Project Deliverables: Improvement of Reliability of 220 KV Power Transmission network

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Project Name: Improvement of reliability of 220kV power transmission network

Name of the Department: Electrical Power Systems (EPS)

Name of HOD: Mr. Pinaki Bhattacharjee

Name of Mentor: Mr. Abhishek Robinson

Name of Guide: Mr. Dashrath Naidu, Mr. Nitin Rathi

Project Commencement date: 16th May 2024

Project Completion date: 15th July 2024

Project Category: Maintenance

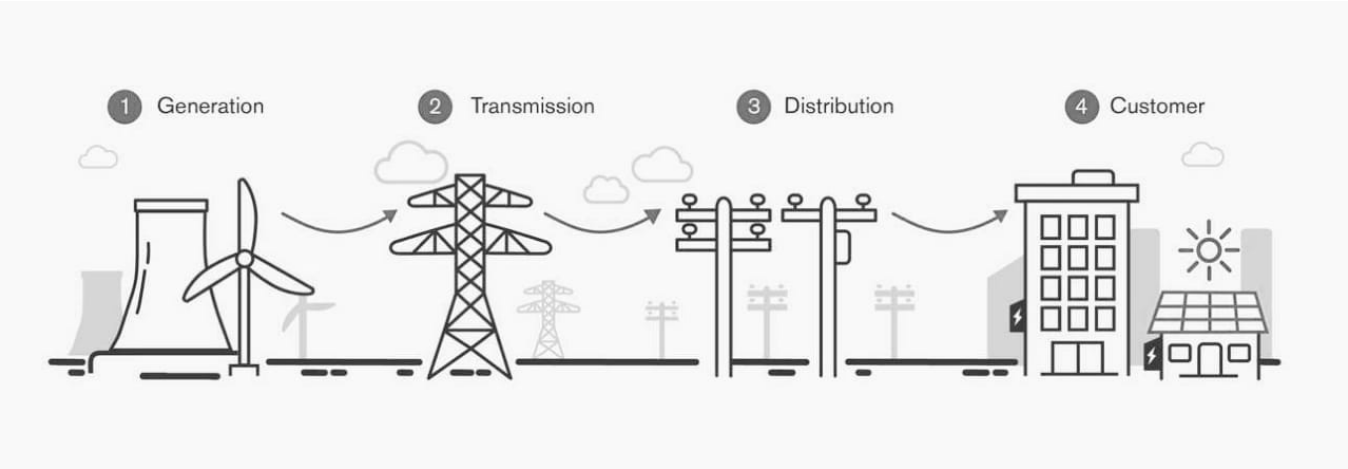
JSP Raigarh

JSP has a steel making capacity of **9.6 MTPA, 1634 MW captive power capacity**.

JSP Raigarh has a steel making capacity of **3.6 MTPA** and **824 MW captive power capacity**.

JSP Raigarh has various departments like RMH (Raw material Handling), Coal Washery, Sinter Plant, Blast Furnace, DRI (Direct Reduced Iron), SMS (Steel Making Shop), Plate mill, SPM (Special Profile Mill), Rail Mill, Power Plant, Cement Plant, Brick Plant and EPS (Electrical Power Systems).

