

## CHAPTER 4

### TRACK RELAYING MACHINES

**401. Track Relaying Machines** - Following systems of mechanized track relaying are available on Indian Railways:

- (1) **Plain Track Laying Machines**
  - (a) Track Laying Equipment (TLE).
  - (b) Track Relaying Train (TRT).
- (2) **Points and Crossing Laying/Changing Machine (PCCM)**

**402. Planning for working of Track Relaying Machines**

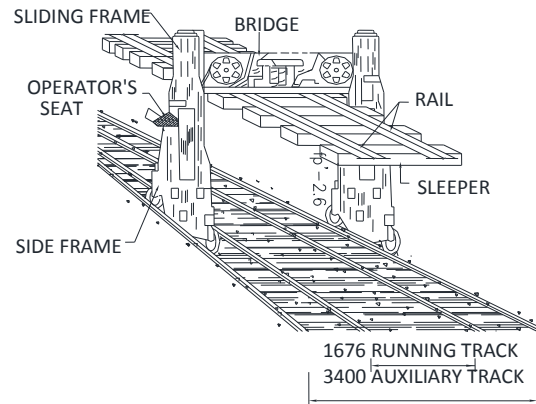
- (1) A proper organization should be set-up first for smooth operation/execution of track relaying work. Agencies for carrying out various works shall be finalized.
- (2) The requisite survey shall be carried out and the longitudinal profile and alignment shall be finalized as per relevant provisions of the **Indian Railways Permanent Way Manual** and **Schedule of Dimensions**.
- (3) Proposed longitudinal profile and alignment shall be indicated at suitable interval along the track by installing permanent reference points.
- (4) Tamping machine may be deployed behind the track renewal work for achieving the desired track geometry.
- (5) LWR/CWR plans may be got prepared and approved in advance.
- (6) Adequate spares for working of all the machines (TRT/Portal Cranes and Tampers etc.) should be arranged in advance and regular supply ensured.

**403. Track Laying Equipment (TLE)** - It is a semi mechanized system of track renewal consisting of self-propelled portal cranes capable of moving on a auxiliary track of 3400 mm gauge. These portal cranes are moved to the work site on flat wagon by suitably modifying nominated flat wagon to have flat support arrangement for stabling and supporting the portals. These portal cranes are capable of self-loading and unloading from flat railway wagon. Once they reach site, these portals are unloaded at site and made ready for moving on auxiliary track. Normally two portal cranes work together at site. A schematic diagram of TLE is shown in Figure 4.1

**404. Important assemblies of Track Laying Equipment (TLE)**

- (1) **Side frames** - The TLE contains two vertical side frames that house two vertical sliding frames.
- (2) **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 bridge can be raised/ lowered to facilitate lifting/lowering of panels.

- (3) **Sleeper gripper** - On the underside of the bridge, grippers to pick up sleepers are provided. Gripping of sleepers by its end is done by two angles welded to the grippers.
- (4) **Rail clamps** - Scissors type clamps are provided on both side of the bridge to hold the rails/panels (upto 13 m length generally) at four locations, two for each rail.
- (5) **Turn table** - To facilitate turning of portal crane for placing it on the flat railway wagon and off tracking in mid section, a turn table is provided on the wagon. This turn table is supported on the wagon over wooden platform.



**Fig. 4.1**

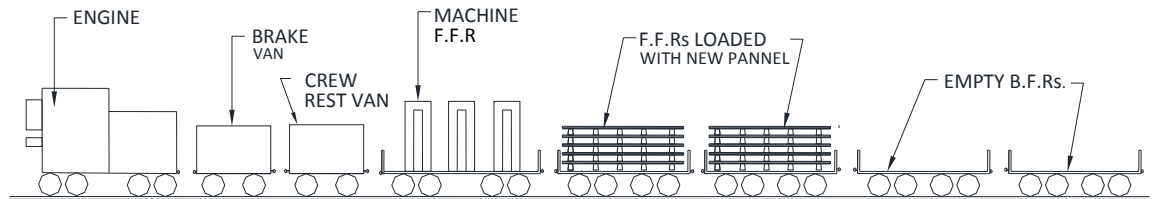
**405. Types of Track Laying Equipment** - TLEs with lifting capacity of 9 t and 12 t are in use on Indian Railways.

Table 4.1	
Lifting capacity	Manufacturers
9 tonnes	<ul style="list-style-type: none"> <li>• Plasser India (PQRS),</li> <li>• BEML</li> <li>• Simplex</li> </ul>
12 tonnes	<ul style="list-style-type: none"> <li>• Simplex</li> </ul>

- (1) The working mechanism of all the above models is similar.
- (2) The dimensional detail of 12 t machine supplied by M/s simplex and 9 t portal supplied by Plasser India is given in **Annexure 4.1**.

**406. Working mechanism and capability of Track Laying Equipment** - The sequence of operation for relaying (CTR) with TLE is briefly described as under:

- (1) Track Panels are fabricated with PSC sleepers and 12.6 m long service rails at a base depot. These panels are loaded on flat wagons in 2 to 3 layers by using portal cranes.
- (2) The existing rails in track are cut in lengths of 12.60 m. Speed restriction of 30 kmph is imposed prior to cutting of rails.
- (3) 10 rail/20 rail panels are unloaded alongside the track. Using the released CST-9 pots or wooden blocks or similar supports, these 10/20 rail panels are used to form the auxiliary track with 3400 mm gauge. The auxiliary track (AT) is laid to proper line and level using new rail panels, if rail renewal is also to be carried out as part of track renewal. Otherwise, released rails are used for making Auxiliary track.
- (4) The rake formation containing TLE and panels loaded on flat railway wagon is brought to site of relaying by diesel locomotive after getting proper traffic and OHE block (for electrified sections). A typical composition of the rake formation is shown in Fig 4.2. Two to three BFRs are kept empty to load the released panels.



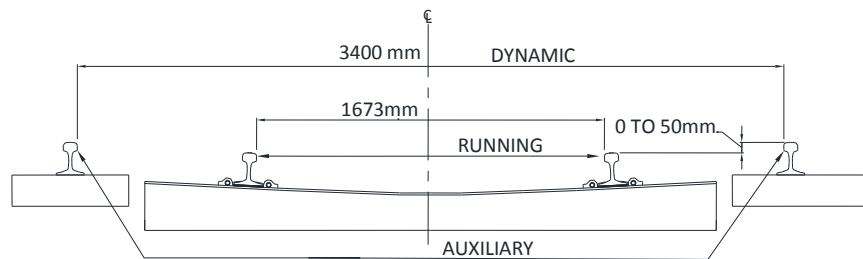
**Fig. 4.2**

- (5) Following three methods of laying of new panels are used depending upon site conditions: -
  - (a) Pulling the rake formation.
  - (b) Pushing the rake formation.
  - (c) Parting the rake formation.

In the pulling mode, the rake is standing on the existing track and is pulled away from the work site. This has an advantage that newly laid track is available for post laying work. This is the most commonly used method for renewal by TLE. In the pushing mode, the rake is pushed towards the work site and moves on the newly laid track. While approaching a bridge or yard, where auxiliary track cannot be continued, this method of laying is used.

In parting mode, the rake is divided into two parts and work is performed in between. In jumbo traffic blocks, by dividing the rake into two parts, of new panel wagons and empty wagons, and using the portals, one for removing old panels and other for laying new panels, travelling time of portals can be reduced.

