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Assessing the Impact of Microsoft Project on Planning and Execution of Electrical Infrastructure Project: A Case Study on Chemical Earthing in Jamshedpur

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ABSTRACT - The study evaluates the role of Microsoft Project in the planning and execution of electrical infrastructure work, using a chemical earthing project undertaken by SMG Electrical at the N-Town VIP section of Tata Main Hospital, Jamshedpur. The moto was to assess how MSP contributes to more accurate cost estimation, realistic scheduling, and structured resource allocation in small to medium-scale electrical projects. The analysis draws on actual site records and Microsoft Project outputs, including cost tables, Gantt charts, and resource reports, resource work overview report.

The comparison between planned values and project outcomes shows that Microsoft Project upgrade the clarity and precision of project planning. The baseline cost generated through MSP ₹188,600 was almost identical to the actual implementation cost (₹187,910), resulting in a very small variance of ₹690. The activities were completed in line with the planned schedule, and no delays were recorded. Resource deployment was also consistent with the MSP plan, with all labor categories closing the project with zero pending work hours. A very important observation is the difference between MSP's calculated cost and the contractor's billed amount ₹218,660, which underlines the usefulness of MSP as a tool for cross-verification and cost control.

Our findings suggest that MSP offers a structured and dependable approach for managing electrical fieldwork by supporting better cost control, schedule observance, and resource coordination. This study also indicates that same projects could benefit from wider integration of MSP with digital monitoring and cost management systems to further improve accuracy and transparency.

1. INTRODUCTION

1.1 Background

The electrical and infrastructure projects often face delays, cost overruns, and resource imbalance due to weak planning and lacking monitoring systems [1],[2]. These issues underline the need for structured project management practices that can support predictable and transparent execution. Tools such as Oracle Primavera P6 and Microsoft Project have become important in this context. Primavera applies methods like the Critical Path Method and Enterprise Project Structure for schedule and resource control, improving overall project performance [3]. Despite such advances, studies continue to note that insufficient planning remains a major contributor to overruns in construction and electrical works [4].

Earthing systems play a central role in electrical infrastructure by safely dissipating fault currents and preventing hazardous voltages. Failures caused by high soil resistivity and poor earthing arrangements have led to operational issues in utilities such as the Al Ain Distribution Company, underscoring the need for reliable grounding practices [5],[6]. Chemical earthing has gained very importance in such conditions because grounding enhancing materials maintain lower and more consistent resistance levels across varying soil properties [8].

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1.2 Planning and Project Management Tools

Project planning software supports scheduling, resource allocation, and monitoring. Primavera P6 is broadly used in high-value and technically complex projects due to its advanced tracking and performance-measurement tools [3],[4]. MSP, however, is increasingly preferred for medium-scale and field-based projects because it offers a simpler interface, efficient resource leveling, and effective progress tracking [1],[2]. Its flexibility makes MSP suitable for case studies focusing on project execution and cost control.

1.3 Chemical Earthing in Electrical Infrastructure

Conventional earthing systems often show inconsistent performance where soil resistivity is high, creating reliability and safety concerns [5]. Chemical earthing addresses these challenges by using conductive backfills that stabilize resistance and enhance current dissipation, making it suitable for industrial regions with varied soil conditions such as Jamshedpur [6],[8].

1.4 Integration of MSP with Earthing Works

While chemical earthing ensures technical reliability, its successful implementation depends on coordinated planning. MSP supports this by helping track material procurement, manpower scheduling, activity sequencing, and cost flow. Integrating MSP into earthing work improves schedule adherence and financial control, reducing the likelihood of delays and overruns [1],[3].

1.5 Aim of the Study

The aim of this study is to evaluate the impact of Microsoft Project (MSP) on the planning and execution of chemical earthing work in Jamshedpur. The study focuses on:

- Assessing MSP's role in scheduling, resource coordination, and cost control.
- Evaluating the performance of chemical earthing in variable soil conditions.
- Proposing a combined framework linking MSP-based planning with field execution of grounding systems.

