



INDIAN RAILWAYS

TRACK MACHINES DIGEST

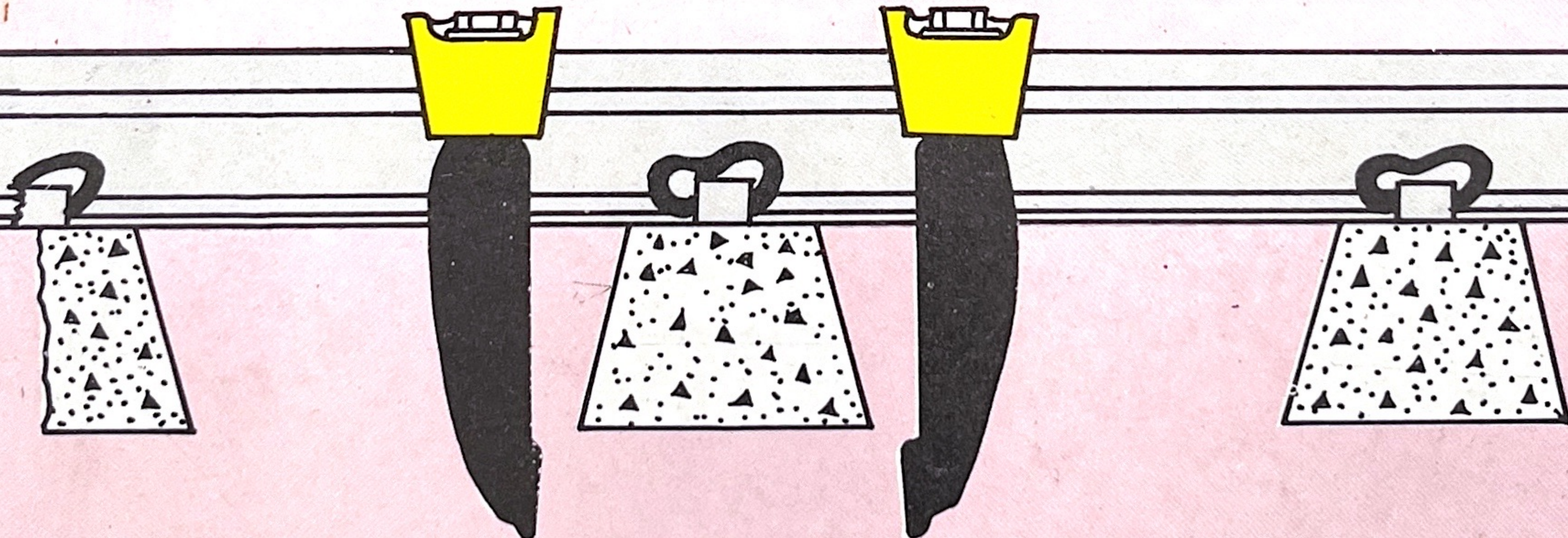
भारतीय रेल, रेलपथ मशीन डायजेस्ट

YEAR 1

ISSUE 2

QUARTERLY

OCT. -- 1992



**: RECENT RAILWAY BOARD CIRCULAR :
: SAMPLE CALCULATION :
: UNIT COST OF TAMPING DONE BY CSM :**

Annexure - I

No. 92/Track/III/TK/15
Dt. 24.4.92/16.6.92.

**The Chief Engineers,
All Indian Railways**

Sub: Procedure for calculation of unit cost of working of different track machines.

A sample calculation for working out the unit cost of the tamping done by CSM is enclosed herewith for the guidance of the zonal railways (Annexure-I)

2. The unit cost of working of the machine shall be calculated taking Capital recovery factor with interest rate of 12 % from the tables in Annexure-C of the Indian Railways Finance Code (1982 edition)

3. The life of the machine in terms of gross unit of work done, unit cost of the machine, weightage of different types of machines, for proportionate distribution of over heads on technical and general supervision and work units between IOHs are listed at Annexure-II. Maximum life of the machine should be limited to 15 years.

4. Zonal Railways should work out the unit cost of the working of the different types of machines available on the railway for every financial year.

5. The unit cost of working the different types of track machines available on the railway for the year 91-92 should be calculated on the above lines and advised to RSDO and Rly. Board.

Sd/-
(R.N. Verma)/Director,
Track (MC) Rly. Board/NDLS.

