-6LDT)	i) Min. dia of new wheel tread measured at 63.5 mm from wheel gauge face.	406	914	15	
		ii) Min. projection of flange of new tyre measured at 63.5 mm from wheel gauge face.	26.5	28.5		
5.	Shoulder Ballast Cleaner (KERSHAW)	i) Min. dia of new wheel tread measured at 63.5 mm from wheel gauge face.	838	914	40	30
		ii) Max. distance apart of bogie centres.	15240	14785		
		iii) Max. length over side buffers.	37340	22300		
		iv) Max. distance between adjacent axles	13240	11890		

6.	Dynamic Track Stabilizer (DGS-62N)	i) M in. dia of new wheel tread measured at 63.5 mm from wheel gauge face.	730	914	60	50
		ii) M in. rigid wheel base for bogie.	1500	1830		
7.	Ballast Cleaning Machine (RM-80)	i) M in. dia of new wheel tread measured at 63.5 mm from wheel gauge face.	900	914	40	30
		ii) M ax. distance apart of bogie centres.	22200	14785		
		iii) Max. length of body or roof for bogie vehicles.	29360	21340		
		iv) Max. length of underframes over headstocks.	29360	21030		
		v) M ax. length over side buffers	30600	22300		
		vi) Max. distance apart between adjacent axles.	20370	11890		
8.	Sleeper Exchanger (KERSHAW)	i) M in. dia of new wheel tread measured at 63.5 mm from wheel gauge face.	711	914	30	
9.	Spoil Disposal Unit (MFS-40)	i) M in. rigid wheel base for bogie truck.	1800	1830	---	30
		ii) M ax. length of body or roof for bogie vehicles.	23146	21340		
10.	Ballast Regulator (66-4)	i) M in. dia of new wheel tread measured at 63.5 mm from wheel gauge face.	838	914	50	40
		ii) M ax. length of body or roof for 4-wheeled vehicles.	9120	8540		
		iii) Max. length over side buffers for 4-wheeled vehicles.	10389	9810		
11.	Self. Propelled Track Laying Crane (UKE-25/18)	M ax. length of body or roof for bogie vehicles 3250 mm wide.	43330	21340	15	40
12.	Self Propelled Rail Welding	i) M ax. rigid wheel base for 4-wheeled vehicle.	7000	6100	40	40

	Machine (PRSM-4)				
		ii) Max. length of body or roof for 4-wheeled vehicles.	12020	8540	
		iii) Max. length of underframe over headstocks for 4-wheeled vehicle 3200 mm wide.	12020	8540	
		iv) Max. length over side buffers for 4-wheeled vehicles 3200 mm wide.	13290	9810	
13.	Track Relaying Train (P-811-S)	i) Min. dia of new wheel tread measured at 63.5 mm from wheel gauge face.	838	914	50
		ii) Min. rigid wheel base for bogie truck.	1727	1830	
		iii) Max. distance apart between any two adjacent axles	12073	11890	
14.	Rail Grinding Machine (Loram)	i) Min. dia of new wheel tread measured at 63.5 mm from wheel gauge face.	838	914	40
		ii) Max. rigid wheel base for 4-wheeled vehicle.	7315	6100	
		iii) Max.. length of body or roof for 4-wheeled vehicles 3200mm wide.	13614	8540	
		iv) Max. length of underframe over headstocks for 4-wheeled vehicles 3200 mm wide.	13614	8540	
		v) Max. length over side buffers for 4-wheeled vehicles 3200 mm wide.	14884	9810	
15.	Points & Crossing Cleaning Machine (RM - 76 UHR)	i) Min. dia. of new wheel tread measured at 63.5 mm from wheel gauge face.	900	914	30
		ii) Max. distance apart of bogie centre.	19500	14785	
		iii) Max. length of body or roof for bogie	23490	21340	

		vehicles.			
		iv) Max. length of underframes over headstocks.	23490	21030	
		v) Max. length over side buffers	24730	22300	
		vi) Max. distance apart between two adjacent axles	17670	11890	
16.	Points & Crossing Changing Machine (AMECA-T-28)	i) Wheel Gauge: Maximum	1604	1602 10	-
		Minimum	1598	1599	
		ii) Min. dia of new wheel tread measured at 63.5 mm from wheel gauge face.	400	914	
17.	Sleeper Handling Crane Model 12-6.	Min. dia of new wheel tread measured at 63.5 mm from wheel gauge face.	508	914 20	-
18.	Ballast Cleaning Machine (RM 80-92-1)	i) Min. dia of new wheel tread measured at 63.5 mm from wheel gauge face.	900	914 50	40
		ii) Max. distance apart of bogie centres.	22200	14785	
		iii) Max. length of body or roof.	28300	21340	
		iv) Max. length over headstocks.	28300	21030	
		v) Max. length over side buffers.	29540	22300	
		vi) Max distance apart between any two adjacent axles.	20370	11890	
19	Shoulder Ballast Cleaning Machine (FRM-80)	i) Min. dia of new wheel tread measured at 63.5 mm from wheel gauge face.	900	914 40	30
		ii) Max. distance apart of bogie centres	16000	14785	
		iii) Max. length of body or roof.	38200	21340	
		iv) Max. length over headstocks	38200	21030	
		v) Max. length over side buffers.	39470	22300	

		vi) Max distance apart between any two adjacent axles.	14170	11890	
20	Spoil Disposal Unit (SD35).	-	-	-	30
21.	UTV 502 L	i) M in dia on new wheel tread.	838	914 60	40
		ii) M ax. rigid wheel base.	8000	6100	
		iii) Max. length of body for 4-wheeled vehicle 3200 mm wide.	11303	8540	
		iv) Max length over headstocks	11303	8540	
		v) M ax. length over side buffers	12522	9810	
22.	SPURT Car	i) M in. dia on wheel tread.	850	914 55	55
		ii) M in. rigid wheel base.	1800	1830	
23	Tamping, Lining & Levelling Machine 08-32M -84 (MG).	-	-	- 40	25
24.	UKE-25/18-MP Motorised Flat Car.	-	-	- 15	40
25	P&C Tamping Machine 08-275 (UNIMAT).	i) M in. dia on wheel tread.	730	914 60	40
		ii) M in. distance apart of bogie centres.	11500	11933	
		iii) Min. bogie wheel base.	1500	1830	
26	P&C Tamping Machine PLM 07-275 (S)	i) M in. dia on wheel tread.	710	914 40	40
		ii) M ax. rigid wheel base.	8000	6100	
		iii) Max. length of body or roof.	14112	8540	
		iv) Max. length over headstocks.	14112	8540	
		v) M ax. length over side buffers.	15512	9810	
27.	Ballast Regulator (56-3)	i) M in. dia on wheel tread.	832	914 60	40
		ii) M ax. length of body.	11074	8540	
		iii) Max. length over	11074	8540	

		headstocks.			
		iv) Max. length over side buffers.	12344	9810	
28	Mobile Flash Butt Welding Machine K355-APT	i) Min. dia on wheel tread.	710	914 60	50
		ii) Min. distance apart of bogie centres.	10000	10023	
		iii) Min. bogie wheel base.	1500	1830	

.....

.

CHAPTER 5

PLANNING, OPERATION AND MONITORING OF TRACK MACHINES

5.1 Planning

5.1.1 General

- i) Working of all Track Machines in a Zonal railway shall be centrally controlled and managed by the Chief Track Engineer in charge of Track Machines hereinafter called CTE(MC).
- ii) By 30th September of every year, Sr. DENs/Co-ordination of divisions will send to the CTE(MC) their Annual Requirement plan for track machines based on maintenance needs, track renewal needs, availability of blocks etc., for the next year commencing from April. Likewise the construction organisations will project to the CTE(MC) their needs for gauge conversion, doubling new lines etc.. The requirement plan shall cover all the track machines such as TRT, PQRS, T-28 etc., for track laying/renewal sites, tampers for rear packing and maintenance packing, as well as special machines such as BCM, SBCM, DTS, Ballast Regulators etc. In drawing the programme, the following aspects shall be taken into consideration:-
- a) base depot locations.
 - b) loco requirements, and loco power availability.
 - c) block requirements, and block availability.
 - d) ballast needs and supply prospects.
 - e) speed restrictions.
 - f) working season.
 - g) output of individual machines.
 - h) effective availability of machines, taking into account slots for POH/IOH, on line repairs etc.
 - i) priorities/targets for completion of projects/works
 - j) co-ordination with and requirement of S&T and TRD branches and
 - k) any other factor having a bearing on machine utilisation.

Requirement of the divisions and the construction organisations shall be examined by CTE(machines) in consultation with the CTE at the Zonal HQ and a 'DRAFT' machine deployment programme is drawn. A copy of the draft deployment plan so chalked out will be sent to every division and the construction organisation by 31st January. On receipt of the "Pink book" and passing of Budget, the draft plan will be revised by CTE(machines) in consultation with CTE to suit the works included in the Pink Book, The finalised deployment plan will be sent to all concerned by 31st March every year.

iii) The Divisions and Construction units on receipt of the draft deployment plan shall initiate all preliminary works such as development of base depots, execution of contracts, arranging blocks, loco power, drawing MOUs, collection of matching materials, ballast collection, co-ordination with other branches, machine staff accommodation, procurement of consumables like diesel oil etc, so that no time is wasted once the machines reach the site.

iv) The machines on arrival in the divisions/construction units shall be deployed as per the approved deployment programme, their progress closely monitored, works completed in time and machines handed over to the next work site as per programme. Any deviation from the approved programme which should be far and few, shall be got approved by CTE or CTE (machines) and the deployment plan got revised, under advice to the concerned divisions/Construction units.

v) The concerned Sr. DEN/DEN shall arrange for expeditious movement of machines as per the approved programme. Timely completion of all preparatory works in the section/division where the machine is due to arrive, shall be ensured.

5.1.2 Project works (Co-ordination & Special Guidelines).

The following factors shall be kept in mind in deploying the machines in Construction/Gauge conversion Projects:

i) The quality of relaying will be better by using PQRS cranes. Hence mechanical laying should be planned to the extent feasible. The advance laying of Auxiliary track to specification as laid down in **para 3.5.3 (iii) and (iv)**, is essential for the trouble free working of the portal cranes.

ii) Keep "Panel assembling locations" or base depot as close as possible to the work sites to reduce the crane movement distance.

iii) Adequate availability of service rails and labour for allied activities shall be ensured for uninterrupted working of machines.

iv) The initial standards of ballast cushioning, track linking and packing shall be such as to ensure safe and efficient working of on-track machines.

v) The availability of a gang to work along with tampers, spot calculation of versines for design lining, and advance work for design mode of tamping for longitudinal surface with a knowledgeable Supervisor are essential for the working of Machines.

vi) Adequate availability of critical spares and consumables and a mobile workshop with a welding plant and gas cutting equipment shall be ensured.

vii) A separate "**imprest**" for urgent requirement of spares and undertaking on the spot repairs shall be kept handy to help intensive utilisation of machines.

viii) An XEN/AEN exclusively nominated may monitor the working of machines and coordinate with Construction branch for safe, efficient and uninterrupted working of machines.

Para 5.1.3

Following track structures and track geometry standards shall be ensured before deployment of track machines on construction projects.

- (a) Track laying standards in respect of gauge, joints, expansion gaps and spacing of sleepers for the new track as specified in Para 316 of IRPWM may be followed.
- (b) The pre-tamping and post tamping operations as specified in Chapter 3 of IRTMM should be followed.
- (c) A minimum cushion of 150mm of clean ballast alongwith adequate ballast on shoulders and cribs should be ensured before deploying the tamping machines.
- (d) The track geometry prior to deployment of track machines for new works of new line, doubling, gauge conversion etc. should be as under:

Peak value of Unevenness	:	15mm on 3.6 m Chord.
Peak value of Twist	:	15mm on 3.6 m Chord.
Peak value of Alignment	:	15mm on 7.2 m Chord.

The above track geometry standards are not safety/slow down tolerances but are only a prerequisite for deployment of track tamping machines for better machine productivity and their optimum utilization.

- (e) For achieving the track geometry parameters as above, suitable small track machines such as off-track tampers etc. may be used.
- (f) Dy.CE.(Construction)/DEN(Construction) should certify the track geometry as mentioned above before deploying the track machines.
- (g) Deployment of DGS alongwith tamping machines is desirable.

(5.1.3 New para added as per correction slip no.8 dated 25.10.2004)

5.1.4 Inter Railways Deployment (renumbered as 5.1.4 vide correction slip no.8 dated 25.10.2004)

All Inter-Railway transfer of machines will be done with the approval of Railway Board only.

When machines are deployed to work in other Railways for short duration the "Owning Railway" shall send the machine staff required for their working. The Zone receiving the machine shall associate its staff to pilot the machine movement in its jurisdiction. The requirement of oils and consumables shall be supplied by the Railway using the machines. The user Railway shall be responsible for the optimum utilisation of machines and shall keep appropriate records for future use. Output of the machine shall however be reported by the 'owning Railway' only in its performance report.

5.2. Line Blocks, Stipulated Corridors and Monitoring

As stipulated by the Railway Board, the on-track machines should work under traffic blocks as per the following options depending up on the track requirement and traffic patterns.

(i) On single line section

Either one block of at least 4 hours or 2 blocks of 2-1/2 hours or in exceptional cases minimum two hours wherever 2-1/2 hours are not possible.

(ii) On double line section

- a) One spell of 4 hours on "Up" or "Dn" line daily.
- b) Two 2-1/2 hours split blocks on "Up" or "Dn" line on alternate days.
- c) One 2-1/2 hours block on each line daily or in exceptional cases minimum 2 hours wherever 2-1/2 hours are not possible.

(iii) On Construction Projects and multiple lines, additional working hours/blocks should be planned.

Chief Engineer and Chief Operating Manager of the railway shall ensure that the identified corridor blocks as above are incorporated in the working time-tables and their availability shall be ensured.

Following are the measures for ensuring availability of blocks:

- a) Inclusion of Engineering maintenance corridor blocks in the Working Time Tables and updating it every year duly providing alternate corridors for those affected by the newly introduced trains.
- b) Daily monitoring of blocks and performance at DRM's level in divisions and daily review at CE COM and GM's level at headquarters.

5.3 Track Machine Organisation

5.3.1 General

- (i) Track Machine Organisation will be responsible for making the machines available as per the approved deployment programme with the requisite crew for efficient working of the machines.
- ii) The blocks asked for and given as also the output shall be monitored on daily basis.
- iii) In the event of breakdowns, action should be taken to rush spares, staff and other assistance to site for immediate commissioning of the machine. The decision as to whether the repairs are to be carried out at site, at divisional depots or at the zonal workshop shall be taken expeditiously in all such occasions and action initiated with the assistance of divisions to move the machines where necessary.
- iv) The periodical schedules for maintenance of the machines shall be drawn out and the divisions advised of the same in advance. Scheduled maintenance activities could be combined with breakdown repairs wherever possible instead of idling the machine exclusively for such activities.
- v) Before taking the machine into block section the machines shall be tested thoroughly for ensuring trouble-free working. Immediately after major schedules/repairs of the

machine, performance of machines shall be closely monitored for the first few blocks.

vi) Divisional officers and Track Machine officers should carry out inspections as per the schedules given in **para 5.3.2. and 5.3.3** preferably, jointly and monitor the effective working of the machines. While the Track Machine Organisation has to organise supply of spares for day to day working and expeditious repairs the division also shall lend assistance with equipment and stores for gas cutting, etc. to reduce downtime.

5.3.2 Inspection Schedules for Track Machine Officers

(i) Deputy Chief Engineer and Senior Engineer incharge of the track machines shall inspect the machines as specified in **para 1.1 of the Manual**.

(ii) **Inspection By Other Officers of The Machine Organisation:**

Sl.No.	Type of Machine	Inspection schedule	
		AEN/MC*	SS E/MC
1	CSM	Monthly	Fortnightly
2	Unimat	Monthly	Fortnightly
3	BCM	Fortnightly	Weekly
4	BRM	Once in two months	Monthly
5	SBCM	Monthly	Fortnightly
6	DTS	Once in two months	Monthly
7	UNO	Monthly	Fortnightly
8	DUO	Monthly	Fortnightly
9	T-28	Monthly	Fortnightly
10	PQRS	Monthly	Fortnightly
11	TRT	Weekly	Daily

*SEN/MC should carry out these inspection if no AEN/MC is posted under him.

Inspection of the above machines will be carried out and the inspection reports shall be sent to Senior Engineer/MC with copies to Deputy Chief Engineer/MC and Jr. Engineer in charge of the machine.

Correction Slip No. 14 to Indian Railways Track Machine Manual-March, 2000

Para 5.3.3 at page 135 may be modified to read as under:

5.3.3 Inspection Schedule for Open Line Officials:

The schedule of inspection of open line officials for Track Machines shall be as hereunder:

Officials	Type of Inspection	Schedule
Sr. DEN/DEN	Track Machines: (i) CSM, BCM, FRM(SBCM), P&C Tamper, DTS, 09-3X Tamping Express (ii) T-28, PQRS, RGM, TRT (iii) Worksite Tampers (UT/UNO/ DUO/WSI etc), BRM, Sleeper Exchanger, UTV and all other machines not included above.	Once in two months when working in section. At least once in a month. As per need.
ADEN	Track Machines: (i) CSM, BCM, FRM(SBCM), P&C Tamper, DTS, 09-3X Tamping Express (ii) T-28, PQRS, RGM, TRT (iii) Worksite Tampers (UT/UNO/ DUO/WSI etc), BRM, Sleeper Exchanger, UTV and all other machines not included above.	Once in a month when working in section. At least once in a fortnight. At least once in a period of working in their section.
SE (P. Way)	Inspection of pre-tamping, during tamping and post tamping operations during working of track machines	Once at the time of tamping.
JE (P. Way)	Inspection of pre-tamping, during tamping and post tamping operations during working of track machines	Once at the time of pre- tamping, during tamping and post tamping.

The Sr. DEN/DEN and ADEN shall inspect the track machines as per above schedule, duly covering all aspects i.e., adequacy of all allied track works, quality of machine work, safety aspects involved, items pertaining to the welfare of machine staff, records such as programme of tamping, actual tamping, variations, repeated tamping, speed restriction etc.

Copy of inspection report of Sr. DEN/DEN and ADEN shall also be sent to Deputy Chief Engineer/Machines.

5.3.3

5.3.4 Important Items to be inspected

For the guidance of the concerned officials, some of the items which should be specially checked by them are listed in **Annexure 5.1 & 5.2**. The list is not exhaustive and they should check all other aspects relevant in each case.