2. LITERATURE REVIEW:

2.1 Literature Review

Project-planning studies consistently show that software-supported scheduling improves accuracy and coordination. Research on multi-project environments demonstrated that resource leveling and what-if simulations reduce demand peaks and help managers select feasible timelines [1]. Case-based work using Microsoft Project (MSP) reports clearer CPM scheduling, better visibility of labor and materials, and improved forecasting when compared with manual planning methods [2]. Primavera P6 studies similarly show stronger workload balance, earlier detection of conflicts, and reduced delay risk through CPM and EPS structures [3]. Broader reviews confirm that weak planning and poor monitoring remain major causes of overruns, and that digital tools substantially reduce coordination errors [4].

In electrical infrastructure, studies highlight the safety implications of poor grounding. Research on earthing design stresses soil resistivity testing, proper grid sizing, and the use of enhanced backfills to maintain safe step and touch potentials [5],[9]. Distribution-network studies directly link grounding adequacy to system reliability and mis-operations [6]. Work on chemical earthing and ground-enhancement materials (GEMs) shows that performance varies with moisture retention, corrosion behaviors, and installation quality, and that engineered materials generally provide more stable resistance across seasons [8],[12],[15]. Several authors also recommend selective use of enhancement materials and adherence to proper installation practices for long-term performance [11],[13],[17] . Comparative studies on project-management tools show that structured tracking of baselines, actuals, and earned-value metrics reduces delay and financial loss in construction projects [7]. Primavera-based evaluations highlight strengths in predicting cost deviations, although many studies focus mainly on time–cost interactions without integrating risk [14]. MSP-specific research shows consistent benefits in dependency management, progress tracking, schedule crashing, and productivity improvements, particularly for small- to medium-scale projects where usability and quick adoption are essential [16],[18],[19],[20]. Recent reviews emphasize MSP's overall suitability for project-level planning and its growing relevance in electrical and construction workflows [10].

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2.2 Gap Identification

Studies on project-management tools show clear benefits for scheduling and cost control, but most work focuses on Primavera P6. Research on chemical earthing, meanwhile, deals with soil behavior, grounding design, and enhancement materials, but does not explain how these tasks are planned, resourced, or monitored within an actual project. The two research streams operate separately. Evidence on using Microsoft Project (MSP) for electrical-infrastructure activities—especially earthing—is almost absent. No studies link MSP's WBS structure, cost baselines, or progress tracking with the technical steps of chemical earthing. Case-based work from Indian urban settings like Jamshedpur is entirely missing, even though soil conditions, procurement delays, and field practices strongly affect outcomes. The core gap is the lack of an integrated framework that connects chemical-earthing workflows (soil testing, material selection, installation, QA, and maintenance) with MSP-based planning elements such as schedule logic, resource/cost baselines, and earned-value indicators. Prior studies also do not provide planned-versus-actual comparisons or quantify time, cost, and reliability impacts for earthing projects. This study addresses the gap by applying MSP to a real chemical-earthing project in Jamshedpur and evaluating its effects on schedule adherence, resource use, and cost variance.

2.3 Objectives

2.3.1 Primary Objective

To evaluate how Microsoft Project (MSP) influences the planning and execution of electrical infrastructure projects, with a specific focus on chemical earthing in Jamshedpur.

2.3.2 Secondary Objectives

- To identify key challenges in planning and executing electrical-infrastructure works, especially chemical earthing.
- To assess the effectiveness of MSP in scheduling, resource allocation, and cost management.
- To examine how MSP supports monitoring and control through time and cost performance indicators.
- To understand how technical requirements of chemical earthing can be incorporated into MSP-based planning workflows.
- To develop a structured approach for improving the planning and execution of chemical earthing projects using MSP.

3. PROBLEM STATEMENT

Electrical infrastructure in cities like Jamshedpur is expanding quickly, yet projects continue to face delays, cost overruns, and poor resource management due to traditional planning methods that do not properly connect scheduling with material and cost allocation [3],[2],[1]. Earthing systems are especially critical, and research shows that inadequate grounding can create unsafe voltages and equipment failures [5],[6]. Chemical earthing offers more stable resistance under varied soil conditions, but its integration into structured project planning remains largely unexplored [8],[15].

