Data Analytics Design Document
Maintenance Performance Analytics

1. Executive Summary

This document describes the end-to-end data analytics solution designed to support maintenance performance monitoring and decision-making. The solution covers data warehouse design, exploratory data analysis (EDA), KPI definition, and dashboard implementation.

2. Business Objectives

• Monitor maintenance performance and operational reliability
• Identify high-risk equipment and cost drivers
• Support executive, operational, and engineering decisions

3. Data Warehouse Architecture

The solution uses a star schema data warehouse design with one fact table and four dimension tables.

3.1 Fact Table – Fact_MaintenancePerformance

Grain: One maintenance event per equipment per date.
Measures: downtime hours, maintenance cost, repair hours, work orders.

3.2 Dimension Tables

• Dim_Date – time analysis and trends
• Dim_Equipment – asset-level analysis
• Dim_Site – location-based analysis
• Dim_Failure – root cause and failure classification

4. Exploratory Data Analysis (EDA)

EDA was conducted to understand data distribution, trends, cost behavior, workload patterns, and failure dominance. Insights from EDA directly informed KPI selection and dashboard design.

5. KPI & Measure Framework

KPIs are grouped by decision level:
• Strategic: Total Downtime, Maintenance Cost, Downtime MoM %, High Risk Equipment Count
• Operational: Total Work Orders, Repair Hours, Cost per Work Order, MTTR, MTBF
• Risk & RCA: Downtime Contribution %, Cost per Downtime Hour

6. Dashboard Design

Three dashboards were developed to support different decision layers.

6.1 Executive Overview Dashboard

Provides high-level performance signals, risk indicators, and cost trends for management decision-making.

6.2 Maintenance & Operations Dashboard

Supports daily execution, workload planning, and operational efficiency analysis.

6.3 RCA & Risk Analysis Dashboard

Enables diagnostic analysis, failure prioritization, and corrective action planning.

7. Analytics Flow

The analytics flow follows a progressive approach:
Executive Overview → Maintenance & Operations → RCA & Risk Analysis.

8. Conclusion

This analytics solution is complete, scalable, and aligned with industry best practices. It enables data-driven maintenance management and continuous performance improvement.