5.3.5 Operation of Machine

i) The machine staff and P. Way staff shall work as a team towards the common goal of ensuring optimum utilisation of the machine and manpower.

ii) The machine staff shall ensure adequate attention to the machine in time as prescribed in RDSO manuals and manufacturer's manuals in respect of their machines and keep the machines ready for availing stipulated blocks. They should, in consultation with the P. Way staff/Engineering controller/Track Machine Control, be aware of corridor block/MOU provisions and line block spell and plan out their maintenance activities in such a manner that blocks are availed without any lapse. The machine incharge shall invariably inform Junior/Section Engineering (P. Way) and if not available, to SM or Engineering Control about readiness or otherwise of the machine for working every day well in time.

iii) The machine shall be berthed in the sidings safely as stipulated in **the G&SR** and the P. Way staff shall arrange for watchman for the machine during the non-working shift. The watchman for the machine should not be frequently changed.

iv) The machine in charge on arrival shall check up the condition of the machine and report any unusual features observed by him such as disturbance to the machine at the berthing place, missing of parts etc. and initiate appropriate action as per extant rules.

v) The machine incharge and Junior/Section Engineer (P. Way) shall jointly inspect and finalise the week's work in advance and discuss the day's programme and share with each other all information required for the working.

vi) The Junior/Section Engineer (P. Way) of the section shall be responsible for the block working of the machine.

vii) The Junior/Section Engineer (P. Way) of the section shall be responsible for all the machine, related track works detailed in **Chapter 3**. He shall always have the requisite men to work with the machine and for rendering possible assistance to clear the section in case of breakdowns.

viii) The Junior/Section Engineer (P. Way) shall be responsible for arranging necessary lighting etc for night works, with the association/involvement of other divisional staff such as Signal/OHE etc.

(ix) It should be ensured by the machine incharge that no person climbs to the top of any machine without OHE block in electrified sections.

(x) The machine incharge shall ensure that all precautionary measures are taken for safety of the staff while working on double/multiple line block section against the danger of trains moving on adjacent lines. The Junior/Section Engineer (P. Way) should provide Lookout-men at the site of machine working as per requirements.

(xi) SM will liaison with Section Controller/Controller to ensure that at the end of work, the machine is brought to the base station and placed in the nominated berthing line at the earliest to enable post block maintenance of the machine being undertaken.

5.4 Working of Tamping Machines in Design Mode :

5.4.1 By working of tie tamping machines in design mode the long wave length irregularities of longitudinal level and alignment can be rectified. Hence, the tamping machines for projects and other work site should be worked in Design Mode.

5.4.2. Guidelines for operation of tie tamping machines in design mode are given In **Annexure 5.3**.

5.5 Specific Guidelines In Respect of Various Machines

5.5.1 Tie-Tampers

i) Tie-tamping machine is the major track maintenance machine and shall have greatest utilisation. The 06-series universal super-lining control type, 08- series unomatics (single sleeper tamping machines), Duomatics (double sleeper tamping machines) and 09-series continuous tamping high output machines are in use on Indian Railways. These machines are capable of lifting the track for longitudinal and cross level corrections, aligning the track (straight and curves) and tamping. Recording and shoulder consolidations are optional equipment and shall be fully utilised wherever provided.

- ii) The pre-tamping, during tamping and post tamping attentions shall be ensured as explained in Chapter 3 in order that the machines optimum capacity could be utilised and the desired purpose is served for the best maintenance of the track and increased retentivity.
- iii) It would be advantageous to utilise the 06-series and 08-series machines for initial tamping at track renewal sites and gauge conversion work sites, thus reserving the potential of 09-series high output CSM machines for maintenance needs.
- iv) The tamping done shall be shown in the sectional gang's chart. The tamping need shall assessed taking into account the previous tamping, laid down frequency of tamping for different track structures as well as the track geometry as recorded during TRC runs.
- (v) At track renewal sites, ballasting should be commensurate with the progress and restoration of sectional speed should be ensured as per the prescribed timetable for machine tamping in IRPWM para 308.
- (vi) To avoid damage to tamping unit by hammering while changing the tools, hydraulic tool extractor shall be used for this purpose.

5.5.2 Points and Crossing Tamping Machine

Points and Crossing Tamping Machine is 08-series type tamping machine capable of lifting, levelling aligning and tamping of turnouts as well as plain track. With specially designed tilting arms, it lends itself suitable for tamping the points and crossings. Hence, it is very necessary that this special purpose machine is exclusively used for tackling the points and crossings with approach tracks in yards and special locations such as level crossings, bridges with check rails etc.

The general pre-tamping and post tamping attention as brought out in Chapter 3 in this Manual will be applicable to this machine as well. However, the following guidelines will help optimum utilisation of these versatile machines:

- (i) The lift should be minimum 10 mm at the high points. The lift should be decided depending upon the track geometry, ballast condition and the constraints of S&T gears.
- (ii) When the unevenness of the track is substantial, a longer distance in the approach is taken for maintenance so as to get better results.
- iii) While tackling the mainline portion, the turnout portion also gets lifted via 'through sleepers' and hence adequate supporting by jacks/wooden blocks is necessary so that subsequently with one round of tamping of the turnout side, the work could be completed without disturbing the already corrected mainline portion.
- iv) When heavy sags/dips are noticed in the crossing portion, supporting the crossing with blocks and special treatment may be necessary.

v) Generally the mainline and turnout side should be tackled in one pass. In case of unavoidable circumstances, when the turnout is not tamped completely, the loop line side of turnouts should be supported with wedges and kutchas. Packings should be ensured to avoid bending of sleepers.

vi) The manufacturers have recommended the various sequences to be followed in tackling different layouts of points and crossings for good results. These sequences are to be followed up scrupulously. These have been shown in **Annexure 5.4**

vii) "S & T" staffs have to be actively associated while attending to the turnouts. Any heavy lifting is likely to affect the operation of points, calling for resetting of point motors/rodding for their trouble-free functioning.

There must be absolute interaction and pre-planning between the machine staff and permanent way staff in tackling complicated layouts as the prescribed "V" / "T" values may have to be applied for better results.

viii) Walkie-talkie will be found very useful in communicating with the Station Master.

ix) Sufficient wooden blocks/shims, jacks and power tools like Off-track tampers etc. for kutchas in the portions uncovered by machines should be available.

x) Special features such as lateral movement facility of tamping banks, provision of lifting hooks and operating inner/outer clamps as needed, alignment corrections of curves as sharp as 8 degree, of this machine render it versatile and useful for multifarious jobs which could be exploited for effective track maintenance.

5.5.3 Ballast Cleaning Machine:

Ballast Cleaning Machine is considered as a special investment oriented machine and its utilisation should be optimum. The following points should be kept in mind in operating this machine:-

- i) The working of this machine should be treated as a 'project' and its performance shall be specially monitored. An AEN may be nominated to exclusively look after this machine.
- ii) The preliminary works including a survey, marking the longitudinal levels for lifting, removal of obstructions etc. shall be ensured as explained in the RDSO's circular and covered in **chapter 3** of this manual.
- iii) The decisions in regard to the lifts to be given, proper cross-fall avoiding formation of water traps, correct speed and ballast distribution should be very judicious to ensure trouble free and efficient working of this machine with quality.
- (iv) The lifting may be done partly in advance by UT/DUO machines, and partly by the BCM itself depending on amount of lift required.
- (v) The periodic schedules for maintenance of the machine should be attended to in time. As the design and systems are complicated and involve more mechanical parts which are likely to loosen out in the course of working, a thorough inspection at siding even with a spare cutter bar

inserted in a pit would help cent percent checking of cutter chain assembly which may otherwise cause in-effective time in the precious block period.

(vi) Minimum 3 sets of cutter chains, sufficient quantity of round shaft chisels, chain bolts, conveyor bolts, buckets etc. should be available.

(vii) The machine working is likely to produce a dusty atmosphere and heavy noise pollution. Hence extra care is necessary on the part of all staff working at site to ensure safety of workers.

5.5.4 Ballast Regulating Machine

(i) This machine helps to do certain pre-tamping as well as post tamping operation.

(ii) In pre-tamping operation, it helps to transfer excessive ballast from the space where it is available to the zones where it is deplete. It also helps to broom the excess ballast under the rail head so as to enable the "roller clamps" of the tamper to have proper grip.

(iii) In the post-tamping operation, it profiles the ballast and helps dressing for tidying up the track.

(iv) The operator's ingenuity is called for to use the wings plow and brooms to complete the operations in a minimum number of passes effectively.

(v) Utmost caution must be taken while lowering the wings to avoid infringement to the adjacent track. Similar caution is necessary while winding up. Since the machine wings are likely to hit with hidden obstacles which may cause derailment of this machine, extra care is necessary to select the depth and speed.

vi) Adequate rerailing equipment (Traverser Jack, Wooden Blocks) are to be kept with this machine to tackle likely derailments.

5.5.5 Dynamic Track Stabiliser

The Dynamic Track Stabiliser helps to achieve a spatial force free consolidation while regaining the resistance to lateral displacement. This helps in relaxing the speed restrictions expeditiously and extension of maintenance cycle and thus constitutes an economically sound measure.

The machine should be used in maximum settlement mode at renewal or deep screening sites. On maintenance site, it should be used in controlled settlement mode. The DTS should be deployed immediately behind the tamping machine.

The following extra precautions are necessary in the operation of this machine:

i) Complete and tight fittings to hold rails with sleepers are essential.

ii) Adequate pre-depositing of ballast for achieving the required profile is necessary.

iii) The vertical pre-load is to be selected if the levelling system is used, in such a way that the determined maximum settlement is not exceeded.

iv) The selection of frequency (depending on track condition), working speed & vertical pre-load should be judicious according to the needs and with/without "Levelling" system in "ON" condition. The frequency is properly set when the machine appears to be in smooth behaviour i.e. the vibrations are transmitted to the track and not back to the machine.

v) When stabilising on bridges, with ballasted deck the frequency selected must not be within the natural frequency of the bridges so as to avoid resonance conditions. The natural frequency of girder bridges with a span of over 10 m lies below 30 Hz. The frequency of 40-45 Hz is selected when stabilizing the bridges.

vi) While working the machine in stretches adjacent to walls, trench walls, retaining walls, platform etc., no restrictions for the working of the machines are normally necessary. However when these structures are defective, extra care is necessary in the proximity of 20 m on either side, to avoid likely damages to the structure.

vii) No stabilizing work in "Tunnels" is permitted.

5.6 Special Precautions While working the Machines in Ghat Sections

The following precautions are essential for safe driving of the machine in sections involving steep gradients, sharp curves, deep cuttings high embankments etc.

i) Drive only from the cabin corresponding to the direction of travel (except during small shunting movements where movement in opposite direction could be done with adequate precautions).

ii) Do not drive the machine at speeds exceeding the prescribed speed for the section, this speed being further reduced over switches and speed restriction zones.

iii) Never drive over slopes or descending gradients without putting into gear and do not switch off gear box key switch.

iv) Do not let the RPM of the engine fall below 1000 and do not switch off the engine before the machine stops in gradient sections.

v) Shift back to lower gears well in time in case of ascending/descending gradients.

vi) Have a special check for the ZF gear box oil level and its working temperature.

vii) Ensure proper working of pneumatic circuit and functioning of all components in the brake system.

viii) Ensure availability of spares particularly in respect of items that are failure prone such as transmission gear like cardon shafts, coupling bolts etc. Availability of a skid is a must.

ix) Also ensure proper working of horns and lights.

x) Be on the look out for trespassers while negotiating sharp curves and also sound horns on such occasions.

(xi): No run through movement shall be done in convoy while moving in Ghat Section. Only one machine shall be allowed to move for run through movement in Ghat Section at a time.

(xii)

(a) Normally machines shall not work in convoy while visibility of track is restricted due to sharp curves and steep gradients. Where the working of track machines in convoy is indispensable i.e. like deep screening, track relaying site etc., the necessary block protection shall be done as per para 806 of IRPWM and special precaution shall be taken as per para 811 of IRPWM for the first machine facing the direction of traffic in double line section and for the front and rear most machines in single line section.

(b) The minimum distance between the machines when working in convoy shall be 50m to avoid collision between machines and danger to life of machine and P. Way staff working with machine.

(c) It shall be ensured that there is no infringement to the adjacent track due to any part of the machine working on the track.

(xi & xii added as per CS 5 dated 15.09.2003)

5.7 Performance Monitoring

5.7.1 Track Machine Control

A Track Machine Control office shall function in the headquarters of railway under the control of JA Grade/Sr. Scale officer of the Track Machine Organisation to co-ordinate between the divisions and headquarters, as also between field units and the base depot/zonal workshops. This control office shall be continuously manned on all the days by staff at a level not lower than Jr. Engineer with suitably staggered roster. The control office shall be provided with both Railway and DOT telephones with STD facilities for effective communication with divisions/field units and headquarters officers etc.

5.7.2 Functions of Track Machine Control

The main functions will be:-

i) Contacting the divisional Engineering Controls for obtaining and recording the daily progress details (block hours, effective time, output, Km. details) to co-ordinate between the divisions and headquarters, as also between field units and the base depot/zonal workshops.

ii) Recording details of failures.

iii) Recording assistance required.

iv) Obtaining next day's programme etc.

v) Communicating essential instructions from HQ to division/field units.

The information collected by the Track Machine Control and instructions given should be recorded comprehensively in a log book which shall be scrutinised by the officials at intervals to ensure effective functioning all round. This log book (as per format shown in **Annexure-5.5**) incidentally can assist building a data base for compiling various statistical information about machines.

5.7.3 Reports and Documents

The following reports/documents shall be used in the monitoring of performance and other items in respect of working of machines.

I. T.M. Organisation's Reports

i) A daily performance report compiled by the Track Machine Control based on the information collected on all divisional engineering controllers/field staff. This will be a computer print out containing details of blocks demanded and actually made available, proportionate output achievable and actually achieved, cumulative figures for the month/year. Brief remarks for less output also shall be included for the information of CTE and CE.

A register shall be maintained by Track Machine Control for serving as a "Master Record" for all relevant data. Copies of this will be sent to CTE(machines), CTE, CE and abstract block position to COM.

ii) A daily report from the machine incharge to SEN incharge of field incorporating block details, performance, schedules done/over due, consumables/spares used, repairs, failure shall be made out and submitted every ten days as per sample shown in **Annexure - 5.6**.

(iii) The machine incharge will submit a report to Dy. CE/SEN incharge on every breakdown of the machine resulting in-failures exceeding half an hour on the proforma placed at **Annexure-5.7**

(iv) Monthly Appreciation reports from the machine incharge on performance furnishing:

a) number of days worked

b) number of days not worked with reasons

c) blocks availed

d) target

e) output

f) reasons for less output

g) other remarks

h) consumables/spares used and cost thereof

i) failures/repairs with spares and cost particulars.

(v) A summarised monthly performance report from SEN/AEN/M C (line) showing schedules of inspections done, health of machine, failure analysis, adequacy of allied track works etc of the machines under their control to Headquarter/Dy CE/CE (M achines).

(vi) A summary as per Annexure 5.8 of availability of each machine for a period of 3 years shall be maintained at the machine and Zonal Depot showing at a glance the availability, breakdowns, schedule repairs and POH of machine.

II. Divisional Reports

i) **A daily** report from the P. Way in-charge to the Divisional Engineering Control giving the following details:

a) block details

b) output kms.

c) ineffective time

d) remarks on quality of work

ii) **A monthly** report giving

a) details of blocks availed

b) output

c) reasons for deficiencies etc.

shall be prepared by the Divisional Engineer incharge of the section.

iii) **A monthly joint report** from the Section Engineer incharge of the section and the machine in-charge furnishing the details of work done by the respective machines (i.e.) Tampers, PQRS, BCM etc., both datewise and cumulative. This report shall be sent to SEN/MC and Sr. DENs concerned and shall form the basis for raising debts through Adjustment Memos for track work done on divisions by TM organisation and certification and acceptance by divisions.

(iv) **A monthly joint report** signed by Sr. DEN and Sr. DOM should be submitted to CTE (M achines) giving position of blocks demanded, the blocks actually made available and the blocks actually utilised.

5.7.4 Monitoring And Systems

Monitoring of machine work involves the aspects of

- Performance
- failure
- consumption of oils and consumables
- consumption of spares
- cost of machine working and financial control
- tampering cycle.

The following systems shall be adopted for monitoring the above items.

i) Performance:

The output of the machine vis-a-vis monthly, targets, and output/block hour mentioned as brought out in the reports in **para 5.7.3** will be the major indices for machines performance. In addition to the above, the officials during inspection of machine sites will review the output/block hour and the ineffective time due to various causes and counsel field staff for ways of reducing the ineffective time.

ii) Failures:

Downtime of the machines is a vital factor to be kept under control. The failures shall be monitored through the daily/monthly reports and analysed at SEN's level for necessary corrective actions. Failure analysis shall be the main agenda in all the meetings of the SEN/AEN with machine staff at appropriate intervals.

iii) Consumption of Oils and Consumables

The consumption of oils by each machine shall be monitored for being kept at specified level. Consumption of diesel oil, lub oil, Hydraulic oil and gear oil are very essential to be kept under control. The daily/monthly reports shall form the basis and apart from cost aspect excess consumption will constitute a symptom, of ill-health of a machine, indicating a need for corrective action.

iv) Consumption of Spares

While the consumption of mandatory spares requiring replacement at specified intervals will have to be on a set pattern, any excess drawl shall be critically reviewed. Similarly - case of spares consumed on repetitive basis, the root cause for such excess consumption should be analysed and corrective action to change the sub-assembly or going in for better quality of spares will have to be decided. The monthly reports will bring out the consumption forming the basis for this item. Issue of stores/spares at Base Depot shall be only with SEN's approval in the case of Imported spares and also when the stock is at a low level.

v) Cost of machine working and Financial Control

The working cost of various machines is ultimately accountable to track maintenance cost under revenue as well as track renewal costs against Estimates. Hence in order that the track laying/track maintenance cost is kept as low as possible, the expenditure on machine working cost has to be monitored.

From the reports mentioned In **para 5.7.3** above, the total unit cost of working shall be worked out

- a) Including the CRF value
- b) Excluding the CRF value

The method for working out cost has been explained in Annexure-5.9. The Railway shall maintain a register for showing the actual expenditure incurred under various heads so that the cost of working could be computed once in three months for review at zonal level and once in a year at all railways level. Machines incurring additional cost should be taken up for critical review and corrective action.

vi) Tamping Cycle

The tamping charts shall be maintained at divisional level and at HQ for monitoring the frequency of Tamping. The track structure, prescribed tamping cycle, last tamped periods (2 cycles) and condition of the track (CTR values of Standard Deviation values) will have to be incorporated in the charts. These charts shall accompany the programmes initiated by the divisions as required in para 5.1.1 (ii). The machine tamping shall be incorporated in the gang charts also. In case of premature deterioration of track, the divisions shall go into reason and come out with adequate justification for the approval of Chief Track Engineer for such additional tamping. The tamping cycle currently in existence is as follows which may have to be reviewed from time to time:

- (a) On PSC sleepers, the frequency of tamping will be once in two years or passage of 100 GMT of traffic whichever is earlier.
- (b) On other than PSC sleepers, frequency of tamping will be once in one year.

5.7.5 Store Depot for Spares:

The general accountal procedures for the procurements stocking, issue and disposal of spares spelt out in Stores code and Accounts code and Engineering code shall be applicable in the case of zonal depots and sub-depots. As the field unit are also keeping with them the day to day requirements of spares, the incharge of the machine shall be a 'custodian' of spares to that extent and shall maintain the DMTR (Daily Material Transaction Register), stock ledgers and returns as per extant norms. He shall be responsible for returning the released spares to the nominated depots for further action and obtain acknowledgement. The zonal depots shall ensure timely procurement and supply of spares and be responsible for disposal of released items either by reconditioning or ultimate condemnation as totally unserviceable.