Project-management tools such as Microsoft Project (MSP) provide strong scheduling, resource, and cost-control features, but their application in electrical-infrastructure projects—particularly chemical earthing—has received very limited academic attention [4]. As a result, there is a clear gap in combining technical earthing practices with software-based planning and monitoring.

This study aims to address this gap by evaluating how MSP can improve planning, execution, and material-cost alignment for chemical-earthing works in Jamshedpur.

4. METHODOLOGY

4.1 Research Design

This study uses a mixed-methods case study approach to assess how Microsoft Project (MSP) supports the planning and execution of a chemical-earthing project in Jamshedpur. Quantitative project data (time, cost, resources) are combined with qualitative insights from engineers and field observations.

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4.2 Data Collection

4.2.1 Primary Data

- MSP project schedules including WBS, task links, and critical-path identification.
- Resource and cost inputs for labor, electrodes, chemical backfill, and related materials.
- Feedback from site engineers, project managers, and electrical contractors.
- Field observations on soil conditions, installation challenges, and handling delays.

4.2.2 Secondary Data

- Project documents, tender specifications, and government guidelines.
- Literature on MSP, Primavera P6, and chemical-earthing practices.

4.3 Tools and Techniques

- MSP for scheduling, resource planning, cost estimation, and performance tracking (SPI, CPI).
- Comparative analysis of baseline versus actual progress to assess delay reduction and cost control.
- CPM for timeline analysis and EVM for cost–time performance.
- Earthing assessment using IS 3043 and relevant IEEE grounding guidelines.

4.4 Data Analysis

4.4.1 Quantitative Analysis

- Planned–versus–actual performance tracking in MSP.
- Calculation of SPI, CPI, and budget variance.
- Assessment of material usage and cost deviations.

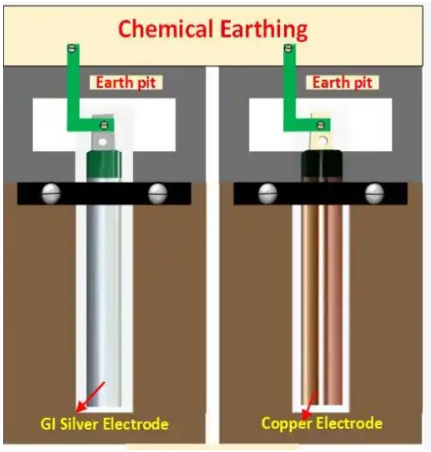
4.4.2 Qualitative Analysis

- Thematic coding of interviews and site notes to identify execution challenges.
- Incorporation of expert feedback to refine MSP models.

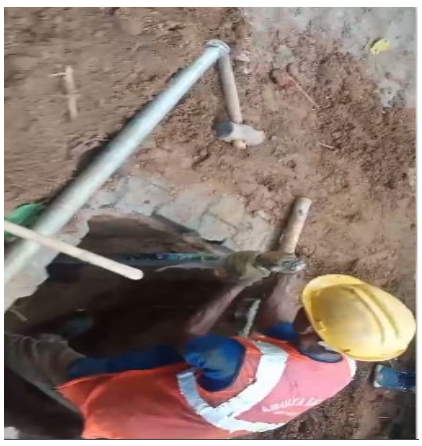
4.5 Validation

- Cross-verification of MSP outputs with on-site execution results.
- Review by project managers and electrical engineers.
- Comparison with findings from prior studies on project-management tools and earthing design.

GI Electrodes



Digging Pit



Electrodes Installation

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Connect Electrodes through GI Patti

Connect machine and Electrodes through GI Patti

Source: SMG Electrical Dimna Jamshedpur

5. RESULT AND DISCUSSION

5.1 Result

This study assessed how Microsoft Project (MSP) supported the planning and execution of a chemical-earthing project carried out by SMG Electrical (JUSCO vendor) in the N-Town VIP area of Tata Main Hospital, Jamshedpur. The findings show that MSP contributed to better cost accuracy, on-time delivery, and efficient use of resources.