1. DATA:

i)	Initial cost of Machine	Rs. 3.1 Crore
ii)	Rate of Interest	12%
iii)	Life (in work units)	7500 Kms
iv)	Expenditure on IOH	Rs. 15 Lac (at 1250 Kms. 2 IOHs bet. POHs)
v)	Expenditure on POH	Rs. 30 Lac (at 3750 Kms)
vi)	Annual expenditure on M/C maintenance: Spares (actuals)	Rs. 3 Lac
	Staff (actuals)	Rs. 0.7 Lac
vii)	Annual operational exp. Consumables	Rs. 2.5 Lac
	Staff	Rs. 3.2 Lac.
viii)	Overheads (Proportionate)	Rs. 1.2 Lac

2. ANNUAL COST OF WORKING:

Actual tamping done in the year 530 Kms.
Life of the m/c (7500/530) 14 Years

Capital recovery factor 0.15087

i)	Capital recovery (0.15087x3.1 Cr)	Rs. 46,76,970
ii)	Proportionate expenditure on IOH/ POH (4x15 + 30) Lac x $\frac{1}{14}$	= Rs. 6,42,857
iii)	Annual Mtc. exp.	= Rs. 3,70,000
iv)	Operational exp.	= Rs. 5,70,000
v)	Overheads	= Rs. 1,20,000

Total Rs. 63,79,827

3. UNIT COST OF TAMPING:

$\frac{6379827}{530} = \text{Rs } 12037 \text{ Per Km.}$

Annexure-II

Type of Machine	Cost (Rs. Crore)	Life of M/C (Gross unit of work done)	Work unit between POH	Work unit weightage between IOH (Two IOH bet. POH)
i) UT	0.45	2500 KM	1250 KM	425 KM 1
ii) UNO	0.65	4500 KM	2250 KM	750 KM 1
iii) DUO	0.85	6000 KM	3000 KM	1000 KM 1
iv) 09-CSM	3.1	7500 KM	3750 KM	1250 KM 1
v) UNIMAT	3.5	10,000 T/O	5000 T/O	1650 T/O 1
P&C Tamper)				
vi) Portal Cranes (set- -of 3)	0.80	500 KM	250 KM	-- 0.5
vii) TRT	15.0	1500 KM	There will be no IOH/POH, Only annual maintenance of these machines	
viii) BCM	6.0	1500 KM		
ix) DTS	3.5	10,000 KM		
x) BRM	1.0	10,000 KM		
xi) RGM	5.0	17,500 KM pass		

MECHANISED LAYING OF PRC SLEEPER TURNOUTS

by C.P. Tayal, Jt. Director, Track M/C, R.D.S.O.

First set of PRC turnout sleepers on Indian Railways was manufactured and successfully laid in track in December 1987. Since then, fan-shaped layout evolved by RDSO has facilitated use of the same set of sleepers on either a left-hand turnout or a right-hand one. Laying of PRC turnout sleepers is a difficult task and slow progress of laying is an indication of lack of mechanised laying procedures (Table-I). To prevent damage & to get long trouble-free life in service, mechanised laying of longer & heavier PRC sleepers linked with intricate geometry is a must. Damage caused to one or a few sleepers in handling may render the entire set unserviceable.

Each set of PRC turnout sleepers is loaded in one flat-bottom BFR/BRH wagon at the manufacturing depot after inspection by RDSO. Shorter sleepers for switch portion are loaded transversely while the longer ones longitudinally along the length of BFR/BRH. Markings are engraved on the shoulders of the sleepers to facilitate correct pattern of unloading. Unloading shall be done in such a manner that the 'L' marking on the shoulder remains on left hand side and the 'R' marking on the right hand side while looking from facing direction. This will avoid rotation of sleepers by 180 degree at the assembly stage.

*** Effective drainage is a must. The problem of drainage is likely to get aggravated with lowering of formation to provide 300 mm cushion. This is especially so in large yards where it may not be possible to drain on side slopes. Therefore drainage should be properly planned and provided prior to laying of PRC sleepers on turnouts.

**** Too low a cess shall be made up to facilitate manoeuvrability of cranes & other equipment, men & material at the time of laying.

***** Care shall be taken to prevent damage to fixtures such as:

- pipes, cables, signalling rods, conductors etc.
- structures with tight overhead clearances
- any other structure/special features.

Temporary removal of such fixtures if not feasible, adequate protection/prominent markings shall be ensured for clear visibility to machine operators.