- (6) Portal cranes (TLE) are unloaded from flat railway wagons on to the auxiliary track.
- (7) Old track panels are removed and loaded on TLE rake, ballast bed is scarified manually and new panels are laid at site by portal cranes at correct alignment using distance gauge w.r.t. auxiliary track.
- (8) Proper ramp is provided at the beginning and at the end of the work before permitting train operation.
- (9) 10 /20 rail panels of auxiliary track are used for rail renewal after completion of work by TLE, releasing the service rails. Welding of the panel is then done. This cycle continues for the remaining work.
- (10) Pushing method is used whenever yard or a bridge is reached.
- (11) **Lifting Capacity** – One 12.60 m track panel of 60 Kg rail and PSC sleeper weighs about 7.5 t. Thus unlike 9 t portal, 12 t portal can carry two 12.60 m released service rails also with the released panels. This saves the effort to separately carry the released service rails from the work site to the depot.
- (12) **Auxiliary Track** – The auxiliary track is laid with a gauge of 3400 mm and it should preferably be at the same level as main line track, but in no case be more than 50 mm higher than rail level as shown in Fig 4.3. Lower AT adversely affects the clearance available over the flat wagons and hence it is undesirable.



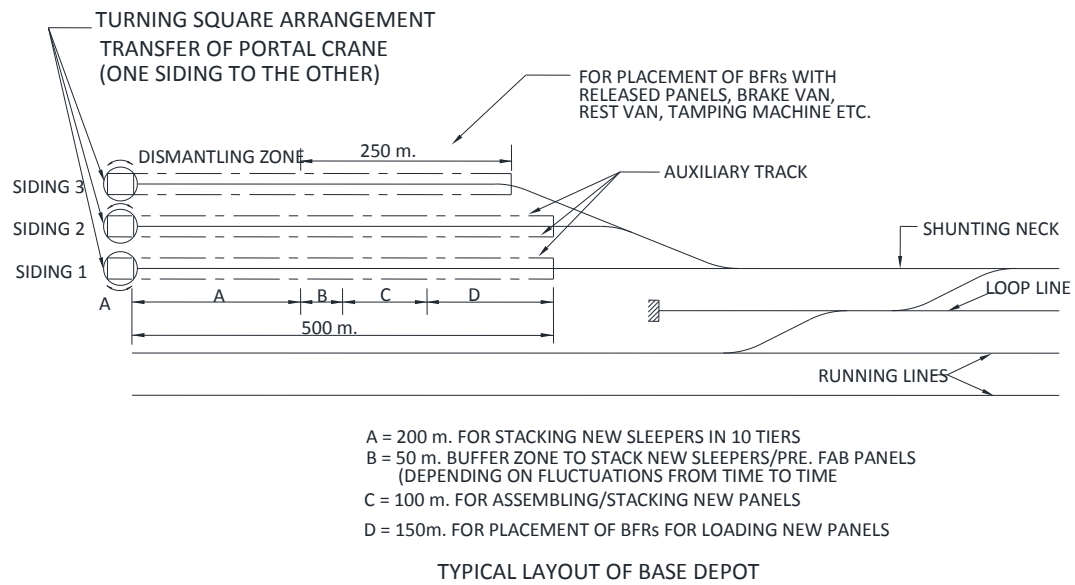
**Fig. 4.3**

#### **407. Setting-up of TLE base depot**

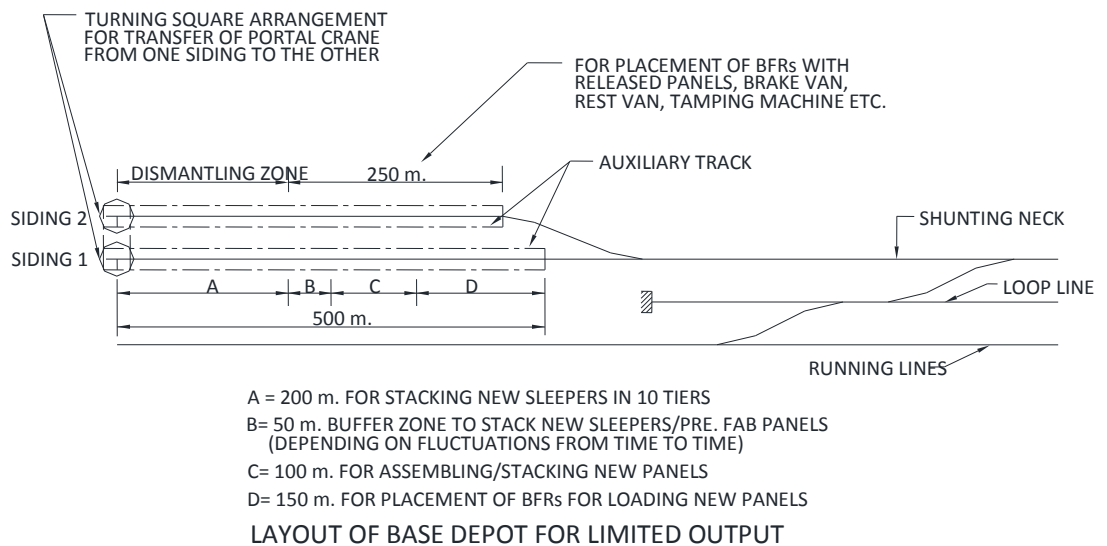
- (1) A well organized and properly laid out base depot is the backbone of relaying by portal cranes. A typical layout of the base depot is shown in Fig 4.4, 4.5 and 4.6. Smooth functioning of base depot will ultimately reflect in efficiency and productivity of the relaying work. The base depot is required to cater to the following activities:
  - (a) Unloading of new PSC sleepers from the rake and stacking.
  - (b) Fabrication of new panels with greasing of ERC and insert.
  - (c) Unloading of released panels.
  - (d) Dismantling of released panels and adequate space for stacking released materials.

- (e) Loading of pre-fabricated new panels.
- (f) Formation of TLE 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.

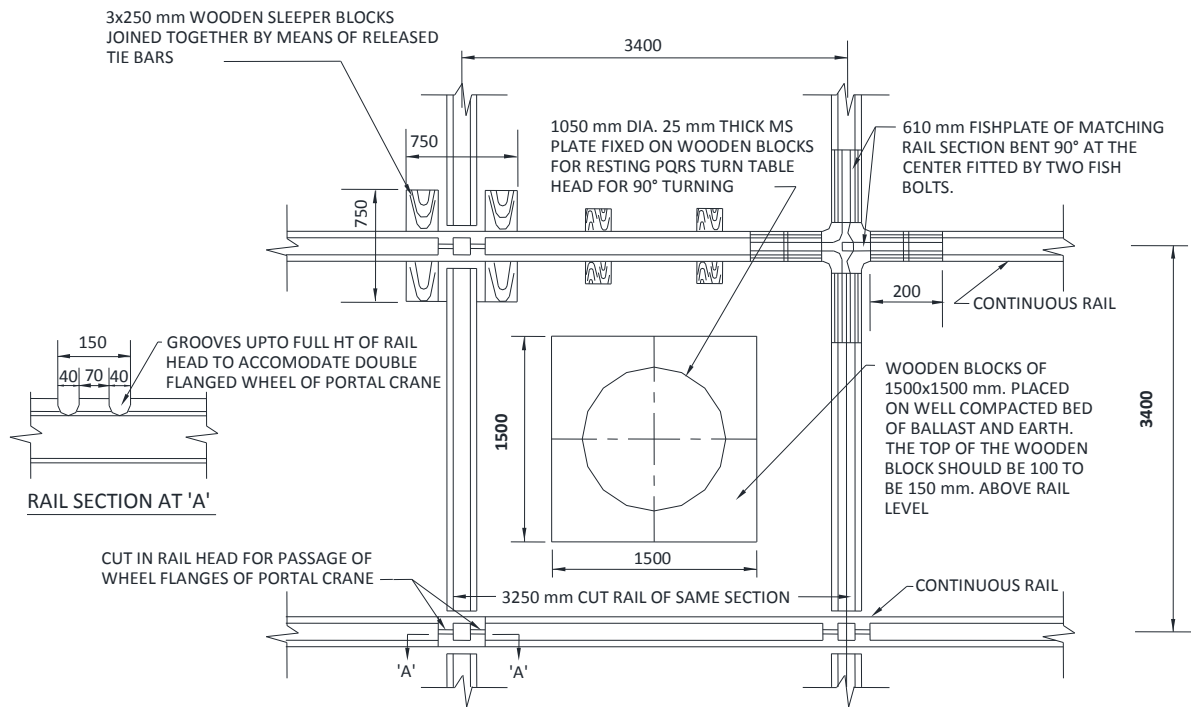
One TLE portal is deployed in the yard for the yard activities. Alternatively, portal arranged by the agency can be provided for in the contract for the work.