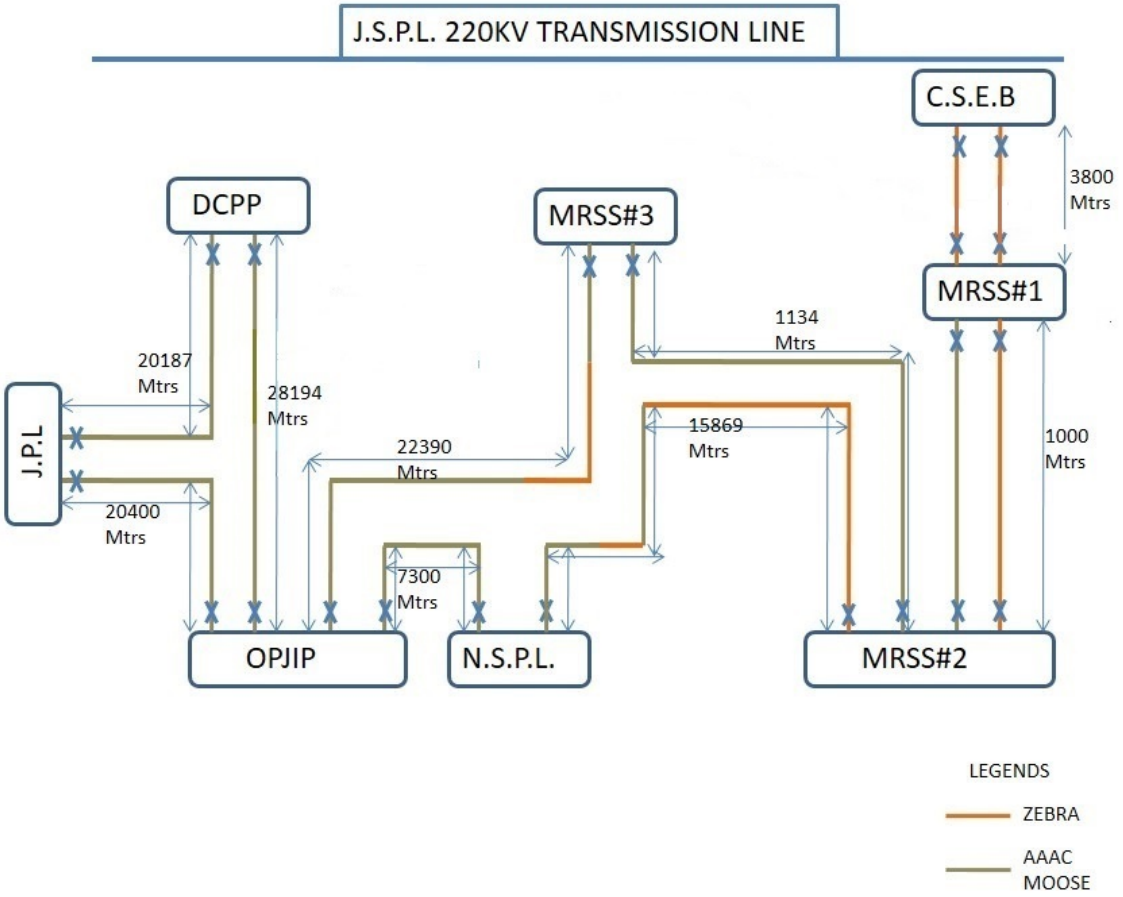
EPS - Transmission lines



The **Electrical Power Systems (EPS)** department acts as the backbone of Jindal Steel and Power's Raigarh plant, guaranteeing a steady and efficient flow of electricity to power not only the plant's critical operations but also fulfilling the needs of the township's households, maintaining critical equipment, transmission lines, towers, etc to implementing safety protocols, scheduled patrolling, etc and optimising energy consumption.

Transmission lines deliver power connecting the power generation units to the consumers and users. Within these facilities, dedicated teams act as internal customer service for electrical needs, ensuring a reliable, stable and cost-effective power supply.

EPS - Transmission lines



Total Length of **76 km (Medium Transmission lines)**

CSEB Line (CSEB to MRSS 1) 4.5km.

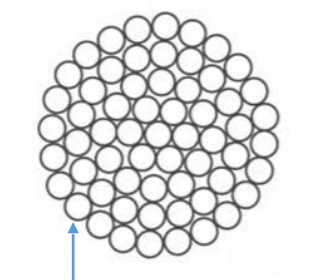
JSPL Line (MRSS 4 to JSPL - also connects NSPL) 24km.