***** Completion & tightness of existing track fastenings shall be ensured to prevent falling of old sleepers while dismantling & lifting of panels.

Table-1: Laying of PRC sleeper turnouts on IR (as on 31.3.1992)

Railways	NR	SR	CR	ER	SCR	Total
Sets manufactured	74	19	5	9	11	118
Sets laid in track	28	11	1	1	2	43

PRC sleepers of fan-shaped design cannot be used on existing layouts of turnouts whether LH or RH. Entire geometry of fan-shaped layout is different from all other layouts, keeping distance between stock joint and TNC unaltered.

1. TRANSPORTATION & UNLOADING:

- * Length of PRC turnout sleepers varies from 2750 mm to 4900 mm (at the back of crossing)
- ** 1:12 turnout is 45.5m long consists of 83 sleepers, weighs approx. 62 t (including rails & crossing)
- *** 1:8.5 turnout is 31.8m long, consists of 54 sleepers, weighs approx. 43 t (including rails & crossing)

2. PLAINING & PRE-REQUISITES FOR LAYING:

Following pre-requisites should be ensured at site before laying:

- * Because of intricate geometry of the turnout, longer/heavier turnout sleepers and S&T fixtures, meticulous planning must be done in advance clearly laying down step-by-step activities with time frame required for each activity so that the work can be completed with minimum traffic block.
- ** Clean ballast cushion of 300 mm below the proposed bottom of PRC sleepers is a must (Track has to be lifted in most cases, alternatively formation may be lowered if unavoidable). Deep screening should be necessary in most cases.

3. LAYING METHODS:

Laying of PRC turnouts is cumbersome due to heavy weight and length of sleepers (the heaviest sleeper is 4.9 m long weighing 700 kg), intricate geometry of the turnout and S & T gears & fixtures.

Laying procedure essentially depends on site conditions and no procedure can cater to all situations. Whatever be the method of laying, switch portion as a rule, should be laid in one piece & as first part of the operation leaving more time for

installation of S&T fixtures.

Laying of PRC sleeper turnouts can be done in two ways:

- * Semi-mechanised methods
- ** Mechanised methods

3.1 SEMI MECHANISED LAYING:

This can be further subdivided into two parts:

- * Laying of switch
- ** Laying of crossing & lead.

3.1.1 Laying of Switch:

Following methods are recommended:

- i) Space is available on cess for pre-assembly: Assembly of switch by the side of existing switch & transverse slewing or placement by 18/22t road crane.
- ii) Space is not available on cess for pre-assembly:

Assembly of switch in a near by siding, loading on BFR/BRH and laying by using PQRS portal cranes. Once the switch has been laid, installation

of S&T fixtures and laying of crossing and lead portion can begin simultaneously.

3.1.2 Laying of crossing & lead portion:

Following methods are recommended:

- i) Space is available or cess for pre-assembly:

Assembly in segments by the side of existing turnout and transverse slewing or placement by road crane.

Capacity of road crane will determine the number of segments for pre-assembly. While 6-7 segments are necessary for 18/22 t crane, 10 segments are required for 8/10 t crane.

- ii) Space is not available on cess for pre-assembly:

Assembly on straight track behind back of crossing (trains can travel via loop line), longitudinal rolling on rails and lowering in position by jacks.

Note: Sleeper-by-sleeper insertion is possible only in case on LH design & there also it should be used only as a last resort

3.2 MECHANISED LAYING:

8 sets of crawler cranes which can move on rails as well as on ballast have been contracted by IR from AMECA of Italy. The system includes moving trolleys, with rotating platforms capable of rotation by 10 degrees on either side to carry turnout assembly. Small versatile road crane capable of 360 degrees rotation for pre-assembly shall be used from indigenous sources. The system aims at mechanised laying of PRC sleeper turnout as a complete set. Detailed guidelines for mechanised laying will be issued after the system is tried out.

4. EXPERIENCE OF S. RLY & NORTHERN RAILWAY:

Northern & Southern Railways have tried semi-mechanised methods employing road cranes. Exhibit-'A' gives the gist of these methods.

5. POST LAYING ACTIVITIES:

Ensure:

- * Perfect geometry during tamping cycles to raise speed to normal.



** Complete & drive fittings.

*** Welding of stock joint and other joints where ever feasible.

**** Continuity of track structure on approaches on PRC road and upto one

rail length on all approaches on non PRC road.

