STM JOURNALS

Journal of
Construction Engineering,
Technology & Management

ISSN: 2249-4723 (Online)
ISSN: 2347-7253 (Print)
Volume 16, Issue 1, 2026
January–April
DOI (Journal): 10.37591/JoCETM

https://journals.stmjournals.com/jocetm

Research JoCETM

# Comparative Study of Time Slice Windows Analysis and Impacted As-Planned Analysis for Data Center Construction Projects Using Primavera P6 Version 24.12

Sachinkumar Sahu[1], Raju Narwade[2,*], Karthik Nagarajan[3]

**Abstract**

*Data centers are an information technology infrastructure that needs to be precisely scheduled and coordinated. Significant financial losses and operational failures may result from building delays. Stakeholders can assign blame and comprehend the reasons behind delays with the aid of forensic delay analysis. Because of their unique approaches and legal acceptability, time slice window analysis (TSWA) and impacted as-planned analysis (IAPA) are commonly used among the many strategies. These methods provide various ways to analyze project schedules and pinpoint significant delays. IAPA looks at how certain events affect project completion, whereas TSWA compares planned and actual timetables. The complexity of the project, the documentation that is accessible, and the particular demands of the dispute resolution procedure all play a role in the decision between various approaches. Among the various delay analysis methodologies available, TSWA and IAPA are two of the most commonly applied techniques, largely due to their methodological rigor and acceptance in legal and arbitration settings. TSWA involves a detailed comparison between planned and actual project schedules across defined time periods, allowing analysts to assess delay impacts as the project progresses. This method is particularly useful for complex projects with extensive schedule updates and reliable contemporaneous records. In contrast, IAPA evaluates the effect of specific delay events by inserting them into the original baseline schedule to determine their impact on the planned completion date. This approach is often applied when contemporaneous updates are limited, but a robust baseline program exists. The selection of an appropriate forensic delay analysis method depends on several factors, including project complexity, availability, and quality of documentation, and the specific requirements of the dispute resolution forum. Understanding the strengths and limitations of TSWA and IAPA is, therefore, essential for accurately analyzing delays and achieving fair and defensible outcomes in data center construction disputes.*

**Keywords:** Construction, data center, delay analysis, impacted as-planned analysis (IAPA), time slice windows analysis (TSWA)

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Received Date: December 30, 2025
Accepted Date: January 22, 2026
Published Date: February 04, 2026

**Citation:** Sachinkumar Sahu, Raju Narwade, Karthik Nagarajan. Comparative Study of Time Slice Windows Analysis and Impacted As-Planned Analysis for Data Center Construction Projects Using Primavera P6 Version 24.12. Journal of Construction Engineering, Technology & Management. 2026; 16(1): 33–51p.

## INTRODUCTION

Data centers are information technology infrastructure that require precise scheduling and coordination. Delays in their construction can lead to significant financial losses and operational setbacks. Forensic delay analysis helps stakeholders understand the causes of delays and allocate responsibility. Among the various techniques, time slice window analysis (TSWA) and impacted as-planned analysis (IAPA) are frequently employed because of their distinct methodologies and legal acceptability. These techniques offer different approaches for analyzing project timelines and identifying critical delays. TSWA focuses on comparing planned versus actual schedules, whereas IAPA examines the impact of specific events on project completion. The choice between these methods often depends on the complexity of the project, available documentation, and specific requirements of the dispute resolution process [1–4].

## LITERATURE SURVEY

Delay analysis is a crucial aspect of project management in large-scale construction projects, particularly in data center developments, where time-sensitive operations and high capital investments are involved. This literature review focuses on two widely used forensic delay analysis techniques: TSWA and IAPA, specifically in the context of data center construction projects. TSWA is a dynamic and observational method that utilizes contemporaneous schedule updates throughout the project lifecycle [5–7].

In contrast, IAPA is a static and hypothetical approach that begins with the original baseline schedule. It involves inserting delay events into the baseline to simulate their impact on the project timeline. IAPA does not consider actual progress or changes during execution and is often used in early-stage claims or when schedule updates are unavailable [8–11].

A case study of a data center construction project in South Asia provides practical insights into the application of these techniques. The project, with a scope of a phase-1 data center with a 16 MW IT load and a duration of six months, involved multiple stakeholders, including the developer, EPC contractor, and mechanical, electrical, and plumbing (MEP) subcontractors [12–14].

The application of TSWA in this case study revealed delays due to late equipment delivery and design changes. It identified a critical path shift from civil works to MEP integration in month 14, resulting in a 45-day compensable delay attributed to client-side changes. This analysis provided a detailed and accurate representation of the project's delay events and their impacts [15–17].

## OBJECTIVE

- Prepare baseline schedule with milestones and without milestones.
- Updating the schedule based on the data date.
- Delays are analyzed within each window.
- The cumulative impact on project completion is assessed.

## RESEARCH METHODOLOGY

### Time Slice Window Analysis

TSW analysis is a forensic delay analysis methodology that relies on contemporaneous schedule updates prepared during the execution of a construction project. This method examines the project program as it evolves over time, rather than relying solely on the original plan. The total project duration is divided into a number of discrete time periods, commonly referred to as “windows,” which are typically set on a monthly basis to correspond with regular progress reporting cycles. Within each window, the planned schedule is compared with the actual progress achieved during that period.

By analyzing performance incrementally, TSWA allows the analyst to identify delays as they occur and understand how their effects accumulate throughout the project lifecycle. One of the principal strengths of this approach is its ability to identify shifting critical paths and evolving delay impacts. As changes occur owing to design development, procurement issues, or site constraints, the critical path may move from one sequence of activities to another. This method captures such changes accurately, making it particularly suitable for complex and fast-track projects. However, the reliability of TSWA depends heavily on the availability of high-quality, regularly updated schedules that accurately reflect actual site conditions. When such records exist, the method is generally considered dynamic and observational, providing a realistic representation of project execution (Figures 1–4 and Table 1).

**Impacted As-Planned Analysis**

IAPA is a forensic delay analysis technique that begins with the original baseline schedule prepared at the commencement of the project. This baseline represents the contractor's intended sequence, logic, and duration of activities. Identified delay events are subsequently inserted into the baseline program to simulate their effect on the planned completion date.

Unlike TSWA, IAPA does not consider actual progress achieved during construction and does not account for mitigation measures, acceleration efforts, or resequencing undertaken on site. Therefore, this method assumes that the project would have proceeded exactly as planned, but for the occurrence of the identified delay events. Consequently, this approach is often applied in early-stage claims, preliminary delay assessments, or situations where contemporaneous schedule updates are unavailable or unreliable. Owing to its reliance on assumptions rather than observed performance, IAPA is generally regarded as a static and hypothetical method, with its accuracy closely tied to the quality of the original baseline schedule [2–4].

**Case Study: Data Center Construction Project**

***Project Overview***

- *Location:* Airoli, Navi Mumbai, India
- *Scope:* Phase-1 Data Center with 16 MW IT load
- *Duration:* 6 months
- *Stakeholders:* Developer, EPC Contractor, MEP Subcontractors

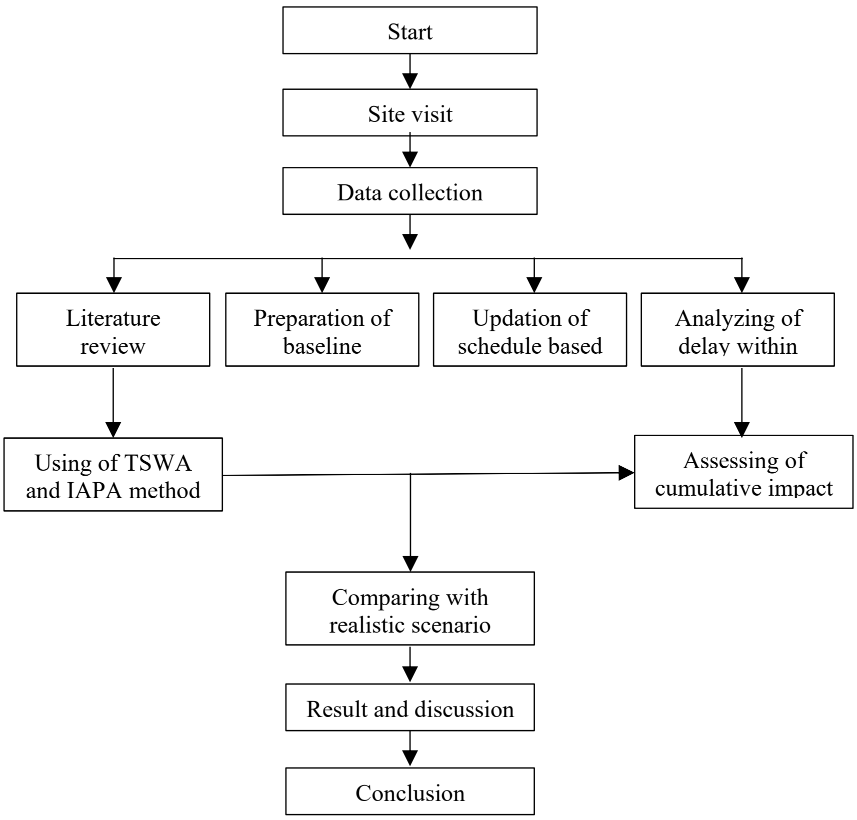
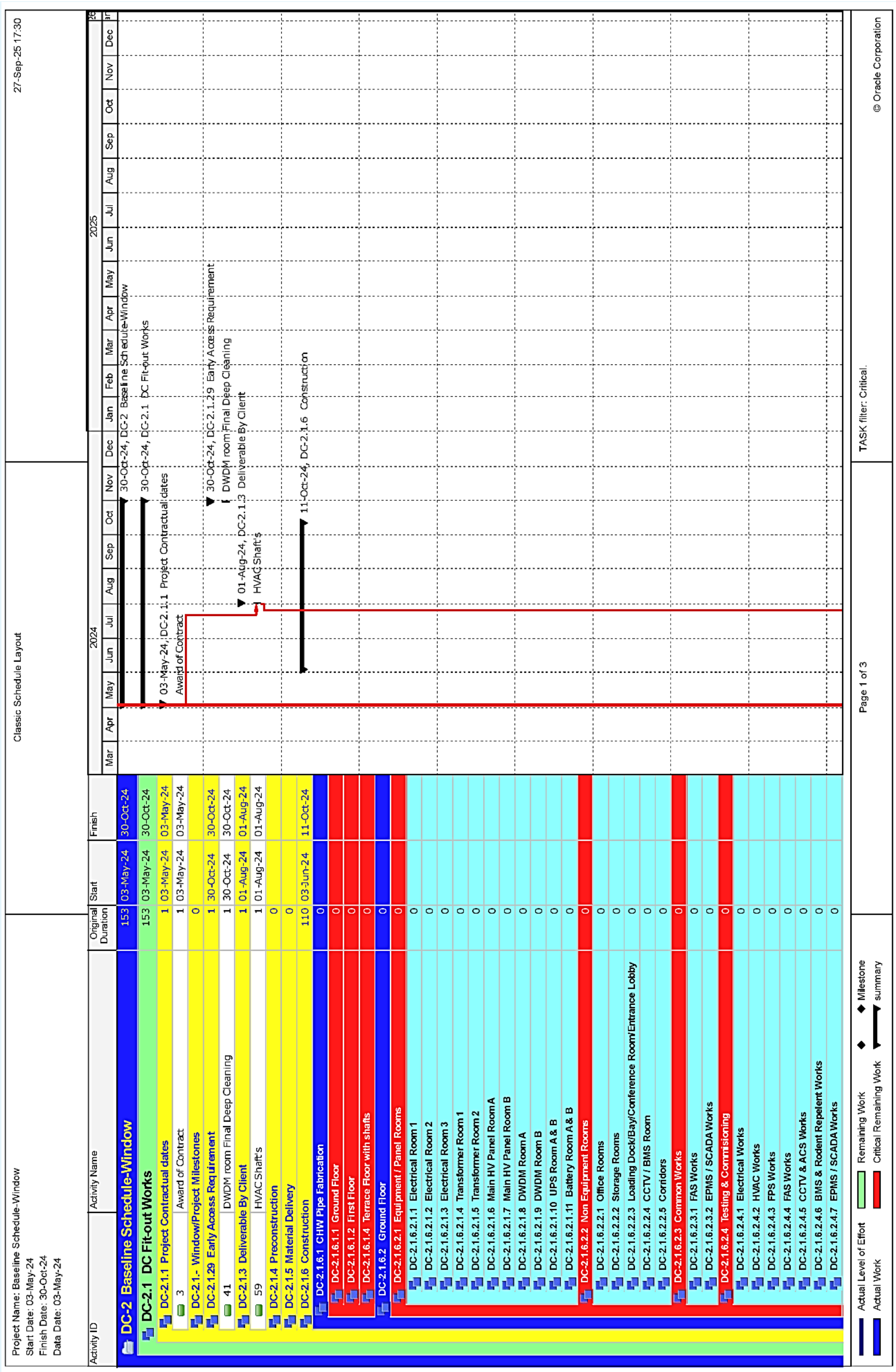