DCPP Line (DCPP to MRSS 4) 26km

JPL Line (MRSS 4 to JPL) 21km

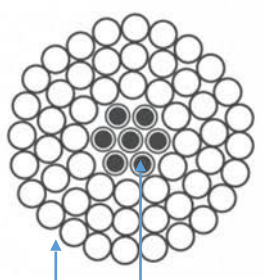
Types of Towers and Conductors

AAAC



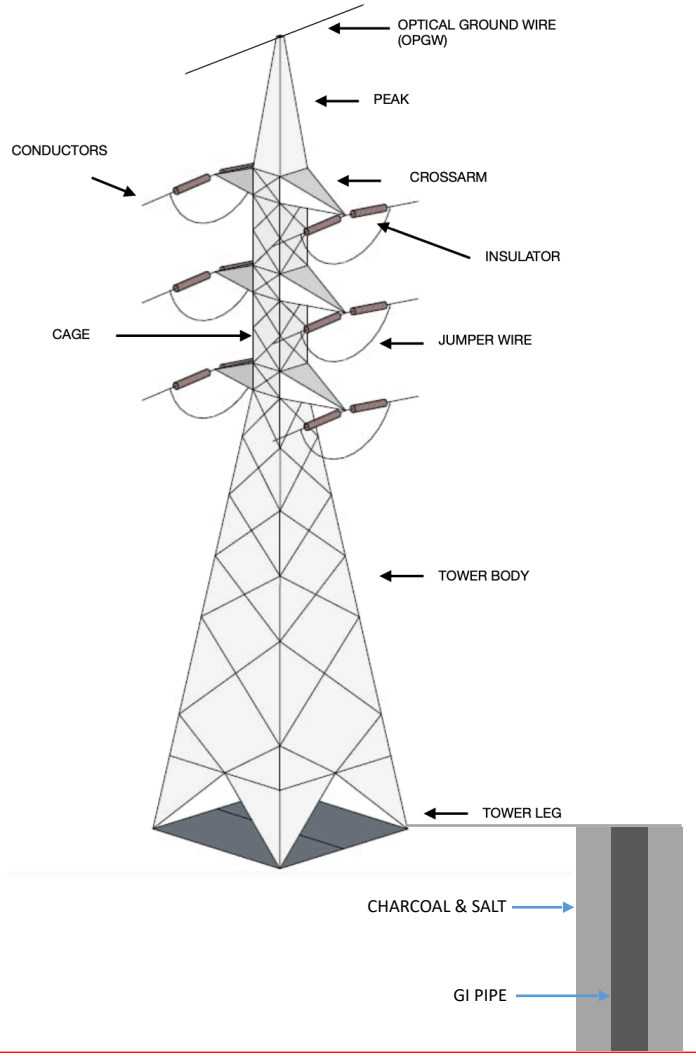
All Aluminium Alloy

ACSR



Steel Reinforced

Aluminium Conductor



CONDUCTOR	VOLTAGE	CURRENT	STRANDS	SIZE
DOG	33-66KV	300A	6A-7S	SMALL
PANTHER	66-132KV	480A	30A-7S	MEDIUM
ZEBRA	220KV	735A	54A-7S	LARGE
MOOSE	220-440KV	800A	54A-7S	LARGEST