**Fig. 4.4**



**Fig. 4.5**



TURNING SQUARE ARRANGEMENT OF PORTAL CRANES

**Fig. 4.6**

- (2) 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 30 – 40 kms. The site selected should also be accessible by road and should have electric power supply and watering facilities. It is desirable that the base depot tracks should have facility of entry and exit on both sides from the running line.
- (3) For smooth working, the base depot should have at least three lines of about 500 meters each connected to a shunting neck of minimum 350 m. Out of three lines, at least two lines should be provided with auxiliary track (AT) for movement of portal cranes.
- (4) To strengthen depot working, it is desirable to install a motorized gantry crane moving on auxiliary tracks in addition to the third portal crane in the base depot for movement of sleepers/rails/panels. Gantry cranes can be of 6.5 m height from rail level to facilitate repair to portal cranes.
- (5) It is desirable to illuminate the base depot so that the depot activities can be undertaken safely at night and to have enough plug points with 3 phase electric supply to facilitate welding/repairs required to the relaying equipment/machines.
- (6) The base yard depot shall be well connected with Engg. control of division, ZMD control as well as HQ and also the site of work for communication.
- (7) The base depot shall have adequate camping facilities for staff, storage space for new as well as released material.

(8) The track laying rake should have minimum 16 BFRs and desirably 20-22 BFRs.

**408. Pre-relaying operations** - Following operations should be under taken before and during actual relaying:

**(1) At base depot**

- (a) Unloading of PSC sleepers from the rake and stacking in TLE depot,
- (b) Fabrication of new panels with greasing of ERC and insert,
- (c) Unloading of released track panels,
- (d) Loading of pre-fabricated new track panels.

These activities are required to be continued uninterruptedly for smooth working and better output. Dismantling of released panels shall also be done simultaneously.

For fabrication of panel following care should be taken:

- Ensure adequate stock of service rails.
- Service rails shall be saw cut on both ends and holes shall be drilled with drilling machine duly chamfered. In no case gas cutter shall be used for cutting rails/making bolt holes.
- The spacing of sleepers shall be marked on full rail section (from head to foot), marking shall not be more than 1 mm thick, starting by half the spacing from rail end.
- The out of squareness of the sleepers shall not be more than +/- 10 mm, and tolerance for spacing shall not be more than +/- 20 mm.
- Correctly driven greased ERCs, proper placing of GRPs and proper setting of correct liners shall be ensured.

**(2) At work-Site**

- (a) Track may be deep screened in advance of relaying, if planned. The remaining quantity of screened ballast should be trained out after relaying,
- (b) Auxiliary track (AT) should be laid at 3400 mm gauge keeping the centre line same as that of main line track, as shown in fig 4.3. CST-9 plates or wooden blocks of size 560 × 250 × 125 mm should be used at 1.5 to 2.0 m distance for laying the auxiliary track. The supports should not be extended beyond 250 mm inside of the track as shown in fig 4.3. The length of auxiliary track should match with the daily progress of work.
- (c) Special care shall be taken while preparing auxiliary track (AT) in curves such that any major alignment of curve & adjustment of SE can be avoided, especially in the summer months.
- (d) 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 50 mm higher than the existing track and in no case it should be lower than existing track.

- (e)** AT may be prepared by using service rails or new rails panels, if TRR is to be done after TLE work.
- (f)** Removal of ballast from the crib and shoulders up to the bottom level of the sleepers should be ensured.
- (g)** Full fittings of the old sleepers should be ensured to avoid its falling off while lifting released panels.
- (h)** Sleepers must be in single piece. All broken sleepers should be removed or replaced in advance with released good sleepers preferably.
- (i)** On girder bridges, the guardrails at the approaches on both ends should be removed temporarily.
- (j)** In case a level crossing is to be encountered, it should be opened in advance and renewed along with approach track.
- (k)** Proper planning and insertion of switch expansion joints at correct locations should be ensured.
- (l)** Cutting of LWR/SWR to single rails should be ensured for lifting released panels. Otherwise, replace the existing running rail (rail panels equal to days working to be cut) by service rails for the stretches, which are to be re-laid during the next day.
- (m)** Temporally disconnect or remove any other permanent obstructions such as cables, signalling rods, axle counters and any other installations like embedded rail pieces, tie bars, OHE connectors etc. to allow unhindered progress of work.
- (n)** Presence of S & T and OHE staff shall be ensured and jumpers should be provided where required.
- (o)** Availability of under noted equipment should be ensured at site:
- (p)** One set each of rail cutting and gas cutting equipment in good working condition.
- (q)** Two sets of rail closures of the each rail section being laid, in various sizes from 0.5m to 3m lengths,
- (r)** 4 sets of junction fishplates with bolts and clamps, in case existing rail section is different from the one being laid.
- (s)** Portable walkie-talkie sets should be provided at each relaying site for effective communication between the site of work and the adjoining stations.
- (t)** Extra number of track panels should be fabricated in the base depot to maintain a buffer stock for one or two working days of relaying work so that work at site does not suffer for want of depot working.

- (u) Wherever AT cannot be provided (e.g. on girder bridge, near P & C, i.e. in station yards), working direction of TLE shall be planned well in advance.
- (v) Fabrication of panels involving special sleepers like LC, bridge etc., shall be fabricated and loaded according to requirement.
- (w) Power and crew arrangements should be done in advance.
- (x) Sequence, arrangement of rake formation and position of machines shall be planned and conveyed to ASM on duty.
- (y) Before entering into the block section it must be tested and ensured that emergency back-up system of machine equipment is in working order. The duplex and simplex chains should also be tested and made fit.

#### **409. Operation during block**

- (1) Adequate traffic block along with power block should be arranged.
- (2) Protection of track and safety of staff working in block should be ensured.
- (3) After ensuring attachment of discharge rods (jumpers) and earthing of AT with running track on either side of the working place, portals should be unloaded.
- (4) Firstly, required numbers of existing track panels shall be removed to create working space.
- (5) Thereafter, sequence of portals shall be so arranged that maximum output can be achieved.
- (6) Sufficient labour shall be kept for alignment and linking of track, filling of ballast and packing the sleepers for passing the trains safely after clearing the block. If, TRR is also planned, separate labour with supervisor shall be deputed.
- (7) While laying of the fabricated panels, due care shall be taken to keep required gaps at joints, keeping in mind the rail temperature and working season, particularly in curved track. Squareness of joints & sleeper squaring should also be taken care of.
- (8) At the end of the day's work, gap between the old track and new track shall be made up with the help of rail closure on both the rails, giving ramp not steeper than of 25 mm / rail length of 12.6 m. If there is level difference between new and old track, joints shall be fish plated and clamped/bolted tightly to pass the traffic.
- (9) During block, continuous watch shall be kept on AT on which portals ply for its stability and continuity.
- (10) The output shall be reviewed judiciously in the context of quality and quantity, both.