Periodical self stock verifications (annually), and by Accounts Verifiers as per norms shall also be ensured in the depots.

Annexure 5.1

List of Important Items to be Specially Checked by Inspecting Officials of Track Machine Organisation.

1. Engine:

- i) Oil Pressure : At idle speed
: At full RPM
- ii) Correctness of the grade of engine oil being used.
- iii) Max engine temperature during working.
- iv) Cleanliness of diesel tank and diesel oil.
- v) Whether air filters, Mobil oil filters and diesel filters changed/cleaned as per schedule or not.
- vi) Tightness of foundation bolts of engine, radiator fan motors, fuel pump, water pump, compressor, alternator, etc.
- vii) Level/topping up of engine oil, diesel oil and water in radiator.
- viii) Observance of maintenance schedules and their quality.
- ix) Condition of batteries and charging system.

2. Hydraulic system:

- i) Hydraulic pressure in various units and leakages.
- ii) Max hydraulic temperature during working.
- iii) Whether hydraulic filters have been changed/cleaned as per schedule or not.
- iv) Whether pumps/motors/valves are being changed as per schedule or not.
- v) Quality of fitment of hose assembly.
- vi) Tightness of mounting bolts of pumps & motors.
- vii) Observance of maintenance schedules & their quality.
- viii) Level/topping up of hydraulic oil.
- ix) Cleanliness of hydraulic tank & oil.
- x) Correctness of the grade of hydraulic oil, last date of laboratory testing and report thereof
- xi) Accumulator pressure.
- xii) Functioning of various valves.

3. **Pneumatic System**

- i) Air pressure, leaks.
- ii) Functioning of various valves.
- iii) Functioning of moisture separator.
- iv) Functioning of brakes

4. **General:**

- i) Functioning of safety devices control unit and measuring units and general cleanliness of the machine.
- ii) Tightness of the nuts and bolts of all moving and vibrating items.
- iii) Condition of the following items of various machines:
 - TTM -** Tamping tools, rail clamping discs.
 - BCM -** Cutter chain, cutter bar, wear plates, corner rollers, screens, conveyors.
 - TRT -** Conveyer pads, sled, dynamic plough, clamping and guiding rollers.
 - BRM -** Wing plates of side plough and front plough broom elements, rail top clearing rubber elements.
 - SBCM/ -** Conveyor belts, tooth bucket, ditches wheel assembly
 - KS C 600** bearings, screens.
 - Portals -** Sleeper gripper, rail clamps, sliding frames.
- iv) Quality of pre and post attention in track for machine working, Officers of machine Organisation will report deficiencies to Sr. DENs/DENs.
- v) Safety aspects (Rules of Protections, Safety equipments, knowledge of safety rules).
- vi) Availability of the updated tamping charts with the machines as well with the divisional officers.
- vii) Maintenance of records pertaining to the machine.
- viii) Items covered in **Annexure-5.2** but not listed in Annexure-5.1

Annexure 5.2

Aspects of Machine Working to be Looked for By Inspecting Officers of Division

When Open line officers carry out inspection of Tamping Machines, they should specifically look for the quality and quantity of the output. They should, in addition, look for the following parameters in the machines.

- (i) Quality of pre-tamping works.
- (ii) Squeezing pressure, of tamping unit be approximately as given below.

a)	PSC sleeper	110-120 kg/sq.cm.
b)	ST, Wooden sleepers	100-110 kg/sq.cm.
c)	CST-9 sleepers	90-100 kg/sq.cm.
- (iii) Vibration motor pressure.
- (iv) Number and condition of tamping tools.
- (v) Setting of tamping depth.
- (vi) Number and condition of lifting rollers.
- (vii) General lift and running in and running out of ramps.
- (viii) General condition of the machine.
- (ix) Output of the machine.
- (x) Track parameters after tamping.
- (xi) Quality of post-tamping work.
- (xii) Actual working vis-a-vis programme.
- (xiii) Welfare aspects for the staff accommodation and other facilities.
- (xiv) Adequate safety of staff working in block section against danger of incoming trains on adjacent lines.

Annexure 5.3

Guidelines for Operation of Tamping Machine in design Mode

1.1 Datum rail:

The datum rail for carrying out attentions to longitudinal profile and alignment should be selected as given below:

- (i) Longitudinal section: Non-cess rail on straight track in double line section and inner rail in curves.
- (ii) For alignment: non-cess rail on straight track in double line section and outer rail on curves.
- (iii) For single and middle line in multiple line sections, any of the two rails which is less disturbed may be selected as datum rail, both for alignment and L-section in straight track.

2.0 Survey for vertical profile correction:

2.1 The section identified for surfacing should be divided by stations marked at 10 m interval. The starting point should be opposite a km post and the starting station should be marked 0. Station locations and station numbers should be painted in yellow paint on the web of the datum rail.

2.2 Bench marks:

Bench marks should be established at 200-1000 m interval, relating them to the GTS bench mark levels so that the plotted drawings are properly related to the existing index section. Fixing bench marks in relation to arbitrary levels should be avoided. These bench marks could be established on the top of concrete foundation of OHE masts in electrified sections.

2.3 Recording of Actual Rail levels :

The SE/JE (P. Way) should record the actual rail levels at all the stations of the datum rail, making use of the established bench marks. However, on the stretches where the datum rail is super-elevated, being on a horizontal curve, the rail levels should be taken on the other rail of the track, opposite the station locations. The stretch for which station levels are taken on "non- datum" rail, should be noted in the level book.

In view of the voluminous survey work involved, aut setting levelling instruments should be used to save time and to achieve accurate results.

2.4 Formation levels:

At every 5th station i.e. Station No. 0, 5, 10 etc., the Section Engineer/P. way should remove ballast below the rail seat where rail levels are recorded, up to a level, below which it is not desirable to go, while carrying out deep screening work. This level is referred to as Formation Level. The SE/JE (P. Way) should also record the formation levels. For example, in the redesigned vertical profile the rail level should be 700 mm and 680 mm above the formation level in case of 60 kg and 52 kg rail respectively on PSC sleepers with 300 mm ballast cushion, if sub-ballast is not provided.

2.5 Obligatory Points :

While carrying out the survey, the SE/JE (P. Way) should record the location of obligatory points like level crossings, girder bridges, points and crossings, overhead structures etc., in reference to the station numbers as well as running kilometre. In addition, the location of km posts and gradient posts should also be noted.

3.0 Plotting of vertical Profile:

3.1 The existing vertical rail profile (of datum rail) and formation profile should be plotted on a graph sheet with the length of track as abscissa and elevation of rail top and formation as ordinate. The scale adopted should be:

Horizontal Scale: 1:1000 or 1 cm = 10 m and

Vertical Scale: 1:10 1 mm = 10 mm

3.2 Having plotted the formation levels the desired rail levels should be marked on the graph e.g. by adding 70 cm to the formation level, in case of 60 kg rail on PSC sleepers with 30 cm ballast cushion and 68 cm in case of 52 kg rail on PSC sleepers. The desired rail level so plotted should be taken into account, while marking the proposed vertical profile on the graph.

3.3 Proposed rail Profile:

While deciding the final levels, the following considerations shall be taken into account:

- i) Sub sections shall be selected keeping in view high points and obligatory points.
- ii) As far as possible, long stretches of uniform gradient shall be planned keeping in view the depth of construction to be provided, and relative implications of lifting or lowering of track. In no case the grade should exceed the ruling gradient of the section. While designing vertical curves, provisions of para 419 of IRPWM should be observed.

- iii) The clearance to overhead structures (including OHE) shall be maintained within permissible limits.
- iv) The redesigned profile should not normally involve lifting or lowering of obligatory points like girder bridges, Level crossing and turnouts.
- v) The redesigned profile should aim at easing the sags and humps with manageable lift and lowering. It is not necessarily the intention that the original longitudinal section of the line should be restored.
- vi) Generally, the redesigned profile should be so arrived at as to have lifting only, as machines have lifting facility only, and lowering shall be resorted to in exceptional circumstance.
- vii) Prescribed minimum ballast cushion should be ensured. However the requirement of ballast over and above that for the prescribed cushion can be optimised by designing suitable vertical curves.
- viii) At locations where lifting or lowering is not possible, suitable ramping out preferably in the form of reverse curves in vertical plane should be provided on both approaches. In case lift is proposed at level crossings, the field staff should be prepared to simultaneously raise the road surface and regrade the approaches.

4.0 In redesigning the profile, the requirements to be met are:

- i) For other than vertical curves-

The unevenness on 80 m chord should not exceed as under:

a) on high speed routes with speed above 110 kmph - 40mm (corresponding to 20000m vertical radius).

b) on other lines - 65 mm (corresponding to about 12000 m vertical radius).

- ii) for vertical curves - The unevenness on 20 m chord should not exceed 10 mm (corresponding to 5000 m vertical radius)

The profile designed should be analytically verified so that the above mentioned unevenness limits are not exceeded. The final levels at various points should be calculated rather than scaling out from the drawing which mainly serves the purpose of visual appreciation..

4.1 The proposed levels should be approved by an officer not below the rank of DEN. The working plan so prepared should be distributed to the concerned field staff and AEN.

4.2 Designing Vertical Profile With the help of Computer

For designing of vertical profile, aid of a computer with a software developed by IRICEN/Pune may be taken to speed up the design work.

5.0 Surfacing Operation

5.1 The finally proposed levels of rail top may be marked on the OHE masts for executing the lifting/lowering operation. In case of non-electrified section, permanent level pegs should be provided at every 5th station.

5.2 Actual work of lifting and lowering may be carried out in keeping with the instructions laid down in **paras 233 of P. way Manual**.

5.3 The finished profile may not exactly conform to the redesigned profile, and the resurfaced levels may vary from the design profile. It is, therefore, necessary to check the finished levels in relation to the levels marked on the OHE posts or other reference points. The difference between the finished levels and designed levels should not exceed 10 mm, provided the variation of unevenness from station to station is not more than 20 mm. To ensure this, SE/JE (P. Way) will work out the unevenness at all stations in relation to the finished levels and the machine in charge shall apply correction to levels, to bring the station to station variation of unevenness within the prescribed limit.

6.0 Survey For Alignment Correction:

6.1 All the weld and rail kinks should be rectified/eliminated by dekinking or cutting and welding, before measurement for alignment defects are taken. Hydraulic jim-crows may be used for removing kinks.

6.2 In case some horizontal curves on the section to be surfaced warrant realignment, then the process of realignment should be carried out along with surfacing.

6.3 Alignment should be measured on a 40 m chord on straight track and required slew at alternate sleeper should be worked out by measuring the offsets at every 5 m interval and interpolating the offsets. The slews are marked on every alternate sleeper.

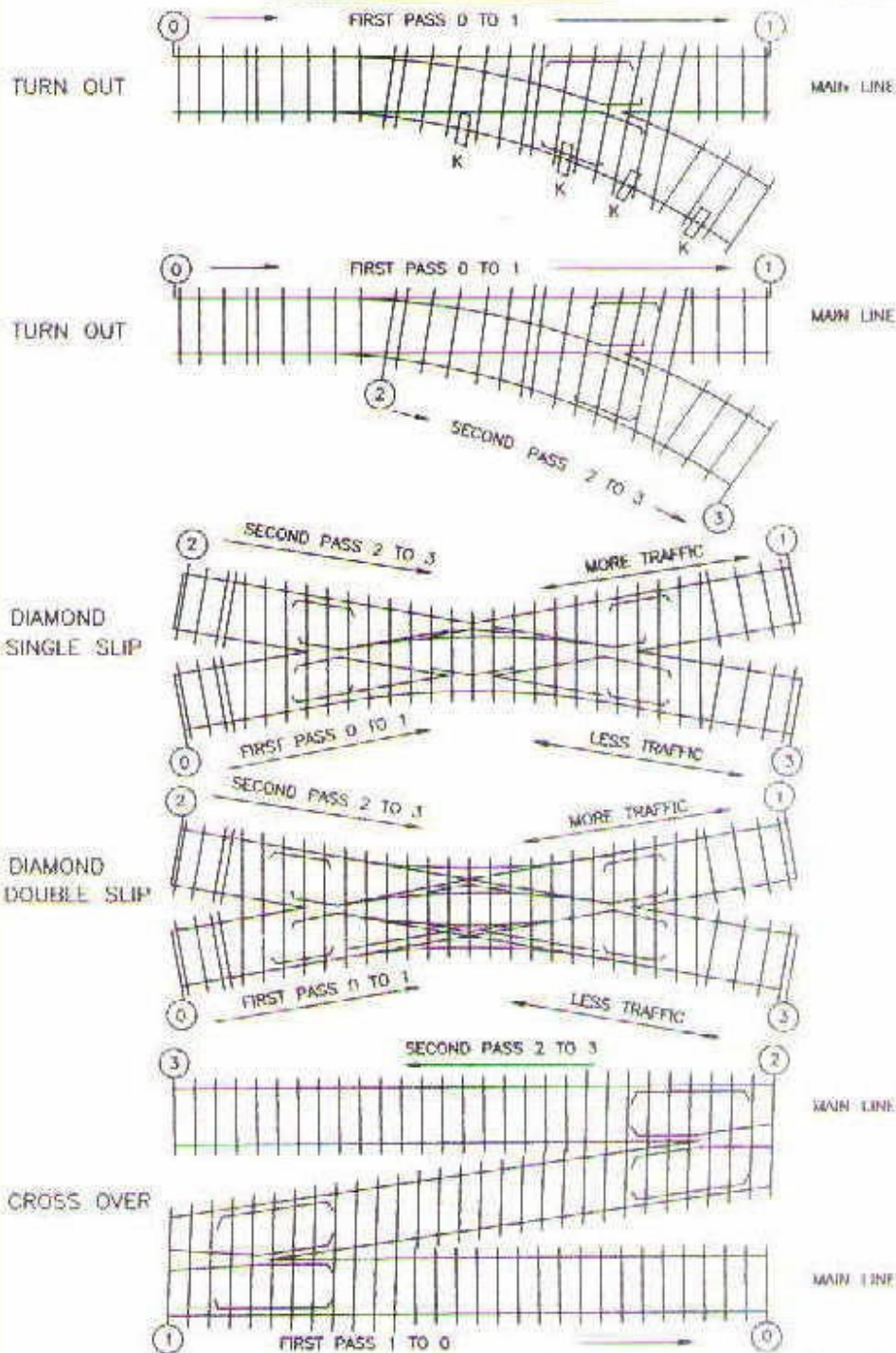
6.4 On curved track, versines should be measured on 20 m chord at 10m intervals. The required slews at the stations are worked out taking note of the obligatory points and interpolated to give slews at every alternate sleeper. The slews are then marked on alternate sleepers.

6.5 While working out slews, position of fixed structures should be noted and infringement to moving dimensions shall not be allowed.

6.6 Pre-tamping and Post-tamping operation and machine related track works as detailed in **Chapter 3** shall be ensured by the Section Engineer P. Way.

SEQUENCES OF TAMPING

Annexure 5.4



NOTE: WOODEN BLOCKS TO BE PLACED AT 'K' POSITION SHOWN ABOVE IN CASE ONLY MAIN LINE TRACK IS TAMPED AND TURN OUT SIDE IS LEFT WHILE PASSING TRAIN.

Annexure 5.5

Format for 'Log Book' to be maintained by the Track Machine Control

1. Date
2. Machine No.
3. Division
4. Section
5. UP/DN
6. Block stipulated
7. Block asked for
8. Block given
9. Effective time
10. Output
11. Location from to
12. Type of work: (Maintenance tamping, Construction/Gauge Conversion, rear tamping at track renewal/BCM site, slack picking etc.
13. Mode of machine working
14. Machine repair details
15. Spares and assistance needed
16. Special remarks in the case of block burst etc.
17. Programme for the next day (time/location)

Annexure 5.6**DAILY PROGRESS REPORT-CUM LOG BOOK**

1. Machine No. _____ Machine Base _____

Work Base ____ Date _____

Machine stabled at: ____ ____ _

Senior Operator : _____

Junior Operator : _____

Section Engineer: _____

2. Machine Movement:

Section		Time		Remarks
<i>From</i>	<i>To</i>	<i>From</i>	<i>To</i>	

3. Block Utilisation

Section Code	Block No.	Planned		Availed		Effective		Location		Up/ Dn	Kms		Sleepers	Length in Km
		From	To	From	To	From	To	From	To		From	To		

4. Base Depot Works (PQRS)

Sleepers unloaded: _____ Panels unloaded: _____ Panels assembled _____

Sleepers stock on date: _____

5. Block time lost

Block No. ____ From: ____ To ____

Reasons: _____

6. Area Worked:

(a) Block No. _____ (TTM) Maintenance: _____

Behind BCM ____ _

Behind PQRS ____ _ Construction: ____ _

(b) Design mode/smoothing mode: _ _ _

7. Track Structure

Rail: _ _ LWR/SWR/FP: _____ Sleeper: _ _ Fastenings: _____

Ballast Cushion: _____

8. Quality

X-Level: ____ _ Alignment: _____

Tamping Tools last changed: _____ Sleepers so far tamped: ____ _

9. Machine Health:

<i>Engine Water Temperature</i>	<i>Lub Oil Pressure</i>			<i>Pneumatic Pressure</i>	<i>Brake Pressure</i>	<i>Smoke</i>	<i>Others</i>
	<i>Low Idle</i>	<i>High Idle</i>	<i>Full Load</i>				

10. System Satisfactory Working

Lifting: _____ Levelling: _____ Lining: _____

Tamping: ____ _ Brake: ____ _

Joint Sleeper: _____ Hydraulic Cooling: ____ _

Axle Support: ____ _

11. Engine Meter Reading:

Start: _ _ Close: ____ _ B/F: ____ _

Duration: ____ _ Cumulative: ____ _

12. Schedule Maintenance

<i>Engine/ Machine</i>	<i>Due on date</i>	<i>Done</i>	<i>Not done with reasons</i>

13. Break-down Details

<i>Break-down Code</i>	<i>From</i>	<i>To</i>	<i>In Block or not</i>	<i>Major/Minor</i>	<i>Remarks</i>

14. Consumable Used

<i>H.S.D. Oil</i>		<i>Lub Oil</i>		<i>Hydraulic Oil</i>		<i>Gear Oil</i>		<i>Others</i>
<i>On date</i>	<i>Cumulative</i>	<i>On date</i>	<i>Cumulative</i>	<i>On date</i>	<i>Cumulative</i>	<i>On date</i>	<i>Cumulative</i>	

15. Spares

<i>Fit/Released</i>	<i>Part Code</i>	<i>Description</i>	<i>Qty</i>	<i>Unit</i>	<i>Schedule/Break-down</i>	<i>Remarks</i>

16. Abstract Performance

TTM: Total tamped on date: ____ Sleepers
 cumulative for month: ____ Sleepers
PQRS : CTR Ref. ____ CTR: From ____ To: ____
 Panels laid on date: ____ Cum. for the month: ____
 Laid in the CTR: ____
BCM: Screened on date: ____ metres
 Cumulative for month: ____ metres
BRM: Actual Km: ____ No. of passes: ____
 ETKM. ____
 cumulative ETKM for the month ____
UNIMAT: Cross over on date: ____ Cumulative for month: ____
 Straight Track on date ____ Cumulative for month: ____
Others: On date: ____ Cumulative for month: ____

17. Special Remarks - Assistance Required

18. Reasons for not Availing Block: (Machine/ S E/P.Way /Electrical/OHE/S ignal)

1) Block not planned
 4) Machine Break down
 7) Machine IOH/POH
 10) PQRS/BCM : Preliminary

2) No staff	5) Bad Weather/Rain	8) Engineering Account	11) No contract Labour
3) Block not granted	6) Machine on movement	9) Traffic Account	12) Want of Loco power

SEN

AEN

SSE/SE (P. Way)

Machine Operator

Instructions to Use above Log Book:

A. In **para 3**, indicate Section Code as follows:-

GDR-MAS	62201 (UP)	JTJ-ED	61207 (DN)
MAS-GDR	62202 (DN)	SBC-JTJ	62310 (UP)
RU-AJI	61203 (UP)	JTJ-SBC	62309 (DN)
AJI-RU	61204 (DN)	ERS-ED	62312 (UP)
JTJ-AJI-MAS	61206 (UP)	ED-ERS	62311 (DN)
MAS-AJI-JTJ	61205 (DN)	SBC-DHW	62313 (SL)
ED-JTJ	62208 (UP)	SRR-M AQ	62314 (SL)

B. In **para 12** for Schedule Maintenance, indicate 'weekly', 'monthly', '200 hrs', A, E checks etc.

C. In **para 12**, denote schedule maintenance as follows:-

- (a) Engine: A- Check, B-Check, E-Check
- (b) Machine: Schedule- I (every day), II (50 hours),
 III (100 hours), IV (200 hours),
 V (yearly), VI (2000 hours), IOH
 and VII (6000 hours), POH.