**Figure 1.** Flow chart of methodology.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Finish Date: 30-Oct-24
Data Date: 03-May-24
Classic Schedule Layout
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Activity ID
Activity Name
Original Duration
Start
Finish
2024
2025
Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
DC-2 Baseline Schedule-Window 153 03-May-24 30-Oct-24
DC-2.1 DC Fit-out Works 153 03-May-24 30-Oct-24
DC-2.1.1 Project Contractual dates 1 03-May-24 03-May-24
3 Award of Contract 1 03-May-24 03-May-24
DC-2.1.- Window/Project Milestones 0
DC-2.1.29 Early Access Requirement 1 30-Oct-24 30-Oct-24
41 DWDM room Final Deep Cleaning 1 30-Oct-24 30-Oct-24
DC-2.1.3 Deliverable By Client 1 01-Aug-24 01-Aug-24
59 HVAC Shaft's 1 01-Aug-24 01-Aug-24
DC-2.1.4 Preconstruction 0
DC-2.1.5 Material Delivery 0
DC-2.1.6 Construction 110 03-Jun-24 11-Oct-24
DC-2.1.6.1 CHW Pipe Fabrication 0
DC-2.1.6.1.1 Ground Floor 0
DC-2.1.6.1.2 First Floor 0
DC-2.1.6.1.4 Terrace Floor with shafts 0
DC-2.1.6.2 Ground Floor 0
DC-2.1.6.2.1 Equipment / Panel Rooms 0
DC-2.1.6.2.1.1 Electrical Room 1 0
DC-2.1.6.2.1.2 Electrical Room 2 0
DC-2.1.6.2.1.3 Electrical Room 3 0
DC-2.1.6.2.1.4 Transformer Room 1 0
DC-2.1.6.2.1.5 Transformer Room 2 0
DC-2.1.6.2.1.6 Main HV Panel Room A 0
DC-2.1.6.2.1.7 Main HV Panel Room B 0
DC-2.1.6.2.1.8 DWDM Room A 0
DC-2.1.6.2.1.9 DWDM Room B 0
DC-2.1.6.2.1.10 UPS Room A & B 0
DC-2.1.6.2.1.11 Battery Room A & B 0
DC-2.1.6.2.2 Non Equipment Rooms 0
DC-2.1.6.2.2.1 Office Rooms 0
DC-2.1.6.2.2.2 Storage Rooms 0
DC-2.1.6.2.2.3 Loading Dock/Bay/Conference Room/Entrance Lobby 0
DC-2.1.6.2.2.4 CCTV / BMS Room 0
DC-2.1.6.2.2.5 Corridors 0
DC-2.1.6.2.3 Common Works 0
DC-2.1.6.2.3.1 FAS Works 0
DC-2.1.6.2.3.2 EPMS / SCADA Works 0
DC-2.1.6.2.4 Testing & Commisioning 0
DC-2.1.6.2.4.1 Electrical Works 0
DC-2.1.6.2.4.2 HVAC Works 0
DC-2.1.6.2.4.3 FPS Works 0
DC-2.1.6.2.4.4 FAS Works 0
DC-2.1.6.2.4.5 CCTV & ACS Works 0
DC-2.1.6.2.4.6 BMS & Rodent Repelent Works 0
DC-2.1.6.2.4.7 EPMS / SCADA Works 0
30-Oct-24, DC-2 Baseline Schedule-Window
30-Oct-24, DC-2.1 DC Fit-out Works
03-May-24, DC-2.1.1 Project Contractual dates
Award of Contract
30-Oct-24, DC-2.1.29 Early Access Requirement
DWDM room Final Deep Cleaning
01-Aug-24, DC-2.1.3 Deliverable By Client
HVAC Shaft's
11-Oct-24, DC-2.1.6 Construction
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
Milestone
summary
Page 1 of 3
TASK filter: Critical.
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ISSN: 2249-4723 (Online), ISSN: 2347-7253 (Print)

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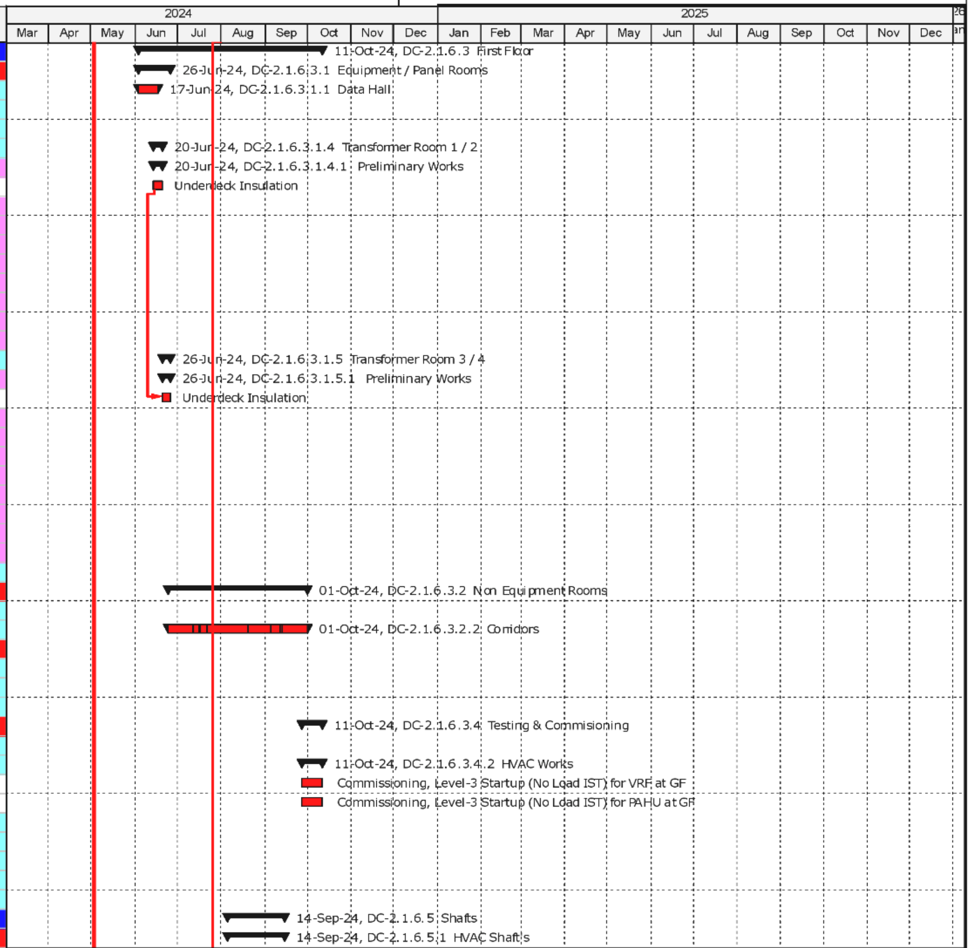
Finish Date: 30-Oct-24
Data Date: 03-May-24

Classic Schedule Layout

27-Sep-25 17:30

| Activity ID | Activity Name | Original Duration | Start | Finish |
|---|---|---|---|---|
| DC-2.1.6.3 | First Floor | 110 | 03-Jun-24 | 11-Oct-24 |
| DC-2.1.6.3.1 | Equipment / Panel Rooms | 20 | 03-Jun-24 | 26-Jun-24 |
| DC-2.1.6.3.1.1 | Data Hall | 12 | 03-Jun-24 | 17-Jun-24 |
| DC-2.1.6.3.1.2 | Electrical Room 1 / 2 | 0 | | |
| DC-2.1.6.3.1.3 | Electrical Room 3 / 4 | 0 | | |
| DC-2.1.6.3.1.4 | Transformer Room 1 / 2 | 5 | 14-Jun-24 | 20-Jun-24 |
| DC-2.1.6.3.1.4.1 | Preliminary Works | 4 | 14-Jun-24 | 20-Jun-24 |
| 1098 | Underdeck Insulation | 4 | 14-Jun-24 | 20-Jun-24 |
| DC-2.1.6.3.1.4.2 | Electrical Works | 0 | | |
| DC-2.1.6.3.1.4.3 | HVAC Works | 0 | | |
| DC-2.1.6.3.1.4.4 | FPS Works | 0 | | |
| DC-2.1.6.3.1.4.5 | FAS Works | 0 | | |
| DC-2.1.6.3.1.4.6 | ASD Works | 0 | | |
| DC-2.1.6.3.1.4.7 | CCTV & ACS Works | 0 | | |
| DC-2.1.6.3.1.4.8 | BMS & Rodent Repelent Works | 0 | | |
| DC-2.1.6.3.1.4.9 | EPMS/SCADA Works | 0 | | |
| DC-2.1.6.3.1.5 | Transformer Room 3 / 4 | 5 | 20-Jun-24 | 26-Jun-24 |
| DC-2.1.6.3.1.5.1 | Preliminary Works | 4 | 20-Jun-24 | 26-Jun-24 |
| 1141 | Underdeck Insulation | 4 | 20-Jun-24 | 26-Jun-24 |
| DC-2.1.6.3.1.5.2 | Electrical Works | 0 | | |
| DC-2.1.6.3.1.5.3 | HVAC Works | 0 | | |
| DC-2.1.6.3.1.5.4 | FPS Works | 0 | | |
| DC-2.1.6.3.1.5.5 | FAS Works | 0 | | |
| DC-2.1.6.3.1.5.6 | ASD Works | 0 | | |
| DC-2.1.6.3.1.5.7 | CCTV & ACS Works | 0 | | |
| DC-2.1.6.3.1.5.8 | BMS & Rodent Repelent Works | 0 | | |
| DC-2.1.6.3.1.5.9 | EPMS/SCADA Works | 0 | | |
| DC-2.1.6.3.1.6 | Battery Rooms | 0 | | |
| DC-2.1.6.3.2 | Non Equipment Rooms | 84 | 24-Jun-24 | 01-Oct-24 |
| DC-2.1.6.3.2.1 | Office Area / Storage Room | 0 | | |
| DC-2.1.6.3.2.2 | Corridors | 84 | 24-Jun-24 | 01-Oct-24 |
| DC-2.1.6.3.3 | Common Works | 0 | | |
| DC-2.1.6.3.3.1 | FAS Works | 0 | | |
| DC-2.1.6.3.3.2 | BMS & Rodent Repelent Works | 0 | | |
| DC-2.1.6.3.3.3 | EPMS / SCADA Works | 0 | | |
| DC-2.1.6.3.4 | Testing & Commisioning | 11 | 27-Sep-24 | 11-Oct-24 |
| DC-2.1.6.3.4.1 | Electrical Works | 0 | | |
| DC-2.1.6.3.4.2 | HVAC Works | 10 | 27-Sep-24 | 11-Oct-24 |
| 1317 | Commissioning, Level-3 Startup (No Load IST) for VR | 10 | 27-Sep-24 | 11-Oct-24 |
| 1316 | Commissioning, Level-3 Startup (No Load IST) for PA | 10 | 27-Sep-24 | 11-Oct-24 |
| DC-2.1.6.3.4.3 | FPS Works | 0 | | |
| DC-2.1.6.3.4.4 | FAS Works | 0 | | |
| DC-2.1.6.3.4.5 | CCTV & ACS Works | 0 | | |
| DC-2.1.6.3.4.6 | BMS & Rodent Repelent Works | 0 | | |
| DC-2.1.6.3.4.7 | EPMS / SCADA Works | 0 | | |
| DC-2.1.6.5 | Shafts | 35 | 05-Aug-24 | 14-Sep-24 |
| DC-2.1.6.5.1 | HVAC Shaft's | 35 | 05-Aug-24 | 14-Sep-24 |