**410. Post Relaying Operations** - Following post relaying operations should be ensured:

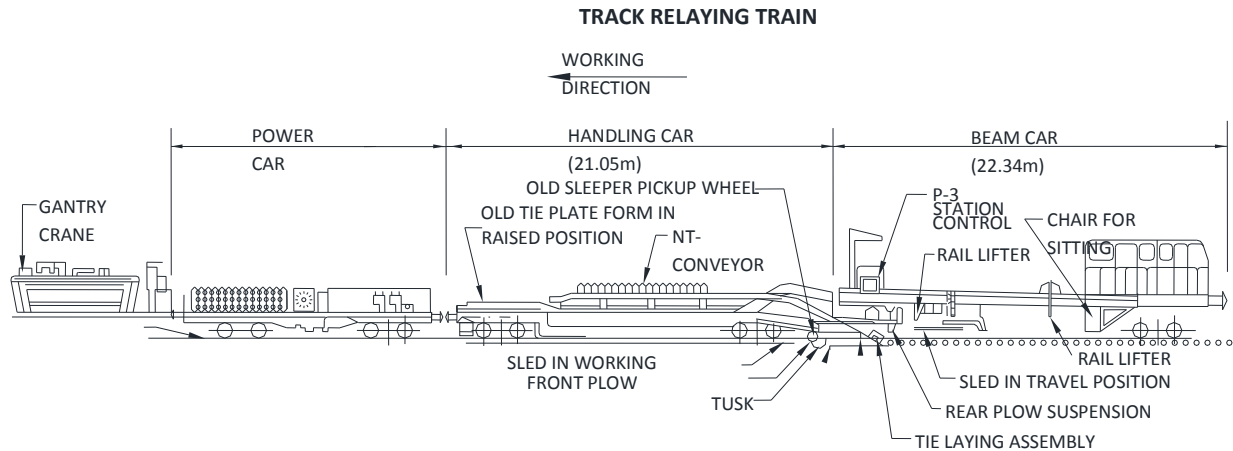
- (1) Clearance of track from any obstructions, infringement to SOD, for FOB/ROB/any other fixed structure/signal post etc. and implantation distance in case of electrified sections, before cancellation of the traffic block.
- (2) Proper lifting and positioning of track, welding of joints, packing, ballast regulating and compaction/stabilization of track to raise the speed of the different stretches as per the table II of Para 308 of IRPWM.
- (3) Training out of adequate quantity of ballast over the newly relayed track to full ballast section. Ballast recoument activity should be properly synchronized with the relaying as to enable raising of speed to normal in three cycles of tamping by on-track tampers.
- (4) Picking up of left-over released materials.
- (5) Dismantling of auxiliary track and relaying the same in advance for the next day's work or use it for TRR as the case may be.
- (6) Restoration of cables, OHE connectors, axle counters and other fixtures e.g. checkrails on level crossing, which were removed temporarily.
- (7) BRM, Tamping machines and Dynamic Track Stabilizer should be deployed to enable raising of speed to normal.
- (8) Provision of SEJ as per approved plan. In-situ welding of panels and de-stressing of LWR should be done after welding of panels.

**411. Track Relaying Train (TRT)** - Indian Railway is using TRT model no. P 811-S manufactured by M/s Harsco Track Technologies, USA.

- (1) **Functions of TRT** – TRT is a system for complete mechanization of track renewal process. It does the following jobs
  - (a) Threads out existing rails from track.
  - (b) Removes old sleepers.
  - (c) Levels and compacts ballast bed.
  - (d) Places new sleepers.
  - (e) Threads in existing/new rails into track.
- (2) **Works by TRT** – Following works can therefore be done by TRT:
  - (a) Complete track renewal (CTR).
  - (b) Thorough Replacement of sleepers (TSR).
  - (c) Thorough Replacement of rails (TRR).
- (3) **Advantages of TRT** – Advantages of TRT vis-à-vis TLE are:
  - (a) There is no need to prefabricate panels and, therefore, base depot work is limited to loading and unloading of sleepers & fittings,

- (b) No auxiliary track is to be laid at work site,
- (c) Concrete sleepers loaded on modified Flat wagons are directly taken to work site and relayed one by one,
- (d) New rails unloaded at work site on shoulders and duly paired and fish plated are exchanged with old rails simultaneously with sleeper renewals.

(4) **General layout** – General layout and important units of TRT model No. P 811-S are shown in Figure 4.7. Its dimensional detail of it is given in **Annexure 4.2**



**Fig. 4.7**

#### **412. Important Units of TRT- Model No P 811-S**

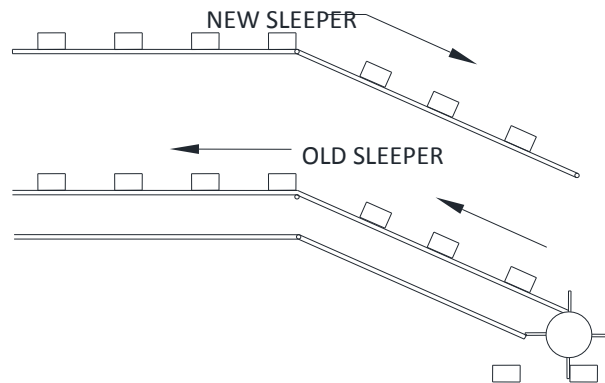
- (1) **Beam Car (22.34 m long)** - The beam car is hinged with handling car and has one common bogie and one independent bogie. Below this car, all the working units like old sleeper pickup, dynamic plough, sleeper flipper, indexing wheel (for sleeper spacing), self-guiding roller (for guiding in and guiding out rails), etc. 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.
- (2) **Handling Car (21.05 m long)** - This car has one independent bogie and one common bogie with beam car. All the conveyors including new tie conveyor are provided on this car.
- (3) **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 utilized for loading of sleepers.

#### **413. Working Mechanism of TRT**

**Fittings of alternate sleepers** are removed in advance. Rest of the fittings are removed after arrival of machine.

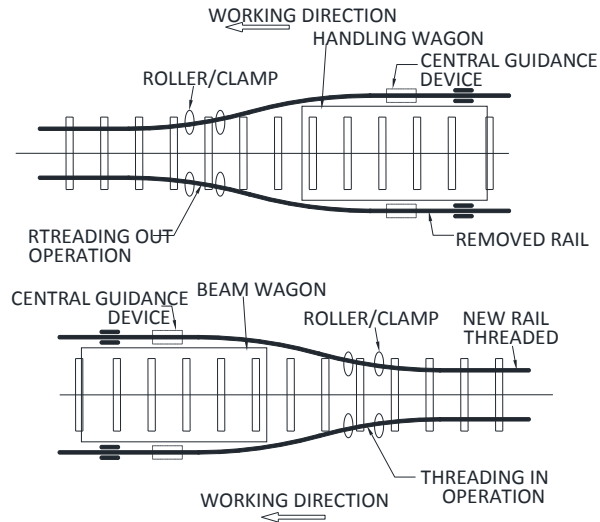
- (1) Rail closer of about 7.0 m length (if TRR also planned) else one cut (if TSR is only planned) is introduced in existing track at the starting point.

