Industrial Internship Report

Larsen and Toubro M&M IC

Prepared By : Siddhartha Saha

Prepared For : L&T Construction M&M

Date : 11th June 2025

ACKNOWLEDGEMENT

I would like to express my heartfelt gratitude to Larsen M&M for granting me the invaluable opportunity to undertake my internship within such a renowned and professionally enriching environment. This internship has played a vital role in shaping my understanding of the fabrication and manufacturing domain, offering me hands-on exposure to industrial practices and organizational dynamics that extend far beyond textbook learning.

My sincere appreciation goes to my mentor, **Mr. Amal Jose**, whose continuous guidance, encouragement, and technical insights were instrumental in my learning journey. His mentorship not only helped me comprehend the intricacies of fabrication processes but also provided me with a broader perspective on professional excellence and work ethics within the engineering industry.

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Furthermore, I am deeply thankful to the entire team at **L&T M&M SBG** for their warm welcome, cooperation, and assistance throughout my internship tenure. Their collaborative spirit and willingness to share knowledge created an encouraging and productive work atmosphere, enabling me to maximize my learning.

This internship has been a truly transformative experience, enhancing both my technical competence and professional confidence. I am profoundly grateful to L&T M&M SBG for investing their time and resources in my development, and I am committed to applying the insights and experiences gained here to my future academic and professional endeavours.

TABLE OF CONTENTS

OVERVIEW OF THE COMPANY

Larsen & Toubro Limited (L&T) is one of India's most respected and diversified multinational conglomerates, renowned for its engineering excellence, innovation, and global presence. Headquartered in Mumbai, L&T operates across a wide spectrum of sectors including engineering, construction, manufacturing, technology, and financial services. With a legacy spanning over eight decades, L&T has consistently delivered large-scale, complex projects across the globe, maintaining high standards of quality, safety, and sustainability.

Among its many verticals, the **Minerals & Metals (M&M) business** stands out as a key contributor to the industrial development landscape. L&T's M&M vertical offers end-to-end solutions for the mining, mineral processing, and metals sectors. This includes engineering, procurement, construction (EPC), and commissioning of large-scale plants and facilities for clients in iron and steel, aluminium, copper, zinc, and other base metal industries.
The **M&M vertical specializes in** the execution of turnkey projects that involve intricate fabrication, heavy equipment handling, and the integration of complex mechanical, structural, and electrical systems. With expertise in both greenfield and brownfield projects, L&T M&M has successfully delivered process plants, material handling systems, smelters, and refineries for leading industrial clients in India and overseas.

A notable strength of the M&M vertical lies in its advanced **Modular Fabrication Facilities (MFFs)**, strategically located to support efficient, high-quality manufacturing. These facilities enable L&T to fabricate and assemble large process modules, pipe racks, equipment skids, and structural components with precision and safety, ensuring faster deployment and enhanced performance at project sites.
Driven by a strong commitment to sustainability, innovation, and operational excellence, the Minerals & Metals vertical at L&T continues to play a pivotal role in supporting the nation's industrial and infrastructural growth, while also strengthening its global footprint through export-oriented projects and collaborations.

Introduction

This compilation report presents a comprehensive overview of five independent yet thematically interconnected projects undertaken for L&T M&M, each contributing to improved operational efficiency, data transparency, and digital transformation within engineering and construction project environments. These projects encompass diverse domains—ranging from SQL procedure optimization and dashboard development to web-based CRUD system design—reflecting a balanced integration of backend logic and front-end visualization.

Each report highlights a distinct problem statement, practical business scenario, and a technically sound solution, underscoring a consistent emphasis on automation, data centralization, and user-centric design. Whether through enhancing transmittal traceability in engineering drawings, developing intuitive dashboards for real-time monitoring (e.g., TQI, FCD, EDRC), or building secure CRUD interfaces for administrative operations, these initiatives collectively demonstrate a focused commitment to solving real-world challenges using structured analytical and technical approaches.

The ensuing sections provide detailed documentation of each project's objectives, implementation methodologies, and outcomes, serving as a testament to the practical application of data and software solutions in complex project ecosystems.

SQL Stored Procedure Modification

Prepared For : L&T M&M

Prepared BY : Siddhartha Saha

Date : 9/5/2025

Objective

To implement a modification in the *Standard Master Derivable List Report* to incorporate and accurately reflect data pertaining to drawings that have been issued directly to the project site without undergoing client approval. This enhancement aims to ensure comprehensive documentation of all transmittal activities, improve traceability of unapproved drawings, and provide stakeholders with a complete and transparent overview of the drawing issuance status, thereby supporting better project coordination and decision-making.

Business Scenario

In standard project workflows, clients require that all engineering drawings be submitted to them for verification prior to being dispatched to the project site. This review process ensures that the documents meet the required standards and specifications, and only upon successful verification and approval are the drawings authorized for site use.

Each drawing within a project may undergo multiple revisions over time. To manage this effectively, every revision is assigned a *Category Key* that defines its status and intended distribution. The two primary Category Keys used in this process are:

- Category Key 2 – Assigned to drawings that are complete and have been issued to the client specifically for approval. These revisions are pending client review and cannot be used on-site until formally approved.

- Category Key 3 – Assigned to drawings that are considered final, with all necessary changes incorporated. These revisions have met all internal requirements and are deemed ready for direct issuance to the project site without requiring further client approval.

Problem Statement

Traditionally, engineering drawings follow a structured approval workflow wherein each revision is submitted to the client for review and approval before being dispatched to the project site. During this process, completed drawings are initially categorized as **Category 2**, indicating that they are pending client approval. Once approved, they are reclassified as **Category 3** and released for site execution.

However, in the case of our current client, there is a deviation from this standard process. The client has requested that the majority of the engineering drawings be issued directly to the site without undergoing the formal client approval procedure. Consequently, these drawings are directly assigned **Category 3**, bypassing the intermediate approval stage. This approach is intended to accelerate project execution and reduce delays associated with the approval cycle.

While this method supports faster delivery and project momentum, it introduces complications in the generation of the ***Standard Master Derivable List Report***. The report logic, originally designed to track drawings through the full approval lifecycle, does not accommodate drawings that are directly issued to the site without client endorsement. As a result, data related to these direct-to-site (Category 3) drawings is either excluded or inaccurately represented, impacting visibility, reporting accuracy, and stakeholder tracking.

Technical Work

So, to mitigate this issue and make the report properly show the data related to this project and to make sure it's still compatible with other projects which maintain the approval-construction cycle there had to be many changes to be made.

There are three main areas that I had to modify the stored procedure to make it all work :

All Transmittal Logic

```
OUTER APPLY (
    SELECT TOP 1
        T.Transmittal_Number,
        T.Transmittal_Released_Date,
        T.Transmittal_Category_Key,
        CASE
            WHEN NOT EXISTS (
                SELECT 1
                FROM vi_STD_Transmittal_Details T3
                WHERE
                    T3.Document_Key = D.Document_Key
                    AND T3.Transmittal_Category_Key = 2
            ) THEN 1
            ELSE 0
        END AS Is_All_Category_3
    FROM vi_STD_Transmittal_Details T
    WHERE
        T.Document_Key = D.Document_Key
        AND T.Internal_Revision_Key = D.Internal_Revision_Key
        AND (
            T.Transmittal_Category_Key = 2
            OR (
                T.Transmittal_Category_Key = 3
                AND (
                    T.Internal_Revision_Key = 0
                    OR NOT EXISTS (
                        SELECT 1
                        FROM vi_STD_Transmittal_Details T2
                        WHERE
                            T2.Document_Key = D.Document_Key
                            AND T2.Transmittal_Category_Key = 2
                    )
                )
            )
        )
    ORDER BY
        T.Transmittal_Released_Date ASC
) Transmittal
```

Main Purpose of this Outer Apply? -

Get the **first matching transmittal** (by Transmittal_Released_Date) for a document revision:

- Prefer **Category 2** transmittals.
- If **Category 2 is absent**, allow **Category 3**, but only if:
    - The revision is initial (Internal_Revision_Key = 0) **OR**
    - No Category 2 exists for that document.

How it Works? -

- **SELECT TOP 1 ... ORDER BY Transmittal_Released_Date ASC**:
    - Picks the earliest matching transmittal (based on release date).
    - Useful when multiple transmittals exist for a document.
- **WHERE clause**:
    - Limits to only the transmittals of the **same document** (Document_Key) and **same revision** (Internal_Revision_Key).
    - Allows:
        - Category 2 directly.
        - Category 3 only **if**:
            - Internal_Revision_Key = 0 (initial revision), **or**
            - No Category 2 exists for that document (NOT EXISTS subquery).
- **Is_All_Category_3**:
    - Indicates whether **no Category 2 transmittals exist** for the document at all.
    - It is 1 if the NOT EXISTS subquery finds no Category 2 transmittals: else 0.
    - This flag is required to properly show the data in the front-end.

Latest-Transmittal Logic

```
outer apply
(
    select top 1
        Transmittal_Number,
        Transmittal_Released_Date,
        Revision_Number
    from vi_STD_Transmittal_Details T
    where T.Document_Key = D.Document_Key
        --and T.Internal_Revision_Key = D.Internal_Revision_Key
        and T.Internal_Revision_Key <= LR.Internal_Revision_Key
        and T.Transmittal_Category_Key in (2,3)
    order by
        case when T.Transmittal_Category_Key = 2 then 0 else 1 end,
        Transmittal_Released_Date desc
)Latest_Transmittal
```

Main Purpose of this Outer Apply? –

Get the **most recent** transmittal for a document revision (D.Document_Key) with a preference for **Category 2** but falling back to **Category 3** if necessary.

How it Works? –

- **SELECT TOP 1 ...**:
  - Retrieves **only the most relevant transmittal** record for each document (one per outer row).
- **WHERE clause**:
  - T.Document_Key = D.Document_Key: Filters transmittals to only those related to the current document.
  - T.Internal_Revision_Key <= LR.Internal_Revision_Key: Includes **all transmittals for current or earlier revisions** (LR is a joined alias pointing to latest revision).
  - T.Transmittal_Category_Key in (2,3): Only considers transmittals that are **Category 2 (preferred)** or **Category 3 (fallback)**.

