

INTRODUCTION OF RAIL GRINDING ON INDIAN RAILWAYS – AN EMPHASIS ON PRE, DURING AND POST GRINDING ACTIVITIES

By Sri. M.R.K.Raju, Chief Instructor, ZCETI, SCR, Kachiguda.
and Sri. P. JAYASANKAR, Sr. Instructor, SRCETC, SR, Chennai.

1.0 Introduction

The decision for running heavy axle loads in railway system is governed mainly by overall economy of its operations. Indian Railways has been running the increased axle loads to 22.32t on all the routes and 22.82t on selected routes since 2005 as compared to 20.32t axle loads previously. IRs has also plans to run 25t axle loads on selected routes and 32.5t axle loads on Dedicated Freight Corridors in which construction is under progress.

Even though there is substantial revenue generation for the railway system by increasing the pay load of the existing wagons without increasing its tare weight, it leads to increase in annual maintenance cost as well as replacement cost of assets due to greater damage to rails and other track components.

With limited experience of running 22.82t axle loads, the effect of increased stresses on track components, bridges and rolling stock has already been experienced in various forms. The ill effects of the increased stresses can be mitigated to some extent by having suitable maintenance strategy like grinding of the rails at regular interval, testing of rails at an increased frequency on the rational approach, and management of rail defects as being done on other railway systems.

2.0 History

The Concept of Rail Grinding was originated in 1930s for removal of rail surface defects. First production grinder was built in 1954 by Frank Speno Railroad Ballast Cleaning Co. It was a 9 car train with 96 grinding motors (7.5 hp each) working at 3 kmph.

Later Speno International and Loram Maintenance of Way built many different types of grinders in 1960s & 1970s. All these have manual adjustments to change grinding motor angle to control the position of the motors on the rail head and it was a very cumbersome and time taking process. Speno has built the first fully automated adjustable rail grinding train in 1982. The Selection of programme, grinding pattern was made possible at central control station. This led to a totally a new concept of rail grinding called 'Preventive Rail Grinding'. Indian Railways purchased the first Rail Grinder in 1992.

2.1 Experience of Indian Railways

Indian Railway Maintenance with Rail Grinding was introduced in 1992. RGM-SX11, a 16 stone grinder was run on KK line of S.E.Railway. Grinding was done on sharp curves. Drastic reduction in rail fractures and reduction in derailments was observed. The machine was then shifted to Ambala Division due to concerns of increased incidences of rolling contact fatigue (RCF) defects.

2.2 New RGM on Indian Railways

Indian Railway is procuring two high production rail grinders. One of them was already reached South Central Railway in the month of October 2010. To make use of the machines to the fullest possible extent and to achieve the successful operation on Indian Railway, the guidelines which are already issued by Railway Board regarding working of traffic blocks i.e. FTICB (Fixed Time Integrated Corridor blocks and MBs (Mega Blocks) should be implemented for RGM also. The Joint Engineering and Operating circulars issued at Zonal level lays down the modalities to greater level for implementation by all the units of concerned departments.

3.0 Pre grinding works - General

The following activities are to be performed by respective Divisions of the Zonal railways in which the rail grinding is first programmed before the RGM machine is actually deployed.

3.1 Establishment of Test sites and target rail profiles:

Around 185 number of test sites were already established and representative samples of rail profiles were collected over S.C.Rly. and N.C.Rly.

Around 550 number of wheel profiles were also recorded from various C&W workshops and coaching depots of those Railways.

They are being studied by the Technical experts of National Research Council, Canada for fixing the different Target Profiles for different stretches of track as per the above representative samples. Based on which the machine does the grinding.

3.2 Arrangement of Traffic Blocks:

Under the ideal conditions, the machine grinds about 8- 10 kms. in an effective block of 1 hour. Its setting and closing time put together is about 20 mins. Therefore for grinding one block section (of about 12- 15 kms.), a block of 2 hrs is required, including any pre grinding operations. Wherever feasible, the blocks should match corridor blocks of the section. Planning and obtaining traffic blocks will depend on length of the block section, curves in the section and the speed (15 kmph) at which the machine is going to be operated. Blocks shall be planned in such a way that 3 block sections (length of 25-30 kms.) are ground in a day (in a total block of not less than 4 hrs.).