D. In **para 13**, choose breakdown codes from below:-

	06	05	02	01	08	07	09
	Mechanical	Hydraulic	Electrical	Electronic	Engine	Pneumatic	Hose Fittings
1.	Gear Box	Cylinder	Battery	Relays	Radiator	Unloader	No. 20 Hp
2.	Axle	Pumps	Wiring	PCBs	Water Pump	Valves	No. 16 Hp
3.	Bogie Structure	Motors	Alternator	Others	Lub oil Circuit	Throttles	No. 10 Hp
4.	Chain	Valves	Starter motor		Injectors	Others	No. 12 Hp
5.	Chain Links	Others	Others		Filters		No. 8 Hp
6.	Others				Compressor		No. 4 Hp

7.					Others		No. 6 Hp
8.							No. 24 Hp

Example: For Alternator failure - Write : 02 - 3

E. In para 15 for spareparts code, refer Stores/Spare Parts Catalogue.

Note:

(i) There may be sections where Code No. is not given. In such cases, write the section between major junctions.

ii) For single line portion of SBC-JTJK, give the down line code.

Annexure 5.7

Breakdown Report of Track Machines

(a) Report by Machine Incharge

1. Machine No. _____ Date of breakdown _____

2. Block permitted from _____ Hrs. to _____ Mrs.

3. Block section _____ Division _____

4. Time of breakdown _____ Hrs. to _____ Hrs.

5. Time of block cleared _____

6. Detention to train if any _____

7. Description of failure _____

8. Date of last POH/IOH: a) Machine _____ b) Engine _____

9. Date of last schedule maintenance _____

And observations made _____

10. Rectification action _____

11. Date and time M/c made fit _____

12. Report on failed part:-
 No. & description of part _____
 Make of the part _____
 Date of fitment _____
 Part identification code _____
 Spare part brought from _____

13. Name of the machine I/c _____

14. Officer/Supervisor at site _____

15. Assistance required, if any, from SEN/TT/Line office _____

16. Action suggested to prevent recurrence/reduce breakdown time
 Dated _____ Signature _____

(b) Report by Line Officer

1. Detailed description of failed part _____

2. Expected life of component _____

3. Period of service given by component at time of failure _____

4. If premature failure:
 a) Reason of failure _____
 b) Name of supplier & brand _____

5. Whether warranty period exists or not _____

6. If mature failure reason for not changing component _____

7. Whether failure was avoidable or unavoidable _____

8. Staff held responsible and action taken against _____

9. Action suggested to prevent recurrence _____
 Dated _____

SEN/TT/LINE

Copy to:

Dy Chief Engineer/TT/Line

Dy Chief Engineer /TT/HQ

Availability of Track Machine

Legend: M/c available (Black) Shi fting (black) Schedule Maintainance/IOH (Blue) Under POH (Yellow) Break Down (Red)

[illegible]

Annexure 5.9

Procedure for Calculation of Unit Cost of Working of Different Track Machines.

1. The unit cost of working shall be calculated taking capital recovery factor with interest rate of 12% from the tables in **Annexure-C of Indian Railways Finance Code (1982 Edition)**.
2. Life of the machine in terms of gross units of work done, unit cost of the machine, weightage for different types of machines for proportionate distribution of overheads on technical and general supervision and works units between IOHs are as follows:

S. N.	Type of machine	Life of machines (Gross Units of work done) (Km)	Work Units between POH (Km)	Work units between IOH (2 IOHs between POH) (Km)	Weightage
1	UT	2500	1250	425	1
2	UNO	4500	2250	750	1
3	DUO	6000	3000	1000	1
4	CSM	7500	3750	1250	1
5	UNIMAT	10000 T/Outs	5000 T/outs	1650 T/outs	1
6	Portal Crane of 3 sets	500	-	250	0.5
7	TRT	1500	750	250	3
8	BCM	1000	500	175	1.5
9	DTS	10000	5000	1700	1
10	BRM	10000	5000	1700	0.8
11	RGM	17500	8750	2925	1
12	SBCM	3000	1500	500	1.5
13	Multipurpose Tamping Machines	7500	3750	1250	1
14	Tamping Express (09-3X)	11000	5500	1850	1
15	Points & Crossing changing Machine (T-28)	1000	500	175	1

(Para 2 revised as per correction slip no.10 dated 12/12/2006)

3. The life of machines has been given in terms of km. This divided by annual output will be the life of machines in years. The maximum life should be limited to 15 years.

4. The proportionate expenditure on IOH/POH should be as follows:

$$\frac{(4 \times \text{cost of IOH} + \text{Cost of POH})}{15}$$

5. Unit cost of working for different machines shall be worked out for every financial year.

Unit Cost of Tamping Done by CSM

I. Data:

- i) Initial cost of the machine : Rs. 3.1 Crore
- ii) Rate of interest : 12%
- iii) Life of machine : 7500 km
- iv) Expenditure on IOH : Rs. 15 lakhs
- v) Expenditure on POH : Rs. 30 lakhs
- vi) Annual expenditure on machine maintenance:
 - Spare (actual) : Rs. 3.0 lakhs
 - Staff (-actual) : Rs. 0.7 lakh
- vii) Annual Operational expenditure:
 - Consumables : Rs. 2 lakhs
 - Staff : Rs. 2.6 lakhs
- viii) Overheads (Proportionate) : Rs. 1.2 lakhs

2. Annual cost of working:

- Actual tamping done in the year : 500 km
- Life of machine (7500/500) : 15 years
- CRF (Capital recovery factor) : 0.14682
- i) Capital recovery : Rs. 45,51,420
- ii) Proportional expenditure on : Rs. 6,00,000

$$\frac{\text{IOH} + \text{POH} (4 \times 15 + 30) \text{ lakhs}}{15}$$

- iii) Annual maintenance. expenditure : Rs. 3,70,000
- iv) Operation expenditure : Rs. 4,60,000
- v) Overheads : Rs. 1,20,000
- : Rs. 61,01,420

3. Unit Cost of Tamping Rs. $\frac{61,01,420}{500}$ **= Rs. 12,203/km.**

CHAPTER 6

PERIODICAL REPAIR AND MAINTENANCE OF MACHINES

6.1 General

Maintenance and repairs are essentially required for ensuring reliable and efficient working of track machines

Para 6.2 may be modified and read as under: **(CS17)**

6.2 Maintenance Schedule for Track Machines:

Maintenance and repairs of machines shall be carried as per different Schedules I to VII. Schedule VI and VII pertains to Intermediate over Hauling (IOH) and Periodic over Hauling (POH) respectively. Normally two POH are required in the life time of machines.

Maintenance Schedule for Machines other than Rail Grinding Machine (RGM):

Machines	Schedule	Periodicity	Duration	Location
Group-I Track Laying Equipment (TLE), BRM, RBMV & UTV	Schedule – I	Daily	One hour	In the Track Machine Siding.
	Schedule –II	50 Engine hrs.	Two hrs.	-do-
	Schedule –III	100 Engine hrs.	One day	-do-
	Schedule –IV	200 Engine hrs.	Two days	-do-
	Schedule –V	1000 Engine hrs.	7 days	In Satellite Depot/Zonal Workshop
	Schedule –VI (IOH)	2000 Engine hrs.	15 days	In Zonal Workshop
	Schedule-VII (POH)	6000 Engine hrs.	1 st POH-45 days, 2 nd POH-60 days	In Zonal Workshop/CPOH Workshop
Group-II Points & Crossings Changing Machine & DTS	Schedule – I	Daily	One hour	In the Track Machine Siding.
	Schedule –II	50 Engine hrs.	Two hrs.	-do-
	Schedule –III	100 Engine hrs.	One day	-do-
	Schedule –IV	200 Engine hrs.	Two days	-do-
	Schedule –V	1000 Engine hrs.	7 days	In Satellite Depot/Zonal Workshop
	Schedule –VI (IOH)	2000 Engine hrs.	15 days	In Zonal Workshop
	Schedule-VII (POH)	6000 Engine hrs.	1 st POH-45 days, 2 nd POH-60 days	In CPOH Workshop
Group-III WST-08-32, UNIMAT-2S, UNIMAT-3S & HOT-CSM	Schedule – I	Daily	One hour	In the Track Machine Siding.
	Schedule –II	50 Engine hrs.	Two hrs.	-do-
	Schedule –III	100 Engine hrs.	One day	-do-
	Schedule –IV	200 Engine hrs.	Two days	-do-
	Schedule –V	1000 Engine hrs.	7 days	In Satellite Depot/Zonal Workshop
	Schedule –VI (IOH)	2000 Engine hrs.	21 days	In Zonal Workshop

	Schedule-VII (POH)	6000 Engine hrs.	1 st POH-60 days, 2 nd POH-75 days	In CPOH Workshop
Group-IV HOT-3X & UNIMAT-4S	Schedule – I	Daily	One hour	In the Track Machine Siding.
	Schedule –II	50 Engine hrs.	Two hrs.	-do-
	Schedule –III	100 Engine hrs.	One day	-do-
	Schedule –IV	200 Engine hrs.	Two days	-do-
	Schedule –V	1000 Engine hrs.	7 days	In Satellite Depot/Zonal Workshop
	Schedule –VI (IOH)	2000 Engine hrs.	30 days	In Zonal Workshop
	Schedule-VII (POH)	6000 Engine hrs.	1 st POH-75 days, 2 nd POH-90 days	In CPOH Workshop
Group-V Track Relaying Train (TRT)	Schedule – I	Daily	One hour	In the Track Machine Siding.
	Schedule –II	50 Engine hrs.	Two hrs.	-do-
	Schedule –III	100 Engine hrs.	One day	-do-
	Schedule –IV	200 Engine hrs.	Two days	-do-
	Schedule –V	1000 Engine hrs.	7 days	In Satellite Depot/Zonal Workshop
	Schedule –VI (IOH)	2000 Engine hrs.	45 days	In Zonal Workshop
	Schedule-VII (POH)	6000 Engine hrs.	1 st POH-75 days, 2 nd POH-90 days	In CPOH Workshop
Group-VI Ballast Cleaning Machines (BCM,SBCM)	Schedule – I	Daily	One hour	In the Track Machine Siding.
	Schedule –II	50 Engine hrs.	Two hours	-do-
	Schedule –III	100 Engine hrs.	One day	-do-
	Schedule –IV	200 Engine hrs.	Two days	-do-
	Schedule –V	1000 Engine hrs.	7 days	In Satellite Depot/Zonal Workshop
	Schedule –VI (IOH)	2000 Engine hrs.	30 days	In Zonal Workshop
	Schedule-VII (POH)	6000 Engine hrs.	1 st POH-90 days, 2 nd POH-105 days	In CPOH Workshop

Note: (i) Railways should prepare a 2-years plan for their requirement of POH & IOH (firm for one year and tentative for next year), so that spares are arranged in time.

(ii) Before POH & IOH, major components to be attended in unit exchange & spares required in general should be kept in readiness.

Items to be checked and attended under various schedules shall normally be as per RDSO's instructions. In case of any doubt, it is to be referred to RDSO for clarification & till then the maintenance can be done as per manufacturer's instructions on the subject or as considered suitable with approval of CE/TMC of the Concerned Zonal Railway.

Maintenance Schedule for Rail Grinding Machine (RGM):

Maintenance of RGM shall be done by a separate maintenance team attached with each RGM. This team will be in addition to the operating team.

- a) Day to day maintenance (Schedule-I) of RGM should be done by separate maintenance group before and after traffic block, as it involves considerable work load & time. Operating team of the machine shall do daily pre-block check and duration of such check should not be more than one hour.
- b) Schedule II to IV should be carried out by maintenance group along with regular operating team.
- c) During IOH/POH of machines (Schedule VI & VII), the operating group & maintenance group should be actively involved and carry out jobs along with IOH/POH staff.

The maintenance schedule to be followed for RGM shall be as given below:

Machines	Schedule	Periodicity	Duration	Location
Rail Grinding Machine	Schedule – I	Daily	8 hours	In the Track Machine Siding
	Schedule –II	50 Engine hrs.	10 hours	-do-
	Schedule –III	250 Engine hrs.	12 hours	-do-
	Schedule –IV	1000 Engine hrs.	3 days	-do-
	Schedule –V	2000 Engine hrs.	10 days	In CPOH Workshop
	Schedule –VI (IOH)	6000 Engine hrs.	20 days	In CPOH Workshop
	Schedule-VII (POH)	15000 Engine hrs or 60 months whichever is earlier.	1 st POH-45 days, 2 nd POH-60 days	In CPOH Workshop

Items to be checked and attended under various schedules shall normally be as per RDSO's instructions. In case of any doubt, it is to be referred to RDSO for clarification & till then the maintenance can be done as per manufacturer's instructions on the subject or as considered suitable with approval of CE/TMC of the Concerned holding Railway.

A new para 6.2.1 shall be added after para 6.2 in Chapter 6 of IRTMM-2000 as per following details: **(CS16)**

6.2.1 Inspection of Wheel and Axle of On-Track Machines:

Track Machine wheels are solid wheels and follows the wheel profile as per RDSO drawing no. SKETCH-91146. Visual inspection, Physical inspection and Ultrasonic inspection of the wheels and axles of on-track machines are required to be done during initial procurement as well as during service.

6.2.1(a) Visual & Physical Inspection

Visual and Physical inspection of wheels of on-track machines shall be done during service as per "Procedure for Visual & Physical Inspection of Wheels of On-Track Machines" issued by Track Machine and Monitoring Directorate of Research Designs and Standards Organization (RDSO). Inspection shall be done at a frequency of once in a year or once after every 1000 engine running hours whichever is earlier.

6.2.1(b) ULTRASONIC TESTING OF WHEEL AND AXLE OF ON-TRACK MACHINES

- (i) Ultrasonic Flaw Detection(USFD) testing of Axles and Wheels of On-Track Machines shall be done as per "Code of procedures for Ultrasonic testing of Axles and Wheels of Large Track Machines" issued for different on-track machines by Research Designs and Standards Organization (RDSO).
- (ii) The Wheels shall be tested ultrasonically at the time of initial procurement only. The ultrasonic testing of new wheels shall be done according to the RDSO report no. IRS R-34-2003.
- (iii) The Frequency of ultrasonic examination of Axles of On-Track Machines shall be between 40,000 to 45,000 kms of running or three years, whichever is earlier.
- (iv) Testing shall be done by supervisors possessing Regular/Refresher course certificate from RDSO.
- (v) For the conduction of ultrasonic testing of Axles and Wheels, minimum qualification of supervisors shall be-
 - (a) Graduate in Science with Physics from a University or Institution recognized by Central/State Govt./UGC/or International Institute/University.
OR
 - (b) 3 years regular Diploma in Mechanical/Civil/Electronics/Electrical Metallurgical/Chemical Engg. From a University or Institution recognized by Central /State Govt./Technical education board or International Institute/University.
OR
 - (c) M.Sc in Chemistry, provided that physics was one of the subject at ISC/Intermediate/10+2 level.
OR
 - (d) B.E/B.Tech in Mechanical/Civil/Electronics/ Electrical/Metallurgical/chemical/I.T/Computer Science or Engg. From a University or Institution recognized by Central/State Govt./Technical education board or International Institute/University.
- (i) The validity of regular course certificate shall be 3 years and Refresher course certificate shall be 5 years.
- (ii) Metallurgical & Chemical Directorate of Research Designs and Standards Organization regularly conducts training of supervisors for ultrasonic examination of Wheels and Axles. Railways shall nominate their proper staff for required training.

6.3 Types of Workshops

Workshops, to deal above schedules, shall be following five levels:-

- i) Central Periodical Overhauling Workshop (CPOH)
- ii) Intermediate Overhauling Workshop (IOH)/Zonal Base Depot
- iii) Satellite depot
- iv) Mobile Workshop
- v) Camp Coach Workshop

6.3.1 Central Periodical Overhauling Workshop (CPOH)

At present, there is one CPOH Workshop at Allahabad, catering to the POH of tamping machines. POH of other machines is carried out by Zonal Railways, as prescribed by the OEM. The functions of CPOH workshop are as under:-

- i) P.O.H. of machines
- ii) Overhauling of tamping units, gear assembly, axle assembly and lifting, - lining assembly for unit exchange either at shop floor or field.
- iii) Post POHs Service to Zonal Railways and performance monitoring of overhauled items
- iv) Development of expertise, standardisation/documentation/dissemination of knowledge with respect to overhauling of assemblies.
- v) Study of inter-changeability of components and sub-assemblies.
- vi) Study of failures, finding out remedial measures, trouble shooting and development of maintenance practices.
- (vii) Procurement of stores and equipments required for POH and their inspection.
- (viii) Inspection and testing of machines/assemblies received prior to and after POH.
- (ix) Study of new imported machines and preparation of inventory list with complete series of machines (machine-wise) and checking for changes with reference to old series of machines.
- (x) Development of indigenous substitutes and reliable competitive sources of supply.
- (xi) Development of drawings and material specifications for manufacture of spares.
- (xii) Providing shop floor training regarding maintenance of machines.

The crew incharge of the machine shall accompany the machine sent for POH to CPOH workshop and associate in overhauling of the machine throughout. The zonal railway should make out a detailed report about the health of machine being sent for CPOH, indicating the history of defects and failures of the machine and sent it to Dy.CE/CPOH at least one month in

advance of arrival of the machine, for CPOH workshop to take preparatory action. The zonal railway should send the complete machine without removing any of the part before POH.

After overhauling of the machine, the staff of the machine shall receive the machine only after all the tests and trials have been carried out. An officer of the owning railway should be present during the testing and trials.