- **ORDER BY clause**:
  - CASE WHEN…: This ensures:
    - **Category 2** transmittals are prioritized over **Category 3**.
    - Within each category, the **latest (most recent)** transmittal is selected.
    - This ensures that if **Category 2 exists**, the most recent one is selected.
    - If **no Category 2**, then the most recent **Category 3** is selected.

Previous-Transmittal Logic

```
outer apply
(
    select top 1
        Transmittal_Number,
        Transmittal_Released_Date,
        Revision_Number
    from vi_STD_Transmittal_Details T
    where T.Document_Key = D.Document_Key
        and T.Internal_Revision_Key <= LR.Internal_Revision_Key - 1
        and T.Transmittal_Category_Key in (2,3)
    order by
        case when T.Transmittal_Category_Key = 2 then 0 else 1 end,
        Transmittal_Released_Date desc
)Prev_Transmittal
```

Main Purpose of this Outer Apply? –

Retrieve the latest transmittal (Category 2 preferred, Category 3 fallback) for a prior revision of a document — specifically, any revision before the latest one (LR.Internal_Revision_Key - 1). This is needed in the front-end.

How it Works? –

SELECT TOP 1 ...:

- Ensures that **only one** matching row is returned: the **most recent transmittal**, using a prioritization logic.

WHERE Clause:

- T.Document_Key = D.Document_Key: Limits transmittals to those belonging to the current document.
- T.Internal_Revision_Key <= LR.Internal_Revision_Key - 1:
    - Only considers **earlier revisions** (strictly before the current one).
    - Excludes the current revision itself.
- T.Transmittal_Category_Key in (2,3):
    - Only includes **Category 2 (preferred)** or **Category 3 (fallback)**.

Output

Here are the modified reports that reflect the changes I showcased above :

MDL_Report_Intership_Chanderiya.xlsx

MDL_Report_Intership_Paradip.xlsx

FCD Status Summary Dashboard

Prepared For : L&T M&M

Prepared BY : Siddhartha Saha

Date : 16/5/2025

Objective

The primary objective is to develop a comprehensive visualization and tracking system for Field Change Documents (FCDs) across multiple projects, enabling stakeholders to monitor their statuses, associated costs, schedules, and workflow stages in real time. This system aims to facilitate informed decision-making, enhance project oversight, and ensure efficient management by providing actionable insights into project progress and potential challenges.

Business Scenario

The organization is actively overseeing a portfolio of industrial projects, including initiatives such as KBL-VARD, the 5 MTPA Pellet Plant at NMDC, JSW Dovi BF3, JSW Dovi SMS2 Expansion, 160 KTPA Zinc Roaster, and the NMDC Dry Circuit System. These projects involve the use of Field Change Documents (FCDs) to formally document and manage project changes, track their respective statuses (whether open or closed), and evaluate their impacts on both cost and schedule. To support this, a Power BI dashboard has been implemented, offering a centralized and visually intuitive summary of critical project data

Problem Statement

Project managers require a streamlined and real-time mechanism to access a detailed overview of FCD statuses, cost and schedule impacts, and the progression of workflow stages across all ongoing projects. The current process of manually analysing raw data to extract meaningful insights is time-consuming and prone to errors, leading to delays in identifying critical issues. There is a pressing need for an automated, data-driven solution that empowers managers to quickly identify delays, prioritize corrective actions, and mitigate risks effectively, thereby ensuring project timelines and budgets are adhered to while maintaining high standards of operational efficiency.

Technical Work

Changes in the SQL Standard Procedure :

```
truncate table dbo.FCD_Report_Internship_Siddhartha

insert into dbo.FCD_Report_Internship_Siddhartha(
DOC_Number ,
DOC_Description ,
Order_No ,
Order_Description,
DOC_Status ,
IDOC_ID ,
INT_REV_NO ,
[Created on] ,
Area,
Sub_Area ,
Discipline ,
[Sub contractor] ,
[Technical Requirments] ,
[Existing Condition] ,
[Recommended Disposition] ,
[Potential Cost Impact] ,
[Potential Schedule Impact] ,
[Final Disposition] ,
Review_Stage_Activation ,
Review_Stage_Completion ,
Review_Stage_User ,
Validate_Stage_Activation ,
Validate_Stage_Completion ,
Validate_Stage_User ,
Approval_Stage_Activation ,
Approval_Stage_Completion ,
Apporval_Stage_User ,
Ref_Document_Desc ,
Ref_Document_No ,
Ref_Document_Rev ,
Current_Workflow_Stage ,
Workflow_Stage_Users ,
Current_Stage_Activation_Date
)
```

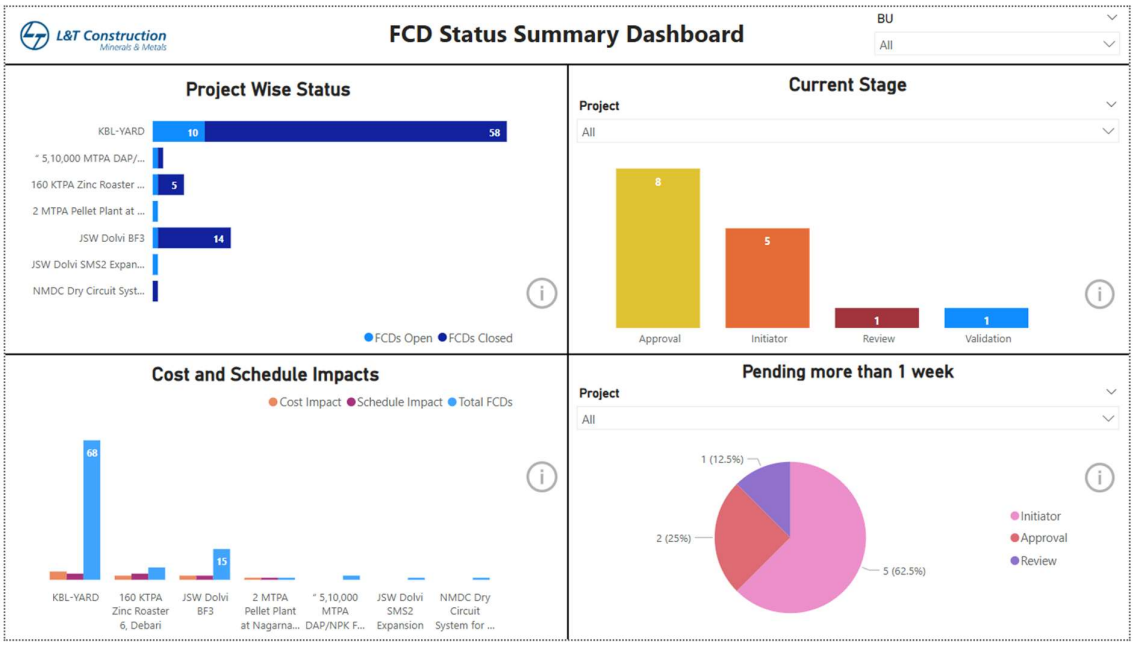
“truncate table dbo.FCD_Report_Internship_Siddhartha”

This part of the code in the standard procedure makes sure that the SP removes the data from the table while keeping the table schema and then rewrite the new data into the table. This SP runs regularly, and this is required so that SP doesn’t keep taking more space than required.

```
"insert into dbo.FCD_Report_Internship_Siddhartha(
        DOC_Number ,
        DOC_Description ,
        Order_No ,
        Order_Description,
        DOC_Status ,
        IDOC_ID ,
        INT_REV_NO ,
        [Created on] ,
        Area,
        Sub_Area ,
        Discipline ,
        [Sub contractor] ,
        [Technical Requirments] ,
        [Existing Condition] ,
        [Recommended Disposition] ,
        [Potential Cost Impact] ,
        [Potential Schedule Impact] ,
        [Final Disposition] ,
        Review_Stage_Activation ,
        Review_Stage_Completion ,
        Review_Stage_User ,
        Validate_Stage_Activation ,
        Validate_Stage_Completion ,
        Validate_Stage_User ,
        Approval_Stage_Activation ,
        Approval_Stage_Completion ,
        Apporval_Stage_User ,
        Ref_Document_Desc ,
        Ref_Document_No ,
        Ref_Document_Rev ,
        Current_Workflow_Stage ,
        Workflow_Stage_Users ,
        Current_Stage_Activation_Date )"
```

This part of the code makes it so that the result generated from the SP is stored into a separate table called "FCD_Report_Internship_Siddhartha" so that it can be later used to power the dashboard.

FCD Dashboard powered by Power Bi :



This is the main page of the dashboard. The Power BI dashboard titled "FCD Status Summary Dashboard" provides a comprehensive overview of Field Change Document (FCD) statuses across multiple projects, focusing on their progress, cost/schedule impacts, and workflow stages. Here's a detailed breakdown:

1. Project-Wise Status (Top Left) : Displays the number of FCDs (open and closed) for each project. The user can click on any of the stacked bars and hit the “i” button to get their respective details.
   For example, let’s check out the KBL-YARD project -

FCD Details

FCD Number	FCD Description	Current Stage	Workflow User(s)	Raised On
KBL-YARD-FCD-0045(SMP#3 B.C-4)	As per the drawing item number 16A FOUR numbers required. But only 2 are mentioned in the BOQ	Validation	GEDELA TULASEE DAS, Mohd Vaish	14 May 2025
KBL-YARD-FCD-0048(B.F#3)	Additional joint approval request	Validation	GEDELA TULASEE DAS, Mohd Vaish	18 May 2025
KBL-YARD-FCD-0049(B.F#2)	Additional joint approval request	Validation	GEDELA TULASEE DAS, Mohd Vaish	18 May 2025
KBL-YARD-FCD-0003	TQ-196 (Additional joint approval)	Initiator	Abhilash Tiwari, Mohd Vaish, Rathna Kumar S SUBRAMANIAM	09 April 2025
KBL-YARD-FCD-0013	Near side & far side panel send in two parts . Top chord and bottom chord bracing will be send in loose ccondition	Initiator	PANDIYARAJAN MARIMUTHU	12 April 2025
O22085-FCD-0003	TQ-196 (Additional joint approval)	Initiator	Mohd Vaish	09 April 2025
KBL-YARD-FCD-0044(B.F#2)	1)Additional joint approval request 2)Already joint done as per this sketch	Approval	Manas Kumar Khara	13 May 2025
KBL-YARD-FCD-0046(B.F#3)	(Additional joint location were changed) We was requested to you previous joint approval request as per material supplier confirmation. But now arrived 12000mm length plate so we will sent the approval request as per the available size.	Approval	Manas Kumar Khara	16 May 2025