Most important is that all the blocks should be made available in a specified span of 12 hours in a day and such specified span should be specified in advance by the traffic branch so that the Machine staff (OEM, M/S LORAM, and USA for first two years) can be made available during that time. Cancellation or regulation of trains are to be planned for getting more RGM blocks. In case of double lines, single line working may be introduced to achieve the desired progress.

Block duration specified above are based on the assumption that the machine is on a running line. In case the machine is on siding, it has to be brought to running line and then only block shall be granted. Therefore, sufficient advance planning has to be made by concerned Traffic and Engineering staff to bring the machine from siding to running line before granting the block.

Arrangements for watering at the sidings where RGM is planned for stabling are to be planned in advance by DEN/Sr.DEN of the section. Wherever feasible, existing carriage watering facilities by TXR staff can also be made use of. Sufficient advance intimation shall be given by engineering control to TXR control for making necessary arrangements. Section controller shall regulate goods trains carrying POL products, on the immediate adjacent lines during the traffic block because the sparks generated during rail grinding may create fire hazard.

OHE block shall not be required for working of RGM. However, during maintenance in siding, there may be a need of OHE block. Therefore, RGM should ideally be stabled in either unwired line or siding having OHE isolation system.

3.3 Arrangement of fuel and water:

Fuelling of RGM and fuel tanker at RCDs will be arranged in principle by Stores and the same is specified in the JPO issued at AMs level. This is also communicated to all Zonal Railways vide, Director, Railway Stores/POL/RB's lr. no. RS(POL)/58/0501/2/2008/RGM dt.20.05.09. Full fuelling of RGM is to be made at RCD or when it passes through RCD on the development routes during course of working. If additional fueling needs to be done, RGM fuel

tanker/additional BTPN wagon needs to be moved to the nearest RCD. Sufficient advance intimation shall be given by Engineering Branch to Power control and Sr.DME/Power for arranging fuelling.

RGM requires about 500 ltrs.of diesel and 7500 liters of water (for firefighting as it emits heavy sparks while grinding) per effective one hour block.

3.4 Stabling and Movement of formation:

Operating department shall ensure expeditious movement of RGM formation (RGM, fuel tanker, water tanker, mobile work shop, and camping coaches) as per the plan to avoid loss of time. Advance planning shall be made. RGM can travel at 80 Kmph in self propelled mode. Accordingly the movements shall be planned.

The RGM formation need to be moved to the new location daily as the stabling location of RGM gets changed on daily basis as per the days progress. This shall be arranged by Operating Department using available traffic power. Around 58 nos. of sidings are under construction in the SCR for stabling arrangements. Stabling sidings wherever not ready by that time of arrival of RGM, Traffic sidings or even running lines can be made use of for stabling the RGM.

3.5 Arrangement of Crew and Guard:

Separate roaster for Loco Pilot and Guard shall have to be organized at divisional level, so that work does not suffer on account of Pilot and guard. This roaster should be made considering 12 hrs. span specified for the blocks. Obtain route learning certificates like other Track machine staff at the earliest to enable them to operate RGM and thus avoid requirement of additional pilot and guard in the long run.

Division shall nominate Traffic Inspector in the control office as long as RGM works on the division. The TI shall co-ordinate to draw and implement the weekly MOU as per advance planning done by Sr. DEN/Co-ordn. Sr. DOM, Sr.DME/C&W and Sr. DME/Power.