- (2) Crib and shoulder ballast in rail closer portion is taken out.
- (3) TRT is taken to site of work hauled by a locomotive (DSL/Electric).
- (4) The TRT is stopped at site of work in a position such that side plough is on first sleeper of cut rail.
- (5) Lowering of shoulder / side plough.
- (6) Removal of 7.0 meter long rails closures.
- (7) Lowering sled (3.4 m) from beam car on to the rail seats of rail closures removed.
- (8) Bringing idle bogie of handling car on to the sled and lock (by bringing back the machine).
- (9) Slew out old rails and move TRT ahead so that sled clears rail closure portion.
- (10) Remove the old sleepers manually from the closure area and level the ballast portion.
- (11) Sleeper pick up wheel and dynamic plough are lowered in place cleared by removal of old sleepers.
- (12) Rail ends of proceeding day's work shall be connected to the new rails laid on the sleeper shoulder.
- (13) TRT moves forward and starts removing old sleepers by pick up wheel as shown in Fig 4.8
- (14) Commence laying of new concrete sleepers by advancing the machine on Automatic mode.



**Fig. 4.8**

- (15) As TRT moves ahead old rails are threaded out and new rails are threaded in with the help of guiding rollers provided all along the length of TRT as shown below in Fig 4.9.



**Fig. 4.9**

- (16) Fixing of fittings are done at rear.

#### **414. Operations Prior to Deployment of TRT**

##### **(1) 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, liners and rail pads.
- (c) Ensure proper line and level of auxiliary track for 3400/3700 mm gauge for portal working, if required for loading and unloading of sleepers.
- (d) 30 nos. BFR's should be modified for one set of TRT 114 sleepers (approx.) are loaded in one BFR and about 1500-2000 or more sleepers should be loaded as required during block. While loading PSC sleepers on special BFRs, wooden battens of 75 mm × 75 mm or light rail section should be provided between different layers on the outer side of MCI inserts. This will enable gripper of gantry to function properly.
- (e) Load rail fastening like elastic rail clips, liners and rail pads as required during block.

##### **(2) At Work Site**

- (a) Condition of sleepers should be seen. All corroded and broken steel/CST-9 sleepers should be marked.
- (b) Foot by foot survey should be carried out to identify the locations having lateral or longitudinal infringements. There should be no infringement

within one meter of sleeper ends. All obstructions like creep posts, alignment posts etc. within 1 meter of sleeper end should be removed.

- (c) Adequate ballast should be available before relaying operations start so that tamping and raising of speed is not delayed.
- (d) 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.
- (e) Check-rails of the level crossings falling in the range of work should be removed in advance.
- (f) All longer fish bolts and joggled fish-plates should be removed from the range of work.
- (g) New rails should be unloaded, paired, fish plated or welded in one piece (as required for a day's work) and set at about 1.5 m from track centre. Rails should be kept on foot with adequate support so that they do not get shifted during working of the TRT.
- (h) 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.
- (i) All longer wooden sleepers from joints be either removed or cut to size in advance of TRT working.
- (j) Interlaced sleepers of height different from remaining sleepers should be removed.
- (k) Ensure that the fittings in old track are not jammed and can be removed while working. Loosen them and refit in advance if any problem is anticipated.
- (l) 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, Seven wooden sleepers/PSC sleepers should be laid in track at location 5 sleepers behind the rail cut and ballast around them removed for easy placement of plough.
- (m) At location where relaying is to start, two rail pieces of 7.3 m length are cut and connected together using well-greased fish-bolts to enable quick opening during block.
- (n) 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.

- (o) Walkie-talkie sets for communication should be available with engine driver, Junior/Sr. Section Engineer (P. way), machine staff and adjoining stations.
- (p) Ensure availability of S & T staff to connect- any wire/rodding disturbed during the block.
- (q) Ensure removal of OHE bonds before the block. Temporary bonding of the OHE masts should be done by OHE staff while removing these bonds and providing these bonds after completion of work.
- (r) Ensure earth bonding of new rail panels. There should be minimum 3 bonds in each panel length of 300 meters.
- (s) 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. Similarly, ERC should be checked for jamming and jammed ERC's should be removed and re-fixed before block.
- (t) Existing PSC sleepers of about 2 rail lengths can be replaced with wooden sleepers to avoid loss of time while working.
- (u) De-stressing, at high temperature, of the old tack should be carried out as provided in **Manual of Instructions on Long welded Rails**.

#### **415. Operations During the Block of TRT**

- (1) Shield hydraulic pipes and other moving parts of the TRT so that in case of any mishap, these do not hit OHE mast.
- (2) Always take OHE block, as staff may be required to climb on top of the machine for repairs etc. in case of any break down.
- (3) 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.
- (4) Utmost caution should be taken while lowering and raising clamp in order to avoid infringement to the adjacent line.
- (5) Impose speed restriction on the adjacent line of not more than 50 kmph to ensure safety of men working at site.

#### **416. Post Block Operations for TRT**

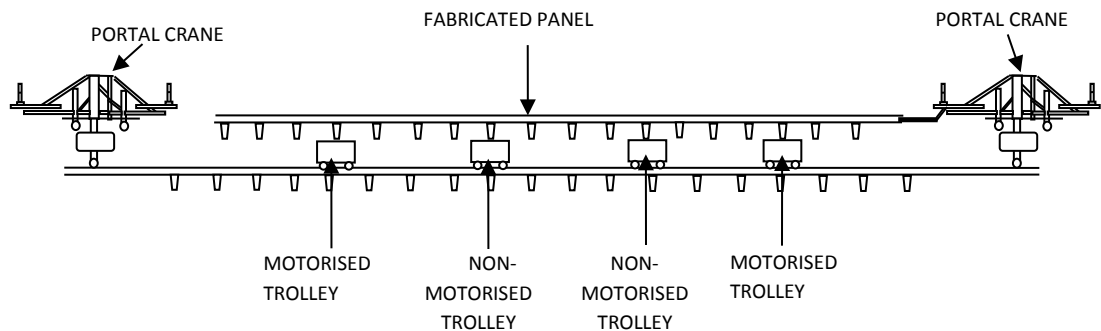
- (1) Ballasting of the track should be done immediately after track relaying operation.
- (2) Ballast Regulator, Tamping machine and Dynamic Track Stabilizer should be deployed to enable raising of speed to normal in shortest possible time.
- (3) In-situ welding of joints should be done before restoration of speed to normal.
- (4) Switch Expansion Joints should be provided at locations as per approved LWR/CWR plans.
- (5) Check rails should be provided at level crossing after final tamping of the track.

- (6) De-stressing of LWR should be done immediately after welding the rail panels to form long welded rails.

**417. Precautions during TRT working** - The following precaution should be taken for TRT working:

- (1) 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.
- (2) Do not unload excess ballast in advance as this causes excessive drag on the machine.
- (3) Do not open out all keys in advance. This should be opened up only as the machine approaches the planned site of renewal.
- (4) Do not stand close to the machine or modified BFRs and do not touch the gantry rails.
- (5) Do not stand on the BFR while the gantry is moving over with new/old sleepers.
- (6) Do not allow the gantry to stand with its wheels on different BFRs.
- (7) Without work, do not sit on the rail seat meant for liner/rubber pad placement.
- (8) Do not climb to the top of TRT without OHE block in electrified section.

**418. Points and Crossing Laying/ Changing Machine (PCCM)** - The machine (PCCM) available on IR is T-28, manufactured by M/s AMECA of Italy and is used for replacing and laying of complete assembly of turnout. Important units of AMECA T-28 are shown in Fig 4.10.



**Fig. 4.10**

**419. Important Units of AMECA T-28**

- (1) **Portal Crane (2 Nos.)** - A set of two cranes (capacity 30 t each) can lift and handle a complete turnout (60 kg 1 in 12 weighing about 54 t). It can also be used to handle normal track. When working in pair, the connection between two portal cranes is provided by the turnout or track portion which is being handled.

The portal cranes are provided with rail wheels for movement on track and crawler for movement on firm ground.