SIZE: DOG < PANTHER < ZEBRA < MOOSE

AAAC MOOSE & ACSR ZEBRA - 220 KV CONDUCTORS

Understanding the Project and its Objective

- Improvement of reliability of 220kV power transmission line network

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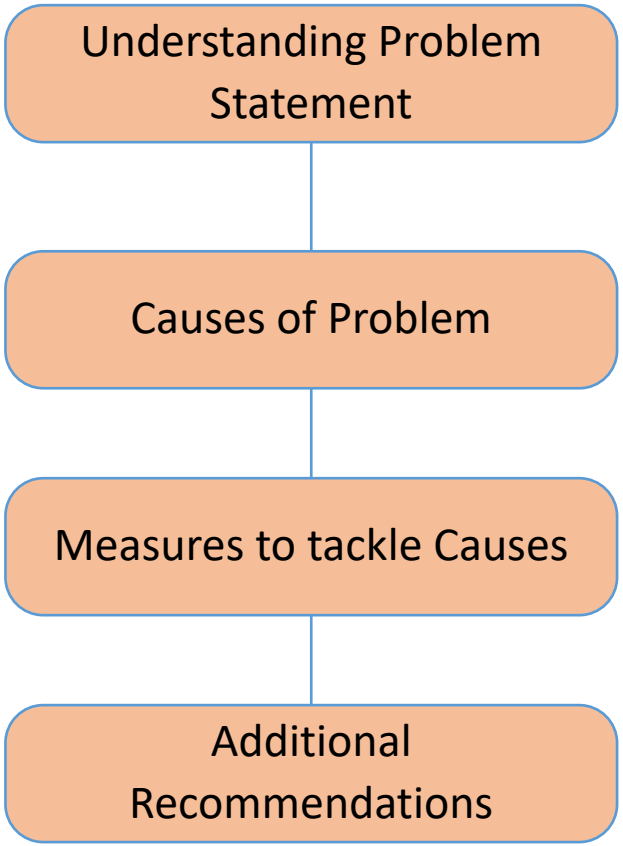
Flow of Presentation

