

# Mine Safety in Haulage and Transportation System

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**Abstract:** In the Mining Sector, Safety is utmost important factor. The major goal of this article was to reduce the Mine Accidents with respect Mine Haulage and Transportation system in underground Coal mines. Total 11 major hazards are identified as Principal Hazards in Indian coal mines, as per DGMS Circular No.5 of 2016 for which Principal Hazard Management Plans (PHMP) are to be prepared and to be put in operation as per CMR 2017. HAULAGE and TRANSPORTATION SYSTEM is one of them. In addition to the stipulated 11 principal hazards, no additional hazard has been identified as a principal hazard in the Broad Brush Risk Assessment (BBRA) of the RKNT Incline Mine. However, other hazards which are not potentially hazardous to result in multiple fatalities have been identified and Management control plans shall be put in place for managing those hazards.

The HAULAGE & TRANSPORTATION SYSTEM hazard has been critically assessed by the Safety management team of the mine and hazard mechanisms through which the hazard can result in a risk or an accident have been identified and risk assessment has been done. Risk scoring has been done as per DGMS Circular No. 2 of 2011. Risk ranking has been done to identify hazard mechanisms with higher risk scores and appropriate control measures are put in place to mitigate the same. Existing control mechanisms have been analyzed for their effectiveness in finalizing the proposed control measures. Responsibility fixing has been done rationally, duly considering practical possibilities. The inputs required for effective implementation of this PHMP has been identified and action plan drawn up to procure the same.

**Keywords:** Mine Safety in Haulage, Safety in Mine Transportation, Underground Safety, Safety Precautions in mines

## 1. INTRODUCTION

Indian Coal Mining Industry makes a major contribution to the national economy and to the wellbeing of the society as a whole. For the continuing viability and stability of the industry, it is important that full advantage be taken of developments in mining methods & procedures, modern machinery & equipment's and advances in approaches to management of all mining activities, including health & safety. While safety in any sphere of activities is important, it has special significance when the risk is greater. Unlike other major industries, mining has high potential risk of accidents. It has a dubious distinction of involving a very high actual hazard as the environment changes continually with the progress of work.

Hazard factors related to machinery, humans, the work environment and work methods were the causes identified for the different types of safety risks in underground coal mines. Total 11 major hazards are identified as Principal Hazards in Indian coal mines, as per DGMS Circular No.5 of 2016 for which Principal Hazard Management Plans (PHMP) are to be prepared and to be put in operation as per CMR 2017.

HAULAGE and TRANSPORTATION SYSTEM is one of them. In addition to the stipulated 11 principal hazards, no additional hazard has been identified as a principal hazard in the Broad Brush Risk Assessment (BBRA) of the RKNT Incline Mine. However, other hazards which are not potentially hazardous to result in multiple fatalities have been identified and Management control plans shall be put in place for managing those hazards.

As per **Regulation No.104 of CMR -2017**, Principal Hazard Management Plans (PHMP) are to be prepared for the identified principal hazards in a mine and included in the SMP of the mine. HAULAGE & TRANSPORTATION SYSTEM is considered as one of the Principal hazards, since any risk or accident arising out of the HAULAGE & TRANSPORTATION SYSTEM hazard would result in multiple fatalities. Hence this PHMP (Principle Hazard Management Plan) for HAULAGE & TRANSPORTATION SYSTEM is developed for implementation at the RKNT Incline mine.

## 2. PROJECT STUDY

The project study briefly explains the Underground Transport arrangements and Types of Haulages used in Underground coal mines, as well as Hazards in the Haulage and transportation, Safety Devices used in Haulage Road ways etc.

### **Underground Transport Arrangements:**

In the underground mines, the transportation system is divided in to three types they are

1. Underground to surface /main Haulage
2. Underground to underground / Gathering Haulage
3. Surface to Surface Haulage



### 1. Underground to surface / main Haulage:

Underground to Surface / the main haulage system, which removes the coal from the mine. Main haulage systems must be designed to handle large, instantaneous production from the cutting machines, whereas the outer haulage systems must be designed to accommodate such surges from several operating faces.

### 2. Underground to underground / Gathering Haulage:

Underground to underground / Gathering Haulage system is that portion of the haulage system immediately adjacent to the face. In long wall mining, the face belt or tubs and track along the face constitute the gathering haulage system.

### 3. Surface to Surface Haulage

a. Underground to surface arrangement is that which operates between winding shaft/incline and the main underground loading points. At the main loading point, the loads are collected from one, two or more districts and then transported to the surface.

b. Underground to underground arrangement is that which operates between the working faces and the main loading points situated underground.

### 3. TYPES OF HAULAGE

There are Four Types of Haulages systems are available, they are

1. Rope haulage.
2. Conveyor system of haulage.
3. Locomotive haulage.
4. Aerial ropeway

#### 1. Rope haulage:

Further to the above the rope haulage is divided into the following types.

##### A. Direct rope haulage

- Single drum direct rope haulage.
- Double drum direct rope haulage.

##### B. Endless rope haulage

- Over rope.
- Under rope.

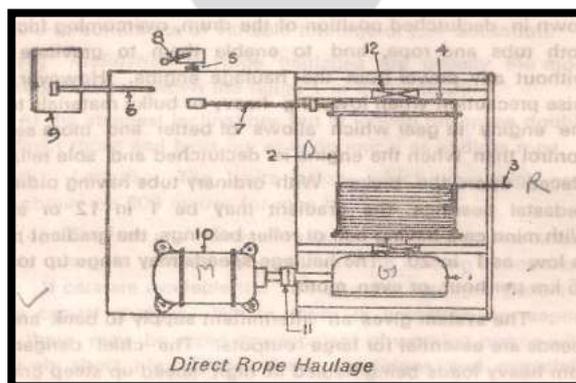
##### C. Main & tail rope haulage.

