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COAL MINING UNDER THE RAILROAD LINES IN THE CHELYABINSK BASIN

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The problem of coal mining under railroad lines is of considerable practical value in the Chelyabinsk Basin. This basin has a dense network of sidings and, if pillars are left to protect the railroad, a large amount of coal would be lost because of the numerous and rich coal seams. The danger of underground fires also exists.

The structure and composition of strata, as well as their location, facilitate mining under the railroad lines. The strata are mainly formed of plastic clayey rock (argillite 50-70 percent, sandstone 10-20 percent, conglomerates 1-2 percent). The coal seams dip for the most part.

Experiments on working under railroad lines in the Chelyabinsk Basin were first carried out in 1934; during the past 3 years, this work has been particularly well developed. Mine surveying for this operation has been carried out by the Ural branch of the VNIMI (All-Union Scientific-Research Institute of Mineral Deposits) since 1946. Simultaneously with observations conducted by means of instruments, a great amount of information was gathered on all the places in the basin where mining was carried on under railroad lines.

The most typical cases are as follows:

1. Kopeysk-Korkino Railroad Branch

The roadbeds in the mining area have an embankment, 1-2 meters high, and intersect the mine face obliquely. Coal mining under the railroad line takes place at face No 56 of seam 1, Mine No 204. This face is mined at the fourth layer of the seam, located at a depth of 64-110 meters, with a 10-12 degree dip and a thickness of 2.4-2.9 meters. The length of the face is 210 meters. The roof is controlled by stoping at 1.6-meter intervals.

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The rock above seam 1 is mainly argillite and "avlevrolity" interspersed with sandstone. The bed rock is covered with overburden, 20 meters thick.

Considerable displacement of the roadbed resulted from this underground mining. Maximum sags reached 1,736 millimeters, with 450 millimeters of horizontal displacement.

During the mining operation, the roadbed was constantly repaired by adding ballast to restore the profile. No breakdown or delay of train traffic occurred. The speed of passenger trains was reduced to 5 kilometers per hour in the mining area.

2. Kopeysk-Mine No 41 Railroad Branch

Coal mining under the railroad line takes place at faces No 5 and 5-bis of seam 1, Mine No 41. In this sector the track is partly built on a fill and partly in a cut, and runs above the hauling drift.

At faces No 5 and 5-bis, coal is extracted from the lower layer of the seam which is 2.5 meters thick and lies at a depth varying from 72 to 90 meters. The seam dips at a 6-8 degree angle and the faces are 70 meters long. The average monthly advance of face No 5-bis is 15-17 meters, that of face No 5, 5-6 meters. The rock above the seam is mainly composed of argillites interspersed with sandstone. The overburden is 24-30 meters thick.

As a result of mining, the roadbed sagged 1,080 millimeters, the horizontal displacement reached 500 millimeters. There was no significant distortion of the railroad track. Ballast was constantly added, and the train traffic was not stopped because of mining.

3. Siding--Mine No 43-bis

Mining under the railroad lines takes place at Mine No 42 kap. Face No 4 is roughly parallel to the railroad track, which in this area is laid on an embankment 1.5-1.7 meters high. At face No 4 coal is extracted from the upper layer of seam 2, which is 2.15 meters thick and is located at a depth of 34-60 meters. The seam dips at a 15-degree angle and the length of the face is 135 meters. The roof is controlled by stoping at intervals of 1.8 meters. Rock overlying seam 2 is argillite interspersed with sandstone (up to 1.5 meters). The overburden is 30-32 meters thick.

Because of the mining, sagging of the surface reached 1.5 meters; stretching, 22.8 millimeters per meter (interval 14-15); contraction, 25.2 millimeters per meter; deviations, 69 millimeters per meter.

Because of the slow advance of the face, cracks parallel to the face appeared on the surface and disappeared under the roadbed.

All through the process of mining the roadbed was repaired by adding ballast, and at the time of the last survey was in satisfactory condition. In this sector extra ballast was added from marker 8 to marker 17. There were no breakdowns or interruptions of train traffic.

4. Tayandy-Yemanzhelnika Railroad Line

The railroad line runs above the center of mining operations in the "Sputnik" seam, Mine No 18-bis. Mining is carried on at a depth of 50 meters. The seam dips at a 16-degree angle and has a thickness of 1.6 meters. The roof is controlled by complete stoping. Overlaying the "Sputnik" seam are two seams of sandstone 20 meters thick.