6. PERFORMANCE TO DATE:

Allahabad division where several PRC sleeper turnouts were installed dur-

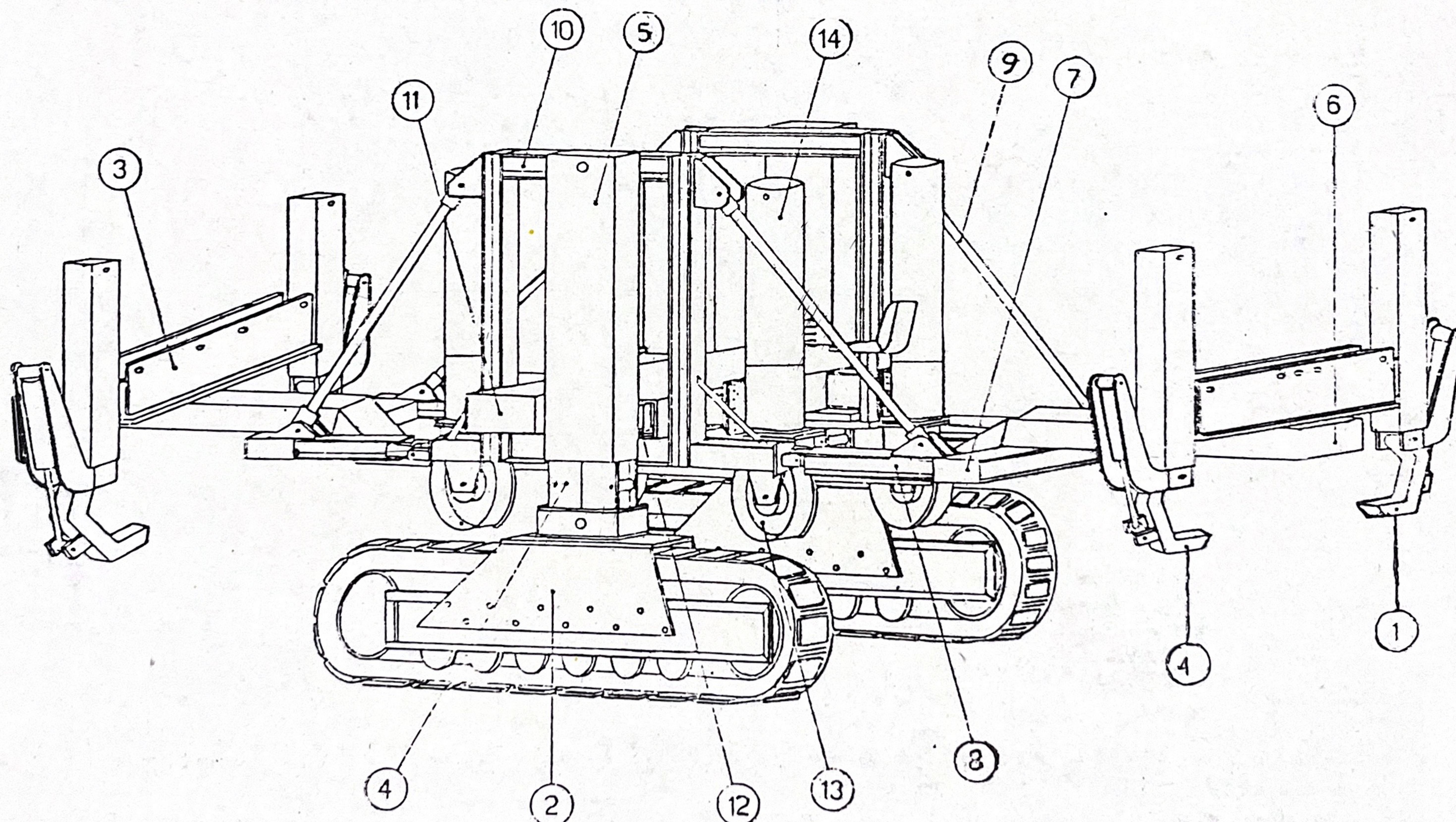
ing 1988 have pleasing experience of over 3 years. Gauge, alignment and levelling hold excellently well in "A" category. Maintenance operations are confined to occasional tamping & replacement of crossing and tongue rails.