5.1 Cost Performance

MSP provided a close match between planned and actual expenditure. The baseline cost in MSP was ₹188,600, while the project was executed at ₹187,910, resulting in a very small variance of ₹690. Most activities finished with zero deviation, and only the electrode installation task showed a slight reduction in cost. This consistency indicates reliable budgeting and controlled field execution. A key observation is that the contractor's billed amount was ₹218,660—almost 16 percent higher than MSP's actual cost. This difference shows how MSP can help identify billing discrepancies and support transparent financial verification.

5.2 Schedule Performance

According to the MSP Gantt Chart, the project ran exactly as planned. Work started on 20 August 2025 and finished on 19 September 2025 with no delays. Tasks such as excavation, electrode installation, GI patty connection, RCC chamber construction, testing, and handover followed their scheduled dates. The absence of slippage suggests that MSP's task linking, activity sequencing, and critical-path visibility helped maintain a stable and predictable timeline.

5.3 Resource Utilization

MSP's resource reports showed accurate estimation and smooth deployment of labor. All assigned resources—technicians, skilled and unskilled labor, supervisors, and safety staff—completed their tasks with zero remaining hours. This alignment between planned and actual usage indicates balanced workload distribution, minimal idle time, and effective labor` management.

5.4 Overall Project Performance

Across cost, schedule, and resource indicators, MSP created a structured and transparent project environment. The software enabled:

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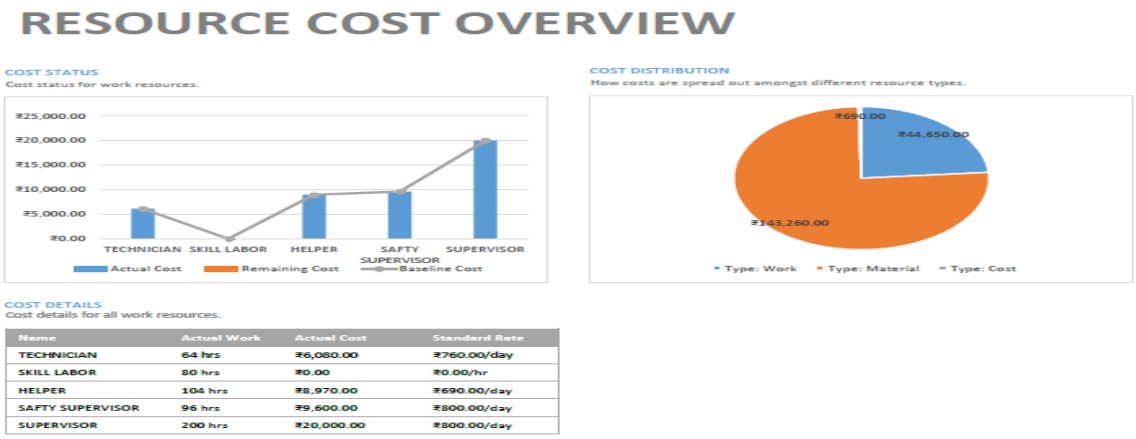
- Realistic forecasting of cost and duration,
- Continuous monitoring of progress,
- Early visibility of deviations,
- Better coordination among field teams,
- Reliable documentation for verification and billing

The project was delivered on time, within estimated cost, and with efficient resource use. Overall, the results confirm that Microsoft Project significantly improved the planning and execution quality of the chemical-earthing work.

