

# Control on Blast Furnace Skip Car Derailment by use of Pareto Analysis

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## ABSTRACT

The skip car in blast furnace is used to transfer and charge raw materials such as coke, iron ore, sinter and additives like limes stone dolomites into the furnace. This Skip Car has to withstand heavy wear caused by loading and unloading of those raw materials onto the Car body, which subjects it to derailment while delivering the charge (raw material) into the blast furnace. If skip car derailed during travelling material charging stopped in blast furnace has been stopped and due to that hot metal production has stopped. Most of the derailment occurs during skip car return from dumping level near of track changing area. Due to derailment of skip car skip bridge structure & skip car body got damaged, also repositioning of skip car is difficult task as car gets toppled from track. We have required to strengthening of bridge structure which got damaged during skip car derailment. For this purpose, corrective measures are suggested to minimize the derailment of skip car with the help of Quality Circle tools.

**KEYWORDS:** Blast furnace, Skip car, Pareto diagram, Pareto analysis, Production process, Derailment

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## INTRODUCTION

Skip car is used for charging of raw materials into the Blast furnace. To charge the raw materials into the furnace, 2 nos. of skip car are available. The raw materials carried by the skip for charging in to the Furnace are as follows:

1. Coke: Act as a fuel, reducing agent and burden bearing material.
2. Iron ore and sinter: Iron bearing material.
3. Limestone as a flux.
4. Manganese ore, quartzite etc. as chemical additive of iron.

One car loaded with raw material travels upward on inclined rail on the way to charge the material into the furnace while other empty car gets down on a parallel inclined path approaching to the respective raw material hopper. Four no's of wheel on each car are made of cast steel. Both the skip cars are rope driven mounted on a single winch drum with two drive gear box in parallel. While one of skip car remains in skip pit to receive raw materials from hopper, the other one remains at the top to discharge material to furnace The raw material which are carried by the skip car to Blast Furnace are hard coke and iron ore, sinter and additives like Limestone, Dolomite, Quartzite etc. Normally hard coke of approximately 7 Ton and mixture of iron ore and sinter of 13 Ton are charged in sequence through skip car. Both the skip cars travel in an inclined rail. It takes 54 sec of travel from feeding point to discharge point, in the plant under study.

**Reasons for selecting the problem are as follows:**

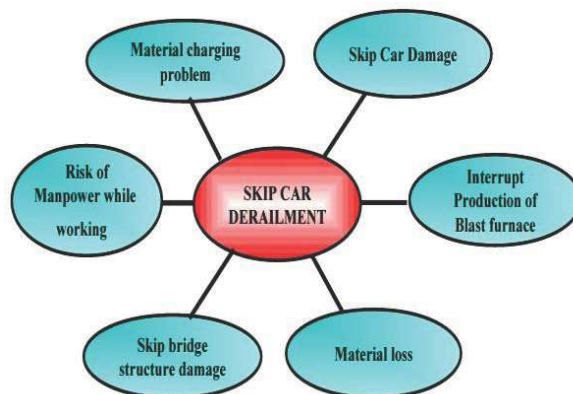
- A – Safety – material, structure, manpower
- B – Production Delay
- C – Excess use of manpower

D – Cost

## Problem

Skip car travelling on skip rail track of skip Bridge for raw material charging from stock house to receiving hopper of blast furnace .Skip car travel up to 61 mtr in skip bridge rail track at an angle of 53deg. If skip car derailed during travelling material charging stopped in blast furnace resulted material distribution stopped in furnace. Due to that hot metal production stopped. Most of the derailment occurs during skip car return from dumping level near of track changing area. Due to derailment of skip car skip bridge structure & skip car body got damaged, also repositioning of skip car is difficult task as car got toppled from track. We require strengthening of bridge structure which got damaged during skip car derailment. Now, we require long time for rectification of the problem due to derailment of skip car.

## IMPACT OF THE PROBLEM



**OBJECTIVES**

1. To ensure 100% safe work with respect to man, machine, tools and materials.
2. To stop skip car derailment.
3. To avoid blast furnace hot metal production loss.
4. To reduce engagement of excess manpower.

**GOALS :-**

“Zero breakdown in skip car due to derailment”

**Root Cause validation**

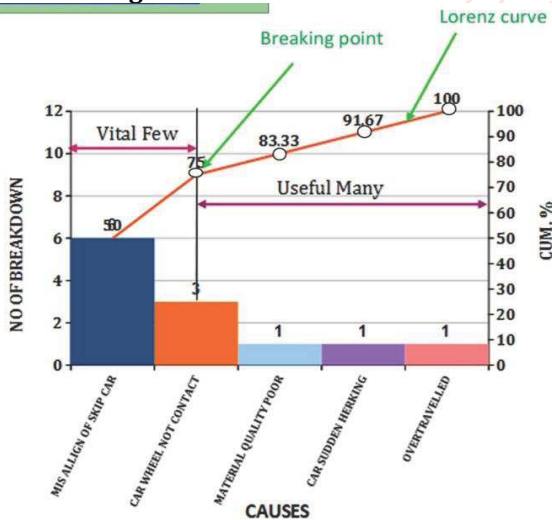
After finding all the causes and sub-causes in relevant locations to solicit views of the non- members and associated people. The members with the help of each cause by examining with the prevailing equipment conditions and existing practices.

After identifying the real root causes of the problems from the number of causes and root causes generated from various

**Pareto Table:-**

S. No	Probable Causes	NOS of Breakdown	CUM Breakdown	%	CUM %
1	Misalignment of skip car rail track	6	6	50	50
2	Skip car wheel not proper contact will rail	3	9	25	76
3	Skip car axle poor material quality.	1	10	8.33	83.33
4	Skip car over travelled on dumping track	1	11	8.33	91.67
5	Skip car sudden jerking	1	12	8.33	100

**Pareto Diagram:**



**Result**

After pareto analysis we get 2 major problem of skip car derailment:-

1. Misalignment of skip car rail track.
2. Skip car wheel not proper contact with rail.

**Causes of Problems:-**

1. Thermal expansion of track rail.
2. Bending of bridge structure due to carry uneven working loads.
3. Rusting of bridge structure and rails.
4. Poor maintenance of skip car.
5. Poor assembly of skip car’s axle box and wheels.

sources, we eliminated all the irrelevant causes and the final Cause and Effect Diagram was made. Selection of valid and rejection of irrelevant root causes were done after rigorous brainstorming and discussions with process & mechanical experts and after carefully evaluating all the reasons in detail with justification.

**PROBABLE ROOT CAUSES**

1. RELEVANT CAUSES
  - A. Misalignment of skip car rail track
  - B. Skip car wheel not proper contact with rail..
  - C. Skip car over-travelled on dumping track
  - D. Skip car sudden jerking.
2. IRRELAVENT CAUSES
  - A. Power failure of skip drive system.
  - B. Slack operation of skip winch system.
  - C. Skip car axle poor material quality.

**CONCLUSION:**

This paper utilizes pareto analysis to explore the causes of failure of skip car. After Pareto analysis we got to know the most common reasons due to which skip car was derailed. Hence for every cause of derailment of skip car, a solution was found and applied. By this application of solutions we were able to minimize the derailment of Skip Car.

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