Actual Level of Effort | Remaining Work | ◆ Milestone
Actual Work | Critical Remaining Work | summary

Page 2 of 3

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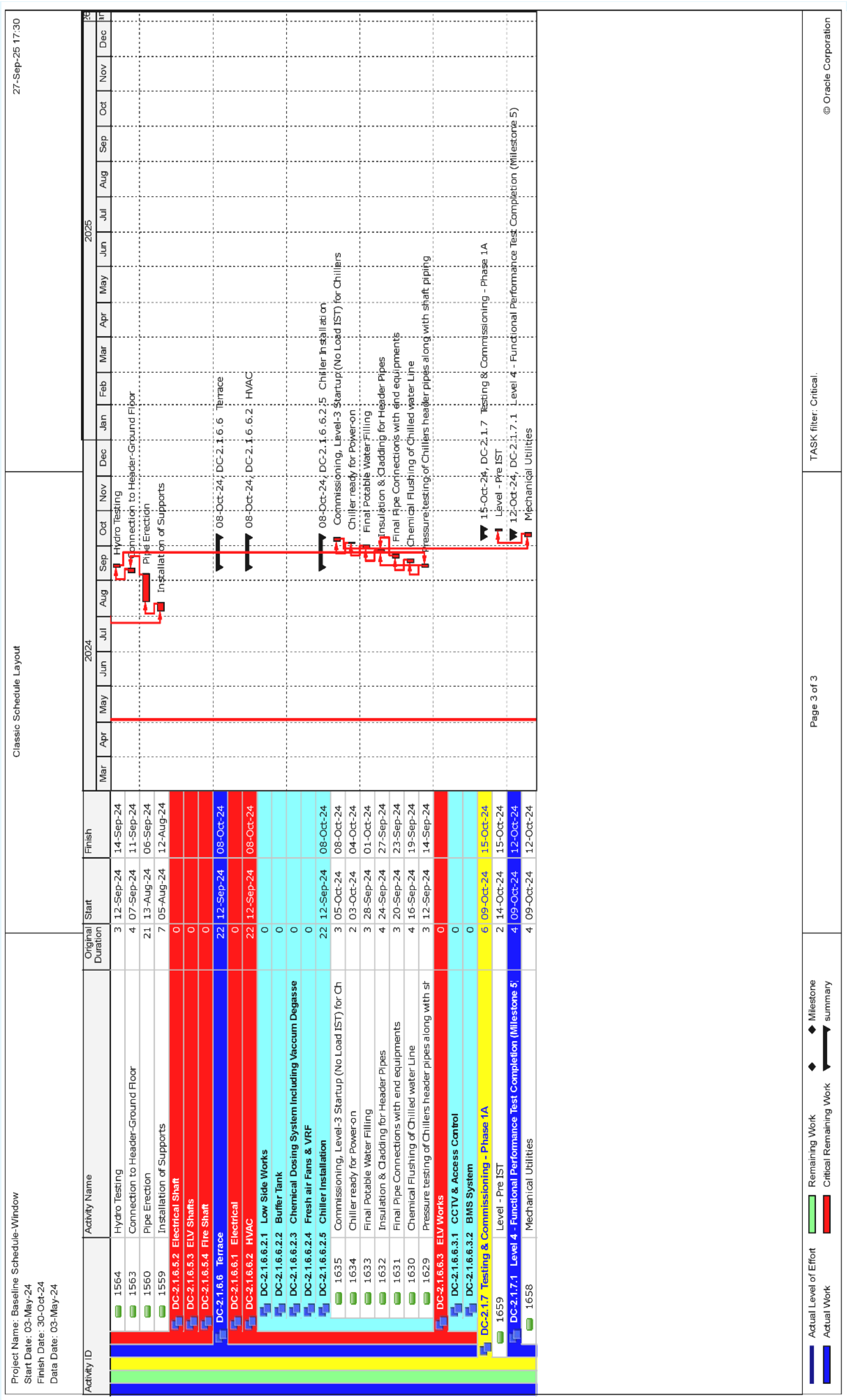
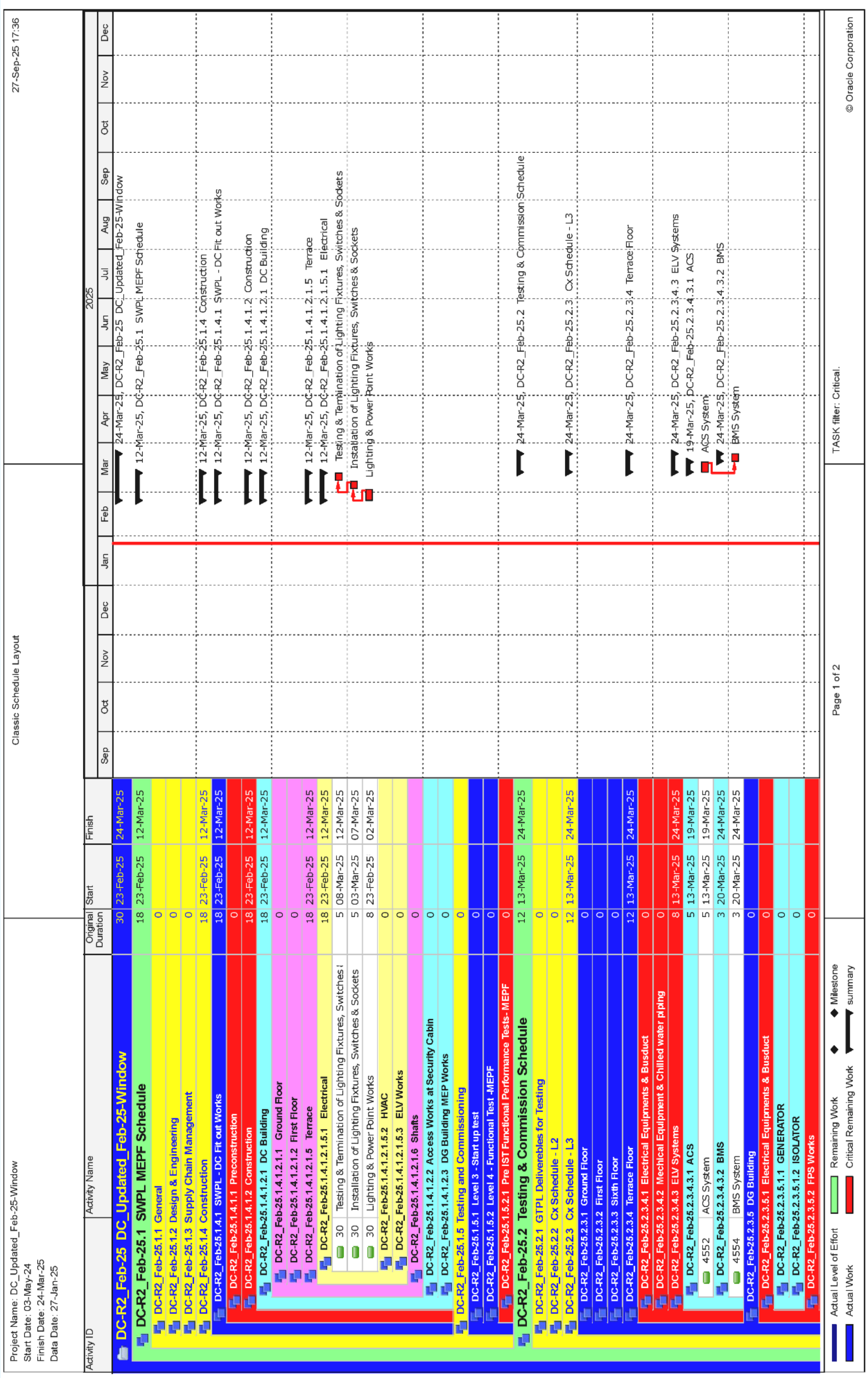



