Mechanization in ISD work

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Synopsis

Mechanization in track construction means application of modern techniques by using track machines instead of applying traditional methods of renewal. Mechanization in handling of concrete sleepers helps the permanent way engineer in a bigway in achieving faster and quality work. Due to enhanced loading standards, the track upgradation is a continual phenomenon. Increasing sleeper density for CC+8+2/CC+6+2 loading is done in a bigway now for improved mobility as enshrined in the corporate plan 2010-2011. An attempt was made in MDU division to do ISD work by both manual and using TRT machine. 87 km of TRT work was done in MDU-MEJ-TEN section. A case study brings out the relative time and cost advantages of both methods.

Mechanization in ISD work

Mechanization in track construction means application of modern techniques in construction of track by using track machines instead of applying traditional methods of manual renewal methods.

Indian Railways has developed modern techniques in track renewals in a rapid pace and thus achieving more progress in track renewals with enhanced quality of work.

Since the concrete sleepers are being adopted universally on Indian Railways, the need for mechanized relaying has been increasingly felt, due to heavy weight of concrete sleepers and it cannot be easily handled by manual labour. Also the concrete sleepers are brittle in nature and are likely to be damaged during manual handling.

And also the progress of conventional manual method of relaying is quite slow and inferior in quality.

ISD work :

Corporate plan 2010-11 highlights improved mobility which is directly related to sectional speed (MPS). For CC+8+2 / CC+6+2 loading M+8 sleeper density is a precursor. Till completion of these works the speeds are restricted as per 'Joint Procedure Order for dealing with operation of 25t Axle load/CC+8+2/CC+6+2 trains vide Joint Procedure Order No.W.315/265/3/CC+8+2/CC+6+2/JPO dated 23.06.2010'.

A speed restriction of 45 kmph exists for track having 52 kg(72 UTS) rails on M+4 sleeper density. This can be relaxed to 60 kmph by increasing sleeper density. On Southern Railway 200 kms of track. ISD work has to be done for certifying for CC+6+2 loading. Faster/early execution of ISD work is essential for increasing throughput and mobility.

The various track machines developed for construction of track are:

1) TRT – Track Relaying Train
2) PQRS – Pleasser Quick Relaying System
3) T-28 – Ameca (Point Laying Machine)

Track machines used for maintenance

1) BCM – Ballast Cleaning Machine
2) SBCM – Shoulder Ballast Cleaning Machine
3) Tamping Machines – Track
    1. Duomat
    2. CSM
    3. Tamping Express 3 X
4) Tamping machines - Points & Crossings
        1. Unimat
5) BRM – Ballast Regulating Machine

Track Relaying Train – TRT

What a sophisticated invention for relaying of track!

It is a latest state of art in track machines.

TRT can carry out track relaying work automatically with minimum manual efforts.

The TRT is designed to carry out simultaneously and continuously various multifarious functions such as removal of old rails, removal & stacking of old sleepers, leveling & compacting of ballast bed, placing new sleepers in position, laying of new rails.

TRT consists of the following parts:

1. Main vehicle
2. Handling Gantry
3. A set of BFR's

1**. Main Vehicle**

a) This consists of a sleeper handing device which removes the old sleepers and replaces them with new material with the help of a number of conveyors.
b) The power vehicle is fitted with ' Rail lifting and guidance system' for dissecting the old rails to the side of the track.
c) The unit includes a 'triangular smoothing plough' and acompaction plate to prepare the ballast bed for the reception of new sleepers.

The main vehicle weights about 110 tonnes and has an over all length of about 45 metres.

2. **Handling Gantry** :

The train has handling gantry for the transport of old and new sleepers. The gantry weighs about 6.6 tonnes and has lifting force of about 50 K.N. It can lift at a time about 20 concrete sleepers and can travel at a maximum speed of 15 kmph.

3. **A set of B.F.R** :

For the storage of old and new sleepers. These are fitted with an inter-connecting rail track on which the handling gantry runs

The renewal train can be coupled with a normal train and can have a speed up to 100 kmph. The train can, however, move independently with hydraulic drive and its speed while working is maximum 720 m per hour.