2. Current Stage (Top Right) : Shows the distribution of FCDs that are currently open across different workflow stages. Here there's a drop-down menu for the user to choose the project they want to wish to investigate and get the respective insights and the user can select any of the current stages and get insight to that stage and what documents are available. For example, let's check out the JSW Dolvi SMS2 Expansion project –

FCD Current Stage Status

Project	FCD Number	FCD Description	Current Stage	Raised On	Workflow User(s)
JSW Dolvi SMS2 Expansion	O24013-FCD-0001		Review	08 February 2025	KAUSHIK SAHA, Simanchala Gouda

3. Cost and Schedule Impact (Bottom Left) : Highlights FCDs with their potential Cost and Schedule Impacts. These are Clustered Bar Charts which show the total number of FCDs in the project and the number of FCDs that have any Cost/Schedule Impact. The user can click on any of the cluster and hit the "i" button to get more information about the FCDs in the respective projects. For example, let's check out the JSW Dolvi BF3 project –

FCD Impact Details

FCD Number	FCD Description	Potential Cost Impact	Potential Schedule Impact	Raised On	Current Stage	Workf
O24012-FCD-0002	In cyclone structure fixing of 60 mm dia foundation bolt in P1 & P1A pedastal is getting foul with top two layer of pile cap rebar. Base plate 150x150 mm size of bolt is getting fouled with 32 mm dia top rebar	NO	NO	05 February 2025		
O24012-FCD-0004	In ECR, Plinth beam PB1 is getting generated from pedestral & pile cap portion altogather as per drawing. Dowels fixing from both pile cap & pedestral will be difficult due to level & dimension difference	NO	NO	06 February 2025		
O24012-FCD-0005	Main ECR grid ;E/1-4 PEDASTAL DETAILS NOT AVAILABLE IN BOTH THE DRAWINGS OF WDSP AND MAIN ECR	NO	NO	06 February 2025		
O24012-FCD-0007	In stock house P6A pedestral bolt details are not matching with drawing & written number of bolts	NO	NO	07 February 2025		
O24012-FCD-0008	In stock house PC7 pile cap RC & foundation bolt details of P7B Pedestral	NO	NO	11 February 2025		
O24012-FCD-0010	Details of pedestal not given in Inter Plant Pipe rack and cable gallery drawing at sec-B'	NO	NO	27 February 2025		
O24012-FCD-0011	Pile cap detail of PC6F not given in drawings	NO	NO	27 February 2025		
O24012-FCD-0012	Pedestral details in iNTERPLANT PIPE RACK PC5 TW8 grid	NO	NO	11 March 2025		
O24012-FCD-0015	In stock house PC11 pile cap, 3 nos. pile found top be outside of pile cap alignment & position.	NO	NO	13 March 2025		
O24012-FCD-0016	RELEASE THE HOLD PORTION	NO	NO	18 March 2025		
O24012-FCD-0019	Stock house P7G,P8B column concrete top level not mentioned in drawing. Pedestral P7,P7A dimesion detail is different between GA,RC & bolt details drawings.	NO	NO	28 March 2025		
O24012-FCD-0020	Main ECR Grid C-E/ 8-10 grid plinth beam PB1 required depth is not available in adjacent cast House PC16,PC17 pile cap	NO	NO	26 April 2025		
O24012-FCD-0003	In interplant pipe rack & cable gallery RC detail of pile cap, stirrup to be fixed with pedestral vertical rebar inside pile cap depth. But spacing, number & set detail s o stirrups has not been denoted	YES	YES	06 February 2025		
O24012-FCD-0006	C-B/2 - Part-II , Item No 37, top Plate of 120 mm fixed instead of 100 mm	YES	YES	13 May 2025	Initiator	Rahul

4. Pending more than 1 week (Bottom Right) : Shows the number of FCDs pending for more than 1 week. The user can click on the pie chart and check out the FCDs. Here is an example –

FCD Pending Status

Project	FCD Number	FCD Description	Current Stage	Raised On	Workflow User(s)
KBL-YARD	KBL-YARD-FCD-0003	TQ-196 (Additional joint approval)	Initiator	09 April 2025	Abhilash Tiwari, Mohd Vaish, Rathna Kumar S SUBRAMANIAM
KBL-YARD	KBL-YARD-FCD-0013	Near side & far side panel send in two parts . Top chord and bottom chord bracing will be send in loose ccondition	Initiator	12 April 2025	PANDIYARAJAN MARIMUTHU
KBL-YARD	O22085-FCD-0003	TQ-196 (Additional joint approval)	Initiator	09 April 2025	Mohd Vaish
" 5,10,000 MTPA DAP/NPK Fertilizer Plant & 1,80,000 MTPA Phosphoric Acid Plant at Chanderiya Lead & Zinc Smelter, Chanderiya, Rajasthan".	O22106-FCD-0002	GENERAL NOTES FOR ARCHITECTURAL WORKS	Initiator	07 March 2025	Vijay Singh

All these visuals are prepared by using several Power Bi DAX measures for accurate results.

Output

Main_Query.sql

FCD Status Summary Dashboard.pbix

TQI Dashboard

Prepared For : L&T M&M

Prepared BY : Siddhartha Saha

Date : 22/5/2025

Objective

Design and implement a TQI Dashboard for L&T Construction to provide a centralized platform for monitoring the Total Quality Index (TQI) of projects. The dashboard will calculate TQI by integrating Engineering Quality Index (EQI), Procurement Quality Index (PQI), and Construction Quality Index (CQI), presenting results through interactive gauge visuals. It will enable stakeholders to filter data by financial year (e.g., FY 2024-25) and quarter (e.g., Q4), categorize projects into Ferrous, Non-Ferrous, and Ferrous (TFL), and access detailed EQI, CQI, and PQI values via hover-over tables for enhanced quality oversight.

Business Scenario

L&T Construction seeks to streamline quality management by deploying a TQI Dashboard that consolidates and visualizes the Total Quality Index (TQI) for ongoing projects, such as Alumina Refinery Expansion at Lanjigarh and 2 MTPA Pellet Plant at Nagarnar. By calculating TQI from EQI, PQI, and CQI metrics, the dashboard will offer gauge-based visuals (e.g., TQI scores like 84, 89, 83) and support filtering by financial year and quarter, alongside category-specific views (Ferrous, Non-Ferrous, Ferrous TFL).

Problem Statement

L&T Construction currently faces challenges in efficiently monitoring and analysing quality metrics across its project portfolio due to the absence of a centralized TQI Dashboard. The lack of a unified system prevents stakeholders from easily accessing and comparing TQI scores—derived from EQI, CQI, and PQI—for projects like AMNSI BF Steel Plant Expansion in Hazira (TQI 88) and NMDC Dry Circuit System in Kirandul (TQI 89). Additionally, the inability to filter data by financial year (e.g., FY 2024-25) or quarter (e.g., Q4), categorize projects into Ferrous, Non-Ferrous, and Ferrous (TFL), and view detailed EQI/CQI/PQI breakdowns on demand leads to fragmented quality assessments, delayed interventions, and potential inconsistencies in maintaining high-quality standards across all projects.

Technical Work

The Dashboard is powered by the SQL backend which has the bulk of the logic for easier maintenance. Let's have a look at how it works!

```
ALTER PROCEDURE TQI_Internship
    @Project_IDs NVARCHAR(MAX)
AS
BEGIN
    SET NOCOUNT ON;
    SET TRANSACTION ISOLATION LEVEL READ UNCOMMITTED;

    -- declaring variables for previous quarter
    DECLARE @TargetFY NVARCHAR(20);
    DECLARE @TargetQuarter NVARCHAR(5);

    -- getting current date and assigning year and month accordingly
    DECLARE @CurrentDate DATE = CAST(GETDATE() AS DATE);
    DECLARE @CurrentMonth INT = MONTH(@CurrentDate);
    DECLARE @CurrentYear INT = YEAR(@CurrentDate);

    -- decalring variables for current fy and quarter
    DECLARE @CurrentFYStartYear INT;
    DECLARE @CurrentFY NVARCHAR(20);
    DECLARE @CurrentQuarter NVARCHAR(5);

    -- Calculate current FY (April-March)
    IF @CurrentMonth >= 4
        SET @CurrentFYStartYear = @CurrentYear;
    ELSE
        SET @CurrentFYStartYear = @CurrentYear - 1;
    SET @CurrentFY = CAST(@CurrentFYStartYear AS NVARCHAR(4)) + '-' + CAST((@CurrentFYStartYear + 1) % 100 AS NVARCHAR(2));

    -- Calculate current Quarter
    SET @CurrentQuarter = CASE
        WHEN @CurrentMonth BETWEEN 4 AND 6 THEN 'Q1'
        WHEN @CurrentMonth BETWEEN 7 AND 9 THEN 'Q2'
        WHEN @CurrentMonth BETWEEN 10 AND 12 THEN 'Q3'
        ELSE 'Q4'
    END;
```

This part of the SQL Standard Procedure declares the various variables and calculating the current year and quarter

Declare Variables:

- @TargetFY: Stores the previous quarter's financial year (string, 20 chars).
- @CurrentDate: Captures the current date using GETDATE().
- @CurrentMonth: Extracts the month from the current date.
- @CurrentYear: Extracts the year from the current date.
- @CurrentFYStartYear: Stores the starting year of the current FY.
- @CurrentQuarter: Stores the current quarter (string, 5 chars).

Calculate Financial Year:

- If the current month is April (4) or later, the FY starts in the current year: `SET @CurrentFYStartYear = @CurrentYear;`
- Correct FY calculation: `SET @CurrentFY = CAST(@CurrentFYStartYear AS NVARCHAR(4)) + '-' + CAST((@CurrentFYStartYear + 1) % 100 AS NVARCHAR(2));` Concatenates the start year and the next year's last two digits (e.g., 2024-25).