The CPOH workshop shall stand warranty for satisfactory working of the machine, for a period of six months after commissioning of the machine. CPOH workshop shall advise the machine holding railway about the indigenous components used in the overhauled/repared assemblies and the zonal railways shall submit feedback to CPOH workshop about their performance.

For overhauling of tamping units, the railways will plan their annual requirements and advise the CPOH workshop in advance. Also the railways will make their own arrangements for transportation of tamping units from the workshop.

Model activity flow chart for POH of tamping machine is shown in **Annexure 6.1**. Typical list of facilities for CPOH workshop is given in **Annexure 6.2**.

6.3.2 Intermediate Overhauling Workshop/Zonal Base Depot

Normally, there shall be one IOH Workshop with each zonal railway. The IOH shall be carried out as per Schedule VI mentioned in **para 6.2** unless otherwise stipulated by the OEM. Items like engine top overhaul, renewal of pumps and motors and valves, tyre tuning, attention to measuring system, attention to tamping unit and brakes etc should be attended. In addition, attention shall be given to other items on condition basis as per repeated failures reflected in the log-book. Proper advance preparation shall be done after survey of the machine to be overhauled. Normally, two IOHs shall be done before each POH. If POH/IOH at lesser interval is considered necessary, approval of Chief Track Engineer (Machines) should be obtained. Normally, such instances will arise only if there are major structural damages or cracks or major overhaul of power packs or major modifications are necessary. Heavy overhauling of assembly can be clubbed with POH when considerable stripping/disassembly is required to reach some important components for check or rehabilitation.

Typical facilities required at IOH workshop are mentioned in **Annexure 6.2** alongwith CPOH Workshop facilities.

6.3.3 Satellite Depot

In addition to IOH workshop, zonal railways will set up Satellite Depots to meet the spares and maintenance needs of a group of 10-12 machines working nearby in one or more divisions.

The track machines shall be brought to the Satellite Depots for repairs, which can not be performed in the field. Facilities at Satellite Depots shall include stores for essential and consumable spares with facilities for housing the track machines and carrying out the repairs/assembly replacements and offices for supervisors/Officer-in-charge. The supervisor/officer incharge of the machine (s) shall also be in-charge of the Satellite Depot.

6.3.4 Mobile Workshop-cum-Transport Van

Each Railway shall have adequate number of Mobile Workshops (Road Vehicles) of adequate capacity to repair track machines, which are deployed all over the zone. The mobile workshop shall attend each track machine periodically to cover Schedules II to V and breakdown repairs. It will carry spares and consumables to be replenished. For this, sufficient inventory of spares will be maintained in the van. The mobile workshop shall be provided with well trained staff who can handle repair of various systems.

Typical facilities to be provided in a Mobile Workshop, are given in Table 6.1:-

Table-6.1

S.N.	Items	Quantity
1	Two tonne crane/hoist to handle tamping unit, engine etc.	1
2	Portable tent	1
3	Portable Electric drill machine, Flexible shaft grinder	1 each
4	Bench grinder	1
5	DG set 10 KVA	1
6	Welding Plant	1
7	Gas cutting equipment	1
8	Work table -with bench vice, tool kit	1 each
9	Lighting arrangement	1
10	Air Compressor (600 CC)	1
11	First Aid Box	1
12	Nominated inspection gadgets as prescribed by OEMs i.e. PLASSER, CUMMINS, MWM, ZF, DEUTZ, REXROTH, SKF, PARKER, DENISON	1 set
13	Heavy duty jacks, pullers, pushes upto 50 ton capacity	1 set
14	Multimeter	1
15	Tachometer (Contactless)	1
16	Small pry bars	2 sets
17	Temperature meter digital (contact type)	1
18	Vibration (Frequency) Meter	1
19	Reamers	8
20	Seals installation kits	1 set

21	Bearingpuller/ pushers, presses	1 set
22	Accumulator pressure checking and filling device PC-250 complete	1 set
23	Seal measurement kit	1
24	Wheel defect gauge	1
25	Torque Wrenches	1 set
26	Magnetic base dial gauge	1
27	IC Tester, Relay Tester, Diode Tester	1
28	O-ring cone	1
29	Gauge cum level	1
30	Pendulum calibration pads	1 set
31	Versine Measuring Chord	1
32	Go-NO-Go gauge for tampingynes	1 set
33	Hydrometer	1

6.3.5 Camp Coach Workshop

Camp Coach shall be attached with each machine. It shall contain provisions of small Workshop. These shall be manufactured or re-furnished as per the drawing issued by RDSO.

i) Function of Camp Coach Workshop

It will cater for Schedules I, II, & occasionally III. The spares and equipment for minor repairs and daily usage shall be kept on camp coach.

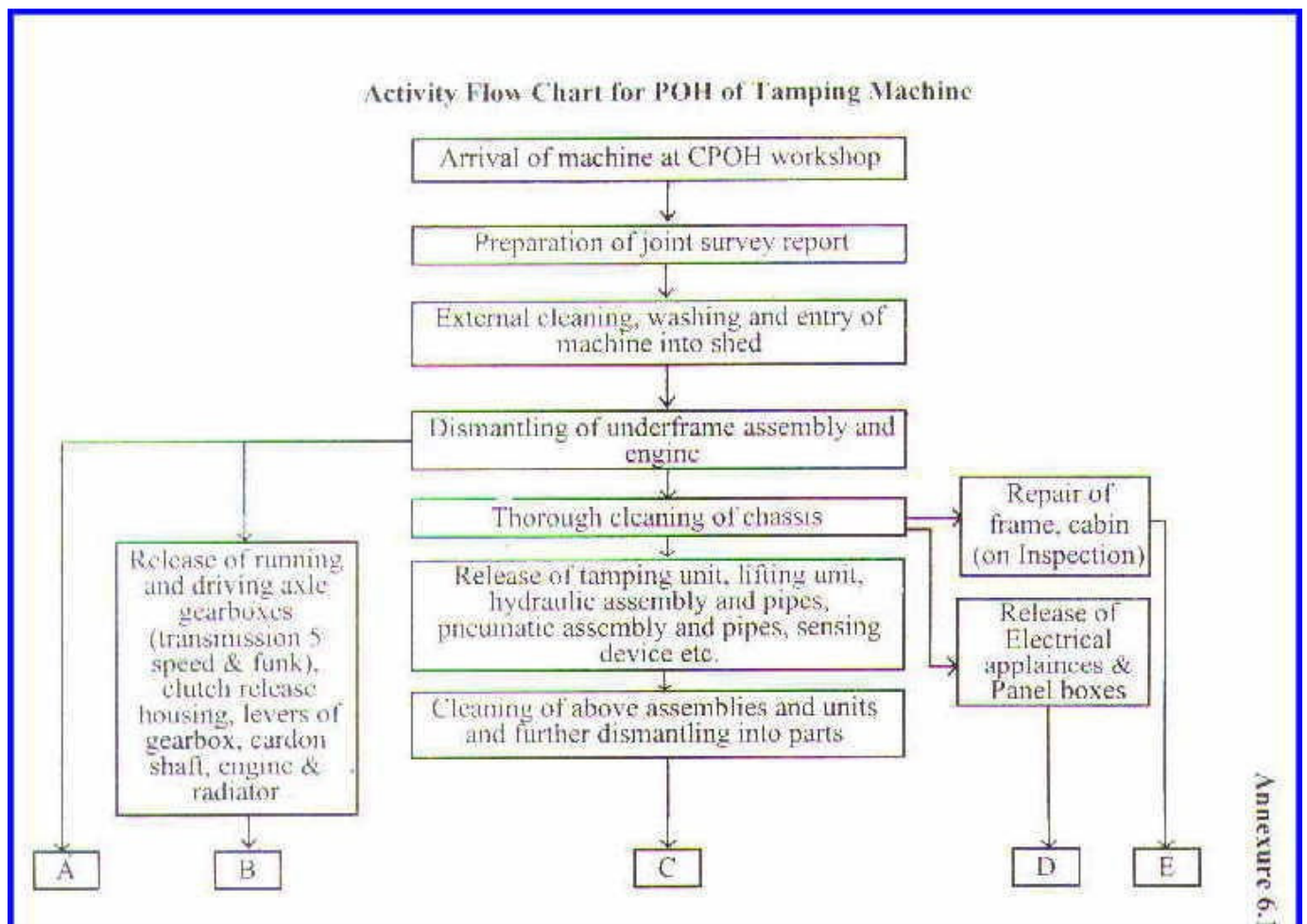
ii) Typical list of equipments to be kept in Camp Coach Workshop are given in Table 6.2 :-

Modified Table 6.2 as per CS12

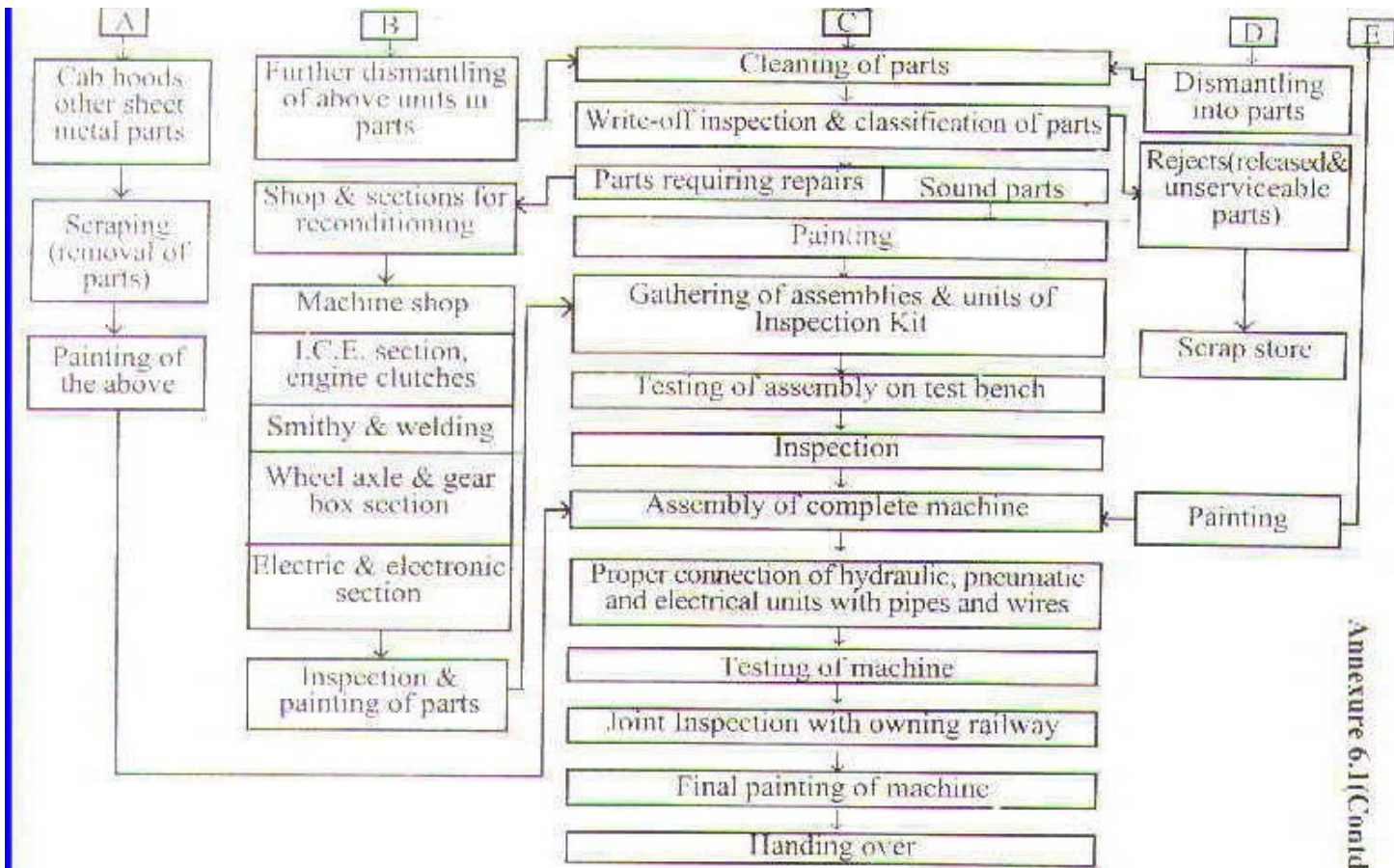
S. No	Items	Quantity
1.	Welding plant	1
2.	Bench grinder	1
3	Bench vice and a work table	1
4.	Drill machine	1
5.	Tool kit	1
6.	Portable filter	1
7.	Portable crimping machine	1
8.	Hot air blowers	1
9.	Digital Multimeter	1

10.	Accumulator pressure checking and filling device PC-250 complete	1 set
11.	Torque wrench	1 set
12.	Pendulum calibration pads	1 set
13.	Versine measuring chord	1
14.	Go-No-Go gauge for tamping tynes	1
15.	Tamping tool profile bore gauge	2
16.	Steel scale 1 to 6"	1 set
17.	Taper gauge upto 1'	1
18.	Feeler gauge	1
19.	Thread gauge	1
20.	Cell Tester (battery voltage)	1

Annexure 6.1



Annexure 6.1(Contd.)



Annexure 6.2

Typical Facilities of POH and IOH Workshops To Overhaul 24 Machines and 100 Tamping Units Per Year

(A) Shed & Structures

SL.	Description of items	CPOH Shed Size	IOH Shed Size for 3 machines
1.	Cleaning and Painting Shed - This shed should be separate and outside the main POH shed to avoid pollution of dust, oil, paint, grease etc.	30m × 15m	-
2.	POH & Repair Shed - This shed shall house 6-8 machines at time	6 × 30m × 15m	30m × 30m
3.	Tamping Unit POH Shed	30m × 15m	30m × 15m
4.	Tamping Unit Dismantling Shed	30m × 15m	-
5.	Room for repair and testing of Hydraulic and Pneumatic system	6m × 4m	5m × 4m
6.	Room for repair and testing of Electrical and Electronic systems	5m × 4m	5m × 4m
7.	Room for stores and inspection and samplings	16 nos.	16 nos.
8.	Open fenced space for housing Hydraulic Oil, Diesel	30m × 30m	30m × 30m
9.	Open fenced space for housing scrap materials	15m × 15m	15m × 15m
10.	Administrative Block	16 nos.	8 nos.
11.	Rest House	24 Bed Accommodation	8 Bed Accommodation
12.	Overhead Water Tank	50,000 litres Capacity	10,000 litres Capacity
13.	Room for Electrical substation, DG set, Transformers	Yes	Yes
14.	Workshop enclosures of Pucca Boundary wall	Yes	Yes
15.	RPF Check post & room for visitors	Yes	Yes
16.	Test Track (PSC)	2 × 500m	-
17.	Zero Error test track	1 × 50m (concreted)	-
18.	Siding and shunting lines with manual Turntable arrangement/ triangle	Yes	Yes
19.	Garage for housing vehicles	3	3

(B) Machinery and Plant

SL.	Description of items	CPOH Shed Size	IOH Shed Qty for 3 machines
1.	Precision inspection gadgets/ instruments i.e.	1 Set	1 Set

	Electronic/Air gauge, Micrometers. Dial gauges, USFD equipment, Hydraulic Electronic/Electrical/Tamping Unit Test Bench. Digital Multimeter with high accuracy of resolution, oscilloscope 35 MHz. Testing device for analog evaluation for setting of PCB & other control amplifiers. Test bench for testing all types of PCB, ZF test kit, Pendulum & transducer testing device		
2.	Nominated inspection gadgets as prescribed by OEMs i.e. PLASSER, CUMMINS, MWM, ZF, DEUTZ, REXROTH, SKF, PARKER, DENISON etc.	1 Set	1 Set
3.	Mechanised Hydraulic arrangement for lifting and removing heavy assemblies i.e. Axles	3 Set	3 Set
4.	Hydraulic power plant for Hydraulic testing (Operation of Hydraulic tool)	1 Set	1 Set
5.	5 Tonne EOT Cranes in each POH shed	8 Set	3 Set
6.	Hydraulic tools	4 Set	1 Set
7.	Pneumatic tools for assembly/disassemblies works	4 Set	1 Set
8.	LUCAS type power packs	3 Set	1 Set
9.	Power Hacksaw machine	2	1
10.	Circular Saw for metal cutting	2	1
11.	Gas welding & cutting equipment	2	1
12.	Spray painting/ high pressure jet cleaning equipments	2	-
13.	D. G. Set for standby power supply	1 set of 110 KVA	1 set of 30 KVA
14.	Hot cleaning tank	2	1
15.	Freezing Unit	2	1
16.	Heating tank (Oil bath)	2	1
17.	Hydraulic Press 30 Tonne Capacity	2	1
18.	Heavy duty jacks, pullers, pushers upto 50 tonne Capacity	2 Sets	-
19.	Milling Machine	1	-
20.	Radial drill machine	1	-
21.	Lathe	1	1
22.	Shaper	1	1
23.	Horizontal Vertical Honing Machine	1	-
24.	Horizontal Vertical Boring Machine	1	-
25.	Electric Welding Plant	1	1
26.	Turning Bench/jigs & fixtures for gears	2	1
27.	Turning Bench/JIGS & Fixtures for tamping unit	16	2
28.	Motorised Trolley	1	1
29.	Shop floor Cleaning Machine (Scrubber)	2	1
30.	Heavy Duty Vacuum Element	1	1
31.	Hot Air Blowers	1	1
32.	Exhaust Fans	12	6
33.	Portable Filtration Equipment	2	1

34.	75 GPM ON LINE Hydraulic Tester for measuring oil flow, pressure and temperature	1	1
35.	Accumulator Pressure checking and filling device PC-250 complete	2	1
36.	Parker PLC-2000 (Laser Particle Counter)	1	-
37.	Digital Multimeter	1	1
38.	Db Meter (For Noise Level)	2	1
39.	Tachometer (Digital Photo Tachometer)	2	1
40.	Small Pry bars	4 Sets	1 Set
41.	Digital Temperature Meter (Contact Type)	2	1
42.	Vibration (Frequency) Meter	1	-
43.	Reamers	16 Sets	2 Sets
44.	Seals installation kits	4 Sets	1 Set
45.	Bearingpuller pushers, presses	2 Sets	1 Set
46.	Flow meter	4	1
47.	Vacuum Gauge	4	4
48.	Digital Pressure Gauge	2	1
49.	Seal Measurement Kit	2	1
50.	Wheel Gauge	2	1
51.	Height Gauge	2	1
52.	Gland Bush Grooves Measuring Gauge	2	-
53.	Gear Set Centre Matching Instrument	1	-
54.	Wheel Diameter Gauge	2	1
55.	Surface Table	2	1
56.	B-Block for roundness checking	2	-
57.	Depth Bore Gauge (1M X 50MM to 200MM dia	2	-
58.	Slip Gauge (key way) internal distance	2	-
59.	Portable Surface Finish Tester	1	-
60.	Magnetic Base Dial Gauge with magnetic	2	-
61.	Snap Gauges Go/No-Go Type)	2	-
62.	Hose Cutting Machine	2	1
63.	Hand Operated Test Pump for proof of hoses	1	1
64.	LUCAS Testing Bench for testing self starters and alternators	1	1
65.	IC tester, Diode Tester, Relay Tester	1	-
66.	O-ring (Parker make) O-ring Tester	1	-
67.	O-ring Cone	1	-
68.	Track Gauge-cum-Level	1	-
69.	Pendulum Calibration Pads	1	-
70.	Track Versine Measuring Chord	1	-
71.	Go-No-Go gauge for tamping tynes	1	1
72.	Tamping tool profile bore gauge	1	1
73.	Dial bore Gauge	1	-
74.	Micrometer of different sizes/type	2	1