Exhibit "A"

LAYING OF CONCRETE SLEEPER TURNOUTS SEMI-MECHANISED METHODS TRIED SO FAR ON IR

Rly.	Laying procedure	Block time required	Speed restriction	Manpower required.
NR	i) Preassembly at site in 8 segments by 22 t road crane.	4.5 Hrs.	20 Kmph	380 mandays
	ii) Assembly, laying switch by PQRS & longitudinal rolling of Xing & lead portion.	3 Hrs' + main line only for extra 2 hrs.	20 Kmph	N.A.
SR	i) Pre-assembly at site in 8 segments for placing by 18 t road crane.	3.5 Hrs	20 Kmph	N.A.
	ii) Pre-assembly at site in 10 segments & placing by 8 t road crane.	4 Hrs.	20 Kmph	N.A.

AMECA T-28 : SELF PROPELLED CRAWLER CRANE FOR LAYING OF PRC SLEEPER TURNOUT



1. Rail Tongs
2. Central Connecting Frame
3. Cross Beam
4. Verticle Guide Column

5. Vertical Shaft
6. Lifting Beam
12. Frame
13. Rail Wheel

- 7,8 & 9. Lowering/lifting arrangement/(hydraulic) for beams
- 10 & 11. Lifting/lowering of Railway Wheels

DYNAMIC TRACK STABILISER

By *Sh. Umesh Kumar Dy. CE/TT/HQ. NEW DELHI.*

Track stabilisation. Sounds something new. Perhaps. Let us see.

Primary concern of a trackman is maintenance not only for safety of trains but also for good comfort. What makes the riding quality on a track good, the following:-

1. Correct geometry of track
2. Sound and uniform packing of ballast under the sleepers.

Correcting geometry of track, is the job of a Tie Tamping Machine. Giving sound packing to ballast under the sleepers, is also the job of a TTM. Fine. But let us also see what a TTM does in the process. Correcting the track geometry in effect, means lifting & slewing the track to the desired extent so as to remove the longitudinal & cross level and alignment defects, followed by packing of ballast under the sleeper. Packing of ballast is accomplished by a set of vibrating tamping tools of TTM. Tools first bring the ballast in a semifluid state & then they close towards each other thus squeezing the ballast pieces together thereby 'Packing' them into the interspaces between one another.

In this process, the following phenomenon takes place:-

- 1) Amount of lift differs from rail seat to rail seat.
- 2) The angular ballast pieces, though get packed into the interspaces between one another, do not bear on each other necessarily on their largest surface areas.

Every trackman notices that the track condition deteriorates due to passage of some traffic after tamping. Cause for the same can now be very well understood. Due to the vibration produced by passing trains, the ballast pieces try to re-orient

themselves so that their larger area surfaces could bear on each other, and consequently, due to the simultaneous action of vertical load, the track tries to settle down. If the amount of settlement remains the same throughout, no deterioration in track geometry would take place. However, let us see the factor on which this settlement depends. It is governed by the following factors:

- 1) The extent of vibrations which the ballast bed undergoes And this depends on the original track geometry (as left by TTM) as well as the condition of the rolling stock.
- 2) The larger the depth of the newly packed ballast (by TTM) under a rail seat, the larger will be the scope for ballast pieces to reorient themselves thus leading to larger settlements under such rail seats, and vice-versa.

As we have already seen, both the above factors are variable. And that is the reason the settlement of track due to passage of traffic, is not uniform throughout. This also explains the reasons for experiencing greater deterioration (i.e. larger settlements) on a track which has been given higher amounts of lift, or a newly deep screened/relayed track, etc.

Occurrence of the phenomenon of re-orientation of ballast pieces and settlement of track under moving loads, is inevitable. However, if the track could somehow be made to undergo the similar ordeal, but in a controlled manner, the settlements would become uniform leaving the track without any deterioration in its geometry and also leaving no scope for any further settlements (of course, non-uniform) due to passage of trains subsequently.

And this is what is called Track Stabilisation. Track stabilisation means make the track stable, so that it does not un-

dergo any changes due to passage of trains.

Dynamic Track Stabiliser, or DTS in short, is the machine available with us for achieving this objective. 'Dynamic', because the action is under dynamic conditions (Vibratory).