**Figure 2.** Critical activity of baseline schedule.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Activity Name
Original Duration
Start
Finish
2025
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
DC-R2_Feb-25 DC_Updated_Feb-25-Window 30 23-Feb-25 24-Mar-25
DC-R2_Feb-25.1 SWPL MEPF Schedule 18 23-Feb-25 12-Mar-25
DC-R2_Feb-25.1.1 General 0
DC-R2_Feb-25.1.2 Design & Engineering 0
DC-R2_Feb-25.1.3 Supply Chain Management 0
DC-R2_Feb-25.1.4 Construction 18 23-Feb-25 12-Mar-25
DC-R2_Feb-25.1.4.1 SWPL - DC Fit out Works 18 23-Feb-25 12-Mar-25
DC-R2_Feb-25.1.4.1.1 Preconstruction 0
DC-R2_Feb-25.1.4.1.2 Construction 18 23-Feb-25 12-Mar-25
DC-R2_Feb-25.1.4.1.2.1 DC Building 18 23-Feb-25 12-Mar-25
DC-R2_Feb-25.1.4.1.2.1.1 Ground Floor 0
DC-R2_Feb-25.1.4.1.2.1.2 First Floor 0
DC-R2_Feb-25.1.4.1.2.1.5 Terrace 18 23-Feb-25 12-Mar-25
DC-R2_Feb-25.1.4.1.2.1.5.1 Electrical 18 23-Feb-25 12-Mar-25
30 Testing & Termination of Lighting Fixtures, Switches & 5 08-Mar-25 12-Mar-25
30 Installation of Lighting Fixtures, Switches & Sockets 5 03-Mar-25 07-Mar-25
30 Lighting & Power Point Works 8 23-Feb-25 02-Mar-25
DC-R2_Feb-25.1.4.1.2.1.5.2 HVAC 0
DC-R2_Feb-25.1.4.1.2.1.5.3 ELV Works 0
DC-R2_Feb-25.1.4.1.2.1.6 Shafts 0
DC-R2_Feb-25.1.4.1.2.2 Access Works at Security Cabin 0
DC-R2_Feb-25.1.4.1.2.3 DG Building MEP Works 0
DC-R2_Feb-25.1.5 Testing and Commissioning 0
DC-R2_Feb-25.1.5.1 Level 3 - Start up test 0
DC-R2_Feb-25.1.5.2 Level 4 - Functional Test -MEPF 0
DC-R2_Feb-25.1.5.2.1 Pre IST Functional Performance Tests- MEPF 0
DC-R2_Feb-25.2 Testing & Commission Schedule 12 13-Mar-25 24-Mar-25
DC-R2_Feb-25.2.1 GTPL Deliverables for Testing 0
DC-R2_Feb-25.2.2 Cx Schedule - L2 0
DC-R2_Feb-25.2.3 Cx Schedule - L3 12 13-Mar-25 24-Mar-25
DC-R2_Feb-25.2.3.1 Ground Floor 0
DC-R2_Feb-25.2.3.2 First Floor 0
DC-R2_Feb-25.2.3.3 Sixth Floor 0
DC-R2_Feb-25.2.3.4 Terrace Floor 12 13-Mar-25 24-Mar-25
DC-R2_Feb-25.2.3.4.1 Electrical Equipments & Busduct 0
DC-R2_Feb-25.2.3.4.2 Mechical Equipment & Chilled water piping 0
DC-R2_Feb-25.2.3.4.3 ELV Systems 8 13-Mar-25 24-Mar-25
DC-R2_Feb-25.2.3.4.3.1 ACS 5 13-Mar-25 19-Mar-25
4552 ACS System 5 13-Mar-25 19-Mar-25
DC-R2_Feb-25.2.3.4.3.2 BMS 3 20-Mar-25 24-Mar-25
4554 BMS System 3 20-Mar-25 24-Mar-25
DC-R2_Feb-25.2.3.5 DG Building 0
DC-R2_Feb-25.2.3.5.1 Electrical Equipments & Busduct 0
DC-R2_Feb-25.2.3.5.1.1 GENERATOR 0
DC-R2_Feb-25.2.3.5.1.2 ISOLATOR 0
DC-R2_Feb-25.2.3.5.2 FPS Works 0
24-Mar-25, DC-R2_Feb-25 DC_Updated_Feb-25-Window
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12-Mar-25, DC-R2_Feb-25.1.4 Construction
12-Mar-25, DC-R2_Feb-25.1.4.1 SWPL - DC Fit out Works
12-Mar-25, DC-R2_Feb-25.1.4.1.2 Construction
12-Mar-25, DC-R2_Feb-25.1.4.1.2.1 DC Building
12-Mar-25, DC-R2_Feb-25.1.4.1.2.1.5 Terrace
12-Mar-25, DC-R2_Feb-25.1.4.1.2.1.5.1 Electrical
Testing & Termination of Lighting Fixtures, Switches & Sockets
Installation of Lighting Fixtures, Switches & Sockets
Lighting & Power Point Works
24-Mar-25, DC-R2_Feb-25.2 Testing & Commission Schedule
24-Mar-25, DC-R2_Feb-25.2.3 Cx Schedule - L3
24-Mar-25, DC-R2_Feb-25.2.3.4 Terrace Floor
24-Mar-25, DC-R2_Feb-25.2.3.4.3 ELV Systems
19-Mar-25, DC-R2_Feb-25.2.3.4.3.1 ACS
ACS System
24-Mar-25, DC-R2_Feb-25.2.3.4.3.2 BMS
BMS System
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
Milestone
summary
Page 1 of 2
TASK filter: Critical.
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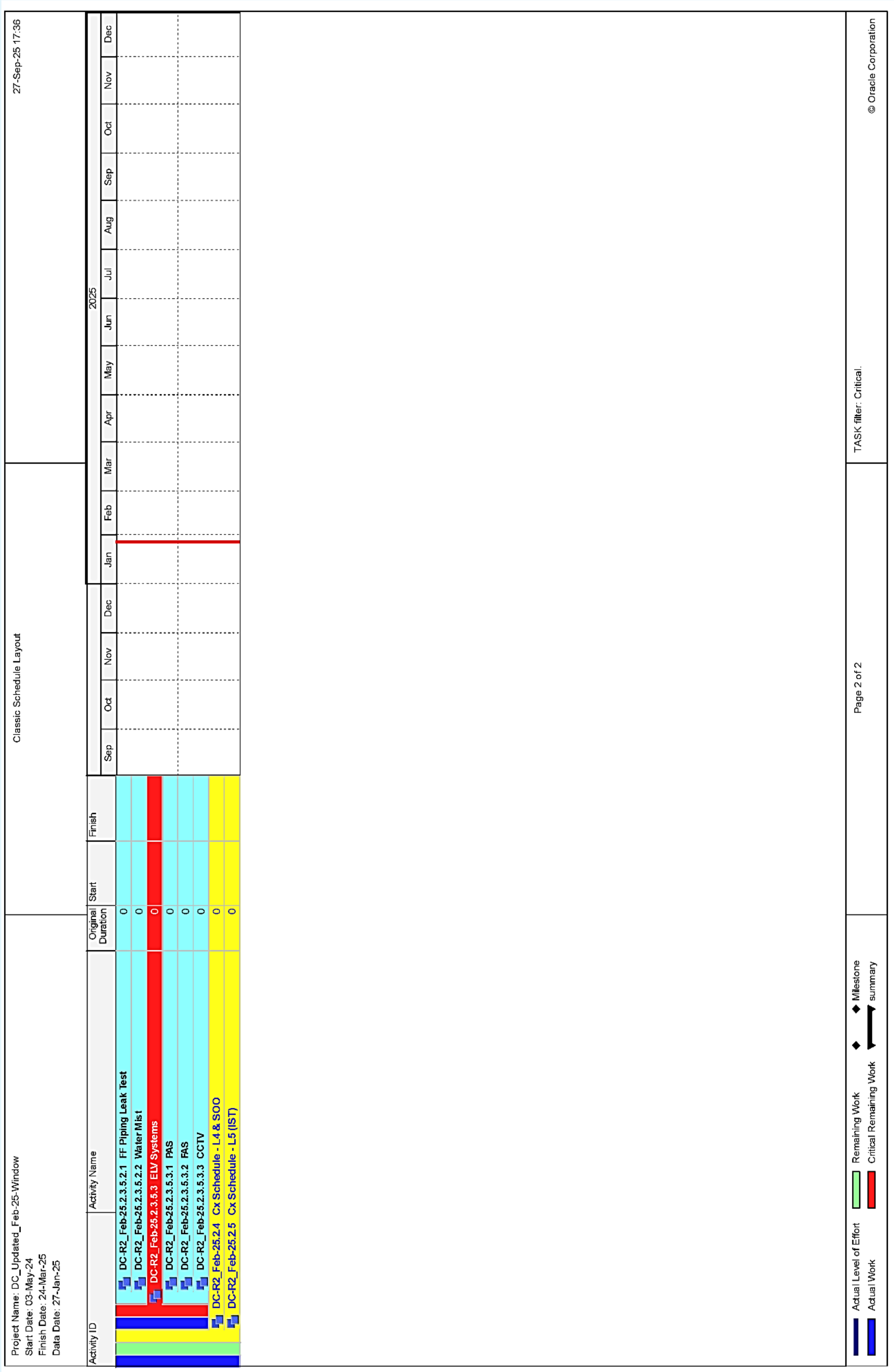
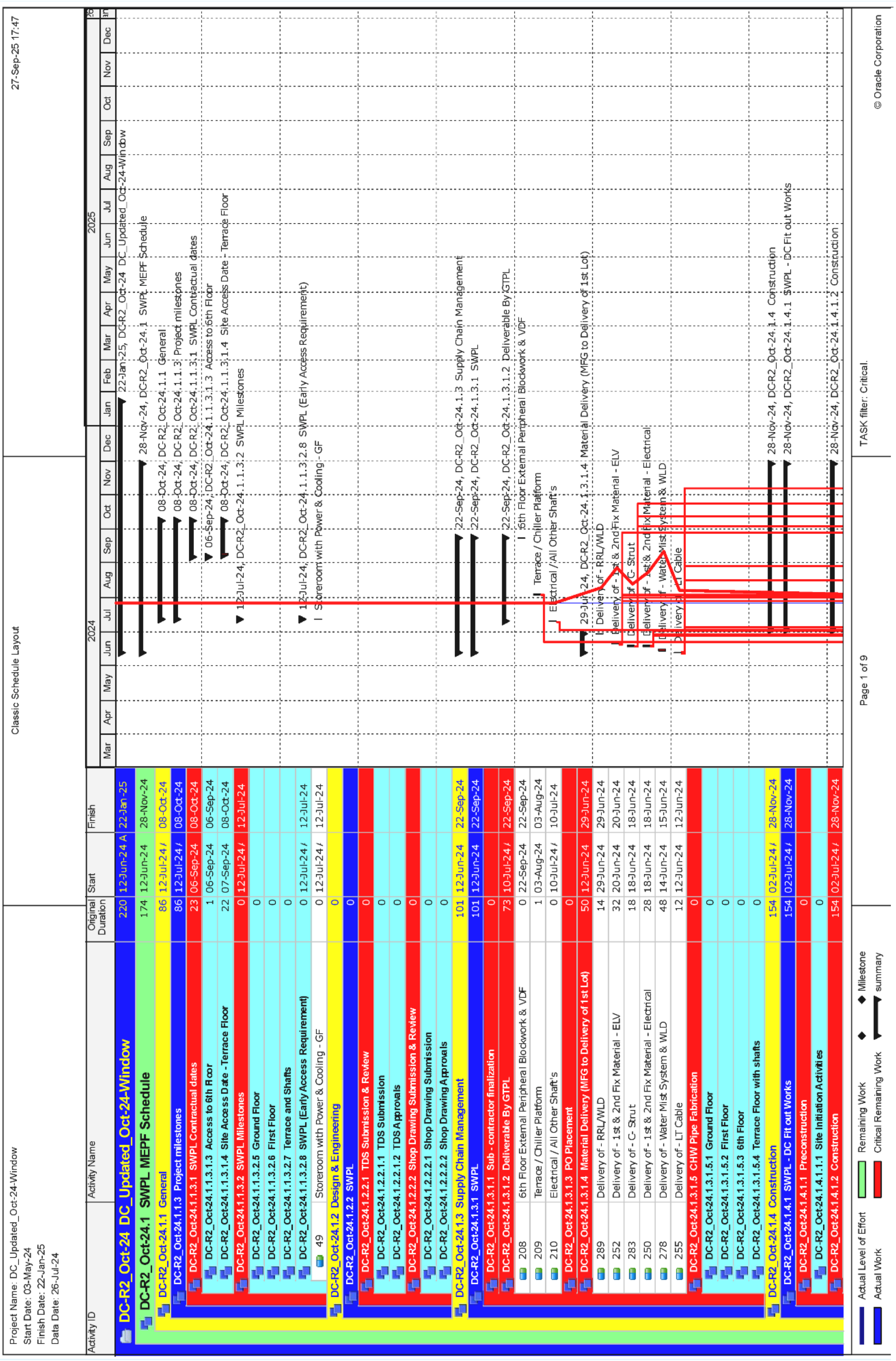



**Figure 3.** Critical activity of updated baseline schedule.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Activity Name
Original Duration
Start
Finish
DC-R2_Oct-24 DC_Updated_Oct-24-Window
DC-R2_Oct-24.1 SWPL MEPF Schedule
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© Oracle Corporation
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
Milestone
summary