Gantt Chart of Chemical Earthing

ID	Task Name	Fixed Cost	Fixed Cost Accrual	Total Cost	Baseline	Variance	Actual	Remaining
1	**CHEMICAL EARTHING**	**₹0.00**	**Prorated**	**188,600.00**	**₹188,600.00**	**₹0.00**	**187,910.00**	**₹690.00**
2	SITE INSPECTION(GIS)	₹0.00	Prorated	₹0.00	₹0.00	₹0.00	₹0.00	₹0.00
3	13 EARTH PIT EXCAVATION	₹0.00	Prorated	₹30,800.00	₹30,800.00	₹0.00	₹30,800.00	₹0.00
4	13 ELECTRODE INSTALLATION WITH BACKFILLING & CHEMICAL COMPOUND	₹0.00	Prorated	₹61,690.00	₹61,690.00	₹0.00	₹61,000.00	₹690.00
5	CONNECTED 2 ELECTRODES, ELECTRODES & MACHINE CONNECTED WITH GI PATTY	₹0.00	Prorated	₹61,060.00	₹61,060.00	₹0.00	₹61,060.00	₹0.00
6	RCC CHEMBER AND COVER FOR SAFTY	₹0.00	Prorated	₹29,670.00	₹29,670.00	₹0.00	₹29,670.00	₹0.00
7	EARTHING VALUE MEASUREMENT	₹0.00	Prorated	₹2,980.00	₹2,980.00	₹0.00	₹2,980.00	₹0.00
8	SUPERVISION AND HANDOVER	₹0.00	Prorated	₹2,400.00	₹2,400.00	₹0.00	₹2,400.00	₹0.00

Activity-wise Cost Table



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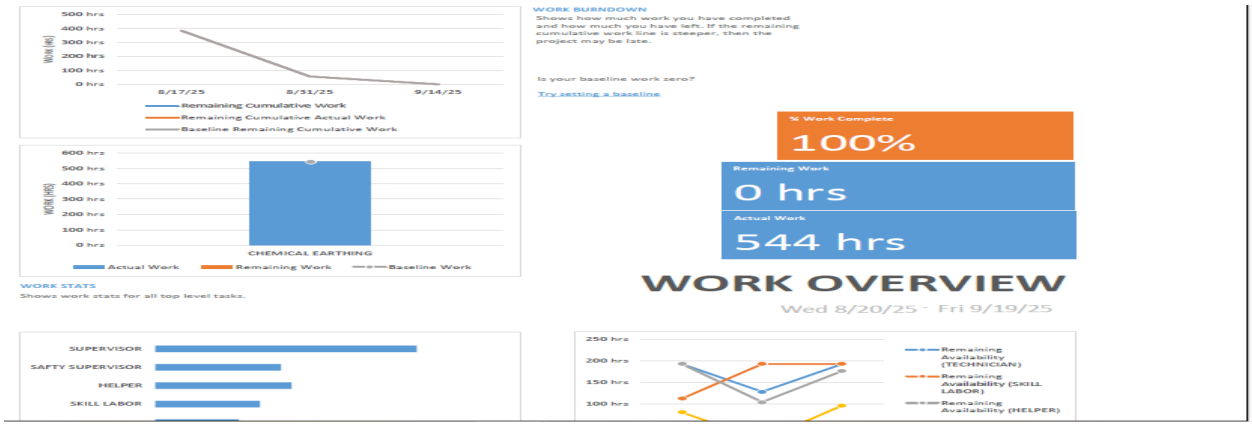
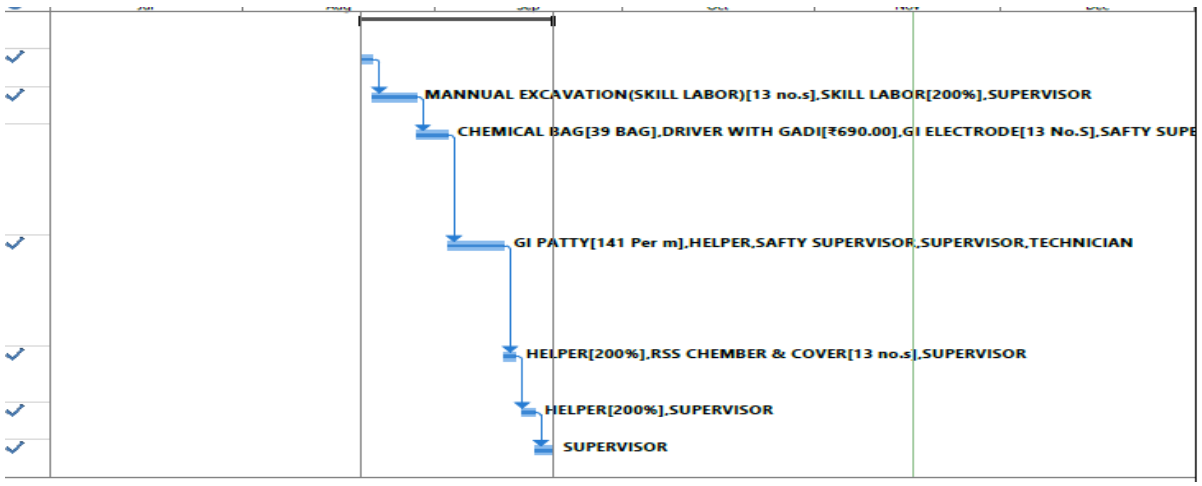


