
Brief analysis on the railway laying technology under the multi-angle slope of track groove of 3103 working face

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Abstract

The laying of track channel railway is the preliminary preparation for the installation of the working face and the necessary passage for the transportation of materials after the production of the working face. The quality of track laying is related to the safety of large equipment and mine car transportation and promotion. In order to ensure the normal operation of the production and overcome the problem of different slopes of the on-site track. When the transportation area was installed, special bending measures were taken at the joints of different inclination angles of the track, so that the sharp connection of the interface was changed to a smooth transition. It ensures that the flatbed, float and mine car will not run off when running.

Keywords

Bent rail; smooth transition.

1. General situation and geological occurrence condition of track channel

Working face 3103 is located in the southwest of pinglou fault and is monoclinical structure. Coal seam strike 66, dip 156, dip Angle 9~27, average 20; In fact, an abnormal area of 3 coals was exposed in the duct of 3103 tape, which was mainly manifested as the thickness of 3 coals gradually thinning within the abnormal area. The roof of the roadway is partially broken, and the roof is partially flooded with water. The amount of flooded water is small, and the siltstone of the old roof is 6.3m, the mudstone of the direct roof is 1.0m, the mudstone of the direct bottom is 0.8m, and the fine sandstone of the old bottom is 8.4m. In the process of tunneling, tunneling angle is adjusted for many times along with the change of coal seam inclination angle, so the slope of the rail gateway is uneven. The angle of some roadway sections varies greatly, which brings great difficulty to track laying. If the track laying quality is not up to standard, it will cause frequent lane drop and affect the transportation and installation of equipment.

2. Standard for road laying

(1) Track fasteners shall be complete and firm, and the clearance of track joints shall not be too large; (2) In the linear orbit, the height difference between the top rail surface and the outer rail of the curve section, the height deviation between the upper rail surface and the inner rail surface after the design is increased, shall not be greater than 5 mm; (3) Daobed must pad flat, absolutely can not appear suspended phenomenon; (4) The track model must be consistent with the line, and there shall be no mixed track. The track of a turnout shall not be lower than the track model of the line; (5) The track should be laid flat, firm, and slag; (6) Track splint bolts shall have flat pads, spring pads, and nuts shall be tightened; (7) The spacing between sleepers shall not be greater than 700mm. In particular, the track connection angle should achieve smooth transition to prevent the track dropping caused by the suspension of wheels in the connection caused by linear connection.

3. Site construction technology and innovation

3.1 The construction technology

(1)The sundries in the construction site should be cleaned up before construction;(2)Actual measurement of the total length of the roadway on site, calculation of the required number of railways, road nails, splints, sleepers and screws, also need to be equipped with rail bender and road hoist;(3)Before laying, the materials will be respectively transported to the track trough bottom yard, middle yard, and the head of the slope, which is convenient for laying and connecting work of each section, and avoids the repeated labor of moving the railway up and down again after laying a section;(4)Choose two people as the first group to place the sleepers. Select eight persons for the second group to carry the railway to the designated position and align the lower end of the installed railway. Then select four people to install the splint and nail for fixing.

3.2 The innovation points

In order to achieve a smooth transition at the junction of inclined section and roadway section, two equilateral triangles with side lengths of 70mm were cut off at 500mm near the railway interface of upper and lower sections. The first triangle was 160mm from the railway end of this section, and the interval between the two triangular areas was 150mm (as shown in figure 1 below).According to the actual situation on site, bend butt joint is carried out to realize the smooth transition of the upper and lower sections of the railway (as shown in figure 2). At the obtuse angle of the interface, if the rail bending measures are not taken but the direct use of right angle butt joint, the car roller will be suspended phenomenon and easy to fall off the track.

3.3 Mechanical validation

According to the knowledge of material mechanics, the track laying of the smooth transition section conforms to the bending normal stress model, as shown in figure 3.Combined with the formula for calculating the maximum bending normal stress:

$$\sigma_{\max} = \frac{My_{\max}}{I_{\max}} = \frac{M}{\frac{I_z}{y_{\max}}} \quad (1)$$

In the formula: σ_{\max} —Maximum bending normal stress M—Bending moment

I_z —Moment of inertia y_{\max} —Distance on the Y-axis

Where, $\frac{I_z}{y_{\max}}$, it only related to the cross-sectional dimension; $W_z = \frac{I_z}{y_{\max}}$ is represented by W_z as the bending section coefficient; the maximum bending normal stress is $\sigma_{\max} = \frac{M}{W_z}$.