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Mining under the railroad line took place over a distance of 300 meters in length. Repairs were carried out every 1-2 days. At the time of the last survey, 2,000 cubic meters of ballast had been added. The speed of trains in this mining area was reduced to 10 kilometers per hour. No break-downs occurred in this sector.

5. Siding -- Mine No 18-bis

The railroad line runs above the center of the mining operations. The seam is 8 meters thick and is worked in three layers (1st layer, 2.4-2.6 meters; 2d layer, 2.2 meters; 3d layer, 1.6-2.8 meters). The dip varies from 18 to 65 degrees. The roof is controlled by complete stopping. Roadbed sagging reached 3 meters, but since ballast was regularly added, the use of the road remained normal.

The above examples indicate a series of varying conditions in mining under railroad lines in the Chelyabinsk Basin: the depth varied from 20-112 meters, angle of dip from 6-40 degrees, the minimum thickness from 1.6-5 meters; the angle formed by the railroad line and the mine face also varied. No serious breakdown and no noticeable delay of trains because of roadbed repairs have ever been observed.

In the majority of cases, tracks were laid on fills or in cuts, the height of which reached 2.5 meters. These constructions have never suffered any malformations except sagging.

Emergency repairs were never necessary, since the maximum rate of sagging never surpassed 50 millimeters per 24 hours, and usually varied 5-10 millimeters. Track repair was carried out periodically, thus enabling one brigade to service several different places. The repair work is very simple and usually consists of adding ballast and straightening rails.

According to the Loading and Transport Administration of the Kopeyskugol' Trust, the reconditioning work costs in the above-noted mines amounted to approximately 127,000 rubles during the year. In the same mines, 254,400 tons of coal were extracted from pillars which otherwise would have been left as supports for the railroads.

The experience in extracting coal pillars led to the following conclusions:

1. Railroad operation in the Chelyabinsk Basin was not disturbed, and there was no considerable expenses for repairs caused by mining, provided ballast was added in time.

Additional expenses for repair of roadbeds in the Kopeyskugol' Trust amounted to an average of 0.20-0.50 ruble per ton of coal obtained from pillars under the railroad. At the same time, coal losses were reduced, and the necessity of building props in certain mines eliminated.

2. Railroad sectors under which mining is carried out are to be carefully inspected, and ballast must be added regularly throughout the whole process of sagging, which varies from 2.5-4 months.

Slag and old refuse ore can be used as ballast for sidings, although this material may shrink up to 50 percent. If the railroads under which mining is carried on handle considerable traffic and if it is not advisable to reduce the speed of the trains, a better-quality ballast should be used.

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3. When mining takes place at a depth of 45 meters or more and there is a dip in the stratum up to 45 degrees, high rate of malformation, which may seriously endanger the tracks, is not to be feared. Even though the active stage of the process of displacement the rate of sagging at the surface is 10-15 millimeters per 24 hours.

4. The chief precautionary measures to be taken when mining is carried out under the railroad tracks are:

a. The limits of the railroad section under which mining takes place must be marked with special signs.

b. The speed of freight trains must be reduced to 10 kilometers per hour and that of passenger trains to 5-6 kilometers per hour. This speed can be increased when higher quality ballast is used.

5. When mining under the railroad is carried on in very thick seams (layer removed) or in a series of seams, a minimum interval of 4 months should elapse between starting the extraction of two different seams or formations.

6. When mining takes place in layers dipping at an angle of 0-45 degrees, mining under railroad lines is possible no matter what the direction of the track is in relation to the mine face. However, in order to improve the conditions of the operation, it is necessary to observe the following:

a. If faces are long and if the contour of the displaced ground area covers a large section of the roadbeds, the direction of the mine face must form an oblique angle with the direction of the track. Underground work in such a case must be carried out gradually, thus facilitating repair work.

b. When faces are short, the mine face must be parallel to the direction of the track.

c. A mine face perpendicular to the track is the most disadvantageous layout, since, in this case, repair work is delayed considerably and covers a large area.

7. Mining under railroad lines is possible when it takes place either in steep seams of medium thickness and there is complete roof stopping, or in series of steep seams and the emptied space backfilled, provided tracks are located above the lower end of the mine and parallel to the direction of the seam.

8. The work in a series of steep seams (or in one very thick steeply dipping seam) with a complete roof stopping results in a total destruction of tracks, which then require lengthy repairs. In this case, either the tracks must be removed from the mining area, or coal pillars must remain under the tracks.

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