ID		Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names	Baseline Cost
1			**CHEMICAL EARTHING**	**27 days**	**Wed 8/20/25**	**Fri 9/19/25**			**₹188,600.00**
2	✓		SITE INSPECTION(GIS)	2 days	Wed 8/20/25	Thu 8/21/25			₹0.00
3	✓		13 EARTH PIT EXCAVATION	6 days	Fri 8/22/25	Thu 8/28/25	2	MANNUAL EXCAVATION(SKIL	₹30,800.00
4			13 ELECTRODE INSTALLATION WITH BACKFILLING & CHEMICAL COMPOUND	4 days	Fri 8/29/25	Tue 9/2/25	3	CHEMICAL BAG[39 BAG],DRIVER WITH GADI[₹690.00],GI ELECTRODE[13	₹61,690.00
5	✓		CONNECTED 2 ELECTRODES, ELECTRODES & MACHINE CONNECTED WITH GI PATTY	8 days	Wed 9/3/25	Thu 9/11/25	4	GI PATTY[141 Per m],HELPER,SAFTY SUPERVISOR,SUPI	₹61,060.00
6	✓		RCC CHEMBER AND COVER FOR SAFTY	2 days	Fri 9/12/25	Sat 9/13/25	5	HELPER[200%],RS CHEMBER & COVER[13	₹29,670.00
7	✓		EARTHING VALUE MEASUREMENT	2 days	Mon 9/15/25	Tue 9/16/25	6	HELPER[200%],SU	₹2,980.00
8	✓		SUPERVISION AND HANDOVER	3 days	Wed 9/17/25	Fri 9/19/25	7	SUPERVISOR	₹2,400.00

Resource Cost Distribution repor



Resource Work Overview report

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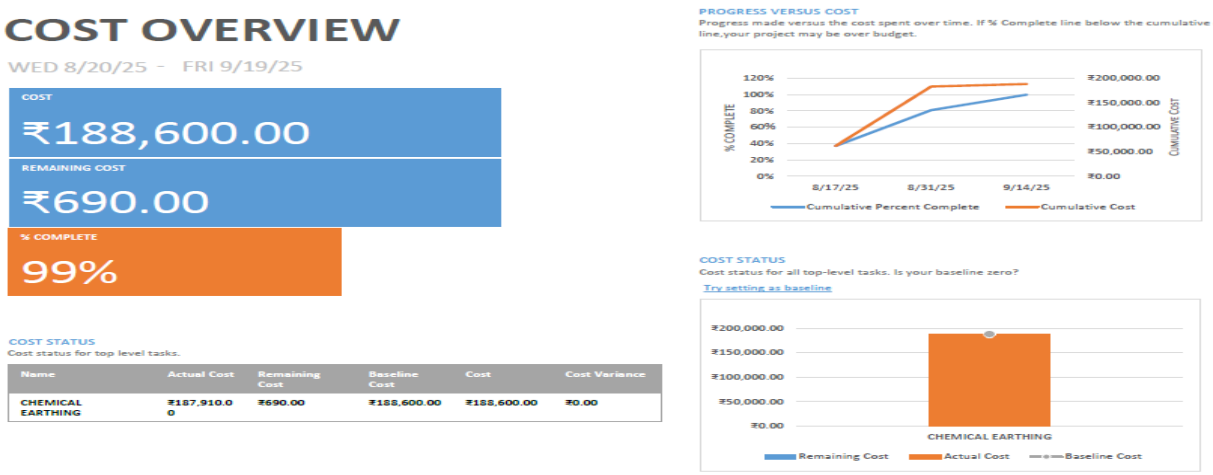