Calculate Quarter:

- Based on the current month:
    - Months 4-6 (April-June): Q1
    - Months 7-9 (July-Sep): Q2
    - Months 10-12 (Oct-Dec): Q3
    - Months 1-3 (Jan-Mar): Q4
- Example: On June 10, 2025, @CurrentMonth = 6, so @CurrentQuarter = 'Q1'.

```sql
-- Calculate the previous quarter
IF @CurrentQuarter = 'Q1'
BEGIN
    SET @TargetQuarter = 'Q4';
    SET @TargetFY = CAST(@CurrentFYStartYear - 1 AS NVARCHAR(4)) + '-' + CAST(@CurrentFYStartYear % 100 AS NVARCHAR(2));
END
ELSE IF @CurrentQuarter = 'Q2'
BEGIN
    SET @TargetQuarter = 'Q1';
    SET @TargetFY = @CurrentFY;
END
ELSE IF @CurrentQuarter = 'Q3'
BEGIN
    SET @TargetQuarter = 'Q2';
    SET @TargetFY = @CurrentFY;
END
ELSE -- Q4
BEGIN
    SET @TargetQuarter = 'Q3';
    SET @TargetFY = @CurrentFY;
END;

-- Validate input and exit if no Project_IDs provided
IF @Project_IDs IS NULL OR LTRIM(RTRIM(@Project_IDs)) = ''
BEGIN
    RETURN;
END

-- Delete existing data for the target FY and Quarter
DELETE FROM dbo.TQI_Dashboard
WHERE FY = @TargetFY
  AND FY_Quarter = @TargetQuarter
  AND Project_ID IN (
      SELECT TRY_CAST(LTRIM(RTRIM(value)) AS INT)
      FROM STRING_SPLIT(@Project_IDs, ',')
      WHERE TRY_CAST(LTRIM(RTRIM(value)) AS INT) IS NOT NULL
  );
```

This part of the query calculates the previous quarter, validates project IDs, and deletes outdated TQI data for the target financial year (FY) and quarter. Here's the breakdown:

Calculate Previous Quarter:

- Based on @CurrentQuarter:
    - If Q1, set @TargetQuarter = 'Q4' and @TargetFY = @CurrentFYStartYear - 1 (previous FY, e.g., 2024-25 if current FY is 2025-26).
    - If Q2, set @TargetQuarter = 'Q1', same FY.
    - If Q3, set @TargetQuarter = 'Q2', same FY.
    - If Q4, set @TargetQuarter = 'Q3', same FY.
- On June 10, 2025 (Q1), @TargetQuarter = 'Q4', @TargetFY = '2024-25'.

Validate Project IDs:

- IF @PROJECT_IDS IS NULL OR LTRIM(RTRIM(@PROJECT_IDS)) = ''
  Exits if @PROJECT_IDS is null or empty (after trimming whitespace), ensuring valid input.

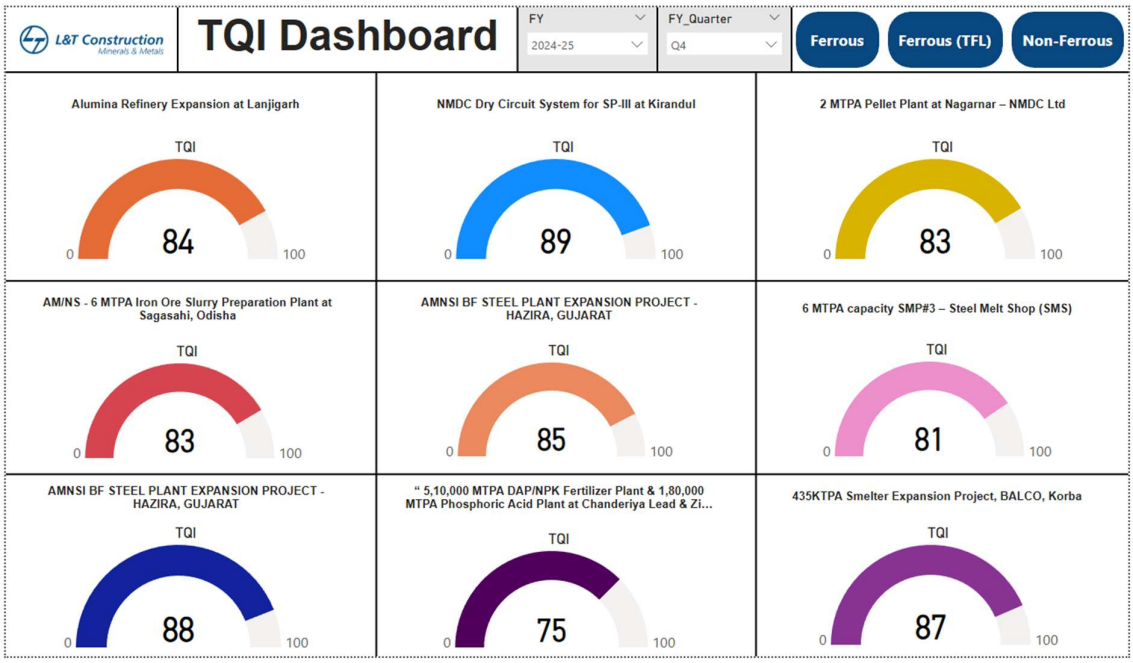
Delete Existing Data:

- DELETE FROM dbo.TQI_Dashboard
  Removes records from the TQI_Dashboard table where:
    - FY = @TargetFY (e.g., 2024-25).
    - Quarter = @TargetQuarter (e.g., Q4).
    - PROJECT_ID matches the provided @PROJECT_IDS (parsed from a comma-separated string using STRING_SPLIT).
- Ensures old data for the target FY and quarter is cleared before new calculations.

```
    -- Insert new data for the target FY and Quarter
    INSERT INTO dbo.TQI_Dashboard (
        FY,
        FY_Quarter,
        Project_ID,
        Project,
        EQI,
        PQI,
        CQI
    )
    SELECT
        @TargetFY AS FY,
        @TargetQuarter AS FY_Quarter,
        O.ORDER_ID AS Project_ID,
        MAX(O.ORDER_DESCRIPTION) AS Project,
        COALESCE(MAX(C.CHAR_368_000), 0) AS EQI,
        COALESCE(MAX(C.CHAR_382_000), 0) AS PQI,
        COALESCE(MAX(C.CHAR_577_000), 0) AS CQI
    FROM CUSTOM_DOC_CHAR_DETAILS C
    INNER JOIN DOC_INFO D ON C.OBJECT_ID = D.IDOC_ID
    INNER JOIN ORDER_MASTER O ON D.ORDER_ID = O.ORDER_ID
    WHERE D.GENO_KEY IN (109024, 109025, 109026)
      AND D.ORDER_ID IN (
          SELECT TRY_CAST(LTRIM(RTRIM(value)) AS INT)
          FROM STRING_SPLIT(@Project_IDs, ',')
          WHERE TRY_CAST(LTRIM(RTRIM(value)) AS INT) IS NOT NULL
      )
      AND C.CHAR_340_000 = @TargetFY
      AND C.CHAR_341_000 = @TargetQuarter
    GROUP BY O.ORDER_ID;
END
```

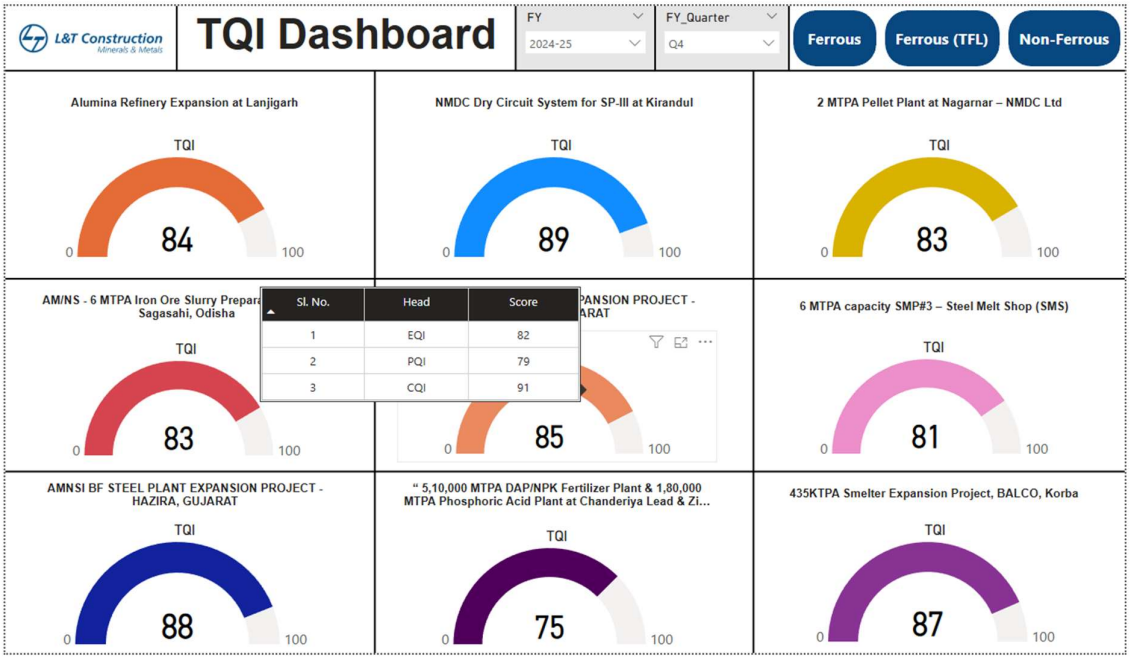
This part of the SQL Procedure Populates the TQI_Dashboard table with calculated TQI, EQI, PQI, and CQI for each project in the target FY and quarter, based on data from CUSTOM_DOC_CHAR_DETAILS and ORDER_MASTER.

Now let’s check out how all this backend makes up the Dashboard.