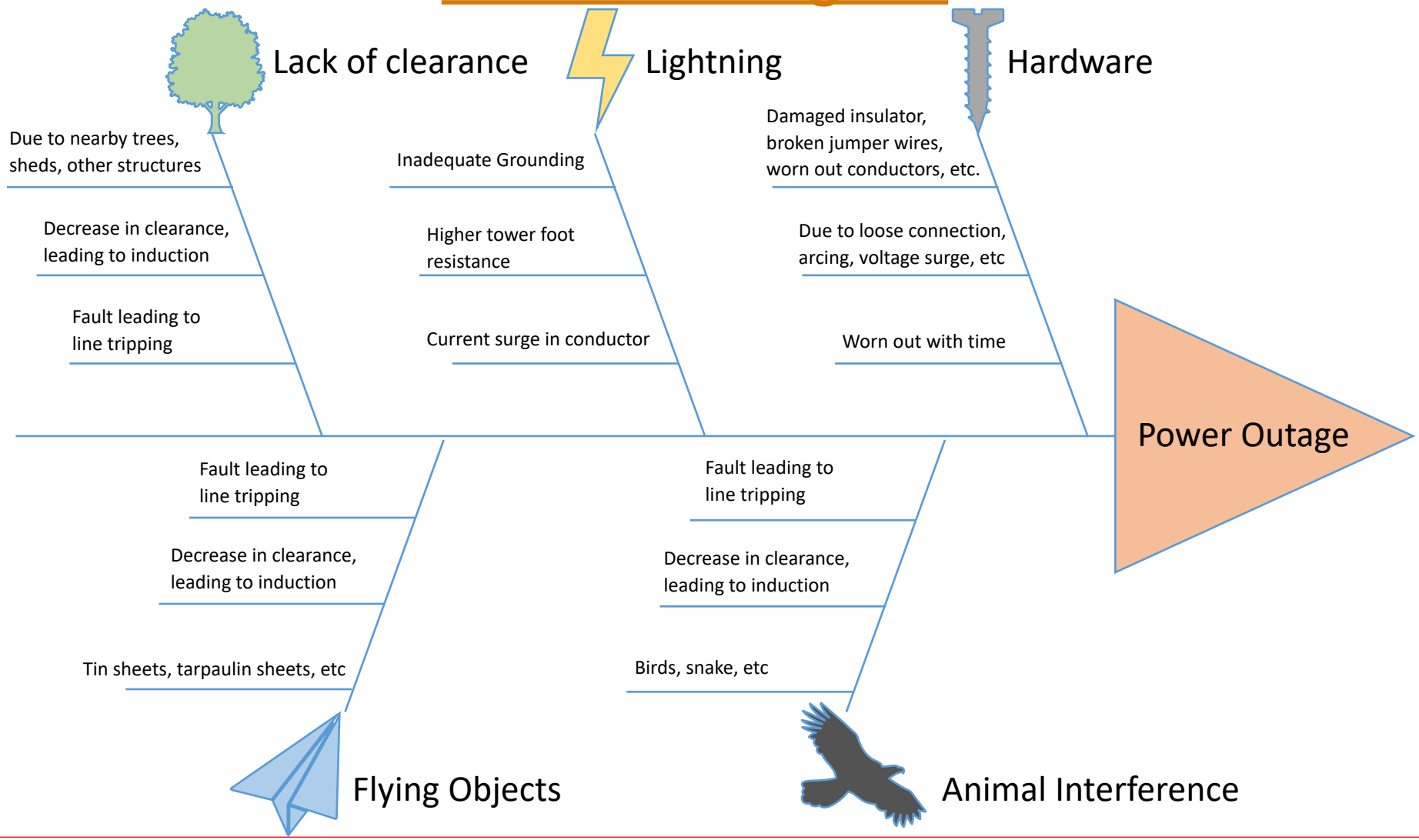


NOTE: Focus put on data analysis to understand the severity of causes of the problem

Root Cause Analysis via 5 WHYs

1 WHY	Lack of reliability due to frequent power outages
2 WHY	Power outages due to tripping in transmission lines
3 WHY	Tripping due to short circuit faults in transmission lines
4 WHY	Faults are caused by various factors like lightning strikes, lack of clearance from trees, metallic duct under the line corridor, animal interference, flying objects, and hardware problems
5 WHY	Inadequate lightning protection, insufficient vegetation management, lack of proper preventive maintenance, and poor quality hardware maybe big contributors to faults

