



भारत सरकार / Govt. of India
श्रम एवं रोजगार मंत्रालय
Ministry of Labour and Employment
खान सुरक्षा महानिदेशालय
Directorate General of Mines Safety



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To

The Owner, Agent and Manager of all Coal Mines

Sub: Strata monitoring in longwall workings in coal mines –reg.

Effective strata control is vital for safe and productive longwall operation in any geo-mining condition. Effectiveness of strata control can be evaluated by a suitable strata monitoring system. During operation of a longwall panel, a thorough investigation of the associated strata and support systems is required to understand the geo-mechanical behaviour of the strata and the performance of the support systems. This enables in effective tackling of the problems arising from strata and in ensuring safety of the men and machineries.

Monitoring of strata behaviour during extraction of longwall panel is not only required for ensuring safety and stability of longwall workings but also to get essential inputs for verification of existing design parameters of the panel, proper planning of future longwall panels, assessing suitable support requirements, etc. Therefore, it is felt that a standard protocol is required for strata monitoring in longwall workings.

In view of the above, a technical workshop was conducted on "latest trends in strata control in longwall mining with a special reference to strata monitoring techniques" on 20.1.2017 at DGMS, Dhanbad, which was attended by 57 participants from different stakeholders like mining industry, research & academic institutions and DGMS. Based on the inputs drawn from the deliberations made in the workshop, the following guidelines have been formulated for strata monitoring in longwall workings:

I. Strata monitoring plan

The Owner, Agent or Manager of every mine shall formulate and implement a strata monitoring plan for every longwall panel in the mine under the guidance of a scientific agency having expertise in this field. The plan shall contain:

- i) proposed instrumentation scheme
- ii) monitoring schedules,
- iii) list of the persons engaged in implementation of the plan and their duties & responsibilities,

- iv) formats for documentation and records of the readings of strata monitoring, and
- v) Any other information related to strata monitoring.

II. The strata monitoring plan referred under Para I above, shall be prepared based on the geo-technical studies by a scientific agency having expertise in this field and every such plan, shall, inter alia, include:-

1.0 Monitoring of gate roadways

- 1.1 Roof to floor convergence of tail and main gate roadways shall be monitored on regular basis by convergence indicators, once at least in every shift up to a distance of atleast 40m from the face at an interval not exceeding 10m.
- 1.2 Load cells shall be installed in main gate and tailgate roadways up to a distance of minimum 40 m from the face at an interval not exceeding 10 m on hydraulic/friction props or with the roof bolts as the case may be. Readings of the load cells shall be recorded in every shift.
- 1.3 The convergence measurements as required under clause no. 1.1 and load cell readings as required under clause no. 1.2 above shall be taken simultaneously.
- 1.4 If roof bolts are used as roof supports in gate roadways, at least 2 to 3 instrumented roof bolts shall be installed in each gate roadway at strategic places to determine the loading pattern on the bolts.
- 1.5 Multi point extensometers/ Tell tales/Sonic probe extensometers shall be installed in main gate and tail gate roadways at an interval not exceeding 50m to monitor dilation/ bed separation in the roof strata. The instruments shall be constantly maintained in the gate roadways of the panel at least upto a distance of 400 m from the face.

2.0 Monitoring of vertical induced stresses (abutment stresses) in barrier/chain pillars and longwall pillar

- 2.1 To predict abutment stresses in longwall pillar under extraction, stress cells shall be installed in the longwall pillar ahead of the face from main gate and tail gate roadways at an interval of 100 m. The stress cells shall be constantly maintained in the longwall pillar at least upto a distance of 400m from the face. The first stress cell shall be installed at the expected main weighting position.
- 2.2 To monitor the stability of the barrier/chain pillars and predict magnitude and location of the abutment stresses in it, stress cells shall be installed in the barrier/chain pillars from main gate and tailgate roadways at an interval of 200 m up to a distance of minimum 400 m from the face. The first stress cells shall be installed at the expected main weighting position.

3.0 Monitoring of load and convergence of Powered Roof Supports (PRS)

- 3.1 Pressure in the gauges fitted in leg circuits of the Powered Roof Supports (PRS) at the face shall be recorded once at least in every shift.
- 3.2 If there is no automatic continuous monitoring system of leg closure of PRS, measurement of convergence (leg closure) of the PRS shall be carried out by tape measurements at least once in every shift during idle period and daily once in other cases.
- 3.3 If there are no automatic continuous monitoring system of leg pressure and leg closure of PRS, the load on and convergence of at least 10 PRS at strategic locations shall be continuously monitored with data loggers to understand the loading pattern on PRS and its response.

4.0 Progressive caving of strata in the goaf

To study progressive caving behaviour of roof strata in the goaf with face retreat, at least three (3) multi-point Borehole Extensometers shall be installed from the surface along the central line of the longwall panel at not more than 500 m interval. In case of presence of goaved-out workings in the overlying seams vertically above the longwall panel, the location and interval between such Extensometers may vary to the extent that may be required to avoid drilling of boreholes through such goaved-out workings.

5.0 Subsidence study

Subsidence survey and maintenance of its records shall be done as per the DGMS circular no 4 of 1988 or its revised version.

- 6.0 If the roof strata of a longwall panel has been categorised as cavable with substantial difficulty or cavable with extreme difficulty based on Caving Index, the following additional precautions shall also be taken in the panel;

- 6.1 Continuous monitoring of strata shall be done using micro-seismic monitoring system with geophones installed from the surface to analyse the possible time of failure and location of the failure zones within the roof strata.
- 6.2 Leg pressures and leg closures of Powered Roof Supports (PRS) shall be monitored continuously by using real time monitoring and automatic data acquisition and interpretation systems.

- 7.0 In the proximity of the geologically disturbed areas of a longwall panel, during development (drivage of gate roadways and set up gallery) and salvaging of longwall panels the strata monitoring shall be carried out as per the instrumentation scheme suggested by the scientific agency referred under para-I above.

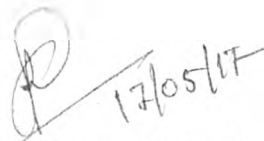
8.0 For every longwall panel, suitable trigger action response plans shall be formulated and integrated with emergency initiated protocols.

9.0 Plan: A part plan of the longwall workings depicting strata monitoring instrumentation with suitable index, shall be kept and maintained in the office of the mine.

10.0 Supervision

In every longwall panel, strata monitoring plan shall be kept under the charge of an Assistant Manager holding 1st Class Manager's Certificate of Competency with relevant experience in longwall, who shall also be assisted with adequate number of trained supervisors and manpower.

The owners, Agents and Managers of all coal mines having longwall workings are advised to ensure compliance with this circular.



(Prasanta Kumar Sarkar)
Director General of Mines Safety