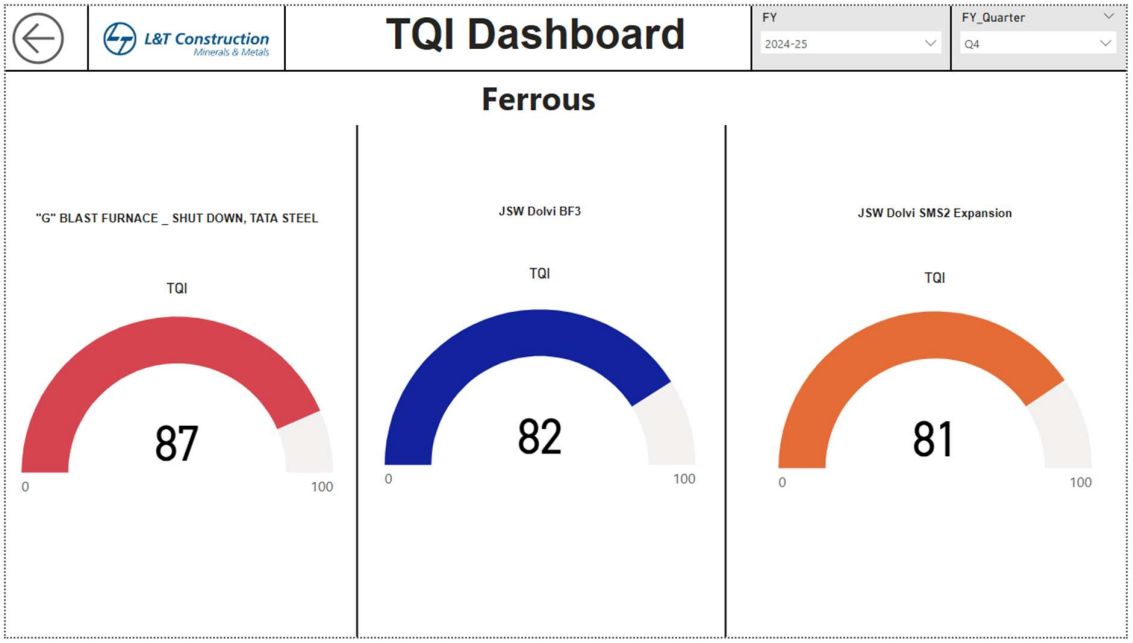


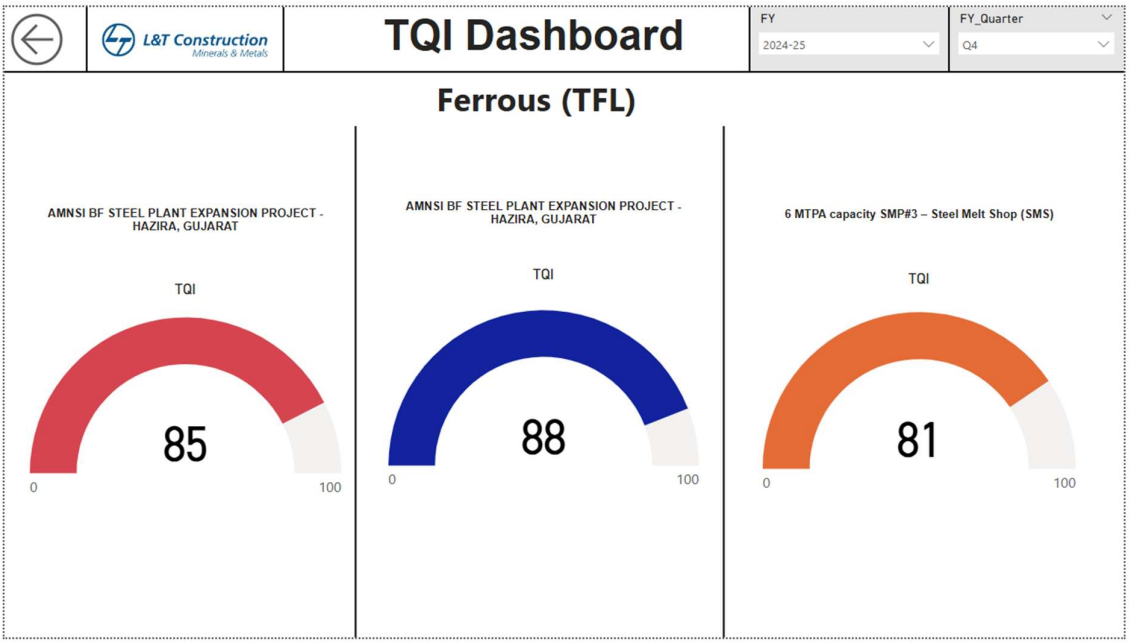
This main dashboard presents a comprehensive overview of Total Quality Index (TQI) data across various projects. The information displayed is dynamically sourced from the underlying database, ensuring that all TQI metrics are consistently updated and reflect the most current operational status. This real-time data integration facilitates informed decision-making and continuous monitoring of quality performance for each project.

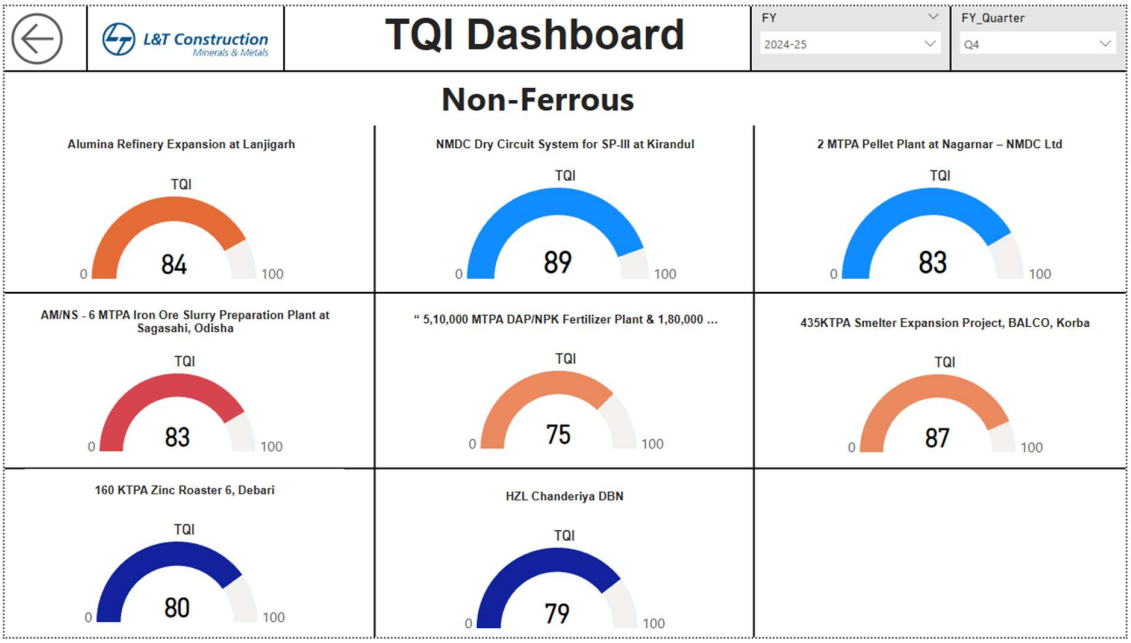
Users can check out the TQI Scores and hover on them to check out the EQI, CQI and PQI scores for the respective projects.



Users can also click on the respective button besides the filters and go to check the projects which fulfil the BU criteria.







Output

TQI Dashboard.pbix

Basic CRUD Operation Website

Prepared For : L&T M&M

Prepared BY : Siddhartha Saha

Date : 21/5/2025

Objective

Design and implement a secure, user-friendly web-based admin dashboard for the L&T Skills Portal to streamline the management of admins and users (employees). The dashboard should enable super-admins to perform CRUD operations (create, read, update, delete) on admin and user profiles, ensure secure access control, and provide a modern, responsive UI with intuitive navigation, subtle animations, and independent panel resizing for efficient interaction.

Business Scenario

L&T, a global leader in technology, engineering, and construction, is focused on enhancing workforce capabilities through its Skills Portal, a platform dedicated to employee upskilling. The company requires a robust admin dashboard to empower super-admins to manage other admins and employees effectively. Super-admins need to oversee account statuses, update profiles, and ensure only authorized personnel access the dashboard. The system must support a seamless user experience with visually appealing design, smooth page transitions, and optimized navigation, catering to a diverse user base across devices, while maintaining data integrity and security using local-Storage for persistence.

Problem Statement

L&T, a multinational technology and engineering conglomerate, seeks to develop and test a basic CRUD (Create, Read, Update, Delete) operations website for its Skills Portal to empower employees with seamless access to their professional data. The absence of a centralized platform creates inefficiencies in managing employee profiles, skills, and account statuses, leading to challenges in upskilling initiatives. The current manual processes are time-consuming, prone to errors, and lack proper access controls, risking data security.

Technical Work

Architecture and Structure

Frontend Framework: Built using vanilla HTML, CSS, and JavaScript, ensuring lightweight performance without external dependencies.

File Organization:

- index.html: Landing page with a login button linking to login.html.
- login.html: Login interface for admin authentication.
- dashboard.html: Core admin dashboard for CRUD operations on admins and users.
- Corresponding CSS (index-style.css, styles.css, dashboard.css) and JS (login.js, dashboard.js) files for styling and logic.

Navigation Flow:

- Implemented a linear flow: index.html → login.html → dashboard.html.
- Used “window.location.href” and “window.location.replace” for navigation, with history manipulation (“history.pushState”, “history.replaceState”) to skip login.html on back navigation.

Functionality (CRUD Operations)

Data Storage:

- Utilized “localStorage” for persistent data storage of admins and users.
- Initialized default data (super-admin: superadmin@example.com, super123) in login.js.

Admin Management:

- **Create**: Added "Add Admin" form to create new admins, storing them in “localStorage”.
- **Read**: Displayed admin list with name, email, and status in dashboard.js.
- **Update**: Enabled editing via modal forms (showEditAdminModal, saveAdminChanges).
- **Delete**: Added delete functionality with confirmation (deleteAdmin).

User Management:

- Similar CRUD operations for users, including skills field (addUser, modifyUser, deleteUser).

Status Toggling:

- Implemented “toggleAdminStatus” and “toggleUserStatus” to activate/deactivate accounts.

Super-admin Protection:

- Disabled edit/delete actions for the super-admin using conditional logic and CSS (disabled class).

UI/UX Design

Responsive Layout:

- Used flexbox in dashboard.css for a split layout (.split-container, .left-panel, .right-panel).
- Ensured independent panel resizing by removing flex: 1 and setting width: 50% with align-items: flex-start.