4.0 Pre grinding Works - Track

4.1 Works to be carried out before rail grinding:

1. Conduct a survey for type of Rail (Section, UTS or head hardened), sleeper (wooden,ST,CST-9, PSC etc.), joint type(LWR,SWR,FP) and ascertain the Sectional GMT, axle load, residual life of rail (estimated in the form of GMT), sleepers and fastenings.
2. Record the locations of SEJs, Points & X-ings, Girder bridge, Level-Xing, Axle counter and any other articles which may infringe the grinding.
3. Decide the type of grinding as corrective, preventive & preventive gradual. Preventive gradual is adopted for Indian Railways.
4. Find the locations of stretches where TRR/CTR is due in near future or excessive corrosion /wear has already occurred etc. where grinding will not be done.
5. Find the Locations where grinding Machine will be stabled. (ideally unwired line or siding having OHE isolation system)
Proper and sufficient space must be available at stabling point for machine and staff. Preparation of siding(length of about 300 mtrs.) for machine, camp coach and material van (for keeping spare parts, Grinding stones, HSD oil, water, reconditioning units, welding rods, petrol or other consumables) is very essential.
6. Potable drinking water and electric supply and other lighting arrangements for maintenance work may be done in the nights or as and when required.
7. Sufficient food & lodging facilities should be available (including toilets and bathrooms).

8. **Fire hazard protection:**

Create awareness among the staff working along the track that they should be sufficiently away from track when the Rail grinding machine performs working nearer to their workspot. Oil installations located near the track must be intimated in advance and their staff must be alerted for fire protection. Inform the civil authorities and fire stations.

Advertise among the people living near the track area and level crossings to beware of fire and splinters coming out. Sufficient Fire protection equipments should be available in easily accessible locations. Record of locations of the nearest fire stations and their phone numbers must be available on the machine and displayed at convenient location. Arrange to remove the dry grass existing on or near the track which may create fire hazard.

9. The staff working on machine and field must be well trained and they should be fully conversant with machine and section.
10. Arrangement for supply and storage of HSD oil, water and other consumable.
11. Effective Communication system is to be established between machines, Engg.Dept. Station, Civil authorities and control office.
12. A display board for phone numbers and other communication details is to be displayed at prominent location on the machine.

13. Arrangement of vehicles for staff which can be used in the case of repair of parts and for transportation of consumables.
14. A road map (along the track with details of type of road and accessibility of road vehicles to fire station, police station, petrol pump, workshop using lathe machine , shops for electrical fittings, Water tank, ATM, hotel/Dhaba) must be available and displayed at easily located place.

4.2 Attention to track before grinding:

1. Inspection of nominated track must be done for low and high joints , if fish plated joints are loose due to wear of fishing plane grinder may hit the landing rail and make battered joint. Fish plated joint must be fully tightened.
2. In the sections where ballast has been trained out, it may be cleared from rail head and high shoulder ballast should be removed to avoid hitting the ballast either by grinding stone or by the guard provided to protect spark coming out.
3. Large kinks are to be eliminated.
4. De-weeding / removal of dry vegetation are to be done.
5. Any part of wire/bond plate should be below the bottom of rail head.
6. Locations of work start and end must be specified and clearly displayed on site by using display boards.
7. Record and display the locations where repeat of grinding is required and Required number of repeats (as per plan)_
8. Inform the concern S&T staff to avoid delay in removing axle counters if necessary and any failure occurs due to iron dust on glued joints.

4.3 Measurements and condition monitoring before grinding:

1. Measure the rail profile at Test locations. The nominated location must represent the section selected.
2. Measure the rail profile LH & RH rail separately.

On curve, detail of location of starting and end of curve, Degree, LH or RH , and profile of High rail and Low rail are to be measured.

3. Inspection of roaring rails and top pitted rail, wheel burn rail is to be made which may be used for deciding repetition of grinding.
4. USFD inspection and the results are to be made available for quality control.
5. Vertical and lateral wear is to be measured at representative locations.
6. Corrosion on rail is to be checked to decide for rail life. If rail is not fit for track due to wear/corrosion, grinding work need not be done.
7. Measure the rail profile by using Mini Prof (Rail profile – wear, gauge etc.)

8. Take surface photos & perform dye penetration test to identify RCF defects, weld dips, Squats, Wheel burns, hunting etc.