The very concept of track stabilisation has now been well adopted by all the advanced railway systems all over the world. In fact it has gained considerable importance in the last few years. Having become familiar with its concept now, its advantages can be easily understood. It minimises (or eliminates) the chances of deterioration of track geometry under traffic, hence prolonging cycle of tamping. DTS machine frame via hydraulic cylinders, stabiliser units which run on the track beneath the main frame, make contact with the rail heads through eight nos. flanged rollers on the inside and four nos. flangeless roller discs on the outside. The two synchronised vibration units vibrate the track in a horizontal plane with a frequency adjustable from 0-45 HZS. The correct frequency is the one at which least vibrations are felt on the machine and maximum vibrations are felt on the track. The track is subjected to an impact force (centrifugal force) depending on frequency, upto 320 KN. this vertical load is applied to the track automatically by means of four hydraulic cylinders which are supported against the machine frame in articulated design.

A proportional chordlevelling device enables controlled settlement of track.

A steel chord is spanned over each rail between the feeler rods which are jointed to the inside axles of the bogies.

This enables the unavoidable initial settlement to be 'anticipated' in a controlled manner after any track work. The machine is expected to carry out stabilisa-

tion equivalent to one lac tonnes of traffic passage, in one pass.

possible to allow initial speeds of 40 kmph soon after deep screening, by using the Dynamic Track Stabiliser.

On Northern Railway, it has been

Other technical features of machine are:-

Length over buffers	-	17.24 M
Width	-	2.70 M
Height above rail top	-	3.68 M
Bogie pivot spacing	-	12.00 M
Bogie wheel base	-	1.50 M
Wheel diameter	-	0.71 M
Weight	-	57 t (approax)
Front axle loads each	-	14.5 t
Rear axle loads each	-	14 t
Engine output	-	460 HP - Deutz eninge
Max. Speed under own power	-	80 kmph but RDSO have permitted 60 kmph.
Max speed in train formation.	-	100 kmph but RDSO HAVE PERMITTED 50 kmph.



EDITORIAL

2nd issue of Indian Rlys. Track Machine Digest is in your hands, our effort is to acquaint you with new development in the field of track maintenance and machines.

Your comments, and articles not more than in 3-4 pages in this regard, and suggestions if any to improve the Digest are welcome.

EDITOR : K.P. MATHUR

:Do you know that :

: Hydraulic pressures on 08 Machines :

Working pressure	130-140 Kg/cm ²
Sq. Pressure big cyl. (Conc. Sleeper)	110-125 Kg/Cm ²
Sq. Pressure big cyl. (Wooden ")	100 Kg/cm ²
Sq. Pressure big cyl. (Metal ")	90 Kg/cm ²
Small Sq. cylinder direct pressure	35 Kg/cm ²
~~Booster cylinder for satellite~~	~~40-60 Kg/cm²~~
Vibration motor pressure (Initial torque)	150 Kg/cm ²

Performance of Zonal Rlys. for the year 1991-92
: C.S.M :

Rly.	Holding of M/C	Average No. of days actually worked	Average Gross block hrs. availed	Work done per gross block hrs in kms.	Remarks	
C	6	237	462	0.830	One m/c worked only 8 months	
E	6	225	496	0.856	One m/c worked 11 months	
					-do- 9 months	
					-do- 7 months	
N	6	253	591	0.786	One m/c worked 10 months	
					-do- 6 months	
S	1	81	221	0.887	M/C worked 3 months	
SC	1	71	285	0.807	M/c worked 3 months	
SE	5	236	571	1.003	One m/c worked 10 months	
					-do- 9 months	
W	5	154	414	0.830	One m/c worked 11 months	
					-do- 8 months	
					-do- 1 months	
DUOMATIC						
C	2	226	435	0.553	One m/c worked 8 months	
					One m/c worked 11 months	
E	3	217	460	0.550	One m/c worked 11 months	
					One m/c worked 10 months	
N	5	24	546	0.538	One m/c worked 9 months	
					One m/c worked 8 months	
					Two m/c worked 10 months	
S	3	247	542	0.422	One m/c worked 11 months	
	(1MG)				One m/c worked 10 months	
SC	3	189	690	0.603	-- --	
SE	3	189	517	0.787	One m/c worked 6 months	
					One m/c worked 9 months	
W	3	118	289	0.572	One m/c worked 5 months	
	(1MG)				One m/c worked 8 months	
UNIMAT						
C	2	280	623	1	One m/c worked 11 months	
E	2	230	363	1	-- --	
N	3	228	506	1	Two m/c worked 11 months	
S	1	300	543	0.8	-- --	
SC	--	--	--	--	-- --	
SE	3	213	424	0.6	One m/c worked 10 months	
					One m/c worked 11 month	
W	1	131	319	1.5	One m/c worked 9 months	

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