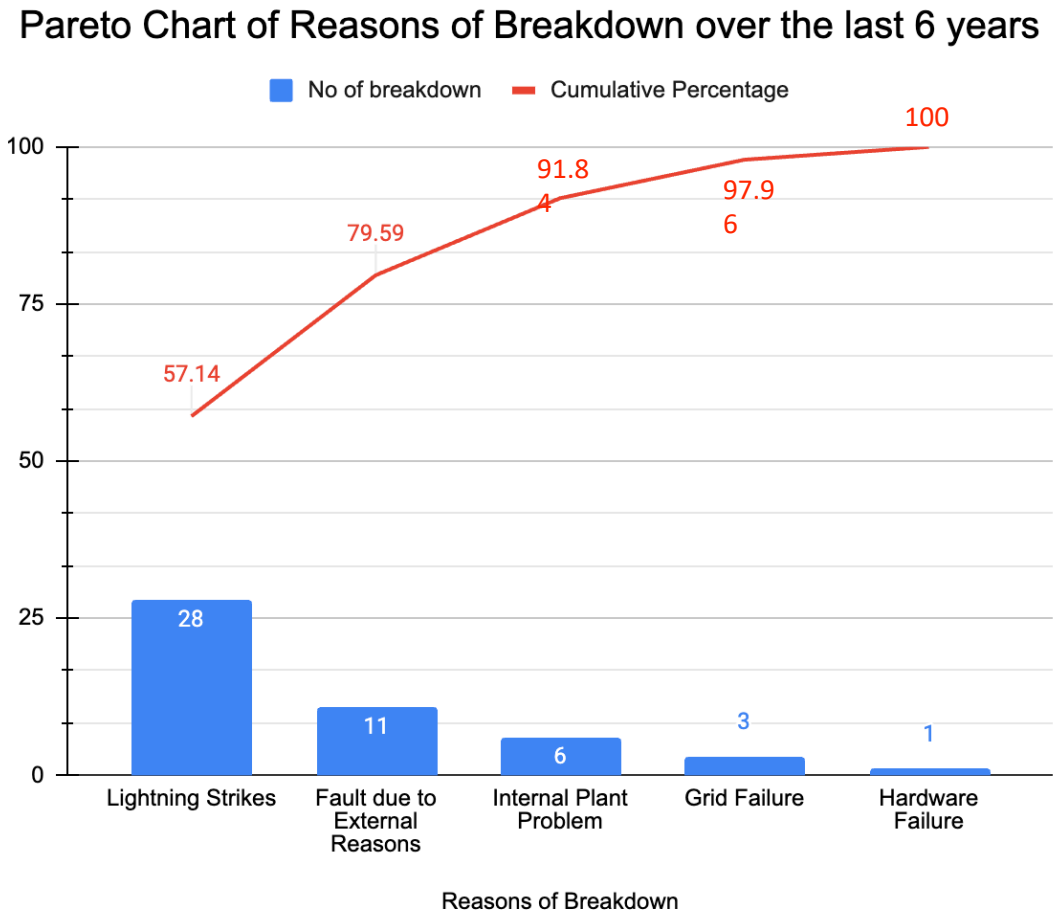
Fish Bone Diagram



Pareto Chart Analysis

Reasons of 220 kV Transmission Line Tripping over the last 6 years

Reasons of Breakdown	No of breakdown	Cumulative Percentage
Lightning Strikes	28	57.14
Fault due to External Reasons	11	79.59
Internal Plant Problem	6	91.84
Grid Failure	3	97.96
Hardware Failure	1	100



NOTE: Fault due to external reasons include factors like fire on vegetation/trees, flying tree branch hit live lines, animal activities etc.

Preventive Maintenance Schedule

Schedule patrolling

Hotline maintenance

String Replacement

Preventive Maintenance

Punctured Insulation Detection (PID)

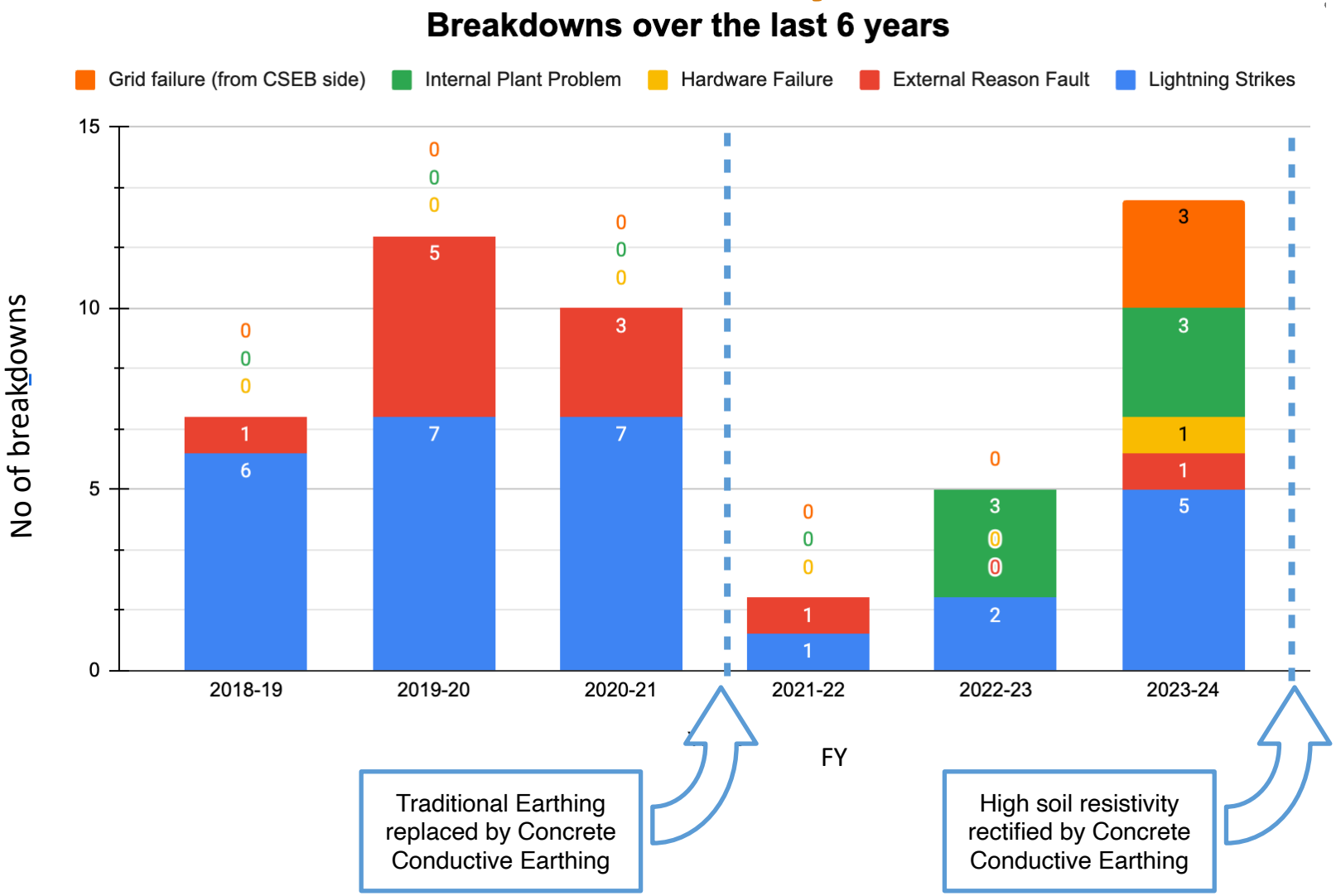
Structural Stability Test (NDT) of towers