4.4 Basic norms to be ensured before grinding:

1. All staff working on machine must wear the protective items as (Helmet, goggles, hand gloves, boots, ear protector and safety jackets etc.
2. All the staff knows the locations of working, their allotted jobs and safety aspects.
3. Obtain the location wise pattern adopted and number of repeats if any and their locations.
4. Any person outside from railway should not be allowed on machine or on track. If accompany, an Indemnity bond is to be filed as per IRPWM provisions.
5. Ensure Machine and communication equipment in working condition. Oiling and greasing of machine is to be done in advance. Grinding wheels which are damaged or worn-out should be replaced.
6. Sufficient HSD, water and grinding wheels must be made available.
7. Dust filter must be made clear and the cover should be in tight. Side cover to prevent splinters must be locked to avoid any damage during running.
8. S&T staff are to be informed for cleaning of glued joints and removal of axle counter etc.
9. Clear instructions must be there for Chief Controller and station masters not to run the vehicles containing highly inflammable material or even not to stable beside of the working track.
10. Check the Water jets for their proper working.
11. If there is any information regarding inflammables fallen on track, avoid the grinding work on that location for time being.

5.0 Works during grinding

5.1 Brake Power:

Necessary brake power certificates (BPC) valid for 30 days shall be issued by the C&W in charge of the base depot. On expiry of the same, the rolling stock formation shall be sent back to base depot for revalidation/ fresh issue of BPC. This 30 days periodicity laid down shall be reviewed after grinding periodically.

2. Obtain the traffic block as per the rules and inform all concern. Only after getting proper authority to proceed, the machine will go into the working section.
3. Check for proper Air pressure, Hydraulic pressure and electric supply etc.
4. Machine speed must be proper. Speed should not be less since it will cause burning of rail head. If the speed is more the grinding will not be effective.

5. Stop the grinding work in advance of 5m distance where grinding is not to be done (SEJ, Point & X-ing etc.)
6. Watch in rear of the machine for fire. If any fire is found, the water sprinklers should be used to stop it. If it is beyond the capacity to stop, immediately call to fire station.
7. Lock the cover guard on grinding zone.

5.2 Condition Monitoring during grinding:

- i) Check whether all the grinding wheels and grinders are in working condition as per plan or not.
- ii) Check the C.C.TV, Cam, Computers and Profile Recorders are working properly.
- iii) On curves avoid lowering the grinding bogies, if lowered on curve it must be checked that bogies are on rail.
- iv) Working speed must be >2.5 kmph. If any bluing of rail surfaces found, it should be reported and avoided at once.

6.0 Works after Grinding

6.1 Track fit certificate –

Train on the blocked line where RGM has worked, will be permitted only after the receipt of a track fitness certificate from site-in-charge of RGM i.e. SSE/JE(P.way).

2. Arrange the machine to come early to base depot for maintenance and other works.
3. Arrange the grinding stone, HSD, Water and other consumables for next days working.
4. Clean dust drums and dust containing small iron chips must be disposed properly. It is dangerous to the persons who will come in contact with those chips.

6.2 Condition monitoring after Grinding:

- i) After grinding check the surface roughness of the rail profile. If surface roughness is found high, greasing on gauge face may be done.
- ii) Clean the top surface of glued joints.
- iii) Refix axle counters or any other fixtures which were taken out before grinding.
- iv) Any fire found near the track should be stopped.
- v) Any parts of machine found on track should be removed from track and assess the damage on machine and machine should be repaired.

- vi) Surface hardness may be checked with the help of integrated hardness tester.
- vii) Measure rail profile on specified locations (Test sites) and analyze the result of grinding.
- viii) Analysis for rail deterioration on grinded zone and non grinded zone is to be done.
- ix) Check the rail profile and match to the target profiles. If target profile has not been obtained, try to achieve it in next round.
- x) Maintain the daily progress report of grinding and as well as track defects to analyze the quality of grinding work.
- xi) Expenditure on various items is to be monitored (consumables, repair work, staff) in detail for further improvement.
- xii) Rail quality and production specialist should visit once a year.
- xiii) Review to re-set the target profile for further work.
- xiv) Any new development on track due to grinding either positive or negative should be reported to higher officials/RDSO for further decision making.

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