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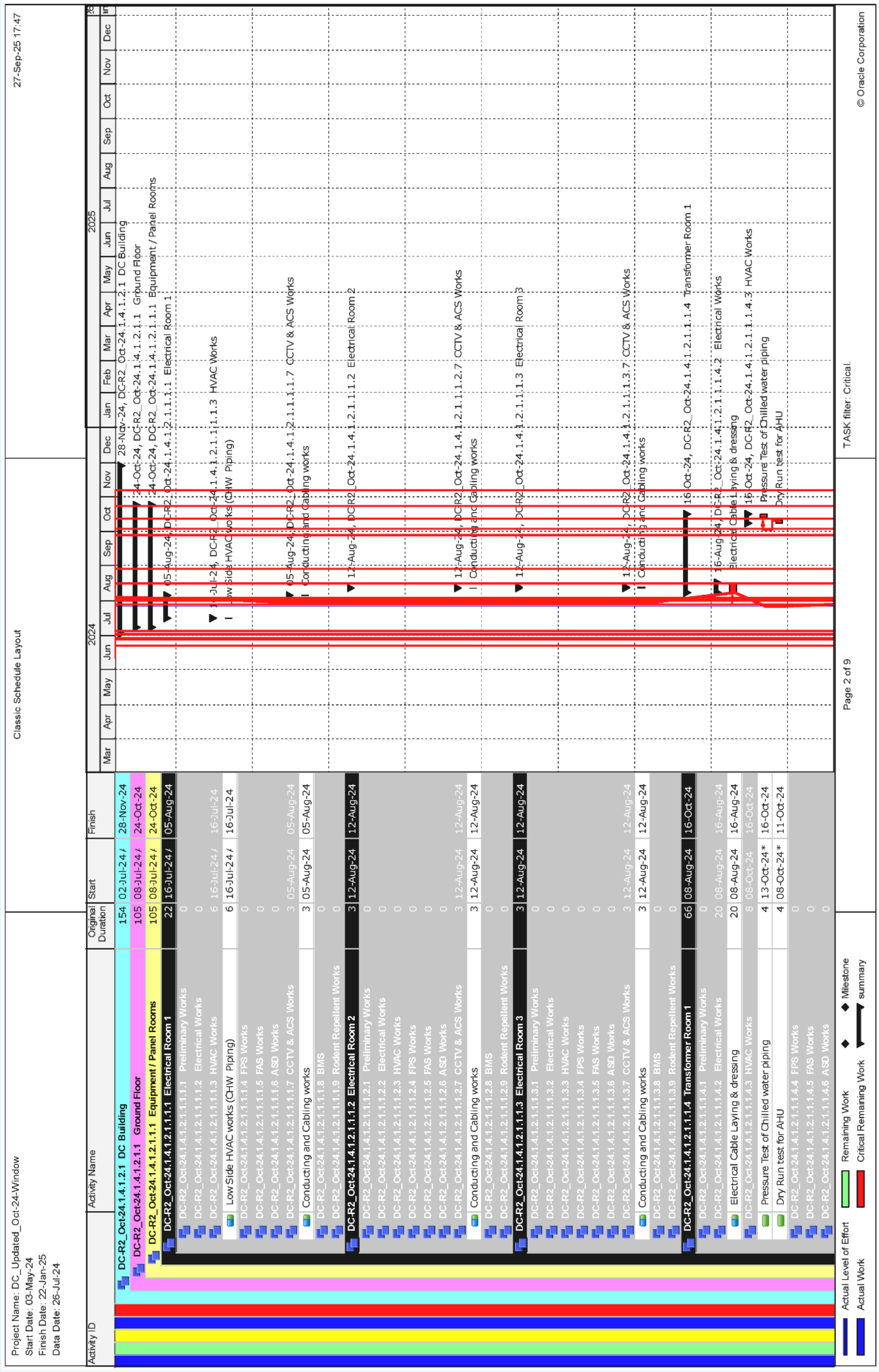
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Data Date: 26-Jul-24
Classic Schedule Layout
27-Sep-25 17:47
Activity ID
Activity Name
Original Duration
Start
Finish
DC-R2_Oct-24.1.4.1.2.1 DC Building 154 02-Jul-24 A 28-Nov-24
DC-R2_Oct-24.1.4.1.2.1.1 Ground Floor 105 08-Jul-24 A 24-Oct-24
DC-R2_Oct-24.1.4.1.2.1.1.1 Equipment / Panel Rooms 105 08-Jul-24 A 24-Oct-24
DC-R2_Oct-24.1.4.1.2.1.1.1.1 Electrical Room 1 22 16-Jul-24 A 05-Aug-24
Low Side HVAC works (CHW Piping) 6 16-Jul-24 A 16-Jul-24
Conducting and Cabling works 3 05-Aug-24 05-Aug-24
DC-R2_Oct-24.1.4.1.2.1.1.1.2 Electrical Room 2 3 12-Aug-24 12-Aug-24
Conducting and Cabling works 3 12-Aug-24 12-Aug-24
DC-R2_Oct-24.1.4.1.2.1.1.1.3 Electrical Room 3 3 12-Aug-24 12-Aug-24
Conducting and Cabling works 3 12-Aug-24 12-Aug-24
DC-R2_Oct-24.1.4.1.2.1.1.4 Transformer Room 1 66 08-Aug-24 16-Oct-24
Electrical Cable Laying & dressing 20 08-Aug-24 16-Aug-24
Pressure Test of Chilled water piping 4 13-Oct-24* 16-Oct-24
Dry Run test for AHU 4 08-Oct-24* 11-Oct-24
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
Milestone
summary
Page 2 of 9
TASK filter: Critical.
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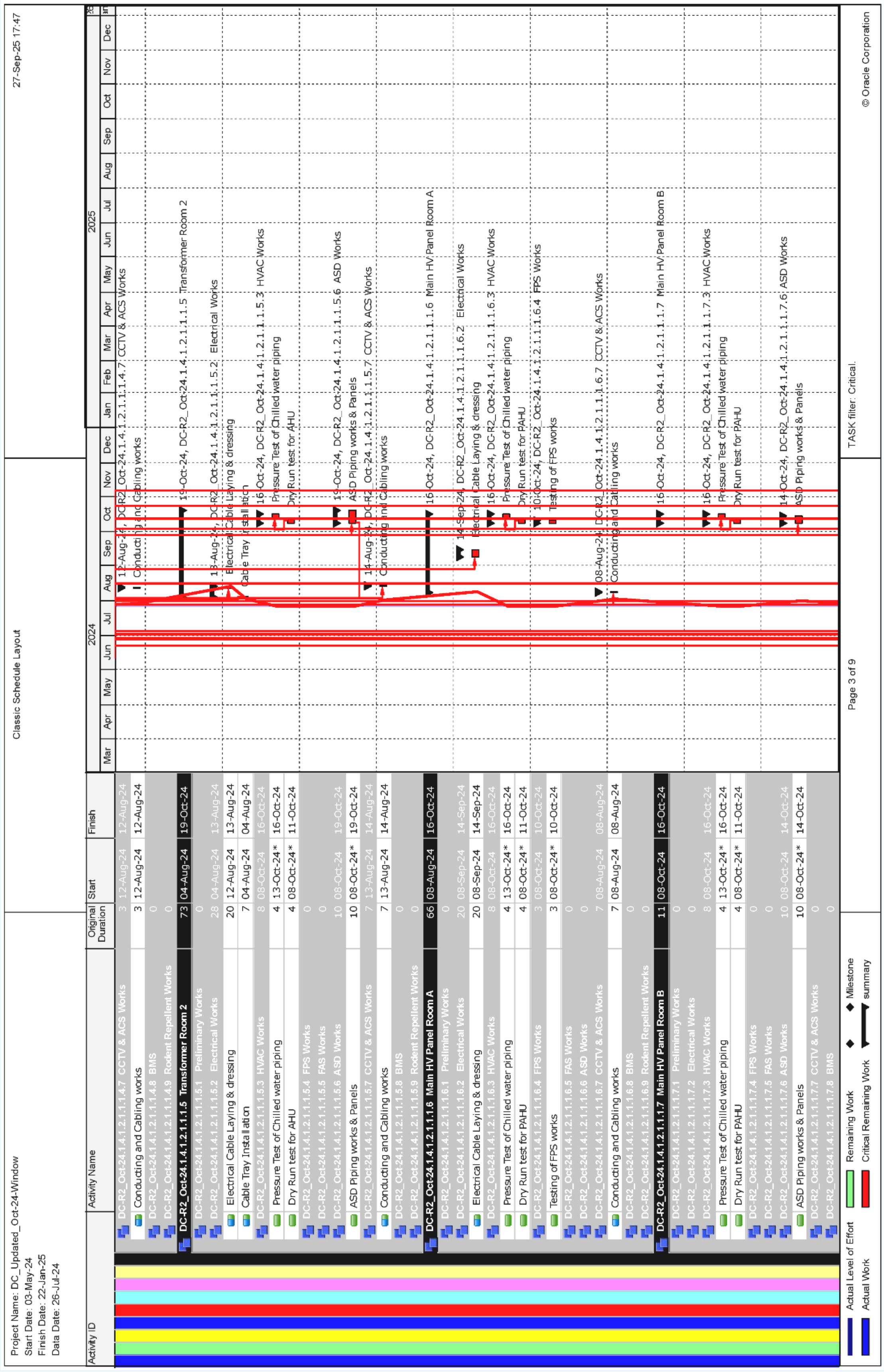
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27-Sep-25 17:47
Page 3 of 9
TASK filter: Critical.
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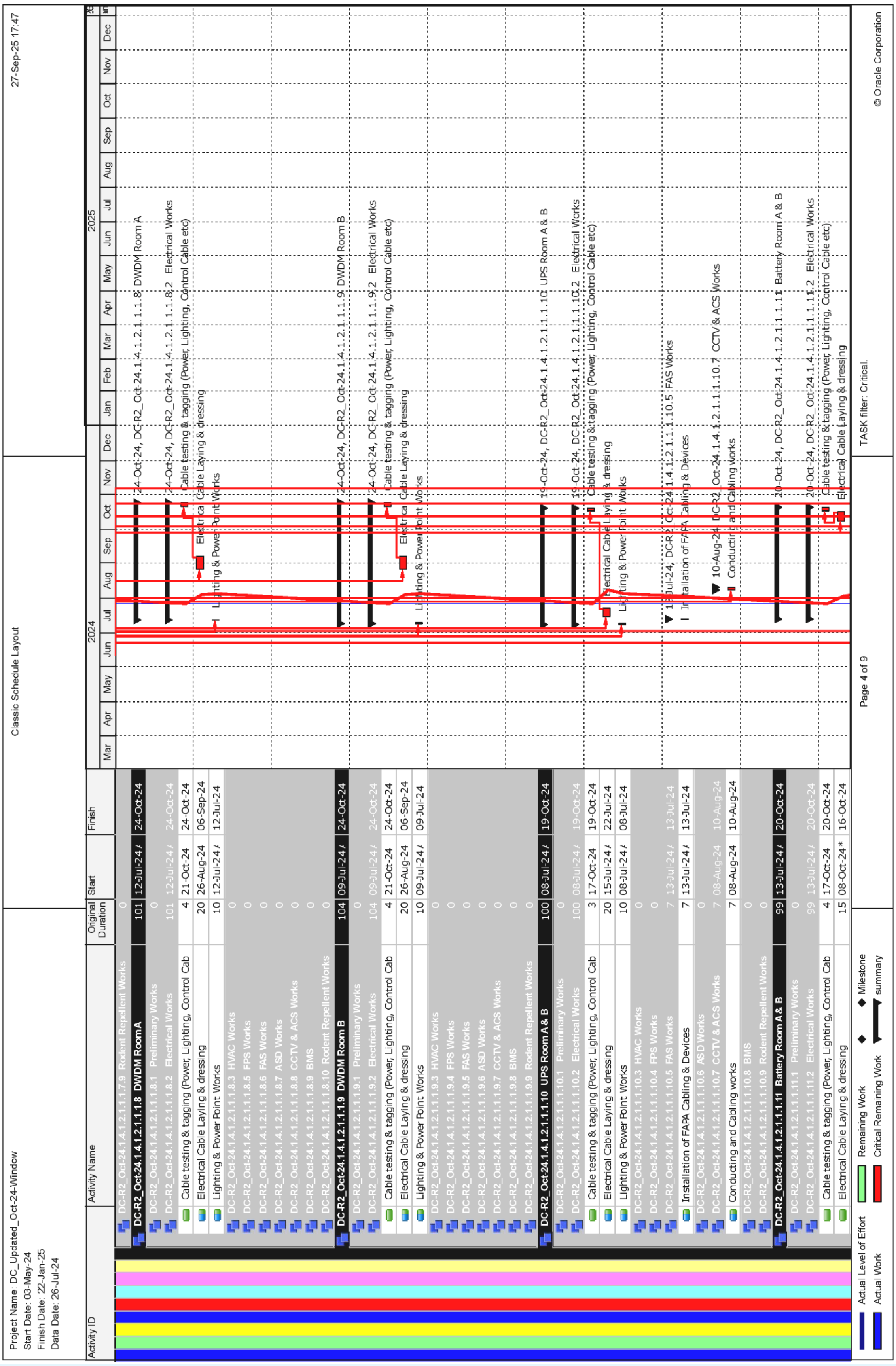
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Start Date: 03-May-24
Finish Date: 22-Jan-25
Data Date: 26-Jul-24
Classic Schedule Layout
27-Sep-25 17:47
Activity ID
Activity Name
Original Duration
Start
Finish
2024
2025
DC-R2_Oct-24.1.4.1.2.1.1.1.8 DWDM Room A
Cable testing & tagging (Power, Lighting, Control Cab
Electrical Cable Laying & dressing
Lighting & Power Point Works
DC-R2_Oct-24.1.4.1.2.1.1.1.9 DWDM Room B
DC-R2_Oct-24.1.4.1.2.1.1.1.10 UPS Room A & B
Installation of FAPA Cabling & Devices
Conducting and Cabling works
DC-R2_Oct-24.1.4.1.2.1.1.1.11 Battery Room A & B
Remaining Work
Critical Remaining Work
Actual Level of Effort
Actual Work
Milestone
summary
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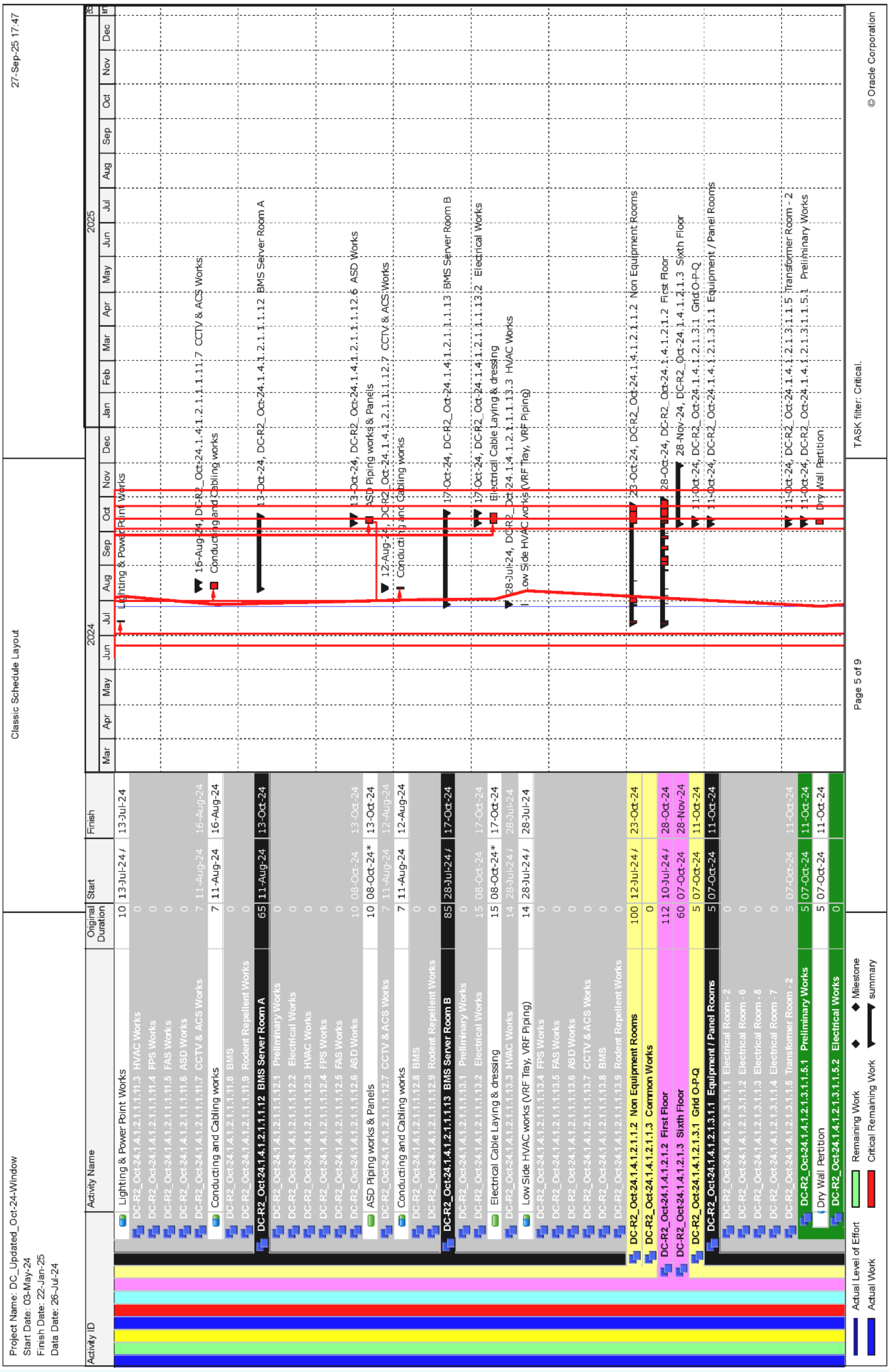
Journal of Construction Engineering, Technology & Management
Volume 16, Issue 1
ISSN: 2249-4723 (Online), ISSN: 2347-7253 (Print)