The fabricated panel is lifted in between its side frames and can be carried forward on crawlers. The panel can also be laterally shifted by these portals.

Both portals are identical. One is used at crossing end, the other at switch end. Since crossing end is heavier, the portal position is so adjusted that load on crossing side portal does not exceed 30 t.

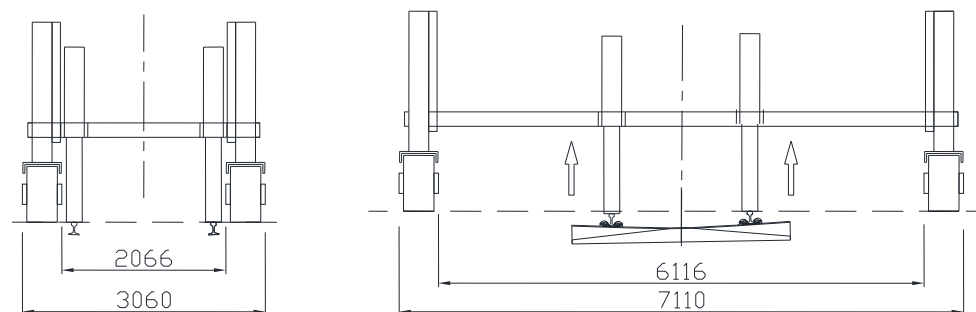
The position of gripping arrangement at portal ends can be adjusted. As both portals are identical these can be used, interchangeably, at either end by adjusting the gripping arrangement.

Additional hook arrangement is provided at centre of portal crane for additional support and to help in proper alignment of turn out assembly at the time of laying.

Important parameters of portal crane are given below:

<b>Table 4.1</b>	
<b>Parameter</b>	<b>Value</b>
Load capacity (max.)	30 t
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	3060 mm (min.) 7110 mm (max.)
Max. axle load	6.0 t
Total weight	24.0 t

The important dimensions of portal are given in **Annexure 4.3**. The crawler's lateral clearance and moving width are shown in Fig: 4.11



**Fig. 4.11**

- (2) **Trolleys (4 Nos.)** - There are two motorized and two non motorized trolleys. These trolleys are used to transport the assembled turnout on track. The motorized trolleys (2 Nos.) have the facility to move laterally by 300 mm on either side or lift vertically by 300 mm. One such motorized trolley is placed each under the crossing portion and switch portion for shifting the turnout laterally or vertically for clearing any obstructions e.g. signal post, OHE mast, platform etc while transporting the assembled turnout. Important parameters of Motorized trolley are given below:

Table 4.2	
Parameter	Value
Height	510 mm
Lateral Shift	+/- 300 mm
Upper table rotation	+ 10°
Vertical lift	+ 300 mm
Capacity	25 t

- (3) **Jib Crane** - Pre-stressed concrete (PSC) sleepers for turnouts require careful handling to avoid damages during loading/unloading, assembling and laying. The sleepers transported on flat wagons are unloaded either at assembly depot or in yards near to the site of laying. Thereafter the PSC sleepers have to be spread at proper spacing for linking of turnout assembly. The jib crane is used for unloading and placement of these PSC sleepers.

**420. Working Mechanism and Capability of AMECA T-28** - Portal cranes of T-28 are self loading/un-loading type and can load /off load itself from the road truck or railway wagon. This is required for long distance transportation from one yard to another.

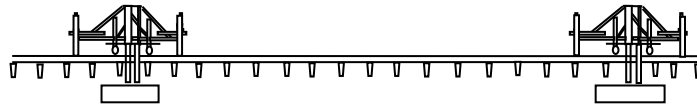
The two portals brought by rail/road wagon off load itself from the wagon along with four trolleys. The trolleys are placed on track and the portal crane position itself over fabricated panel by moving on crawler as well as using its side shifting capability.

The points and crossing renewal can be done by longitudinal/forward launching and also by transverse/side launching or a combination of both depending on site condition.

**(1) Longitudinal/Forward Launching**

- (a) The fabricated panel is lifted by the portal cranes and shifted laterally to place on four trolleys on adjacent Railway track. If the fabricated panel is assembled over track, the trolleys are pushed underneath after portal cranes lift the panel.
- (b) The loaded panel is then towed by one of the portal crane moving on its rail wheel to the site of laying. The other portal crane follows as shown in Fig 4.10.

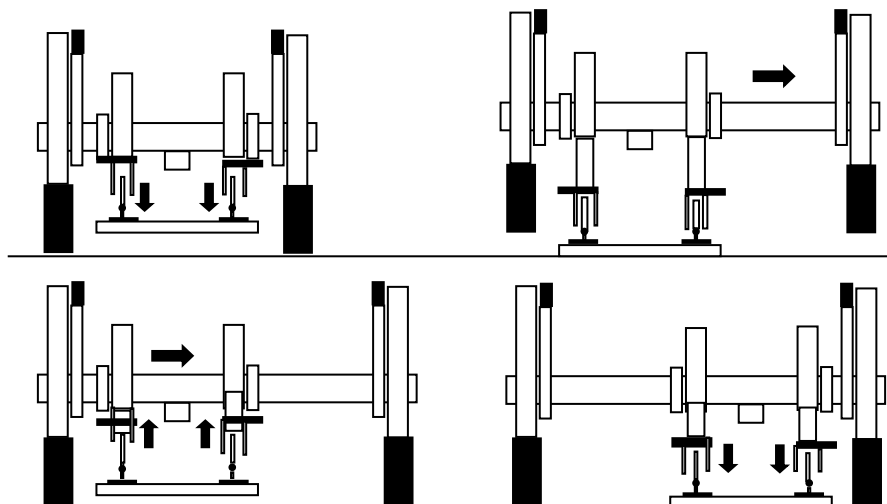
- (c) Both the portal cranes are brought on crawlers by spreading their support legs and moved to the position over fabricated panel on trolleys to lift the panel and releasing trolleys. The trolleys are shifted by pushing them manually to siding.
- (d) The fabricated panel is then longitudinally moved on crawler & placed on pre-prepared bed at correct position as shown in Fig 4.12.



**Fig.4.12**

- (e) The longitudinal and lateral shifting for proper joining with adjacent track and alignment of Panel is also carried out by the portal cranes.
  - (f) The portal cranes, after placement of turnout in position, load itself on the newly laid turnout supported on its own rail wheels and move to the siding line.
  - (g) The siding can also be cleared by portal cranes and trolleys, if required. For this, each portal can attach two trolleys with it and laterally shift to the ground or other line or even can self upload on Flat wagons or road vehicle as per requirement for clearing the siding.
- (2) Transverse/Side Launching** - When the fabricated panel is by the side of location where it is to be laid, the T-28 machine can lay the pre-fabricated panel without using the trolleys.

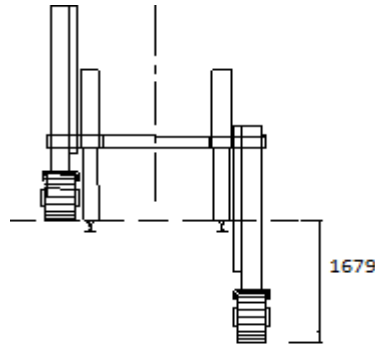
The fabricated panel can be lifted by using both portals and laterally shifted to position of laying using side shifting system of the machine as shown in Fig 4.13. The lifted panel can be longitudinally adjusted & positioned using crawler base.



**Fig.4.13**

Working capability of AMECA T-28 are:

- (a) **Lateral Shifting** - With 1 in 12 T/O, maximum lateral shifting of switch side of T/O assemblies is 1.5 m approximate and on crossing side is 0.75 m approximate in each shifting operation.
- (b) The Portal crane can negotiate a level difference of 1679 mm while moving on the ground as shown in Fig 4.14.