75.	Calipers of different sizes/types	4	2
76.	Steel Scales	10	2
77.	Rubber Hardness Tester (Shore -A)	2	1
78.	Taper Gauge upto 1"	2	1
79.	Radius Gauge	2	1
80.	Feeler Gauge	2	1
81.	Hydrometer	2	1
82.	Thread Gauge	4	2
83.	Cell Tester (Battery Voltage)	2	1
84.	Multimeter	2	1

CHAPTER 7

DUTIES OF DIVISIONAL OFFICERS & STAFF IN CHARGE OF P. WAY

7.1 Duties of incharge SSE/SE/JE (P. Way)

- i) SSE/SE (P. Way) incharge of the section is responsible for pre-block operations, Block operations (other than machine operation) and Post-Block Operations as detailed for various machines in **Chapter 3**.
- ii) After closing of the work by track machines, checking the condition of track and attending to any short-comings manually and ensuring that the track parameters are well within the safety tolerance and free of obstructions/infringements for safe passage of traffic before clearing the line block will be the responsibility of the SSE/SE/JE (P. Way) who works with the machine, including imposition of suitable speed restrictions, if necessary based on the condition of the track after machine working.
- iii) The issue of revised caution orders and modifications to the location and extent of speed restrictions and providing shifting of various engineering indicators to suit the progress of work at the end of each day will be the responsibility of the SSE/SE/JE (P. Way) working with the machine.
- iv) Transportation of tamping tools to be reconditioned and bringing back reconditioned tamping tools will be his responsibility. Similarly, he will be responsible for temporary storage and timely transportation of diesel oil, Lub Oil, Hydraulic Oil and other consumables from the Depots to various machines working in his jurisdiction.
- v) He should make available the details of precise track geometry data for working of the tampers in design mode.
- vi) He shall ensure the quality of work done by the machine and if the quality is not satisfactory he along with machine operator shall investigate and take suitable remedial measures.
- vii) He is responsible for protection of the site of work and adjoining track wherever necessary. He will be responsible for arranging adequate precautionary measures for the safety of staff working with the machine in the block section against danger of trains on the adjoining line(s).
- viii) He is responsible to ensure that the machine(s) are stabled in suitable sidings and at such stations as to minimising idle run of the machines as well as wastage of block hours in entering and clearing of the block section.
- ix) He is responsible for clearing of the block section in case failure of the track machines in mid-section, duly calling for necessary assistance of light engine, breakdown special etc. as necessary.

x) He shall arrange for protecting and watching of stabled machines and to ensure that no sick vehicles etc, are pushed into the same siding affecting the taking out of the machines to avail blocks.

(xi) He shall co-ordinate with other departments like Traffic, OHE and S&T in the field to facilitate working.

7.2 Duties of Assistant Engineer (Open Line)

i) He shall arrange for suitable accommodation for machine staff wherever camping coaches are not provided or are inadequate, with the facility of water supply, power supply and resting arrangement.

ii) He shall periodically inspect track machines working in his jurisdiction as specified in **Chapter 5**.

iii) He shall arrange for transportation of consumables, spares etc., required by the machines from the Depots to site of work.

iv) He shall ensure adequate lighting arrangements where night working by Machines are involved.

v) He monitor output and quality of work done by the machines.

vi) He shall co-ordinate with other departments like Traffic, OHE and S&T in the field to facilitate machine working.

7.3 Duties of Sr. DEN/DEN

i) Sr. Divisional Engineer/Divisional Engineer is responsible for sending the Annual requirement plan for track machines to Headquarters and to initiate all preliminary works on receipt of Draft Deployment Plan from HQ and for timely completion of all preparatory works for operation of machines as per approved deployment programme as detailed in **Para 5.1.1**.

ii) He shall ensure that the pre-requisites for introduction of various track machines as specified in **Chapter 5** are complied with, well in advance of deployment of the machine.

iii) Wherever the frequency of tamping is more than the prescribed tamping cycle, necessary action should be taken by him to improve the track structure and to eliminate the causes leading to such more frequent tamping

iv) He shall make arrangements for adequate external lighting when night working is involved.

v) He shall make arrangements for pre-block, during block and post-block working duly fixing agencies wherever required.

vi) He shall ensure that detailed MOUs for day to-day working are issued jointly with Sr. Divisional Operating Manager at Divisional level based on MOUs issued by the Headquarters.

vii) He shall plan necessary works for providing favourable cross-overs and sidings for berthing of machines wherever necessary. He should also ensure that arrangements are made for adequate lightening and water supply at such sidings.

viii) He shall ensure that machines are utilised in continuous stretches as per planned programme avoiding frequent shifting of the machines.

ix) During inspection of the machine working at site, he shall see the safety aspects of staff against danger of incoming trains on adjacent line(s).

.....

CHAPTER 8

STAFF REQUIREMENTS AND OTHER INFRASTRUCTURAL FACILITIES

8.1 Introduction

Different types of track machines available on Indian Railways are discussed in **Chapter 2** of this Manual. The number of machines required will depend upon the workload, age and health of machines as well as availability of line block.

8.2 Requirement of Staff for Machine Working

8.2.1 The staff required for machine working can be grouped as under:-

- i) Staff for field operation
- ii) Staff for field supervision, technical and general services.
- iii) Staff for repairs and maintenance, excluding POH.

8.2.2 The scale of staff for above groups is given in **Annexure 8.1**.

8.2.3 While scale of staff for group (i) above has been laid down for each type of machine separately, scales of staff for other groups have been laid down for the units of the machines giving weightage factors to different types of machines, as given in para (A) of **Annexure 8. 1**.

8.2.4 It has already been specified in **Chapter 6** that the POH of the machines may be carried out either by Central POH Workshop, Allahabad or by entering into a contract with the manufacturer/authorized service agents.

8.3 Training of Track Machine Personnel

8.3.1 The subject of Track Machines shall form a part of the syllabus of relevant training course at IRICEN/Pune. In addition, officers of Track Machine Organisation shall undergo special courses on Track Machines conducted from time to time. They shall also be exposed to facilities available at IRTMTC and CPOH Workshop/Allahabad.

8.3.2.

“All technical staff working on track machines shall undergo regular courses framed for different categories at IRTMTC/Allahabad. They shall also undergo various refresher courses at IRTMTC once in 5 years. However, the staff performing the duties of driving the track machines shall undergo refresher courses at IRTMTC once in 3 years. Training facilities with manufacturers may also be availed”.

(8.3.2 Revised as per correction slip no.6 dated 13.01.2004 para B)

8.4 Other Infrastructure Facilities

Base and satellite workshops are covered in **Chapter 6**.

Following additional facilities are necessary for day-to-day working of machines:-

- i) Transport and storage facilities for hydraulic oil, lubricants & fuel
- ii) Transport for spare parts.
- iii) Communication facilities.
- iv) Repairs and stabling line for machines.
- v) Resting facilities for staff.
- vi) Cash imprest.

8.4.1 Storage and Carriage Facilities for Fuel and Oil

Special road mobile unit(s) to carry and distribute fuel, lubricants and hydraulic oils with pumping arrangements shall be provided. The mobile van carrying fuel will have to fulfill statutory safety standards in this regard. More than one unit may be necessary for each Base/Satellite Depot depending upon the number of machine units to be catered for.

8.4.2 Transport of Spare Parts, Assemblies.

Large parts/assemblies are required to be transported by road while other items by train service. One or more road vehicles shall be provided with the " Base/Satellite Depot, depending on requirement

8.4.3 Communication facilities.

A walkie- talkie/ VHF communication system shall be available between the site of the work and the adjoining stations. Where communication from mid section to Engg. Control is available, such a facility shall also be used communications related to machine working. Necessary communication sets shall be provided to machine incharge. The machine staff shall communicate with their controlling officers from PCO/FAX/STD booths, if required. The officers of Track Machines Organisation shall be provided with adequate communication facilities including STD and FAX.

8.4.4 Repairs and Stabling Facilities for Machines:

In addition to sidings at Section Engineer (P.Way)'s headquarters, siding of adequate lengths to stable Track Machines & camp coaches shall be available at stations about 30 kms apart. These sidings shall be provided with facilities of electricity water supply. Electric supply will enable minor repairs to be carried out in the workshop of the camp coach.

8.4.5 Resting Facilities for Staff

Rest House facilities shall be provided, attached to each Sectional Engineer (P. way)'s office for Track Machine staff. One camp coach i.e. 'Workshop-cum-Rest Van shall be provided alongwith each track machine. The coach shall be capable of being attached alongwith the machine and also in train formation. List of equipments and facilities in this coach shall be in accordance with the standard plans. (Annexure 8.2.1, 8.2.2, 8.2.3, 8.2.4, 8.2.5, 8.2.6, 8.2.7 & Annexure 8.3") issued by RDSO, including provision of refrigerator and cooking gas.

8.4.6 Cash Imprest:

Suitable cash imprest shall be available with the Assistant Engineer/Track Machine for purchase of minor items of urgent and critical nature and to carry out urgent repairs from nearby local markets. The imprest will also meet needs for communication such as STD, FAX etc.

8.4.7 Rest Roster (Added as per Cs no. 1 dated 18.10.2000)

Staff working on Track Machines may be rostered to work for a period of 3 weeks at a stretch followed by continuous rest for a period of one week at headquarters. The three weeks continuous roster will include the actual period of journey undertaken from headquarters to the place of work and the back. The individuals shall not be employed for more than 12 hours on any day. In respect to overtime, the staff will be governed by extant instructions under HOER in regard to the principle of averaging.

The actual duty hours (timings) for staff working on various track machines shall be decided by the Zonal Railways, keeping in view the timings of the nominated corridor blocks over the sections where the machines are deployed, within the above provisions.

The above instructions will be valid for a period of three years (from July, 2000). This is a temporary exemption from the Provision of Railway Act 1989."

.....

Annexure 8.1.

(CS.9)

Weightage Factors for Track Machines and yardsticks for staff.**(A) Weightage Factors (Units) for Track Machines: (corrected vide correction slip no. 9 dated 20/10/2006)**

Weightage Factors for different types of machines are as under:

S. No.	Type of Machine	Weightage Factor
1.	Tampers, Rail Grinding Machines (each module of 16 stones), Dynamic Track Stabilizer, Mobile Flash Butt Welding Plant, Points & Crossing Laying Machine.	1.0
2.	Ballast Regulator/Utility Vehicle (Self Propelled), Track Maintenance Vehicle.	0.8
3.	Ballast Cleaning Machine, Shoulder Ballast Cleaning Machine and Rail Vacuum Excavating Machine (VM -170).	1.5
4.	Track Relaying Train.	3.0
5.	Portal Crane, Spoil Disposal Unit/Tie Crane/Tie Exchanger/Rail Lifting Units, Rail-Cum-Road Vehicles.	0.5

(B) Scale of Staff for Field Operation.

Scale of Field Operation staff for each type of machine per shift is as given in the following table:

S. No.	Name of Machine	Track Machine Supervisors cum machine operators in the present designations of SSE(TM)/S E(TM)/JE-I(TM)/ JE- II(TM)	Track Machine Maintainers	Track Machine Helper	Cook	Total (Excluding Cook)
1.	Plain Track Tamper (UNO, DUO/ Worksite & CSM)	2	3	3	1	8
2.	P&C Tamper (Unimat)/ Multipurpose Tamper	3	3	3	1	9
3.	Dynamic Track	2	2	2	Nil	6

	Stabilizer					
4.	Rail Grinding Machine (16 Stone)	2	3	2	1	7
5.	Mobile Flash Butt Welding Plant	2	3	3	Nil	8
6.	Ballast Regulator	2	2	3	Nil	7
7.	Ballast Cleaning Machines	3	3	4	1	10
8.	Track Relaying Train	6	8	14	2	28
9.	Portal Crane (one No.)/Spoil Disposal Unit/Tie Crane/Tie Exchanger/Rail Lifting Units/Rail Cum Road Vehicles	1	1	1	1 Per set of 2/3 Portals	3
10.	Shoulder Ballast Cleaning Machine	3	3	4	1	10
11.	P&C Laying Machine (Two T-28 Cranes + one Jib Crane)	3	3	3	1 per set of 2 T-28 & 1 Jib Crane	9
12.	Utility Vehicle (Self Propelled), Track Maintenance Vehicle	2	2	3	Nil	7
13.	Rail Vacuum Excavating Machine (VM 170)	3	3	4	Nil	10
14.	Tamping Express (09-3X-CSM)	2	4	4	1	10

Note:

- i. The categories of Track Machine supervisors cum machine operators, track machine maintainers and track machine helpers shall be operated as cadre posts and the post of cook shall be operated as ex-cadre. No separate provision for Khalasi or helper is to be granted along with the cook.
- ii. The requirement of a cook for BRM & DTS shall be met with out of the provision made for the machine to which these machines are attached.
- iii. For all the above categories, no Leave Reserve (LR), Rest Giver (RG), & Trainee Reserve have been considered. These shall be regulated under instructions of Railway Board, if any, from time to time.
- iv. Distribution & Designation of individual posts in various categories shall be based on restructuring formulae and percentage distribution of various types of grades applicable from time to time.

- v. The nomenclature of track machine maintenance covers all types of artisan staff required for operation of machine.

(C) Scale of Staff for Field Supervision, Technical & General Services for Divisional Depot.

1. Gazetted Posts.

(a) Junior Scale/Senior Scale posts for field supervision: Yard stick for this category of posts is as below:

- (i) 1 (one) post for every 6 units of Track Machines subject to the condition that maximum 1 (one) Jr. Scale post to be provided in each Division for units of Track Machines up to 12 (Twelve).
- (ii) For division with more than 12 units of Track Machines, one Sr. Scale and one Jr. Scale posts are to be provided.

2. Non-Gazetted posts:

Staff requirement for field supervision, technical and general services shall be worked out on the following scale for a set of six track machine units and following set up should be provided in each division:-

S. No.	Category	Nos.
1	Track Machine supervisors cum machine operators in the present designations of SSE(TM)/SE(TM)/JE-I(TM)/JE-II(TM)	2
2	Track Machine maintainers in the present designations of Master Craftsman/Fitter Gr.I/Fitter Gr.II/Fitter Gr.III	3
3	Track Machine Helpers in the present designations of Helper Gr.I/Helper Gr.II	2
4	Sr. Clerk/Material Chaser	1
Total (for a set of 6 units)		8

Note:

- a. Weightage factors as per para (A) shall be applied and units of track machines calculated by multiplying number of each type of track machine with the weightage factor.
- b. For all the above categories, no Leave Reserve (LR), Rest Giver (RG) and Trainee Reserve has been considered. These shall be regulated under instructions of Railway Board, if any, from time to time.
- c. Distribution and designation of individual posts in various categories shall be based on restructuring formulae and percentage distribution of various types of grades applicable from time to time.
- d. The nomenclature of track machine maintainers covers all types of artisan staff required for operation of machine.

D. Scale of staff for repairs and maintenance for Zonal Depot.

The scale of staff for repairs and maintenance in zonal depots excluding POH is as under:

1. Gazetted Posts.

Senior Scale and JA Grade posts for Zonal Depots: Yardstick for this category of posts is as below:

S.No.	Category	Sr. Scale	JA Grade
1.	Up to 25 Units of TMs	1	0
2.	25 to 40 Units of TMs	0	1
3.	More than 40 Units of TMs	1	1

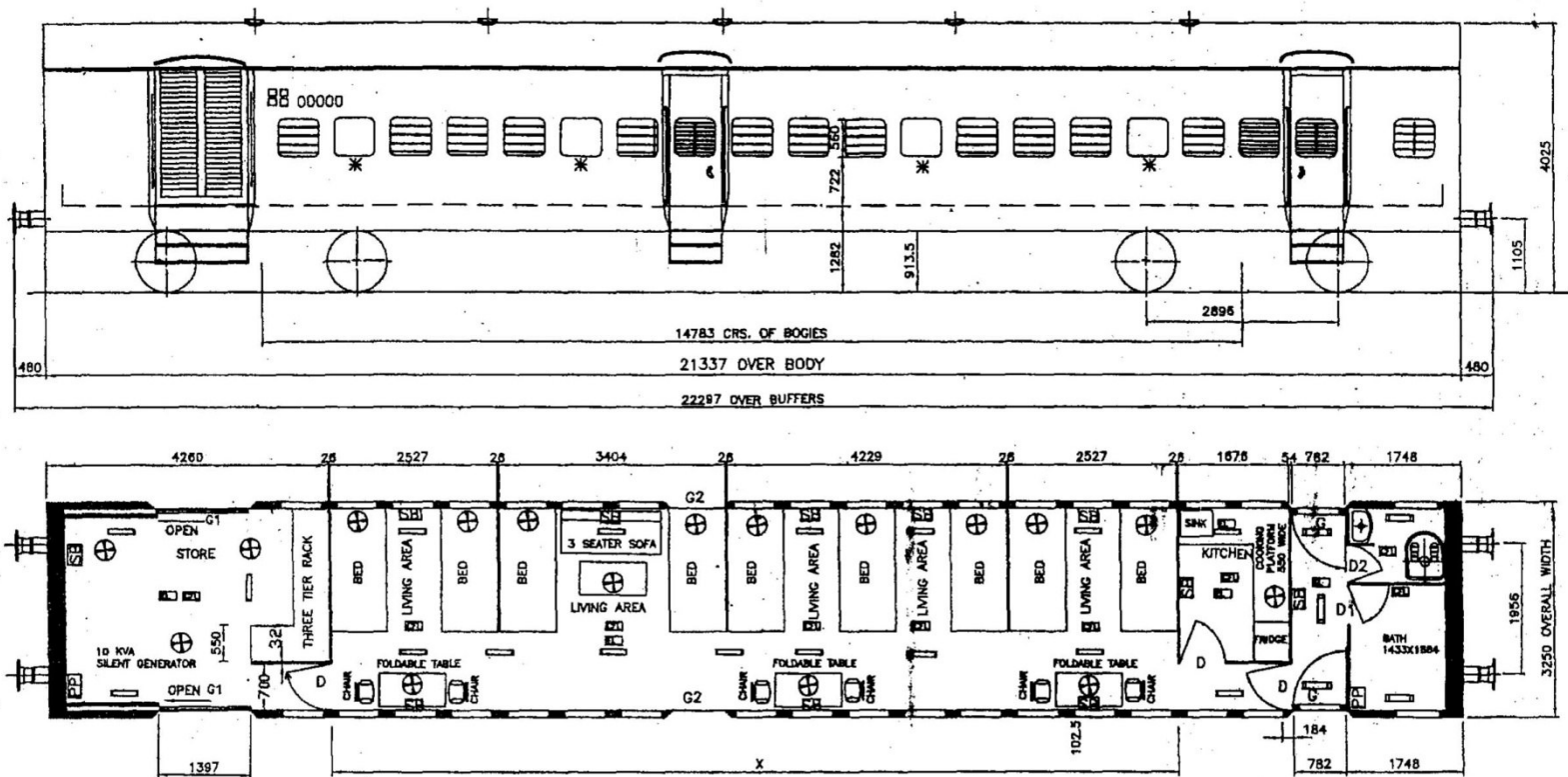
2. Non-Gazetted posts.