Cost Overview Report

Vendor Name: SMG Electrical
Vendor Code: 13943
Work Order No: 4700027405
Date: 31.07.2025
Proforma Invoice No: SMG/PI/037/25-26
Date: 28.09.2025
Job Description: Chemical Earthing
Location: N-Town, VIP Section

Attn: Mr. Bijan Roy
DO No:

Job Start: 20.08.2025

Job Completed: 24.09.2025

Sl No	Item No	Service No Description	SAC Code	Quantity	Unit	Rate	Amount
1	10	60 mm dia GI pipe chemical earthing pit	9954	13	Nos	10500	136500.00
2	50	S&E of 50 X6 mm GI flats	9954	141	Meter	260	36660.00
3	70	S&E of RCC Chamber with RCC Cover	9954	13	Nos	3500	45500.00
						Total	218660.00

Cntractor Bill

5.5 Discussion

The results clearly show that Microsoft Project (MSP) contributed to better planning and execution of the chemical-earthing work carried out by SMG Electrical in Jamshedpur. The strong match between the baseline and actual cost indicates that MSP supported realistic estimation and effective cost control. A variance of only ₹690 demonstrates that the planned budget was appropriate and that field execution closely followed the financial plan. The schedule-related findings further highlight the usefulness of MSP. All activities started and finished as planned, showing that task sequencing, dependency mapping, and critical-path visibility were well managed. The absence of delays is noteworthy, given that electrical-infrastructure projects often face disruptions related to material handling, labor availability, and site conditions. MSP's ability to structure dependencies and track progress appears to have contributed to stable execution. Resource utilization also aligned well with expectations. Zero remaining work hours for all labor categories suggest that workforce planning was accurate and balanced. The software enabled clear visibility of labor requirements, minimized idle time, and supported efficient coordination among technicians, supervisors, and support staff.A significant observation is the gap between MSP's actual cost (₹187,910) and the contractor's billed amount (₹218,660). This difference of about 16 percent highlights MSP's practical value in financial verification and billing review. Such insights strengthen

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accountability and reduce the likelihood of disputes between contractors and clients. It also reinforces the argument that digital tools are essential for transparent project governance. Overall, the discussion shows that MSP functions as more than a scheduling tool. It supports integrated planning, cost management, resource coordination, and progress monitoring. The findings suggest that MSP can enhance execution quality and provide measurable benefits in electrical-infrastructure projects, especially those involving technical tasks such as chemical earthing.

CONCLUSION

This study concludes that Microsoft Project has a positive and measurable impact on the planning and execution of electrical infrastructure projects. In the case of the chemical earthing project in Jamshedpur, MSP contributed to accurate cost forecasting, precise scheduling, efficient resource management, and transparent project monitoring. The strong alignment between planned and actual performance across all major indicators demonstrates that MSP enhances project control and reduces uncertainties .The findings confirm that MSP helps project teams maintain budget discipline, adhere to timelines, and achieve high levels of execution efficiency. Additionally, the discrepancy observed between MSP-estimated cost and contractor billing highlights the practical importance of MSP for cost validation and governance. Overall, MS Project proves to be an effective and dependable tool for managing small to medium-scale electrical infrastructure projects and can be scaled to larger projects with similar benefits.

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