**Fig. 4.14**

- (c) **Laying of Assembled Diamond Crossing on PRC** - The diamond assembly can also be laid by a set of AMECA T-28 portal with following modifications:
  - (i) The weight of double slip diamond crossing on PSC sleeper is 62 t (approx.). Therefore 5 sleepers (no 50 to 54) will have to be removed to keep the total weight as 54 t.
  - (ii) Since diamond crossing layout has crossing at both ends, the gripping location should be adjusted accordingly.
  - (iii) Position of portals should be adjusted so that both share almost equal load.
- (d) **Laying Half Panel** - In case of breakdown of one portal during traffic block, the fabricated panel can be laid by cutting the panel into two pieces (each panel to weigh less than 30 t) and using one portal for laying each half, one by one. The gripping position however will have to be adjusted according to panel being handled.

**421. Pre-Block Operations of T-28 M/c** - Following preparations are to be made:

- (1) 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 and ERCs & inserts greased. If suitable location is not available nearby, 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.

- (2) The assembled turnout should be loaded on trolleys for transportation where planned.
- (3) Rails on either side of existing turnout should preferably be of the same section as that of new turnout. One rail length rail of same section on either side of new assembly should be kept in readiness or should be changed in advance.
- (4) 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 turn out. Proposed rail profile should be plotted both for main line and loop line.
- (5) Point machines should be disengaged and S & T gears of turnout should be disconnected before taking up its replacement.
- (6) Ballast from crib and shoulder of sleepers should be removed up to sleeper bottom for full turnout length.
- (7) 60 wooden blocks, each approximately 60 cm long, should be kept ready for facilitating passage of crawler on the obstacles.
- (8) 4 nos. of rail pieces each 70 cm long should be kept ready for supporting the rail wheels of the crane during shifting.
- (9) Jumpering of both ends of the turnout should be done by electrical staff before lifting and removing of existing turnout.
- (10) Adequate arrangements should be made for protection of the line involved and adjacent lines, while the machine is working.
- (11) Fish bolts should be lubricated and worked to facilitate easy removal during block.
- (12) Location where clamp of each crane will hold the crossing and switch portions for lifting should be marked.
- (13) Motorised trolleys shall be filled with petrol and their working efficiency shall be checked.
- (14) Concrete breaker shall be available to break any obstructing concrete foundation(s).

#### **422. Operations During Block of T-28 M/c**

- (1) Immediately after getting adequate traffic block, the fish bolts of existing turnouts should be opened. OHE connectors shall be disconnected.
- (2) Both cranes should be traversed and brought in position for handling the existing turnout at the demarcated position.
- (3) Old turnout should be lifted by cranes and traversed to suitable location for further dismantling after the block.
- (4) The crane should be traversed to the pre-assembled concrete sleeper turnout and both the cranes should be taken to demarcated position on turnout.

- (5) 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. If any hindrance is encountered, it shall be removed immediately to allow the turnout sleeper to rests at its place and level.
- (6) 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.
- (7) Pre-fabricated turnout should be held by the crane. The cranes with the turnout be traversed in stages and brought to the location of laying. The turnout is laid in position and fishplates are bolted to the existing track.
- (8) One crane is traversed on the track and the second is utilized for final alignment of turnout. After placing the turnout, gangs should fill back the ballast manually.

#### **423. Post Block Operations of T-28 M/c**

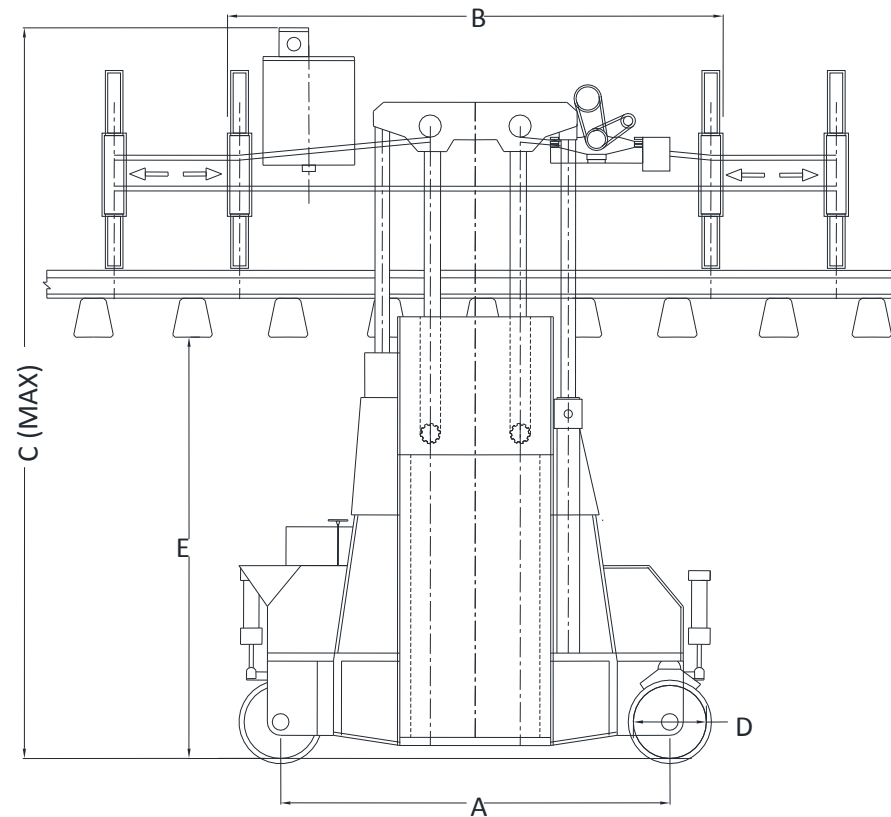
- (1) Ballast deficiency should be made good by putting additional ballast. Profiling and boxing of ballast should be done.
- (2) The turnout should be tamped with the help of UNIMAT machine. Both alignment and levels should be corrected while tamping the turnout.
- (3) The turnout may be interlocked and point machine engaged immediately after laying the turnout. OHE connectors shall be put into place.
- (4) Damage to the cess during block operation should be made good.
- (5) Provision of proper earthing points should be ensured by the Electrical staff.

#### **424. Miscellaneous**

- (1) Because of small diameter of wheels (400 mm) of the machine, movement over fixed diamond crossing must be avoided in the section, where machine is required to run in service.
- (2) The maximum permissible speed of crane is 10 kmph when it runs on its own power.
- (3) Whenever travel is shorter (approximately 100 m) and no major obstacles exist, travelling on crawler is recommended. During traverse of crawlers with lifted turnout, cranes can turn around  $\pm 5$  degrees.
- (4) Motorized 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.