Modal Implementation:

- Created floating modals for editing (edit-admin-modal, edit-user-modal) with blurred backgrounds (filter: blur(4px) on .split-container).
- Added slide-in animations (@keyframes slideIn) for modals.

Animations:

- Implemented a fade-out animation on index.html for login button clicks (body.fade-out, opacity: 0).
- Added slide-down animations for "Add Admin" and "Add User" forms (form-container.visible, max-height transition).

Styling:

- Centered login inputs with text-align: center and box-sizing: border-box.
- Positioned the login modal at the top with align-items: flex-start and blurred the background.

Security Features

Access Control: Enforced admin authentication in loadDashboard by checking email and isActive status, redirecting unauthorized users to login.html.

Super-admin Protection: Disabled CRUD actions on the superadmin account using conditional checks in dashboard.js.

Data Validation: Added basic input validation in addAdmin and addUser (e.g., ensuring name, email are non-empty).

LocalStorage: Used JSON.parse and JSON.stringify for secure data serialization/deserialization.

Navigation Optimization

History Management:

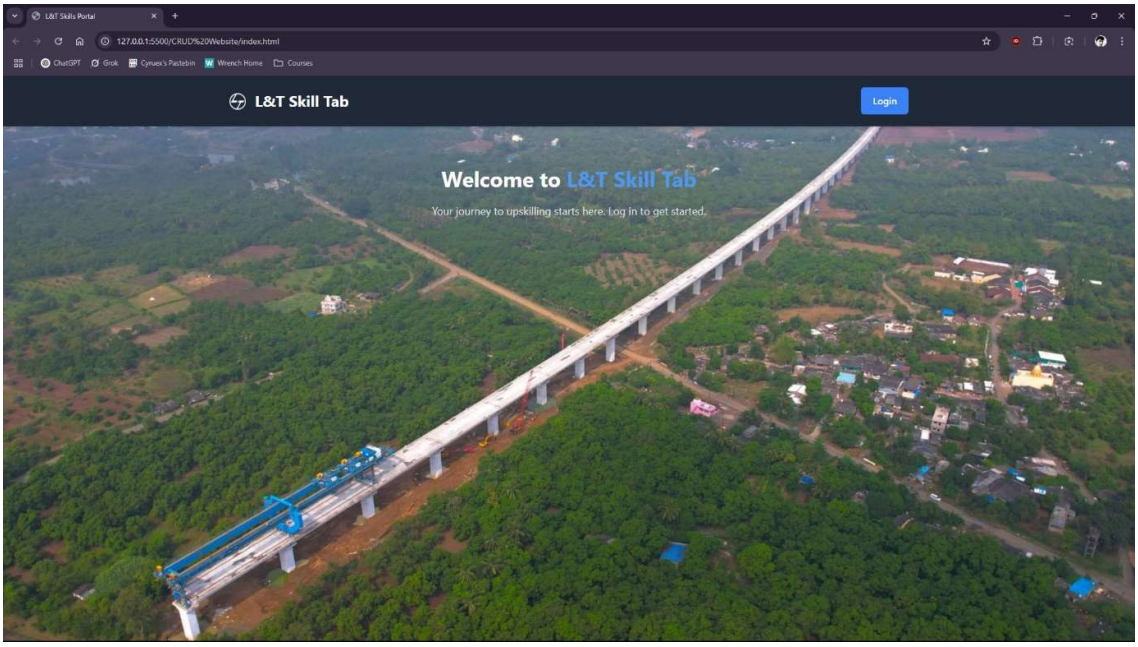
- Used “window.location.replace” in login.js to remove login.html from history.
- Implemented “history.pushState” and “onpopstate” in dashboard.js to redirect back to index.html.

Smooth Transitions:

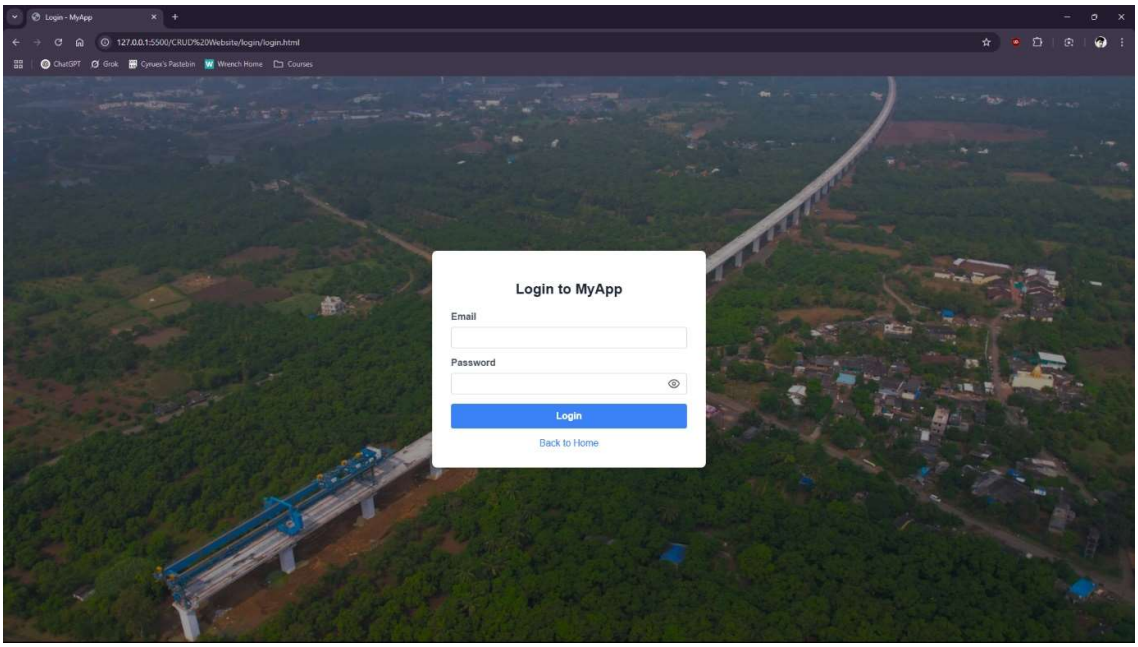
- Added a 300ms fade-out animation on index.html before navigating to login.html.

Output

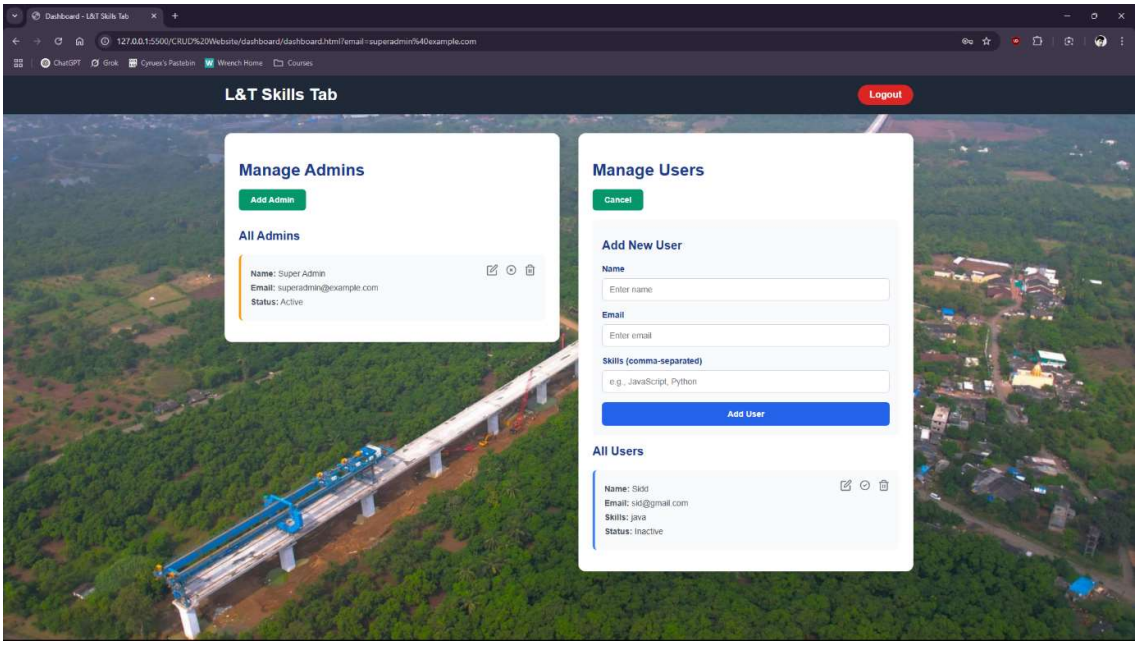
Welcome Page



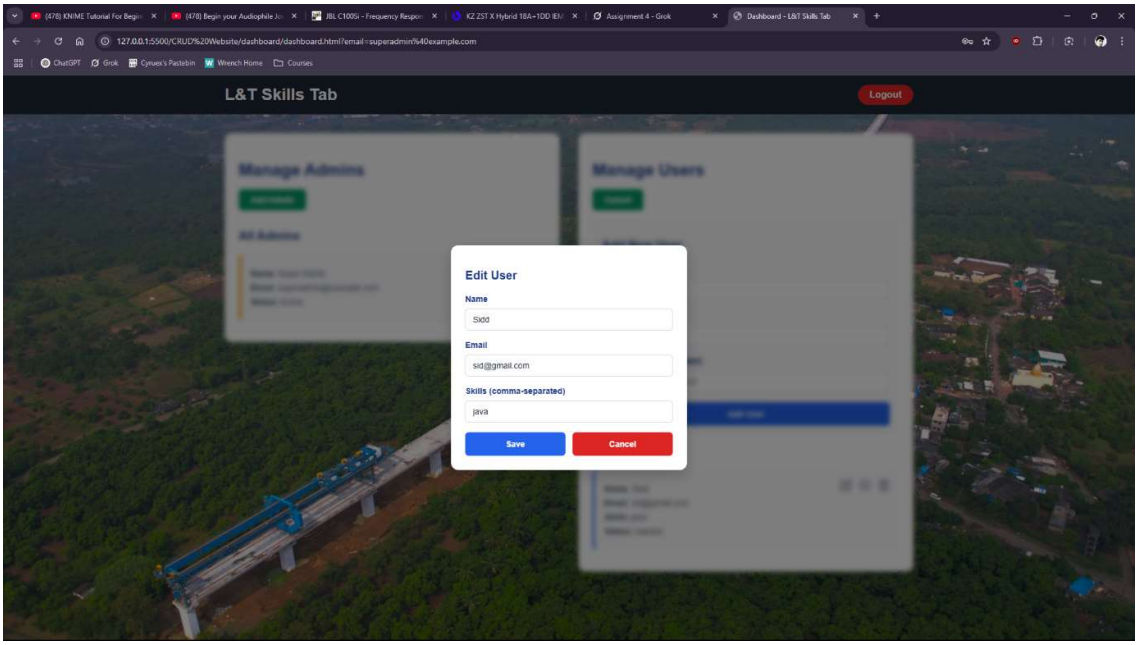
Login Page



Dashboard Page



Edit User Interface



EDRC Submission Summary Dashboard

Prepared For : L&T M&M

Prepared BY : Siddhartha Saha

Date : 28/5/2025

Objective

To build a clean, consolidated, and automated data pipeline using Tableau Prep that integrates multiple data sources (e.g., project details, document info, WBS objects, and custom SQL queries) to create a centralized dataset. This dataset supports a Tableau dashboard for **EDRC Submission Summary**, aimed at tracking and analysing document readiness, submission status, and project-level performance. This particular Dashboard is prepared to better navigate the document review challenges regarding