S. No.	Category	Nos. for large holding zones i.e. > 40 units	Nos. for medium holding zones i.e. > 21 to 40 units	Nos. for small holding zones i.e. up to units
1	Track Machine supervisors cum machine operators in the present designations of SSEITM)/SE(TM)/ JE-I(TM)/ JE-II(TM)	14	10	6
2	Track Machine maintainers in the present designations of Master Craftsman/ Fitter Gr.I /Fitter Gr.II /Fitter Gr.III	30	21	15
3	Track Machine Helpers in the present designations of Helper Gr.I/Helper Gr.II	28	21	13
4	OS	1	-	-
5	Head Clerk	1	1	1
6	Sr. Clerk	1	1	-
7	Draftsman	1	1	1
8	Steno	2	1	1
9	DSK	1	1	1
10	Material Chaser	3	2	2
	Total	82	59	40

Note:

- Weightage factors as per para (A) shall be applied and units of track machines calculated by multiplying number of each type of track machine with the weightage factor.
- For all the above categories, no Leave Reserve (LR). Rest Giver (RG) and Trainee Reserve has been considered. These shall be regulated under instructions of Railway Board, if any, from time to time.
- Distribution and designation of individual posts in various categories shall be based on restructuring formulae and percentage distribution of various types of grades applicable from time to time.
- The nomenclature of track machine maintainers covers all types of artisan staff required for operation of machine.

ANNEXURE-B.2.1



SYMBOL :-

- SUNK IN TUBE LIGHT SHALL BE PROVIDED IN FALSE CEILING.
- BRACKET FAN SHALL BE MOUNTED ON WALL.
- SWITCH BOARD SHALL BE PROVIDED ON WALL.
- POWER POINT SHALL BE PROVIDED ON WALL.
- 10 W EMERGENCY LIGHT
- 15 W CFL ROOF SUNKEN

- X - THE ADDITIONAL ROOF CEILING (FALSE CEILING) SHALL BE PROVIDED FOLLOWING THE SAME CURVATURE OF EXISTING ROOF CEILING WITH MINIMUM HEIGHT OF 2400mm AT THE CENTRE FROM FLOOR LEVEL.
- G1 - SLIDING DOOR AS PER DESIGN IN PARCEL VANS.
- G - NORMAL COACH DOOR.
- G2 - CLOSED COACH DOOR.
- D/D1/D2 - SINGLE LEAF HINGED DOORS OF LIGHT MATERIAL SHALL BE PROVIDED WITH AUTO DOOR CLOSING SYSTEM. THE DOOR WIDTH SHALL BE 700/800/ 520mm. RESPECTIVELY.
- * EMERGENCY WINDOW

3. MINOR CHANGES IN THE LAY OUT NECESSARY AS PER LOCAL REQUIREMENTS MAY BE CARRIED OUT WITH THE APPROVAL OF PRINCIPAL CHIEF ENGINEER.
2. TOTAL THREE EXHAUST FAN TO BE PROVIDED ONE IN EACH FOR STORE, KITCHEN AND TOILET.
1. ALL DIMENSIONS ARE IN MM

R.	D.	S.	O.
CAMP COACH FOR TRACK MACHINES STAFF ON GS COACH BASED ON RDSO DRG. NO. CSC-1592 OR SIMILAR (CODE-RCC)			

CANC./SUPD
REVISED.

RDSO SPECIFICATION

NOTES

SPECIFICATION

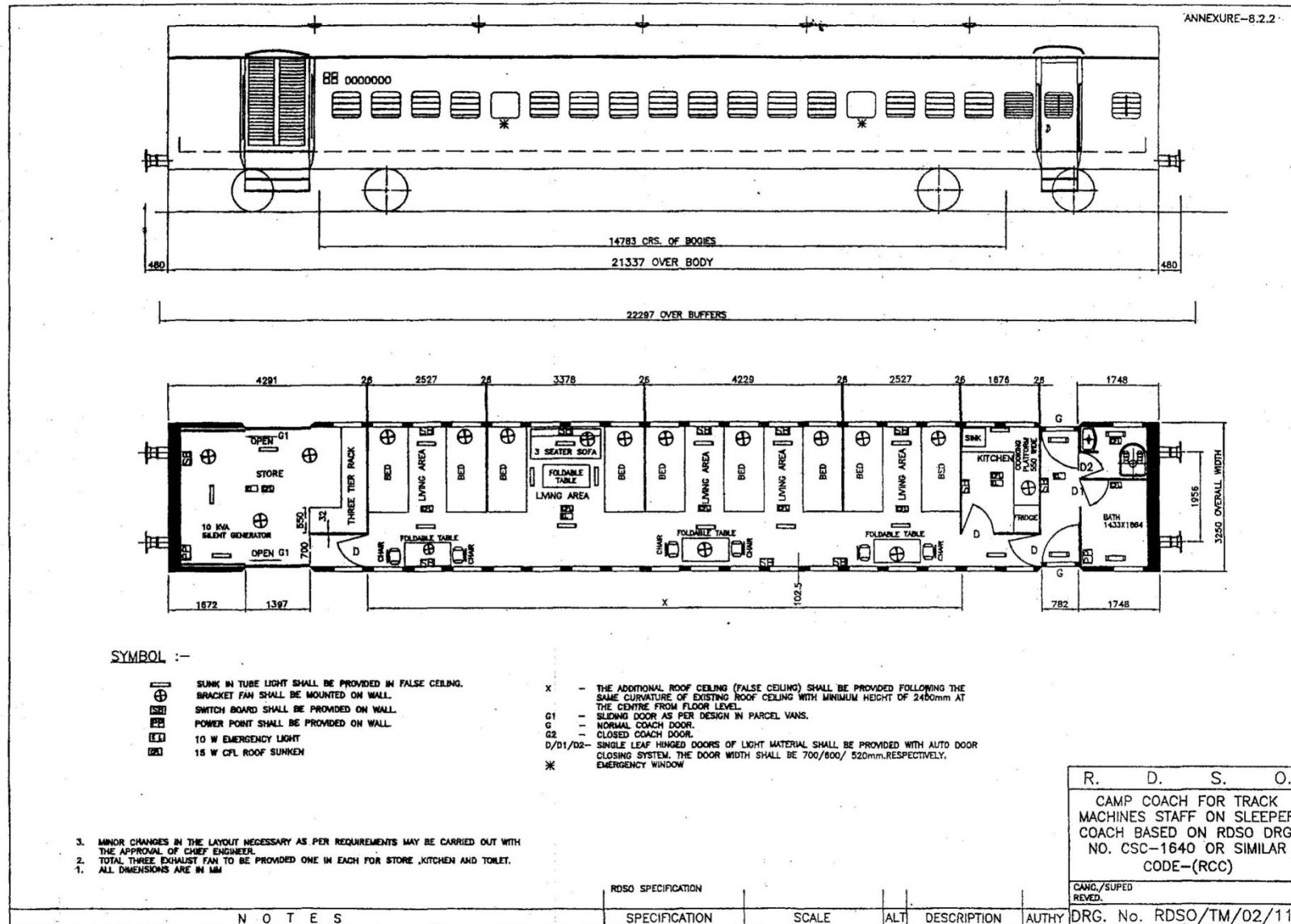
SCALE

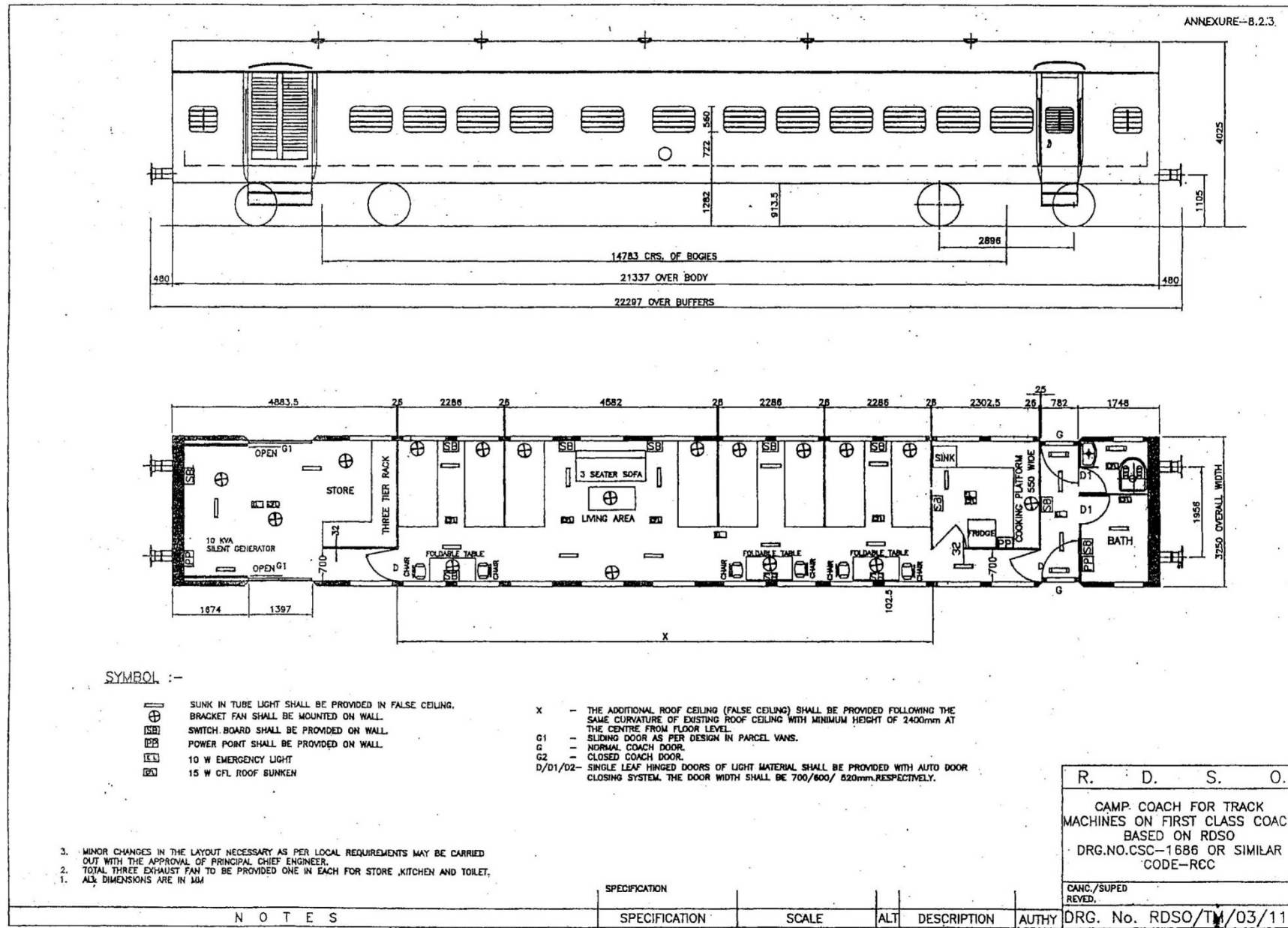
ALT

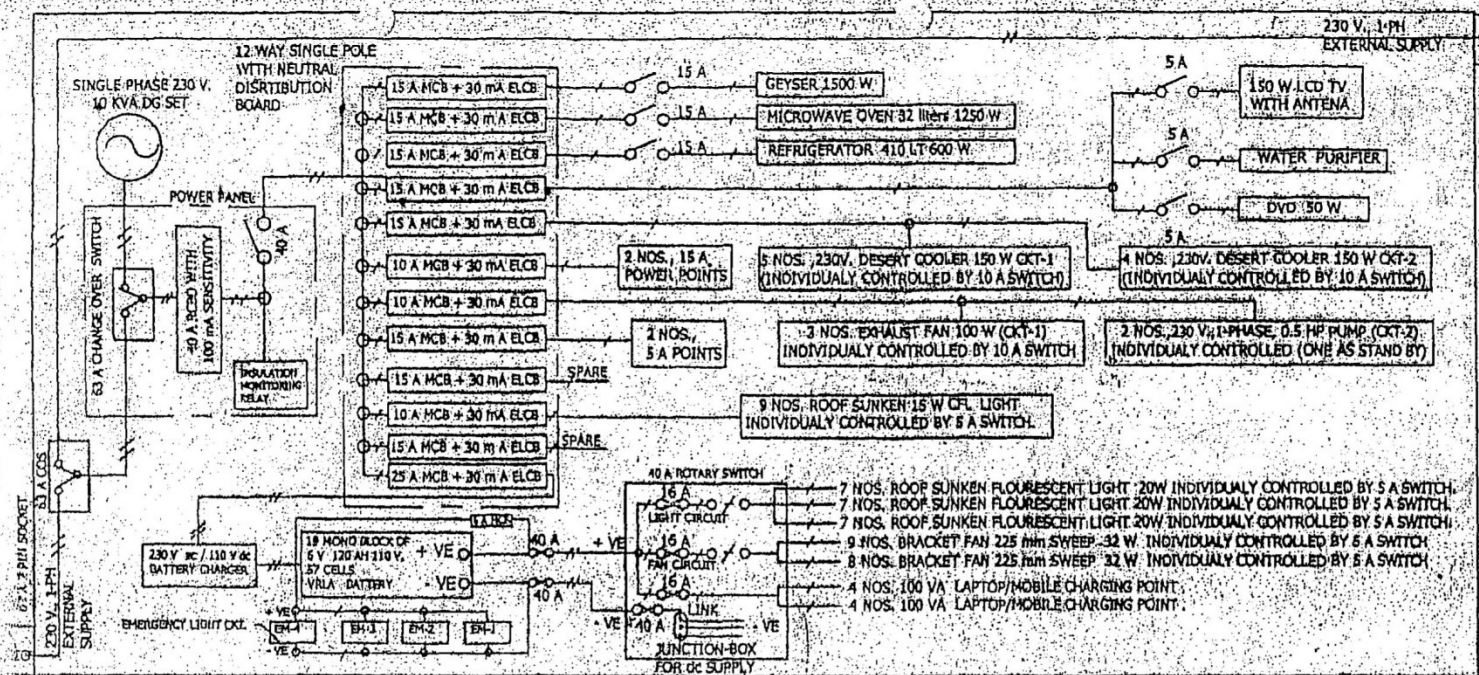
DESCRIPTION

AUTHY

DRG. No. RDSO/TM/01/11







NOTE:-

1. COACH BODY TO BOGIE, BOGIE TO AXLE AND EACH ELECTRICAL EQUIPMENT SHALL BE SOLIDLY EARTH AT MINIMUM TWO POINTS.
2. 230 V., 3-PIN 5 / 15 A PLUG SOCKET WITH SWITCH OF APPROVED MAKE (ICF/RCF) SHALL BE USE.
3. 230 V. CABLES IN SUPER STRUCTURE AND UNDER FRAME SHALL BE LAID IN FLEXIBLE POLY AMIDE CONDUITS. POLY AMIDE CONDUITS AND ITS ACCESSORIES SHALL BE AS PER RDSO SPECN. NO. RDSO/ PE/ SPEC/ AC/ 0138 -2009 (REV. '0').
4. DISTRIBUTION BOX AS IN AC COACH SHALL BE PROVIDED IN PLACE OF EXISTING DISTRIBUTION FUSE BOARD, SO THAT 230 V AC AND 110 V DC WIRING CAN BE DONE.
5. " SYSTEM SPECIFICATION AND CODE OF PRACTICE FOR WIRING FOR 110 V. DC SELF GENERATION TRAIN LIGHTING SYSTEM NO. EL/TL/48-2005 REV. '1') AND " CODE OF PRACTICE FOR TRAIN LIGHTING MAINTENANCE ON PREVENTION OF FIRE NO. EL/TL/56 SHALL BE STRICTLY FOLLOWED FOR COACH WIRING.
6. CODE OF PRACTICE FOR PREVENTION OF FIRE IN AC COACHES RDSO/PE/O/0008-2005 (REV. '0') FOR 230 V. WIRING SHALL BE FOLLOWED FOR COACH WIRING.
7. ALL CABLES ARE OF THIN WALLED FLEXIBLE SINGLE CORE E-BEAM WITH COPPER CONDUCTOR AS PER RDSO SPECIFICATION NO. ELRS/SPEC/ELC/0019 OF FEB., 2011
8. 110 V. dc WIRING SHALL BE CARRIED IN UNDER FRAME IN GALVANISED RIGID STEEL CONDUITS AS PER IS : 9537-PART-II.
9. INSULATION MONITORING RELAY (IMR) OF SUITABLE RATING AND APPROVED MAKE (ICF / RCF) SHALL BE PROVIDED.
10. NO PROTECTION DEVICE LIKE (MCB CUM ELCB) / RCBO & IMR. SHALL BE BY-PASSED IN ANY CONDITION.
11. ALL ELECTRICAL APPLIANCES OF REPUTED MAKE SHALL BE PROVIDED.
12. NO HEATER / ROOM HEATER TO BE CONNECTED IN ANY POWER POINT.
13. DG SET AS WELL AS COACH PANEL SHALL BE OPERATED BY A QUALIFIED ELECTRICIAN.
14. 4 NOS. DCP TYPE FIRE EXTINGUISHERS TO BE PROVIDED IN CAMPING COACH.

CABLE CHART

E-BEAM SPECIFICATION NO. ELRS/SPEC/ELC/0019 OF FEB., 2011		
CABLE SIZE	2.5 SQ. MM	4 SQ. MM
SYMBOL		

REF: EL/6.9.12/SYSTEM | SCALE: NTS | APPROVED BY: (FOR DG)
 GENERAL SCHEMATIC SINGLE LINE WIRING DIAGRAM FOR CONVERSION OF
 GS, 5CN & 1st CLASS NON-AC COACHES INTO CAMPING COACH
 (WITH 10 KVA DG SET, 230 V. AC SUPPLY AND 110 V. DC SUPPLY)

SUPERSEDES

STATUS	REV./ALT.	REF. NO.	DESCRIPTION	APPD BY	DATE
--------	-----------	----------	-------------	---------	------

RDSO/PE/SK/TL/0161-2011 (REV. "0")

SUPERSEDED BY



- | | |
|-----------------------------------------------------------------------------------|-----------------|
|  | Gray |
|  | Golden Yellow |
|  | Indigo |
|  | Light Turquoise |
|  | Black |

ANNE XURE - 8.2.4

AMMENITIES TO BE PROVIDED IN CAMP COACH

SL. NO.	DESCRIPTION	QUANTITY
A.	KITCHEN	
1.	Fire extinQuisher	02 nos.
2.	Commercial Gas Connection with double cylinder	01 set
3.	Four burner LPG Gas stove	01 no.
4.	RO+UV water purifier	01 no.
5.	Refrigerator-410 lit. capacity	01 no.
6.	Dinner set	01 no.
7.	Thermos 02 lit. cao.	02 nos.
8.	Gas Lighter	02 nos.
9.	Presser cooker 5 lit. cap	01 no.
10.	Presser cooker 3 lit. cap.	01 no.
11.	Casserole 10" dia.	04 nos.
12.	Bhagona Copper base as per required sizes	04 nos.
13.	Plate steel 12" dia.	10 nos.
14.	Kadhaee	02 nos.
15.	Spatula (Karchhul) of various sizes	03 nos.
16.	Service spoon Big	03 nos.
17.	Service spoon small	03 nos.
18.	Service bowl big	03 nos.
19.	Gripper	02 nos.
20.	Tea mug	12 nos.
21.	Stainless Steel Spice Box	01 no.
22.	Stainless steel Container 2 lit.	06nos.
23.	Stainless Steel Container for Floor 15 lit.	01 no.
24.	Stainless Steel Container for Rice 15-lit.	01 no.
25.	Stainless Steel Container for water 20 lit.	01 no.
26.	Stainless Steel Bucket 15 lit.	01 no.
27.	Hot chapatti case	02 nos.
28.	Sink	01 no.
29.	Stool for work	02 nos.
30.	Tea set	01 no.
31.	Tea Strainer (Stainless Steel)-4"	01 no.
32.	Tea spoon	12 nos.
33.	Stainless Steel Utensil Stand (Wall Hanging)	01 no.
34.	Stainless Steel Sauce-Pan (Copper Base) 1 lit.	01 no.
35.	Hot plate iron (Tawa)-12"with handle	01 no.
35.	Pastry Board (Chakla) 10"	01 no.
37.	Pastry Roller (Belna)	01 no.
38.	Fridge water Bottle 1 lit.	6 no.