##### D. Gravity rope haulage.

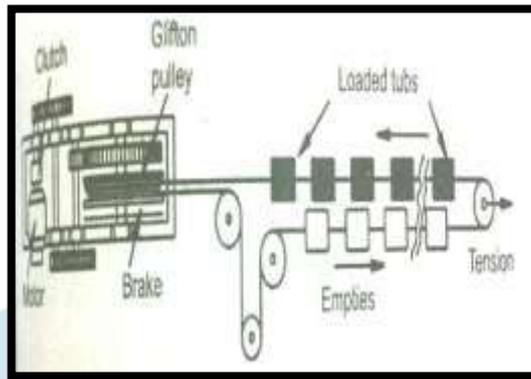
#### A. Direct rope haulage

The line diagrammatic representation for the direct rope haulage is as follows

#### B. Endless rope haulage

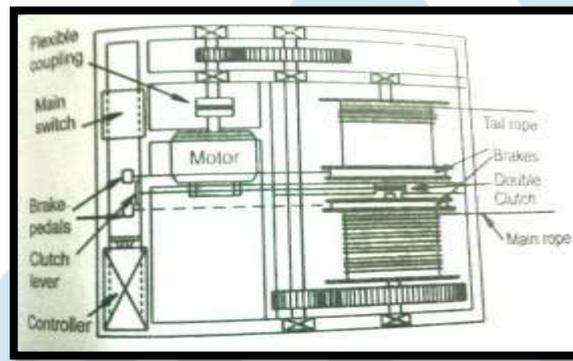


An endless rope passes from the driving pulley which is situated at the in by end & back again to the driving pulley. One track is used for loaded tubs & another track is used for empty tubs



**C. Main & tail rope haulage**

In this system the haulage engine provided with two separate drums, one for main rope which hauls the loaded tubs up the gradient & one for tail rope which hauls the empty tubs down the gradient.



**D. Gravity rope haulage.**

This is haulage without motor or any external source of power. It is used when load is to be transported from uphill to down the gradient.



**2. Conveyor system of haulage.**

A conveyor system is a fast and efficient mechanical handling apparatus for automatically transporting loads and materials within an area. This system minimizes human error, lowers workplace risks and reduces labor costs — among other benefits.

There are many types of conveyor systems, including:

- Belt
- Roller
- Slat/apron
- Ball transfer
- Overhead
- Pneumatic
- Bucket



### 3. Locomotive haulage.

The transport of coal, ore, workers, and materials underground by means of locomotive-hauled mine cars. The locomotive may be powered by battery, diesel, compressed air, trolley, or some combination such as battery-trolley or trolley-cable reel.

#### Types of Locomotive

- Diesel locomotive
- Battery locomotive
- Compressed air locomotive
- Trolley wires locomotive



### 4. Aerial ropeway

An aerial ropeway is an installation in which transportation of material or men is effected by moving carriers pulled by ropes suspended above the ground.

#### Aerial Rope Way types:-

- Mono cable ropeway
- Bi cable ropeway



### 4. HAULAGE & TRANSPORTATION HAZARDS

The hazards associated with the process and operation of “Haulage and Transportation System” are as follows

- Movement of tubs
- Movement of haulage rope
- Man riding Chair lift
- Lack of resources
- Lack of awareness/ knowledge on procedures
- Lack of monitoring Mechanism
- Negligence or wilful Disobedience

## 5. TRIGGER ACTION RESPONSE PLANS (TARP)

TARP is acronym for trigger action response plan which forms an essential part of PHMP. This section outlines the trigger points and/or events which necessitate specific actions to be taken. A TARP basically sets out the actions that key personnel at site are going to carry out when certain conditions are met. A TARP is divided into four zones.

- **Green - Normal operating conditions**
- **Yellow- Level1- Slight increase in risk, based on conditions and data**
- **Orange- level 2- further increased on risk, based on conditions and data**
- **Red -level 3- Maximum level of risk is reached, based on conditions and data**

The following precautions shall be taken:

- Compliance of provisions of CEAR- 2010
- Compliance of relevant provisions of CMR 2017
- Compliance of relevant provisions of Mines Act 1952
- Following the COPs/SOPs scrupulously
- Compliance of DGMS Circulars/ISO Circulars pertaining to Haulage & Transportation.

## 6. SAFETY DEVICES USED IN HAULAGE ROADWAY

Apart from the falls of ground, haulage and transport operations have been responsible for a greater number of accidents involving deaths and injuries than any other single cause. The major proportion of haulage and transport accidents results from runaways. The various safety devices used on haulage roadways are as follows

- Stop blocks.
- Buffers.
- Back catch.
- Pointer plate.
- Drop Warwick.
- Age craft device.
- Back stays or drags.
- Runaway switches.
- Jazz rail.
- Retarders and stoppers.
- Approach warning devices.
- Signaling arrangements.
- Spring catch.
- Manholes.

## 7. CONCLUSION

Considering the changes happening in the underground coal mines in the large scale with Advanced technology of Machinery replacement and manpower changes, the safety for the Men and Machinery is big challenging and top priority, in this project we identified the hazards associated with the process and operation of “Haulage and Transportation System”, they are as follows

- **Movement of tubs**
- **Movement of haulage rope**
- **Man riding Chair lift**
- **Lack of resources**
- **Lack of awareness/ knowledge on procedures / monitoring Mechanism**
- **Negligence or willful disobedience**

This article is reflects the actual situations of Underground coal mines with respect to the safety of “Haulage and Transportation System” and we can effectively Control the risks in the above two different conditions by this project work

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