OPERATIONS PRIOR TO DEPLOYMENT 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) 30 nos BFRs 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 x 75 mm should be provided between different layers on the outer side of MCI inserts. This will enable gripper to function properly.

d) 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 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 one 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.

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 five 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 fish bolts 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 matcheswith 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 three 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.

1) OPERATIONS INVOLVED IN TRT WORKING

1. Threads out old rails from track.
2. Removes old sleepers.
3. Levels and compacts ballast bed.
4. Places new sleepers.
5. Threads in new rails in to track

2) 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 Stabilizer 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 Crossings after final tamping of the track.

vi) Destressing of LWR should be done immediately after welding the rail panels to long welded rails.

ADVANTAGES OF TRT

1**. Progress**

TRT can do relaying of track of one km per day in 4 hour block

Progress – 16 sleepers per minute

- 450 to 550 sleepers per hour
- i.e 300 to 400 m per hour.

But in manual renewal we can able to do only 200 m per day using 40 labour and for completing one km it will take 5 days.

Also in TRT relaying the caution is shifted quickly and thus fuel consumption is saved.

But in manual relaying since the progress is very less, the existence of caution is prolonging and hence the consumption of fuel is increased.

Hence by mechanization in construction of track, we can achieve quality, economy and timely completion of works.

Use of TRT for ISD work

Increasing sleeper density (ISD) work is to increase no. sleepers per kilometer to M+8 from the exg. M+4 / M+7 etc., for CC+6+2 / CC+8+2 loading.

On Southern Railway ….. Kms of track, ISD work to be done for certifying for CC+6+2 loading.

Faster / early execution of ISD work is essential for increasing throughput mobility. Mechanisation in ISD work is advantageous in view of following reasons.

i. enhancement of mobility and throughput
ii. less speed restriction time on track
iii. Enhanced quality of work.
iv. Completing allied works like deep screening, interchanging, TFR etc., in rear / shadow block.

Case study

In MDU division increasing sleeper density work was done first by manual method and subsequently by TRT machine. The brief details of section and work progress are as follows:

Sl. No.	Activity	Mannual method	By TRT	Remarks
1	Engine run section	MDU – VPT	VPT-MEJ-TN/TEN	
2	Block section	VPT-KGD	VPT-MEJ – TN / TEN	
3	Length of ISD	6.0Km	100Kms	
4	Location from Km to Km	516.800-519.000 & 522.300 – 526.100	538/300 – 622/610, 623/210 – 730, 637/950-639/680, 644/970-646/250 & 0/000 – 29/300	
1	Agt. No.	397/2009 dt.22.10.2009	331/2010 dt.8.11.2010	
2	LOA issued date	17.7.2009	30.11.2009	
3	Work started on	9.9.2009	2.12.2009	
4	Work completed on	25.4.2010	19.8.2010	
5	No. of days of progress of work	228	130 / 242	
6	Total progress	6kms	87kms	
7	Average monthly progress	0.79	10.73	
8	Value of work as per final bill	2588962	20000000	
9	Contractual cost per Km	431493	229885	
10	cost of track machines a)duomat b)TRT	a)24,408	b) 7,01,310 (2,16,996)	
11	Average block perday	2hr for machine packing	3.5 to 5.0hr for TRT	

As can be seen above, the progress of work by TRT is very high. This is in addition to very high quality of work in terms of accurate sleeper spacing, no out of square sleepers (hence correct gauge) replacement of track fittings, replacement of broken sleepers etc.

The overall number of days of speed restriction is les for traffic; consequently the mobility of section is less affected for completion of ISDwork in a given engine run section. In these days of depleting man power, harsh manual working methods in TSR / sleeper spacing works – attempting this work by TRT machine is in the fitness of thing in modernization and mechanization of track works.

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CTE/MAS.

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With reference to above, technical paper "Mechanization in ISD work" prepared by Shri B.N.S. Chalam, Sr.DEN/South/MDU and Shri S. Ramesh, SE/P.Way/TN is submitted to be presented in the National Technical Seminar of IPWE (India) to be held on 20th & 21st of January 2011 at Bangalore.

Encl: Technical paper (7 pages).

Sr.DEN/Co-ordn/MDU.

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