SL.NO.	DESCRIPTION	QUANTITY
B.	LIVING AREA	
1.	LCD/LED Television 28".	01 no.
2.	Satellite. antenna for TV (DTH)	01 no.
3.	230V AC Desert cooler	6 nos.
4.	Lap Top	01 no.
5.	Foldable tubular chairs	06 nos.
6.	Folding tables- 1000 x 500 mm.	03 nos.
7.	Wooden Centre Table 1000X500 mm.	01 no.
8.	Radio/Audio Player	01 no.
9.	Pillow Durafoam/Sleepwell	10 nos.
10.	Pillow cover	20 nos.
11.	Curtain	on each window
12.	Bed sheets (Single Bed}	20 nos.
13.	Mosquito net	10 nos.
14.	Woolen Blanket (Ravmond)	10 nos.
15.	Sofa	One 3 seater as per the space available.
16.	Insulated Water jug 10 lit. cap	02 nos.
C.	BATH AREA	
1.	Gevser 20 lit. cap.	01 no.
2.	Bucket 20 lit. capacity	06 nos.
3.	Mug	02 nos.
4.	Aluminium/Stainless Steel Stool	02 nos.
D.	STORE	
1.	Welding set 5 KVA	01 no.
2.	Water lifting pump	02 nos.
3.	Portable Drilling machine	01 no.
4.	Portable grinding machine	01no.
5.	Diesel filling pump	01 no.
6.	Silent DG set 10 tWA	01no.
7.	Foulding Cot (Single Bed)	

PAINT SCHEME FOR CAMP COACH

Following painting system shall be followed:

- | | |
|-----------------------------------------------------------------------------------------------------|----------------------|
| 1. Grit blasting | |
| 2. Isophthalic putty | |
| 3. Primer red oxide zinc chromate to IS: 2074 | One coat |
| 4. Filler grey to IS:110 | One coat |
| 5. Knifing stopper (Putty) to 18:5083 | 1 st coat |
| 6. Wet rubbing | |
| 7. Knifing stopper (Putty) to IS:5083 | 2 nd coat |
| 8. Wet rubbing | |
| 9. Necessary putty | |
| 10. Wet rubbing | |
| 11. Filler grey to IS:110 | 2 nd coat |
| 12. Dry rubbing | |
| 13. Undercoat, synthetic enamel to 18:8662 | One coat |
| 14. Dry rubbing | |
| 15. Finish coat, Synthetic enamel to 18:8662 | One coat |
| 16. Glaze coat (1:1 mixture of synthetic enamel to IS:8662
& Synthetic clear varnish to IS: 524) | |
| 17. Lettering | |

Annexure-8.3

The camp coach shall be provided with Air Brake System. The coupling to be provided shall be normal IR standard screw coupling. The following modification work for non-AC Camping Coaches shall be performed in standard coach as per Annexure 8.2.1, 8.2.2 and 8.2.3 and the amenities shall be provided as per annexure-8.2.4. The drawing in Annexure-8.2.1, 8.2.2 & 8.2.3 and amenities suggested vide Annexure-8.2.4 is only for guidance purposes and Railways may decide to have different drawing & amenities as per their local requirements. Railway may convert selective cabin/cabins into Air Conditioned cabin/cabins as per requirement. In this respect, electrical circuit may be modified accordingly.

1.0 LIVING AREA:

\ The living area in the proposed layouts is marked as 'X'.

- 1.1 Additional roof ceiling (False ceiling) shall be provided following the same curvature of existing roof ceiling with minimum height of 2400 mm at centre from floor level. This will reduce the heat in the coach.
- 1.2 Beds shall be provided at the level of lower berths as in 1st AC coaches
- 1.3 The size of beds shall be 1850 X 850 mm and should be box type with cushion top as in 1st AC coaches.
- 1.4 The beds shall be boxed type and can be open in upward direction to accommodate linen items etc.
- 1.5 Upper existing berths shall be removed.
- 1.6 In place of upper existing berths, wooden cabinets shall be provided of size 1850x300x300 mm (approx) above all the beds just below the false ceiling
- 1.7 Flooring in this area shall be of same standard as in the 1st AC class.
- 1.8 Sofa: tables and chairs shall be provided as shown in the drawing,

2.0 KITCHEN:

- 2.1 Layout and dimensions shall be as per annexure no. 8.2.1, 8.2.2 and 8.2.3.
- 2.2 Granite/Marble top shall be provided on cooking platform (550 mm wide).
- 2.3 One of the existing water tanks of the coach shall be used for water arrangement.
- 2.4 One exhaust fan shall be provided at suitable location.

3.0 BATHING AREA & TOILET:

- 3.1 One of the existing water tanks of the coach shall be used for bathroom water arrangement. Complete bath fittings as available in AC, 1st Class coach, shall be provided in bathing area.
- 3.2 The toilet shall be of 'bio-toilet' type being used in Indian Railways. In this regard Schedule of Tech. Requirement no. C-9908 Rev.1 issued by ROSO may be followed as guidelines.

4.0 ELECTRIFICATION PLAN:

The electric supply arrangement shall be as in annexure-8.2.5.

4.1 Battery blocks provided with the coach shall be utilized as it is, except the self generating equipment and alternator. In place of these, a 230V AC/110V DC battery charger will be provided for the purpose of charging of coach batteries. The coach electrification shall be from following three source of supply.

4.1.1 Electricity may be obtained from outside supply available at Railway stations/Sidings.

4.1.2 A 3-phase 10KVA silent DG set will be housed in camp coach for fulfilling the requirement of electricity.

4.1.3 In case of failure of batteries, there shall be the provision of 9 roof sunken CFL to be illuminated by AC supply.

4.2 The electrical appliances/fittings to be provided in camp coach are being listed below.

4.2.1 Fluorescent lights roof Sunk in- 21 nos.

4.2.2 Brackets fans 225mm - 17 nos.

4.2.3 Roof sunken lights (CFL-15W)-09 nos.

4.2.4 Exhaust fan-03 nos.

4.2.5 Power point 15A-02 nos.

4.2.6 Plug point -02 nos.

4.2.7 Emergency lights-04 nos.

5.0 STORE MANAGEMENT:

5.1 Store room shall be provided, for keeping the small spares of the machine, as shown in the camp coach layout.

5.2 This store shall be provided with cabinets/racks at suitable height with locking arrangement.

5.3 In addition to store given in coach layout additional under slung boxes shall be created for heavy spares of the machines. These boxes shall be used for keeping empty drums, hydraulic hoses and heavy spares of the machine. The design of the boxes shall be according to the requirement for particular machine. The safety factor for welding work of the boxes shall be sufficiently high so that there shall be no failure on account of welding work.

5.4 Existing water tanks of store side shall be removed.

6.0 DOORS:

6.1 D, 01 and 02 as shown in annexure 8.2.1, 8.2.2 and 8.2.3 respectively showing indicating the doors of size 700/600/520mm.

6.2 G indicates normal size of the coach gate.

6.3 Gt indicates the sliding doors similar to parcel van gate to accommodate the DG set and heavy store items.

6.4 G2 shown in annexure 8.2.1, indicates closed coach door.

7.0 WINDOWS:

7.1 Wire mesh on all windows from outside for mosquitoes/insects protection.

7.2 Curtains on all windows.

7.3 Suitable rain-shed should be provided on each window.

7.4 Window frames shall be sealed suitably to prevent water leaking during rain.

8.0 PAINTSCHEMEFORCAMPCOACH

Paint scheme for camp coach shall be as per annexure-8.2.6 and the color combination for all coaches shall be followed as per the diagram attached as annexure-8.2.7. The diagram shown in the annexure 8.2.7 is only symbolic to show the color combination for coach.

CHAPTER 9

STORES

9.1 Store Depot

9.1.1 Track machine base depot shall have a Store Depot attached to it. The Store Depot shall be under the charge of a DSK working under AEN/XEN incharge of Base Depot.

9.1.2 The senior section engineer incharge of a machine or group of machine shall not hold any imprest under him. The materials issued to the machine and the corresponding releases shall be accounted for through monthly MAS returns to the base depot.

9.2 Inventory Control

9.2.1 Pricing of items and Consumption

Each SSE/TM incharge of base depot shall maintain a record in which the cost of various items used in his machine and their normal consumption is entered. The supervisor should maintain close liaison with the DSK to ensure that pricing of the materials is done correctly and that the prices are revised to keep them current from time to time. This will ensure "cost consciousness" on the part of the supervisors.

9.2.2 Estimated Annual Requirements

The stock position, consumption trends and the estimated annual requirements should be reviewed periodically by AEN/XEN incharge of base depot and estimated Annual Requirement revised regularly based on consumption trends.

9.2.3 Inactive Items

- i) Dead-stock items should be segregated i.e. items which are not at all required in the foreseeable future due to obsolescence, change in design etc. These items should be put up before the Survey Committee and suitably disposed off.
- ii) Items which are damaged due to storage handling etc. should be surveyed and suitably disposed off according to the recommendations of the Survey Committee.
- iii) Items which are not likely to be required in the near future on the railway should be offered to other Railways and CPOH work shop Allahabad..
- iv) Every endeavour should be made by the AEN incharge of the Base Depot to utilise the existing stock by making suitable modifications to the extent possible.

9.2.4 Control over Consumption

The officer incharge of the Base Depot should identify specific items, for the renewal of which, the machine-in-charge will have to seek approval from the SSE who will personally check the item before authorising such replacement. As regards the Base Depot replacement will be authorised specifically by SSE (Track Machines) after personal inspection.

9.2.5 *Fast Moving Items*

i) A list of fast moving spares should be prepared by the Officer incharge of the Base Depot. A monthly review of the consumption of the fast moving items should be done at the Depot level. SSE/Base Depot should maintain a record in which he should enter the stock position of the materials affecting the day to-day working. This record will help the officer incharge of the Base Depot to pinpoint the items to be dealt with on priority. Specimen proforma for entries to be made in this record which may be called "Chasing Register" is shown as follows:

ii) Only such items which are affecting adversely the working of Base Depot should be entered in this register.

9.2.6 *Recoupment of Stock*

i) Whenever procurement action is initiated the following shall be ensured:

- that the estimated Annual Requirement/Average Annual consumption based on which procurement action is proposed is correct and current;
- that subsequent to a design change or modification done since the time of last review, no obsolescence of the product has resulted;
- selective procurement possible in times of financial stringency based on realistic technical appreciation of the requirements;
- for proprietary, items, necessary certificate duly signed by the competent authority shall accompany the recoupment sheet/balance return.

ii) Wherever essential, the indents shall be accompanied by detailed specifications, drawings and list of firms duly approved by the competent authority and enquiry shall be sent only to the list of approved firms. The offers received shall be sent to the nominated engineering officer for technical scrutiny and recommendations for acceptance. The order shall be placed after obtaining the acceptance of competent authority.

9.3 Procedure for Procurement of Materials

9.3.1 The officers of Engineering Department, dealing with track machines, shall have the powers to procure spares, consumables and small tools to meet the requirements of track machines, as available to the officers of Stores Department in corresponding posts (CE equivalent to COS, CTE/MC equivalent to CMM, Dy. CE equivalent to Dy. COS and SEN/MC equivalent to SSO).

9.3.2 All rules and procedures as laid down for procurement by the Stores Department, shall be followed by Engineering Department while exercising powers as per para 9.3.1 above.

9.3.3 The tender Committee wherever necessary may be constituted with the Engineering Officers of appropriate level as a Convenor and the other members from Finance and Stores as per the schedule of powers delegated on the zonal railways.

9.3.4 *Items to be procured from trade:*

These items shall be recouped keeping 12 months requirements as the limit.

9.4 Procedure Regarding Approved Suppliers of Indigenous Spares

9.4.1 Zonal railway shall classify the spares required for various groups based on the commonality of the manufacturing process or the source of supply.

The groups can be formed broadly as given below:-

- a) Mild steel components
- b) Alloy steel, heat treated and ground components
- c) Grey iron castings
- d) Alloy steel castings
- e) Engine filters and other components
- f) Hydraulic filters
- g) Hydraulic hoses
- h) Pneumatic hoses
- i) Seals and 'O' rings
- j) Conveyor belts and conveyor chains
- k) Hydraulic cylinders

- l) Hydraulic pumps, motors, valves and other hydraulic components
- m) Printed Circuit Boards (PCBs)
- n) Bearings
- o) Tamping tools
- p) Tamping unit components
- q) Excavating chains
- r) Oils and lubricants
- s) Nuts/bolts and fasteners
- t) Other consumables

9.42 The railway shall maintain the list of approved suppliers of various groups and important indigenous spares shall normally be procured from the list of approved suppliers.

9.43 The railways shall periodically carry out the performance review of the list of approved suppliers for various groups and take action to update the same.

9.44 During the stages of development or trial of new indigenous items of spares or constant deterioration in quality of supply of approved product, the railway shall resort to balancing import.

9.5 Procedure for Inspection and Acceptance of Materials

The inspection and acceptance of materials shall be done by nominated official of Track Machine Organisation and kept on record

9.6 Cash Imprest

- (i) An adequate cash imprest (Rs. 25,000/- or more) shall be provided with the officer incharge of the Base Depot for emergency purchases of essential stores and for day to day repairs of plants, tools and machinery.

(ii) An adequate cash imprest (Rs. 10,000 or more) shall be provided with the officers in-charge of Satellite Depots and of machine-groups for emergency purchase and repairs of machine components, plants, tools & machinery.(CS16)

- (iii) The cash imprest available shall be reviewed on the zonal railways every three years

9.7 Emergency Purchase

Officers dealing with Track Machines shall be delegated special powers for repairs/purchase of spares/components to meet the emergency requirements.

9.8 Purchase of Items for Which DGS&D Rate Contract Exists

Officers of Track Machines Organisation in Sr. Scale and above shall be designated as Direct Demanding Officers.

9.9 Purchase of Items (Other than DGS&D) Through Running Rate Contract

A running rate contract may be entered into with OEM or his authorised agent for supply of such spares.

9.10 Annual Maintenance Contract

These may be entered into with OEM/his authorised agent on a single tender basis for carrying out repairs to machines and/or for supply of spares.

9.11 Other Modes of Repairs Through Contracts

- a) On single tender basis with OEM/his authorised agent
- b) By tender/quotation from service/repair agents as per schedule of powers applicable to works contracts.

9.12 Inventory Management

For better inventory control, the Base Depot and the headquarters of the Track Machines organisation shall be provided with the requisite computer facilities. Suitable software shall be developed for inventory management.



LIST OF ABBREVIATIONS

AEN/MC	Assistant Engineer/Machines
BCM	Ballast Cleaning Machine
BFR	Bogie Flat for Rails
BRM	Ballast Regulating Machine
CE	Chief Engineer
CEE	Chief Electrical Engineer
CFO	Chief Foreman
CME	Chief Mechanical Engineer
CMM	Chief Material manager
CN	Construction
COM	Chief Operating Manager
COS	Controller of Stores
CPOH	Central Periodical Overhauling
CRF	Capital Recovery Factor
CRS	Commissioner of Railway Safety
CSM	Continuous Tamping machine
CSP	Concrete Sleeper Plant
CSTE	Chief Signal & Telecommunication Engineer
CTE	Chief Track Engineer
CTR	Composite Track Record
CWR	Continuous Welded Rail
DEN	Divisional Engineer
DOT	Department of Telecommunication
DSK	Divisional Store Keeper
DTS	Dynamic Track Stabilizer
DUO	Duomatic Machine
Dy. CE/TT	Dy. Chief Engineer/ Tie tamping
ETKM	Equated Track Kilometer
FP	Fish Plate
GR	General Rules
G&SR	General & Subsidiary Rules
GC	Gauge Conversion
GM	General Manager
GMT	Gross Million Tonnes
GPM	Gallon Per Minute
GVA	Geometry Value Assessment
Hp	Horse Power
HQ	Head Quarter
Hrs.	Hours
HS	Hand Signal
HSD	High Speed Diesel
HSK	Highly skilled
I/C	Incharge
IOH	Intermediate overhauling
IR	Indian Railways
IRICEN	Indian Railways Institute of Civil Engineering, Pune
IRPWM	Indian Railways Permanent Way Manual IRTMTC Indian Railways Track Machines Training Centre
JA Grade	Junior Administrative Grade

JE	Junior Engineer
LV	Last Vehicle
LWR	Long Welded Rail
MAS	Material At Site
MC	Machines
MCI	Malleable Cast Iron
MOU	Memorandum of Understanding
MPT	Multipurpose Tamper
OEM	Original Equipment Manufacturer
OHE	Overhead equipments
P. Way	Permanent Way
PCB	Printed Circuit Board
POH	Periodical Overhauling
PQRS	Plasser's Quick Relaying System
PRC	Prestressed Reinforced Concrete
PSC	Prestressed Concrete
RGM	Rail Grinding Machine
RPM	Revolutions per minute
S&D	Supply and Disposal
S&T	Signal & Telecommunication
SBC	Shoulder Ballast Cleaner
SBCM	Shoulder Ballast Cleaning Machine
SE	Section Engineer
SEJ	Switch Expansion Joint
SEN	Senior Engineer
SM	Station Master
SPURT Car	Self Propelled Ultrasonic Rail Testing Car
Sr. DEN	Senior Divisional Engineer
Sr.DOM	Senior Divisional Operating Manager
SSE/MC	Senior Section Engineer/Machines
SSO	Senior Stores Officer
TM	Track Machine
TRT	Track Relaying Train
TTM	Tie tamping machines
UNIMAT	Points and Crossings tamping machine
UNO	Unomatic Machine
USFD	Ultrasonic Flaw Detection
UT	Universal Tamper
UTV	Utility Track Vehicle
VHF	Very High Frequency