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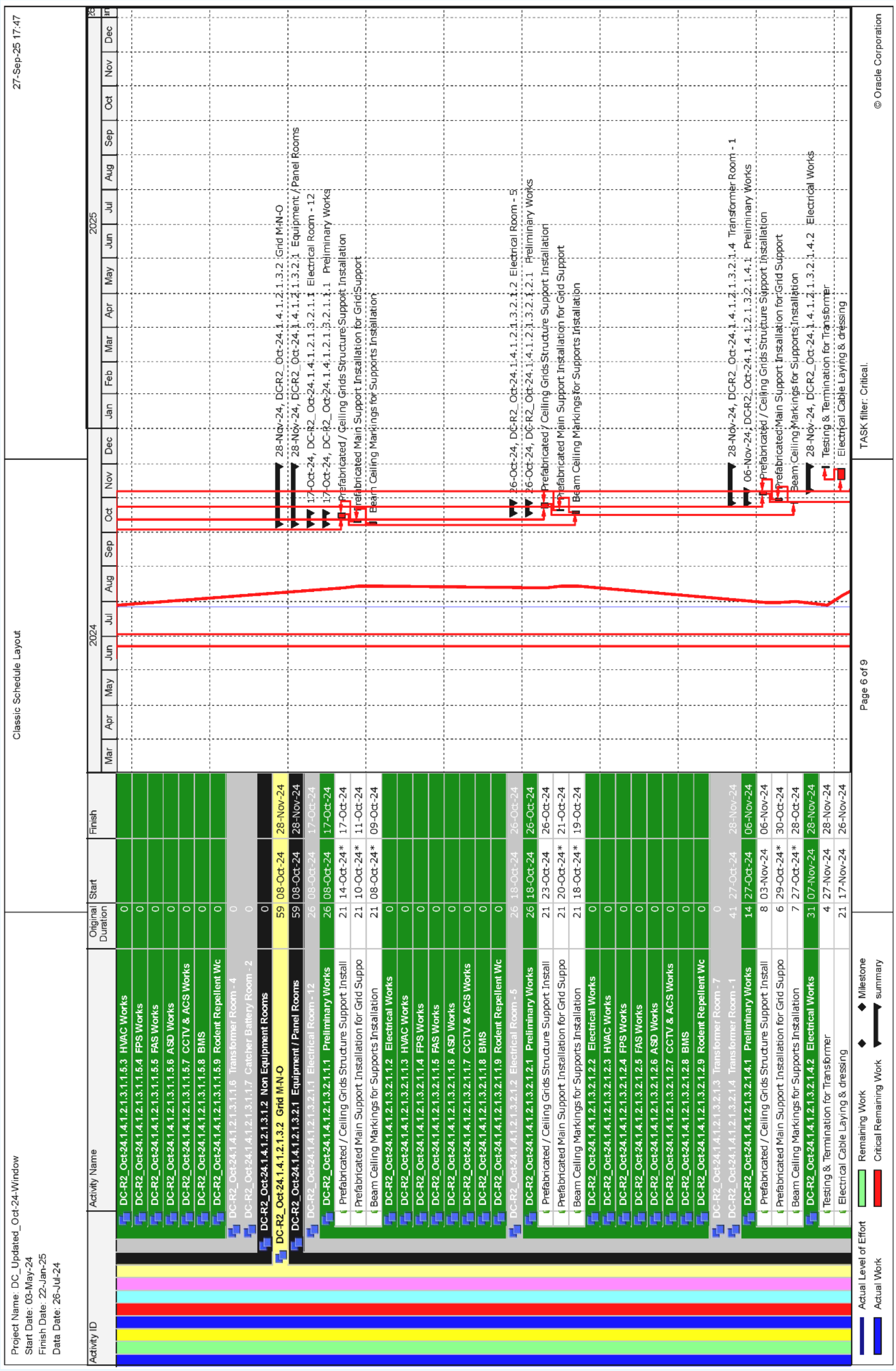