Earthing maintenance

Tree trimming

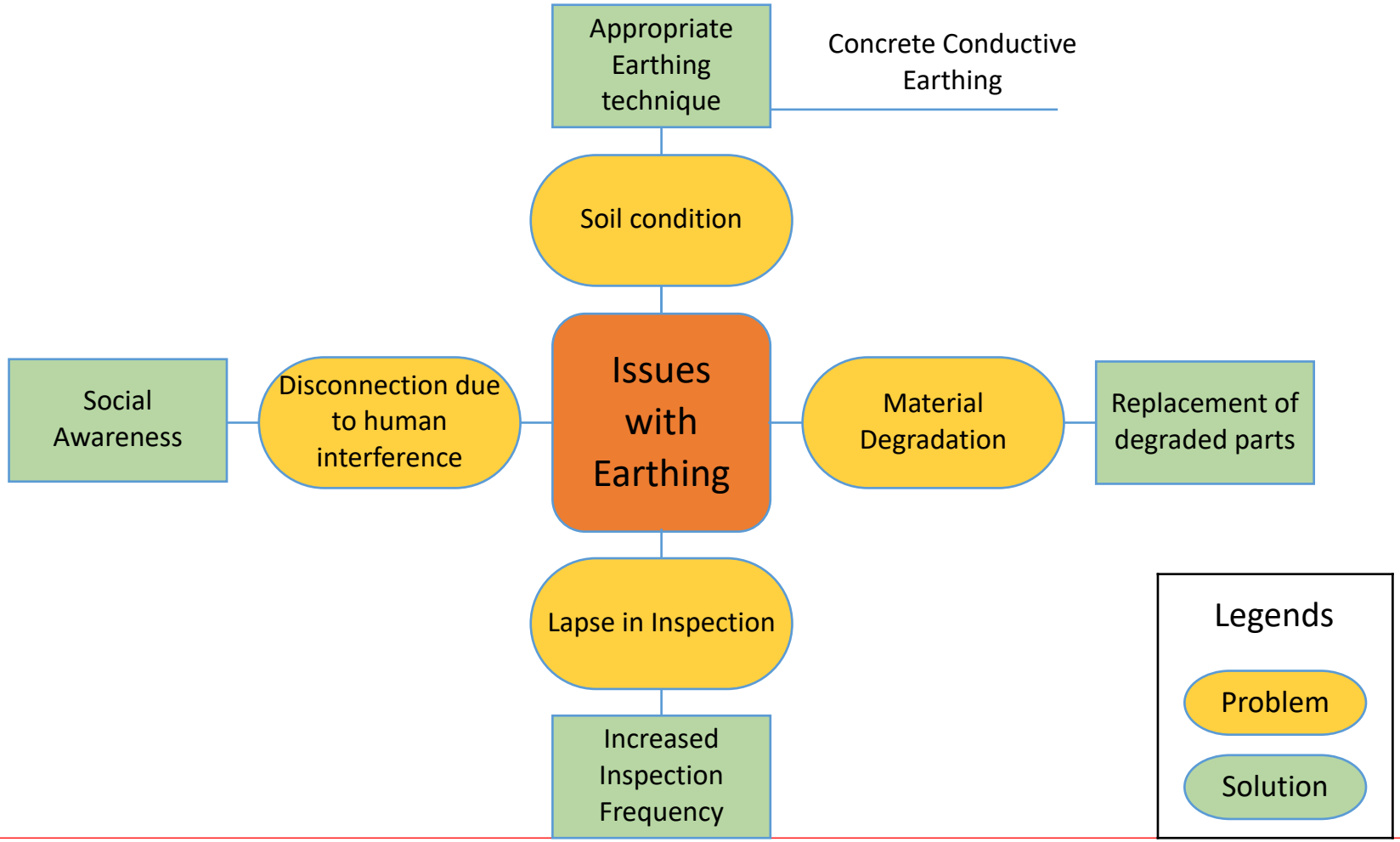
For further reference visit the detailed project report : https://shorturl.at/R2yl7