Therefore, the maximum bending normal stress is directly proportional to the bending moment and proportional to the bending section coefficient.The bending cross section coefficient reflects the influence of the shape of cross section on the bending normal stress.Combined with the inner rail type of the track gateway of the 3103 working face, the section height is 110mm, the vertical height of the triangle is 0.8 times of the side length, and the load of the mining car is 1.5t.After the formula is verified, the rail will not be damaged, so it can be used normally after the rail bending measures are adopted.

3.4 On-site verification

In the on-site lifting transportation project of regular operation, there is no down-going phenomenon at the junction of the inclined lane and the flat lane, which greatly improves the transportation efficiency and provides guarantee for the normal operation of the production.

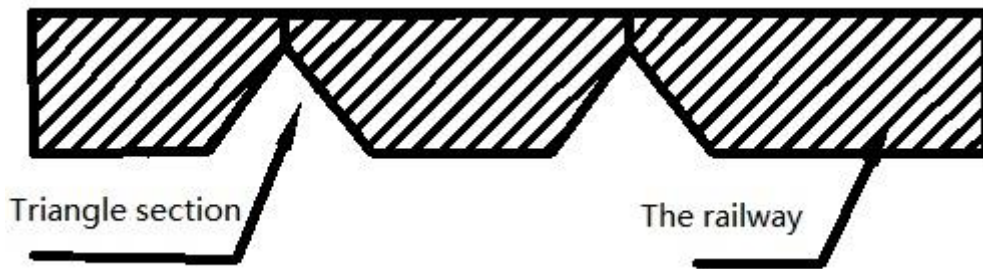


Fig. 1 schematic diagram of triangle cutting area

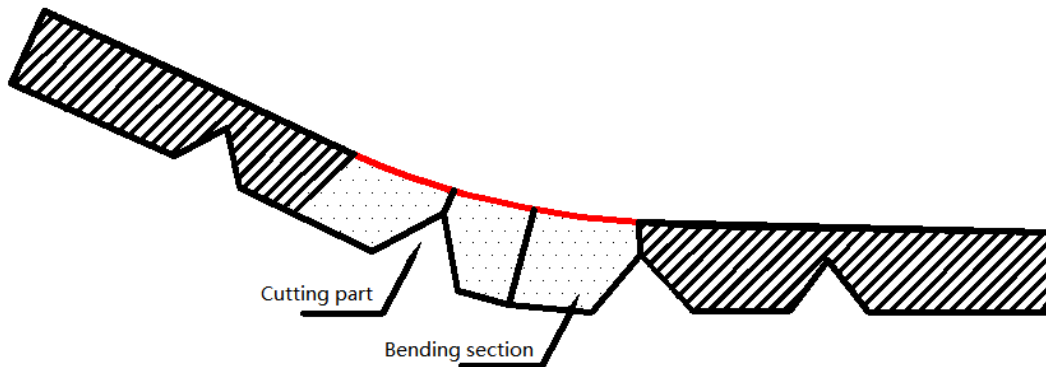


Fig. 2 schematic diagram of connecting curved rail

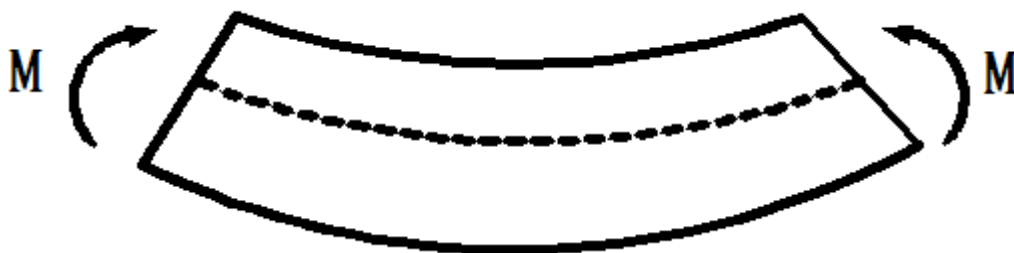


Fig. 3 mechanical model of curved rail

4. Conclusion

If directly use right angle butt joint at the obtuse angle of the interface, the roller of the mining car will be suspended, which is easy to fall off the track. After the rail bending measure is adopted during the installation of the transportation work area, the smooth transition between the roadway segment and the inclined segment in the roadway is realized, and the phenomenon of dropping the roadway is avoided.

Smooth transition of track convergence angle to prevent track dropping caused by suspension of wheels due to linear convergence. This measure can effectively improve the production efficiency and ensure the normal operation of production. It is suitable for roadway laying under similar conditions.

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