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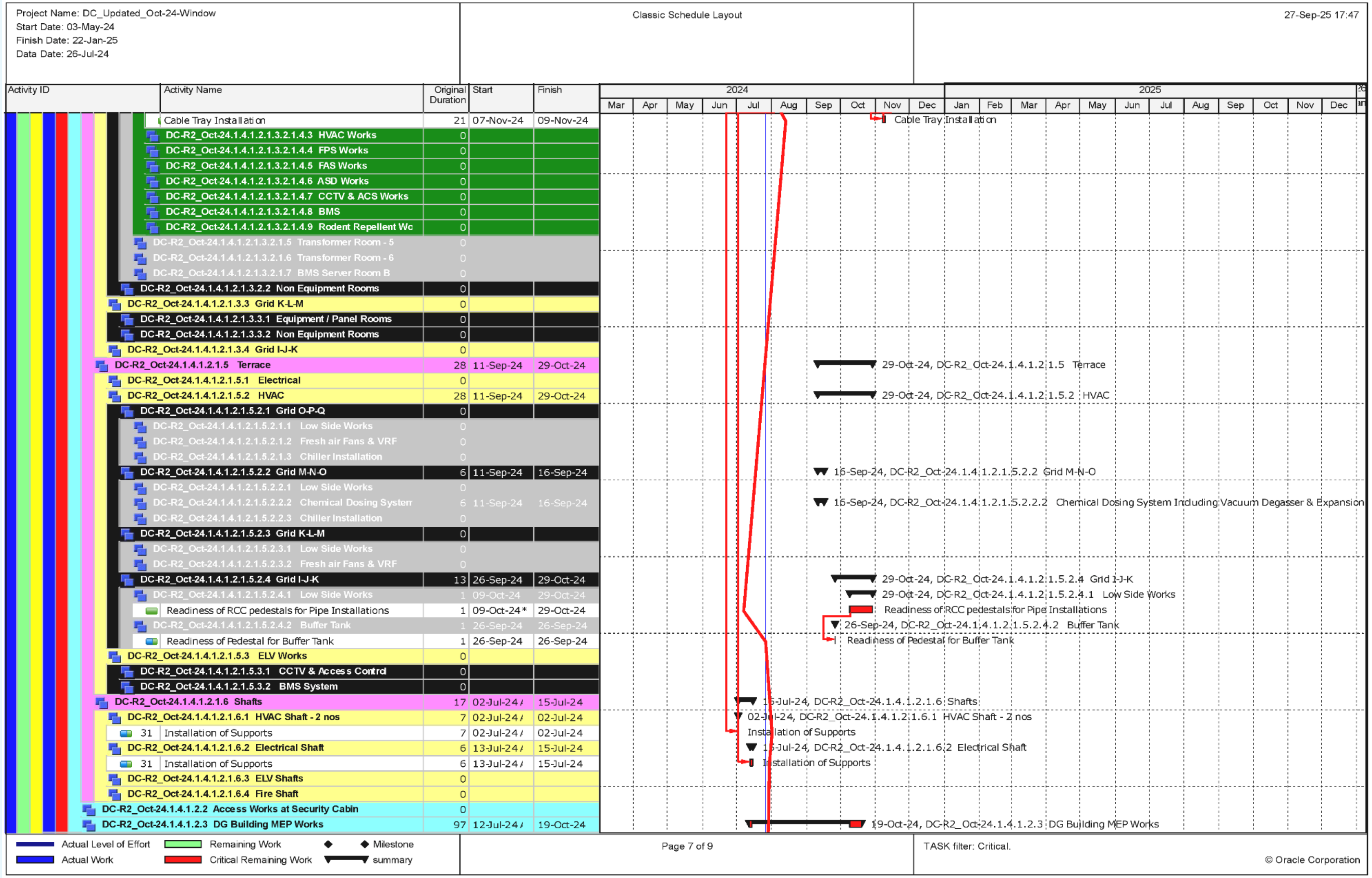


Project Name: DC_Updated_Oct-24-Window
Start Date: 03-May-24
Finish Date: 22-Jan-25
Data Date: 26-Jul-24

Classic Schedule Layout

27-Sep-25 17:47

| Activity Name | Original Duration | Start | Finish |
|---|---|---|---|
| Cable Tray Installation | 21 | 07-Nov-24 | 09-Nov-24 |
| DC-R2_Oct-24.1.4.1.2.1.3.2.1.4.3 HVAC Works | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.3.2.1.4.4 FPS Works | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.3.2.1.4.5 FAS Works | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.3.2.1.4.6 ASD Works | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.3.2.1.4.7 CCTV & ACS Works | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.3.2.1.4.8 BMS | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.3.2.1.4.9 Rodent Repellent Wo | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.3.2.1.5 Transformer Room - 5 | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.3.2.1.6 Transformer Room - 6 | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.3.2.1.7 BMS Server Room B | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.3.2.2 Non Equipment Rooms | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.3.3 Grid K-L-M | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.3.3.1 Equipment / Panel Rooms | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.3.3.2 Non Equipment Rooms | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.3.4 Grid I-J-K | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.5 Terrace | 28 | 11-Sep-24 | 29-Oct-24 |
| DC-R2_Oct-24.1.4.1.2.1.5.1 Electrical | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.5.2 HVAC | 28 | 11-Sep-24 | 29-Oct-24 |
| DC-R2_Oct-24.1.4.1.2.1.5.2.1 Grid O-P-Q | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.5.2.1.1 Low Side Works | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.5.2.1.2 Fresh air Fans & VRF | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.5.2.1.3 Chiller Installation | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.5.2.2 Grid M-N-O | 6 | 11-Sep-24 | 16-Sep-24 |
| DC-R2_Oct-24.1.4.1.2.1.5.2.2.1 Low Side Works | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.5.2.2.2 Chemical Dosing Systerr | 6 | 11-Sep-24 | 16-Sep-24 |
| DC-R2_Oct-24.1.4.1.2.1.5.2.2.3 Chiller Installation | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.5.2.3 Grid K-L-M | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.5.2.3.1 Low Side Works | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.5.2.3.2 Fresh air Fans & VRF | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.5.2.4 Grid I-J-K | 13 | 26-Sep-24 | 29-Oct-24 |
| DC-R2_Oct-24.1.4.1.2.1.5.2.4.1 Low Side Works | 1 | 09-Oct-24 | 29-Oct-24 |
| Readiness of RCC pedestals for Pipe Installations | 1 | 09-Oct-24* | 29-Oct-24 |
| DC-R2_Oct-24.1.4.1.2.1.5.2.4.2 Buffer Tank | 1 | 26-Sep-24 | 26-Sep-24 |
| Readiness of Pedestal for Buffer Tank | 1 | 26-Sep-24 | 26-Sep-24 |
| DC-R2_Oct-24.1.4.1.2.1.5.3 ELV Works | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.5.3.1 CCTV & Access Control | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.5.3.2 BMS System | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.6 Shafts | 17 | 02-Jul-24 A | 15-Jul-24 |
| DC-R2_Oct-24.1.4.1.2.1.6.1 HVAC Shaft - 2 nos | 7 | 02-Jul-24 A | 02-Jul-24 |
| 31 Installation of Supports | 7 | 02-Jul-24 A | 02-Jul-24 |
| DC-R2_Oct-24.1.4.1.2.1.6.2 Electrical Shaft | 6 | 13-Jul-24 A | 15-Jul-24 |
| 31 Installation of Supports | 6 | 13-Jul-24 A | 15-Jul-24 |
| DC-R2_Oct-24.1.4.1.2.1.6.3 ELV Shafts | 0 | | |
| DC-R2_Oct-24.1.4.1.2.1.6.4 Fire Shaft | 0 | | |
| DC-R2_Oct-24.1.4.1.2.2 Access Works at Security Cabin | 0 | | |
| DC-R2_Oct-24.1.4.1.2.3 DG Building MEP Works | 97 | 12-Jul-24 A | 19-Oct-24 |



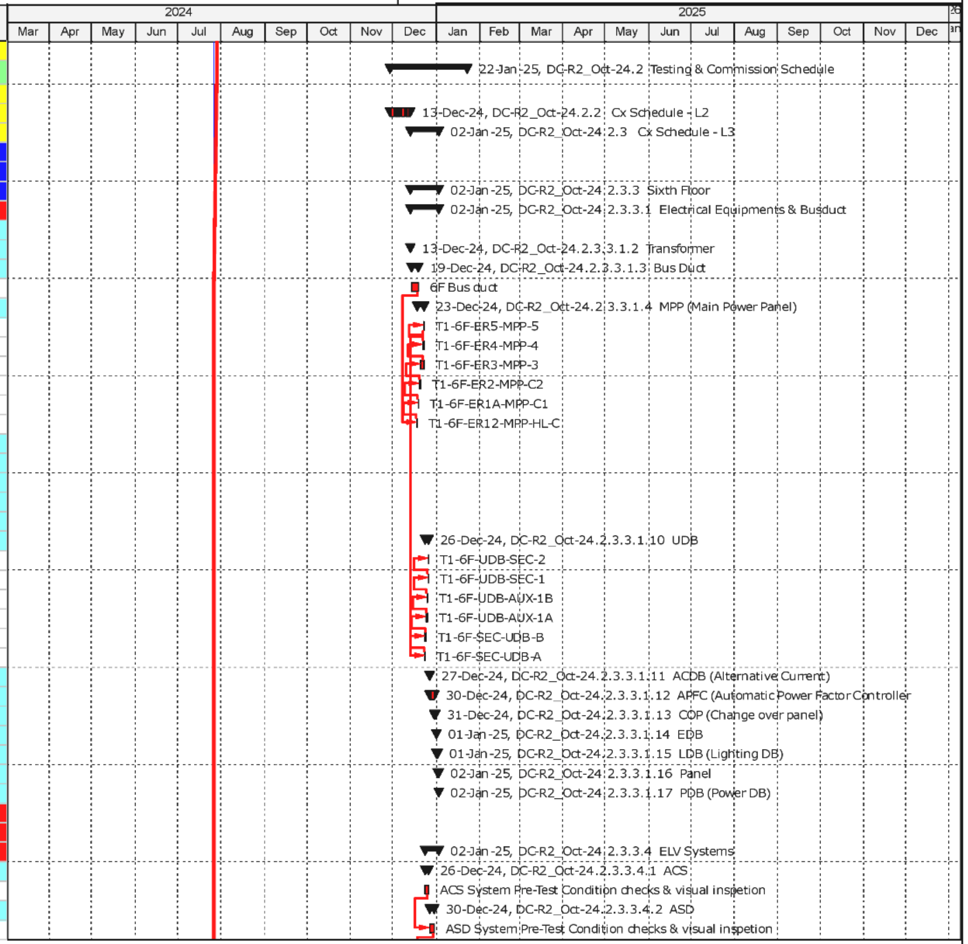
Contd.