Case Study



NOTE: Fault due to external reasons include factors like fire on vegetation/trees, flying Tree branch hit live lines, animal activities etc.

Lightning strikes caused 57% of the breakdowns in the last 6 years



Conductive Concrete Earthing (Marconite Earthing)

Concrete conductive earthing is a specific method for improving the grounding system of structures like 220 kV transmission line towers. It utilises conductive concrete to create a low-resistance path for fault current to dissipate into the ground.

Marconite:Cement:Water ratio is **3:1:1** by weight
It is also available as premix of standard 25kg

Marconite has resistivity of **0.001 ohm m**. The final mixture has a resistivity of **0.1 ohm m**.

Benefits:

1. **Low resistivity**
2. **Versatile**: suits most ground conditions
3. **Long Term Reliability:** 25 years
4. **Cost effective:** Permanent solution for 25 years, with no periodic maintenance like adding water, in case of charcoal and salt earthing
5. **Chemically Inert:** Non corrosive to steel and copper

Recommendations

1. Laying of Secondary Line:
Act as a back up incase of tripping in the primary line.
DCPP line & JPL line.

2. Concrete Conductive Earthing:
Improving grounding system by providing low resistance path.

3. Increased Frequency of Inspection:
More Frequency of regular inspection (specially during monsoon) to locate any missing or damaged earthing parts.

4. Social Awareness:
Spread awareness among locals to prevent them from disconnecting the earthing.

5. Couple Ground Wire: To improve the lightning protection performance of the line and reduce the lightning trip rate of the line, the method of hanging the coupling line under the wire (or near it) can be used. The coupling line can act as a shunt and coupling when lightning strokes the tower, reduce the voltage borne on the tower insulation, and improve the lightning withstand level of the line. Therefore, the probability of the same jump of lightning strike is effectively reduced.

https://drive.google.com/file/d/1XutBTgmyfFTN5VNYSf5_TMIExXs-hdk-/view?usp=sharing

Thank You

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