## Important Features/Dimensions of Track Relaying Machine

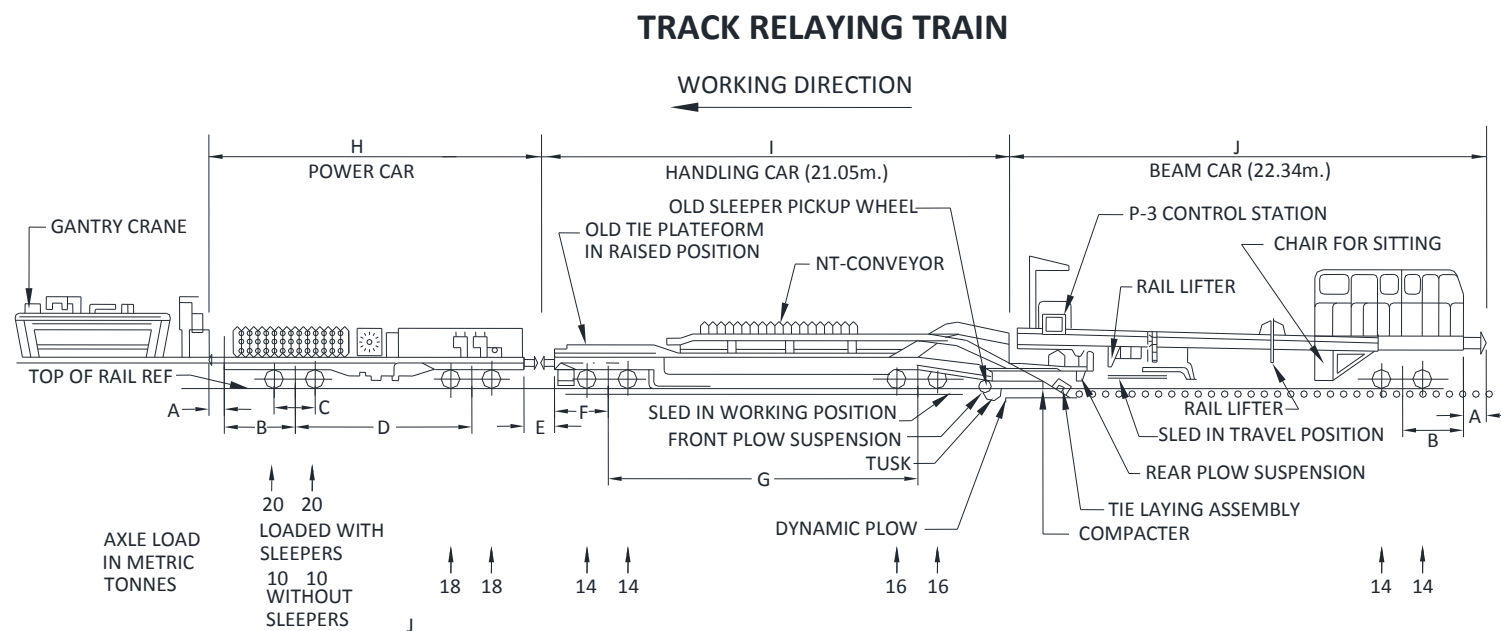
### TRACK RELAYING MACHINE



MACHINE MODEL	A	B	C	D	E	OVER ALL WIDTH	AUXILIARY TRACK GAUGE	LIFTING CAPACITY
12T CAPACITY	2400	3150	4450	450	2725	3850	3400	12T
9T CAPACITY	2400	3050	4390	450	2665	3860	3400	9T

ALL DIMENSIONS ARE IN mm.

## Important Features/Dimensions of Track Relaying Train



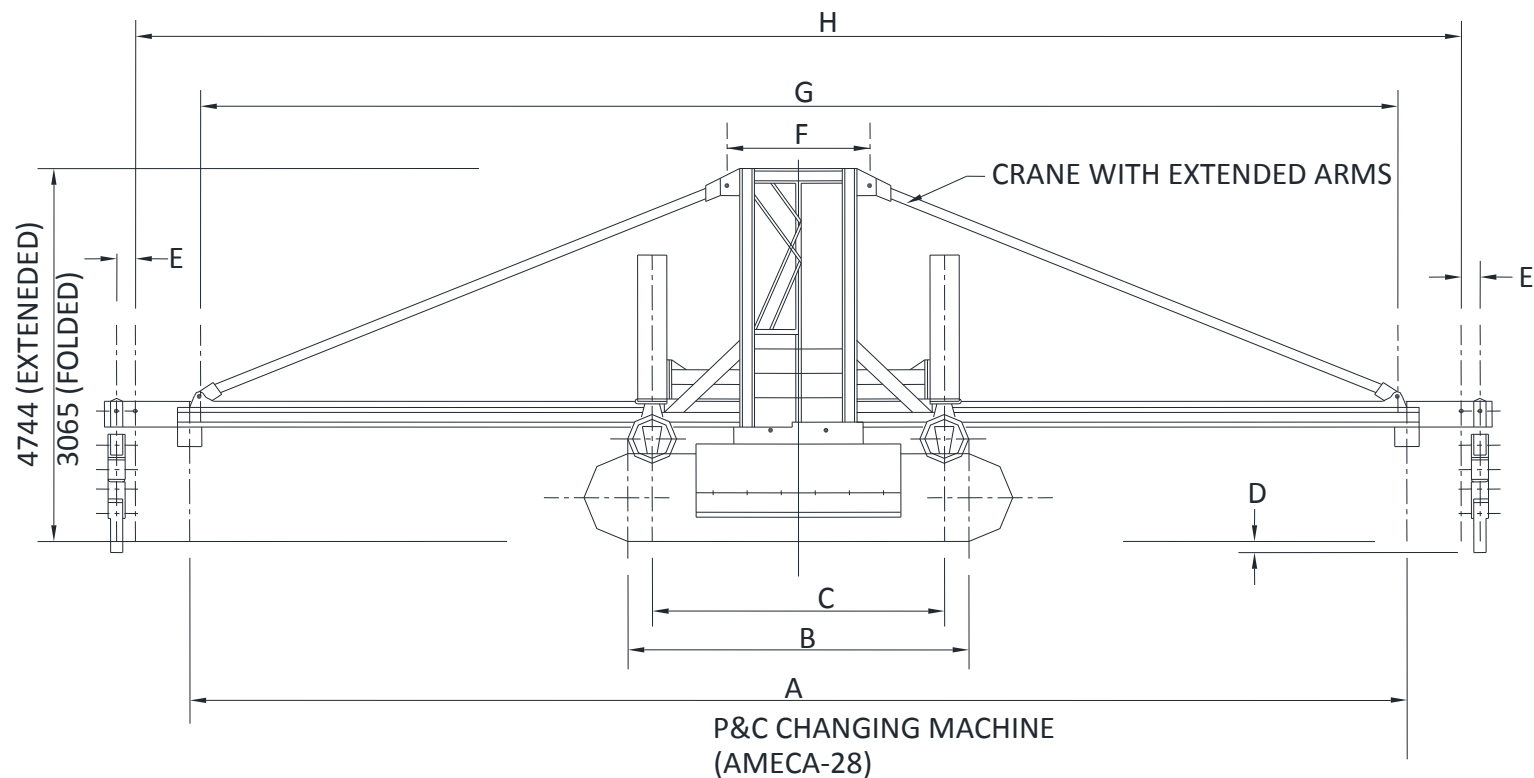
TRT	A	B	C	D	E	F	G	H	I	J
P811-S	641	2699	1727	8318	914	2699	13800	14814	21056	22339

### NOTE-

1. TANK CAPACITY MAIN MACHINE HYDRAULIC OIL-470 GAL(US)
2. TANK CAPACITY MAIN MACHINE DIESEL FUEL -02 TANK @ 228 GAL(US)
3. TANK CAPACITY GANTRY HYDRAULIC OIL-123 GAL(US)
4. TANK CAPACITY GANTRY DIESEL FUEL -100 GAL(US))
5. GANTRY CRANES CAN BE PARKED ON THE SLEEPER WAGON OR ON THE MAIN MACHINE
6. INDIAN RAILWAY WAGON OMITTED FOR CLARITY.
7. ALL DIMENSIONS ARE IN mm.

## Annexure 4.3

### Important Features/Dimensions of Points & Crossing Changing Machine (AMECA T-28)



NAME OF M/C	A	B	C	D	E	F	G	H
AMECA-T28	10870	3100	2670	105	150	1310	10490	11820

ALL DIMENSIONS ARE IN mm.