Project Name: DC_Updated_Oct-24-Window
Start Date: 03-May-24
Finish Date: 22-Jan-25
Data Date: 26-Jul-24

Classic Schedule Layout

27-Sep-25 17:47

| Activity ID | Activity Name | Original Duration | Start | Finish |
|---|---|---|---|---|
| DC-R2_Oct-24.1.5 | Testing and Commissioning | 0 | | |
| DC-R2_Oct-24.2 | Testing & Commission Schedule | 55 | 29-Nov-24 | 22-Jan-25 |
| DC-R2_Oct-24.2.1 | GTPL Deliverebles for Testing | 0 | | |
| DC-R2_Oct-24.2.2 | Cx Schedule - L2 | 15 | 29-Nov-24 | 13-Dec-24 |
| DC-R2_Oct-24.2.3 | Cx Schedule - L3 | 21 | 13-Dec-24 | 02-Jan-25 |
| DC-R2_Oct-24.2.3.1 | Ground Floor | 0 | | |
| DC-R2_Oct-24.2.3.2 | First Floor | 0 | | |
| DC-R2_Oct-24.2.3.3 | Sixth Floor | 21 | 13-Dec-24 | 02-Jan-25 |
| DC-R2_Oct-24.2.3.3.1 | Electrical Equipments & Busduct | 21 | 13-Dec-24 | 02-Jan-25 |
| DC-R2_Oct-24.2.3.3.1.1 | HVSB (RMU) | 0 | | |
| DC-R2_Oct-24.2.3.3.1.2 | Transformer | 1 | 13-Dec-24 | 13-Dec-24 |
| DC-R2_Oct-24.2.3.3.1.3 | Bus Duct | 4 | 14-Dec-24 | 19-Dec-24 |
| 4372 | 6F Bus duct | 4 | 14-Dec-24 | 19-Dec-24 |
| DC-R2_Oct-24.2.3.3.1.4 | MPP (Main Power Panel) | 4 | 18-Dec-24 | 23-Dec-24 |
| 4379 | T1-6F-ER5-MPP-5 | 1 | 23-Dec-24 | 23-Dec-24 |
| 4378 | T1-6F-ER4-MPP-4 | 1 | 22-Dec-24 | 23-Dec-24 |
| 4377 | T1-6F-ER3-MPP-3 | 1 | 21-Dec-24 | 23-Dec-24 |
| 4376 | T1-6F-ER2-MPP-C2 | 1 | 20-Dec-24 | 20-Dec-24 |
| 4375 | T1-6F-ER1A-MPP-C1 | 1 | 19-Dec-24 | 19-Dec-24 |
| 4374 | T1-6F-ER12-MPP-HL-C | 1 | 18-Dec-24 | 18-Dec-24 |
| DC-R2_Oct-24.2.3.3.1.5 | UIB (UPS Input Board) | 0 | | |
| DC-R2_Oct-24.2.3.3.1.6 | UPS | 0 | | |
| DC-R2_Oct-24.2.3.3.1.7 | Battery | 0 | | |
| DC-R2_Oct-24.2.3.3.1.8 | UOB (UPS Output Board) | 0 | | |
| DC-R2_Oct-24.2.3.3.1.9 | PDU | 0 | | |
| DC-R2_Oct-24.2.3.3.1.10 | UDB | 3 | 24-Dec-24 | 26-Dec-24 |
| 4409 | T1-6F-UDB-SEC-2 | 1 | 26-Dec-24 | 26-Dec-24 |
| 4408 | T1-6F-UDB-SEC-1 | 1 | 26-Dec-24 | 26-Dec-24 |
| 4407 | T1-6F-UDB-AUX-1B | 1 | 25-Dec-24 | 25-Dec-24 |
| 4406 | T1-6F-UDB-AUX-1A | 1 | 25-Dec-24 | 25-Dec-24 |
| 4405 | T1-6F-SEC-UDB-B | 1 | 24-Dec-24 | 24-Dec-24 |
| 4404 | T1-6F-SEC-UDB-A | 1 | 24-Dec-24 | 24-Dec-24 |
| DC-R2_Oct-24.2.3.3.1.11 | ACDB (Alternative Current) | 1 | 27-Dec-24 | 27-Dec-24 |
| DC-R2_Oct-24.2.3.3.1.12 | APFC (Automatic Power Factor Controller | 1 | 27-Dec-24 | 30-Dec-24 |
| DC-R2_Oct-24.2.3.3.1.13 | COP (Change over panel) | 2 | 30-Dec-24 | 31-Dec-24 |
| DC-R2_Oct-24.2.3.3.1.14 | EDB | 1 | 01-Jan-25 | 01-Jan-25 |
| DC-R2_Oct-24.2.3.3.1.15 | LDB (Lighting DB) | 1 | 01-Jan-25 | 01-Jan-25 |
| DC-R2_Oct-24.2.3.3.1.16 | Panel | 1 | 02-Jan-25 | 02-Jan-25 |
| DC-R2_Oct-24.2.3.3.1.17 | PDB (Power DB) | 1 | 02-Jan-25 | 02-Jan-25 |
| DC-R2_Oct-24.2.3.3.2 | Mechical Equipment & Chilled water piping | 0 | | |
| DC-R2_Oct-24.2.3.3.3 | FPS Works | 0 | | |
| DC-R2_Oct-24.2.3.3.4 | ELV Systems | 10 | 24-Dec-24 | 02-Jan-25 |
| DC-R2_Oct-24.2.3.3.4.1 | ACS | 3 | 24-Dec-24 | 26-Dec-24 |
| 4502 | ACS System Pre-Test Condition checks & visual inspeti | 3 | 24-Dec-24 | 26-Dec-24 |
| DC-R2_Oct-24.2.3.3.4.2 | ASD | 2 | 27-Dec-24 | 30-Dec-24 |
| 4504 | ASD System Pre-Test Condition checks & visual inspet | 2 | 27-Dec-24 | 30-Dec-24 |




Actual Level of Effort | Remaining Work | ◆ Milestone
Actual Work | Critical Remaining Work | summary

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TASK filter: Critical.

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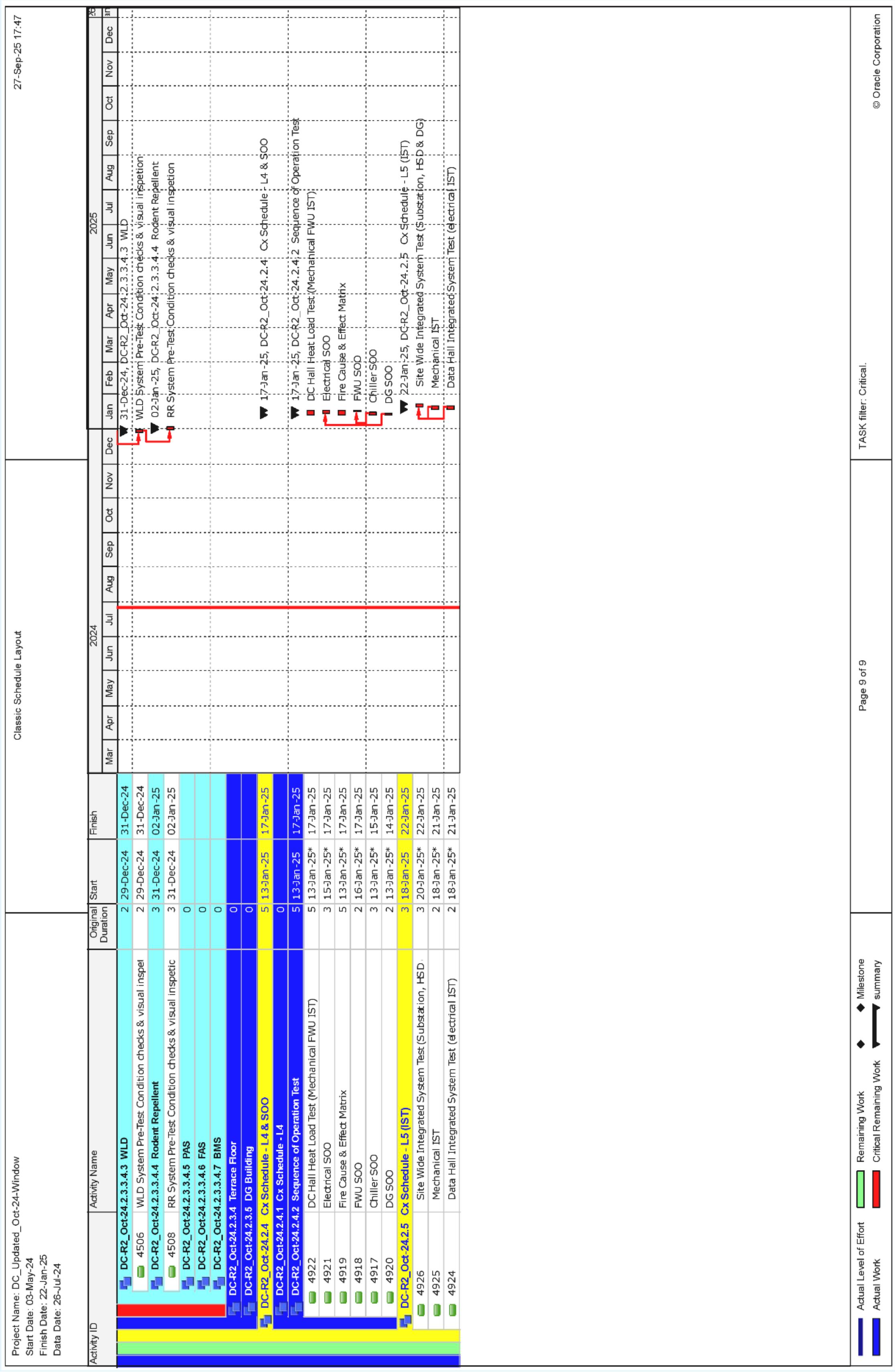

**Figure 4.** Critical activity of final updated baseline schedule comparative analysis table.

**Table 1.** Comparison of TSWA and IAPA.

| Criteria | Time slice windows analysis (TSWA) | Impacted as-planned analysis (IAPA) |
|---|---|---|
| Data requirement | High (monthly update) | Low (baseline only) |
| Accuracy | High (reflects actual progress) | Moderate (ignores real-time changes) |
| Complexity | High (requires detailed analysis) | Low (simpler modelling) |
| Legal acceptability | Strong (based on real data) | Moderate (can be challenged) |
| Critical path sensitivity | Dynamic | Static |
| Use case | Retrospective analysis | Prospective claims |

***Application of TSWA***

- Monthly schedule updates analyzed.
- Identified delays due to late equipment delivery and design changes.
- Critical path shifted from MEP works of ground floor (GF) to MEP works of 1F and system integration in month 3.
- Resulted in 150-day compensable delay attributed to client-side changes.

***Application of IAPA***

- Delay events (design changes, procurement delays, and logistics delays) were inserted into the baseline.
- Simulated impact showed a 120-day delay.
- Ignored acceleration efforts and resequencing done on-site.
- Less accurate but useful for early-stage claim preparation.

## RESULT AND DISCUSSION

### Baseline Schedule Preparation

*With milestones:* A comprehensive baseline schedule was developed, incorporating key project milestones. These milestones served as control points to monitor progress and assess deviations throughout the project lifecycle.

*Without milestones:* A parallel baseline schedule was prepared by excluding milestone constraints to evaluate the pure activity flow and identify flexibility in task sequencing and resource allocation.

***Schedule Updates Based on Data Dates***

The project schedule was periodically updated using the latest data dates to reflect the actual progress.

Each update captured completed activities, revised durations, and adjusted start/finish dates, ensuring alignment with real-time execution.

***Delay Analysis Within Windows***

The schedule was segmented into discrete analysis windows to isolate and examine delays.

Within each window, delays were categorized (critical path, non-critical, excusable, and compensable), and their root causes were identified.

This granular approach enabled targeted mitigation strategies and accountability tracking.

***Cumulative Impact Analysis***

The cumulative effect of delays across all windows was quantified to assess the overall impact on project completion.

The final forecasted completion date was compared with the original baseline, revealing a net delay of 150 days.

 

The analysis highlighted key contributors to scheduling slippage and informed recommendations for recovery actions.

## CONCLUSION

For data center construction projects, TSWA is recommended for its accuracy and legal robustness. IAPA can serve as a preliminary tool but should be supplemented with dynamic methods for final claims. Project teams should prioritize schedule integrity and documentation to enable effective delay analysis. Implementing a comprehensive delay management strategy that incorporates both proactive and reactive measures is crucial for successful project delivery. Regular schedule updates, risk assessments, and stakeholder communication can help mitigate potential delays before they occur. In the event of unavoidable delays, having a well-documented project history and utilizing advanced delay analysis techniques will strengthen the position of the affected party in potential disputes or claims.

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