Business Scenario

Purpose:
Engineering Document Review and Control (EDRC) processes are critical in large-scale projects. Currently, the submission and review status of documents may be tracked using fragmented data sources (Wrench, STD systems, document info tables, etc.). This creates inefficiencies and limited visibility for stakeholders.

By building an integrated dashboard using Tableau Prep and Tableau Desktop:

- We centralize and cleanse disparate data sources.
- We automate the aggregation and validation of document submission metrics.
- We empower project managers, document controllers, and executives with real-time, filterable visual analytics.

Expected Benefits:

- Better visibility into submission delays and bottlenecks.
- Reduced manual reconciliation and reporting time.
- Streamlined project review workflows.

Problem Statement

Current Challenges:

- Multiple data sources (Wrench, STD systems, document metadata, custom queries) are not linked efficiently.
- Manual processes are error-prone and time-consuming.
- Difficulty in identifying submission gaps or pending approvals across different projects or WBS elements.

Specific Problem:

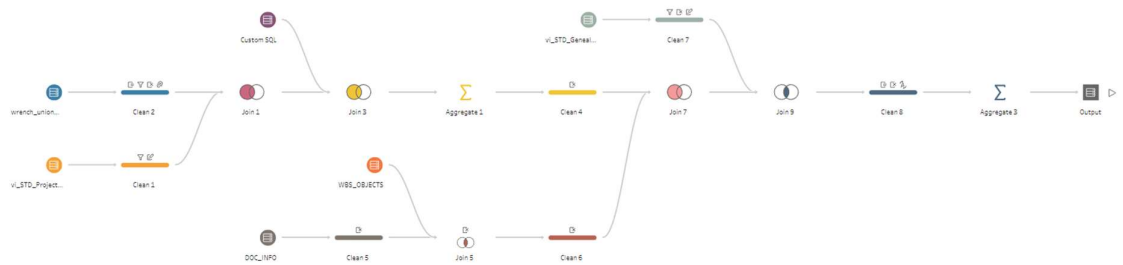
- What documents are pending for approval?
- How many submissions are completed per project/WBS?
- Are there any bottlenecks in document workflows?

Technical Work

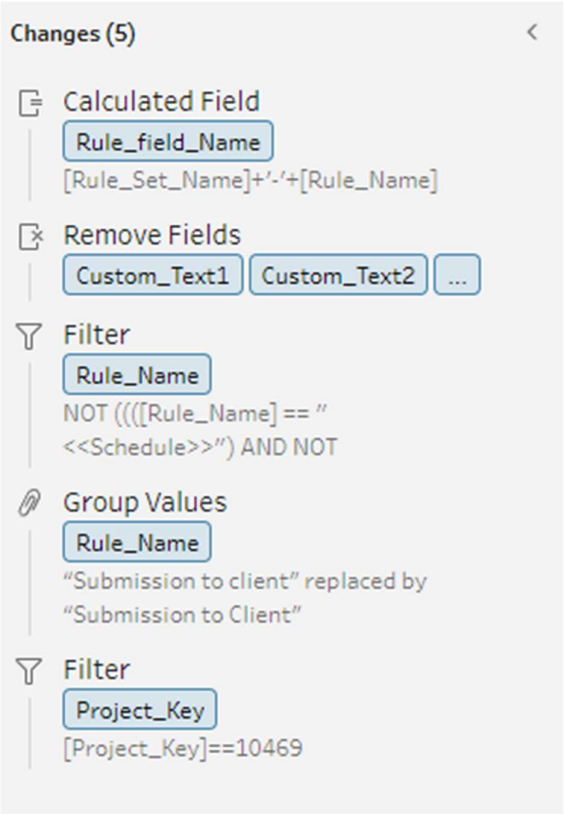
Tableau Prep

The Dashboard is only possible due to the data cleaning and fetching part which is accomplished using Tableau Prep. Let's see what we accomplished there.

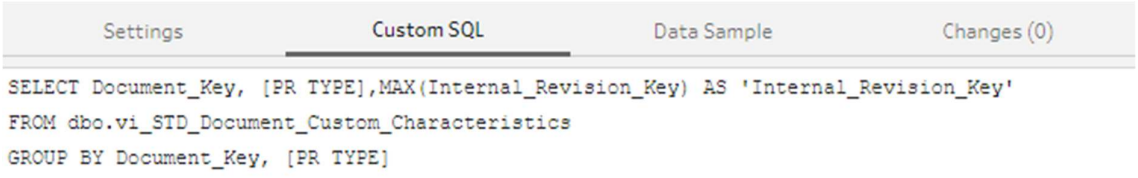
Data Sources Used : wrench_union_wbs_dtl, vi_STD_Project_Details, vi_STD_Genealogy, WBS_OBJECTS, DOC_INFO, Custom SQL



This is our Tableau Prep flow. Here after each time, we import data we have to clean it and make the data usable. We don't want a whole bunch of information that we aren't going to need in the dashboard, so we remove those fields from the data which is done here. For example,

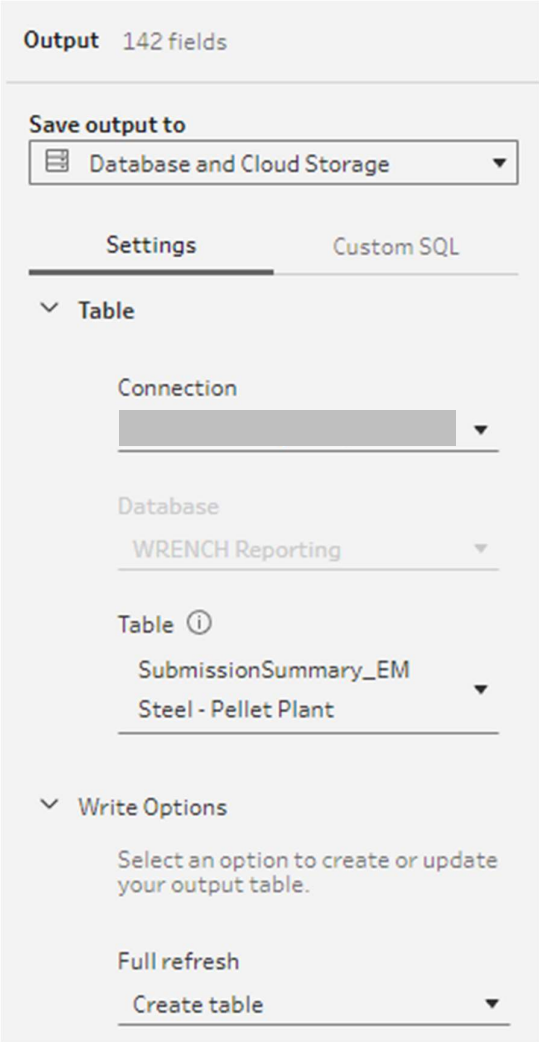


Here we filter out various fields and group some values and remove some fields that are also not needed and most importantly we only take in the data for the project that is required!



Here we can see that some custom SQL is also used to fetch data directly from the database. This helps in eliminating some mundane steps repeatedly.

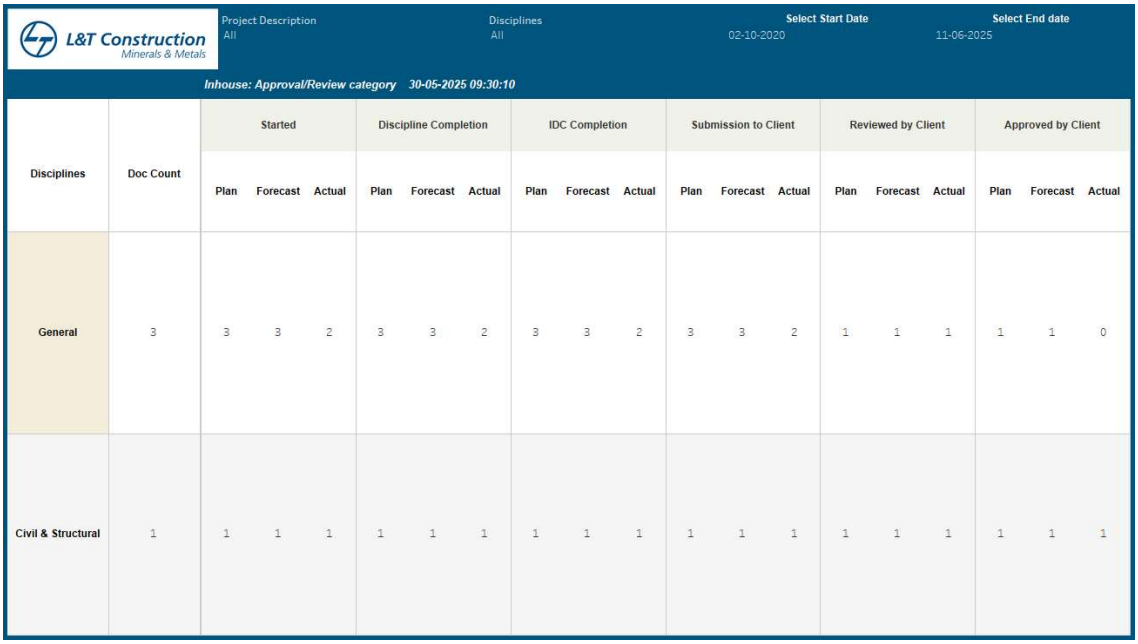
After all that is data is cleaned up and grouped together, we need a single table to store the data and that is done using the output node in Tableau Prep.



Here as shown we provide the server address and then a name for the Table along with instructions for what to do when the table already exists.

Tableau Dashboards

There are multiple dashboards that show various data related to the current Project which here is “EM Stell – Pellet Plant”.

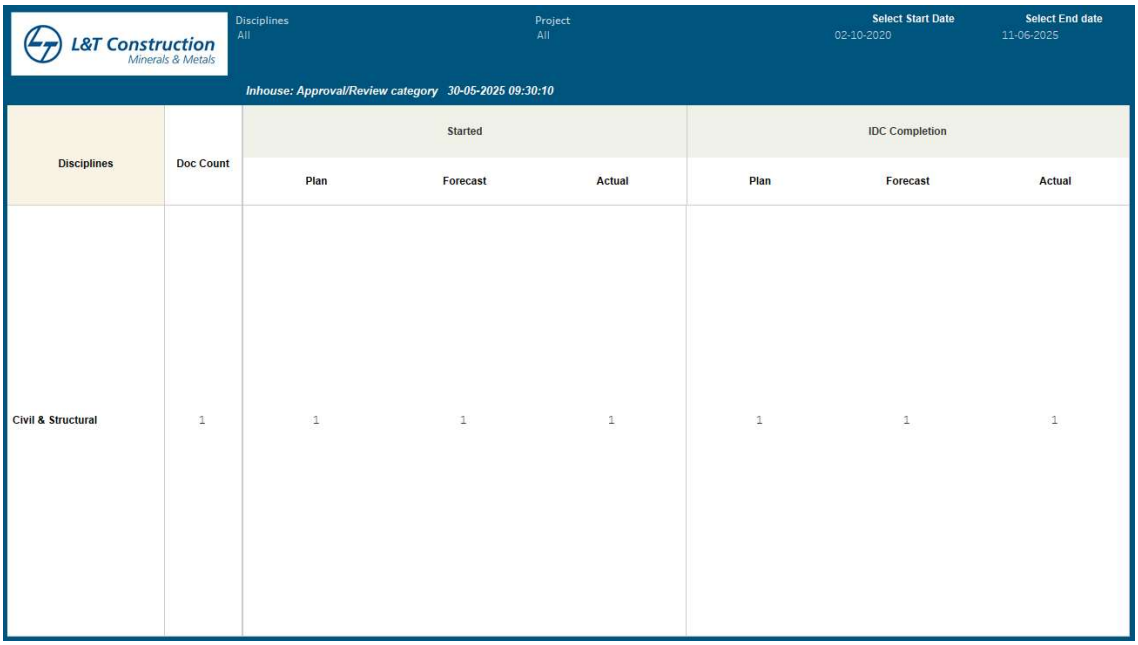


L&T Construction Minerals & Metals

Project Description	Disciplines	Select Start Date	Select End date
All	All	02-10-2020	11-06-2025

Inhouse: Approval/Review category 30-05-2025 09:30:10

Disciplines	Doc Count	Started			Discipline Completion			IDC Completion			Submission to Client			Reviewed by Client			Approved by Client		
		Plan	Forecast	Actual	Plan	Forecast	Actual	Plan	Forecast	Actual	Plan	Forecast	Actual	Plan	Forecast	Actual	Plan	Forecast	Actual
General	3	3	3	2	3	3	2	3	3	2	3	3	2	1	1	1	1	1	0
Civil & Structural	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

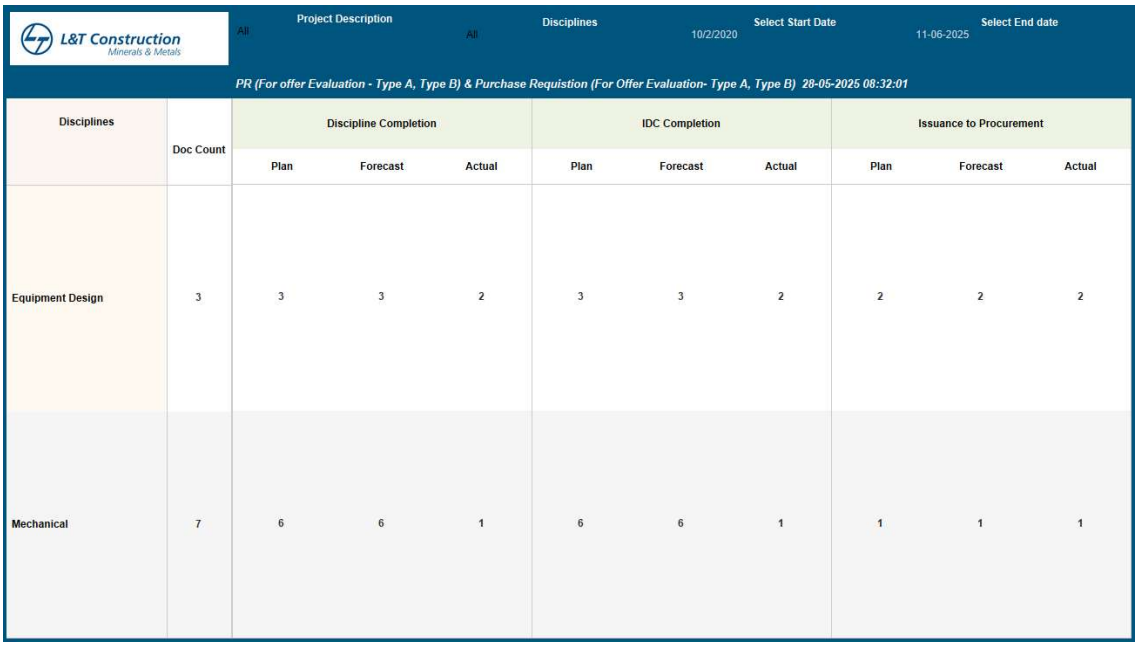


L&T Construction Minerals & Metals

Disciplines	Project	Select Start Date	Select End date
All	All	02-10-2020	11-06-2025

Inhouse: Approval/Review category 30-05-2025 09:30:10

Disciplines	Doc Count	Started			IDC Completion		
		Plan	Forecast	Actual	Plan	Forecast	Actual
Civil & Structural	1	1	1	1	1	1	1



L&T Construction
Minerals & Metals

Project Description	Disciplines	Select Start Date	Select End date
All	All	10/2/2020	11-06-2025

PR (For offer Evaluation - Type A, Type B) & Purchase Requistion (For Offer Evaluation- Type A, Type B) 28-05-2025 08:32:01

Disciplines	Doc Count	Discipline Completion			IDC Completion			Issuance to Procurement		
		Plan	Forecast	Actual	Plan	Forecast	Actual	Plan	Forecast	Actual
Equipment Design	3	3	3	2	3	3	2	2	2	2
Mechanical	7	6	6	1	6	6	1	1	1	1

Purpose of the Dashboards:

This dashboard provides a **discipline-wise summary** of engineering document progress for internal approval and review workflows. It enables stakeholders to monitor and compare the **planned, forecasted, and actual completion status** of documents at various lifecycle stages.

Key Features and Components:

- **Header Information:**
    - **Project Description**: Allows users to filter by specific projects (currently showing “All”).
    - **Disciplines Filter**: Enables users to view submission status per engineering discipline (currently showing “All”).
    - **Date Range**: A custom date selector, set between **02-Oct-2020** and **11-Jun-2025**.
    - **Last Refreshed Timestamp**: Indicates the dashboard was last updated on **30-May-2025 at 09:30:10**.
- **Tabular Layout:**

Output

Submission Summary EM Steel Prep Flow.tfl

EDRC Submission Summary Dashboard.twbx

Future Work

While the projects documented in this compilation have successfully addressed critical operational challenges and delivered tangible improvements, there remain several opportunities for future enhancements and strategic expansion.

One promising avenue involves scaling the dashboards to accommodate predictive analytics by integrating machine learning models. This would enable stakeholders to anticipate potential delays, cost overruns, or quality deviations before they materialize, thus facilitating a proactive decision-making framework. Additionally, the current dashboards and reporting tools can be extended to incorporate cross-project benchmarking, enabling comparative performance evaluations across business units and project types.

From a systems perspective, transitioning from local data sources and manual updates to cloud-based, real-time data pipelines can significantly improve accessibility, scalability, and collaboration. Similarly, the CRUD website may evolve into a fully-fledged role-based enterprise portal with integrated support for user analytics, automated reporting, and third-party authentication mechanisms.

Further optimization of SQL procedures and backend automation remains an ongoing focus, particularly in dynamically adapting business logic to accommodate evolving client requirements without disrupting legacy workflows.

Overall, the foundation established through these projects provides a robust platform for continuous improvement and innovation, paving the way for more intelligent, data-driven, and scalable project management solutions in future phases.

Conclusion

This compilation report encapsulates a series of technical projects aimed at enhancing the efficiency, visibility, and reliability of project execution processes within L&T M&M. Each initiative—from refining SQL stored procedures and developing real-time Power BI and Tableau dashboards to implementing a secure CRUD web interface—demonstrates a methodical approach to solving complex operational challenges through data-driven solutions and thoughtful system design.

The successful implementation of these projects has not only addressed immediate business needs but also laid a strong foundation for future digital transformation initiatives. By integrating automation, improving data integrity, and promoting user-centric functionality, these efforts contribute meaningfully to organizational goals such as improved decision-making, enhanced collaboration, and sustained process optimization.

Collectively, the work reflects a commitment to leveraging technology to streamline project workflows, support strategic planning, and ensure higher standards of quality and accountability. This compilation stands as a testament to the practical value of technical innovation in addressing real-world project management and engineering needs.