Article on Drilling Report

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1. INTRODUCTION

The term drilling indicates the whole complex of operations necessary to construct wells of circular sections applying excavation techniques.

To drill a well it is necessary to carry out simultaneously the following actions (drilling process): -

- To overcome the resistance of the rock, crushing it into small particles.
- To remove the rock particles, while still acting on fresh material.
- To maintain the stability of the walls of the hole.

2. Dataset Information

- **Well ID:** A unique identifier for each well**.** the drill bit.
- **Rig ID:** A unique identifier for the rig used in the operation**.** massive structures housing equipment used to drill.
- **Drilling Depth (m):** The depth drilled in meters on that particular day.
- **Bit Type:** The type of drill bit used (e.g., PDC, Tricone, Roller Cone).
- **Mud Type:** The type of drilling mud used (Water-Based, Synthetic-Based, Oil-Based)**.** essential for cooling.
- **Mud Volume (L):** The volume of mud used during the drilling operation in liters.
- **Formation:** essential for cooling the drill bit. The geological formation being drilled (e.g., Limestone, Granite).
- **ROP (m/h):** The Rate of Penetration in meters per hour, which measures the drilling speed.

- **Downtime (hours):** The amount of downtime in hours due to various issues.
- **Incidents:** The type of incidents (if any) encountered during the drilling operation.
- **Cost (USD):** The cost incurred during the drilling operation on that day in US dollars.
- **Contractor:** The contractor responsible for the drilling operation (e.g., Baker Hughes, Weatherford, Schlumberger).

The dataset offers a broad look at the day-to-day drilling, including performance metrics and cost as well as operational challenges.

3. Purpose and Goal

3.1. Purpose:

- Track the daily operational performance of the drilling process.
- Identify any inefficiencies or issues that may affect the drilling operation.
- Enable decision-makers to act based on real-time data insights.

3.2. Goal:

- **Optimize Drilling Efficiency**: Use key metrics like ROP (Rate of Penetration), Mud type, Mud formation, and bit type to ensure optimal performance.
- **To track the cost of drilling operations:** Monitor costs over time and compare them across different wells. rigs, or formations.

- **Minimize Non-Productive Time (NPT)**: Identify performance bottlenecks and make adjustments to improve operational efficiency.

4. Key Questions on The Data

- Which well has the highest ROP and what are the contributing factors?
- What are the trends in downtime for each rig and well?
- How much drilling depth was achieved daily across different rigs?

These questions allow decision-makers to identify wells that outperform others and understand what operational factors contribute to success. For example, wells with higher ROP tend to complete drilling faster, reducing downtime and overall costs.

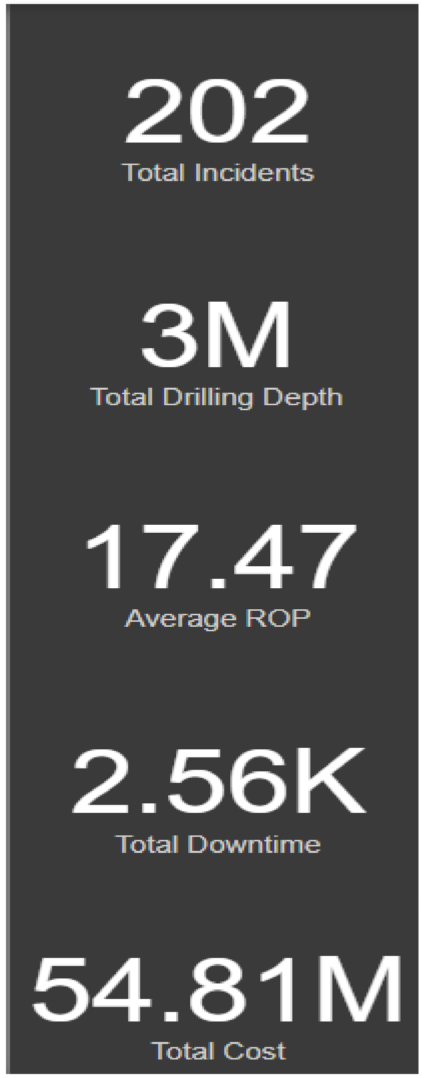
5. Strategies for Effective Data Presentation

In presenting drilling data, it's essential to use visuals and color-coded alerts that highlight key metrics. Filter and drill-down options allow users to focus on specific metrics such as ROP, incidents, and downtime, which help streamline decision-making.

6. Key Performance Indicators (KPIs)

1. **Average ROP**: Monitoring the speed at which drilling progresses.
2. **Total Downtime**: Evaluating inefficiencies due to equipment failure or operational challenges.
3. **Total Incidents**: Understanding how incidents affect the drilling process.
4. **Cost**: Tracking expenses by quarter.

7. Drilling Report Dashboard with Explanation



1. **Total Incidents (202)**
   This number represents the total incidents that occurred during the drilling operations. An incident could include equipment failure, accidents, or any other interruptions that may cause downtime or affect operational efficiency.

2. Total Drilling Depth (3M)
This metric shows the cumulative drilling depth achieved across all operations. It sums up the total distance drilled (in meters) for the entire project, indicating the scope of the drilling activity.

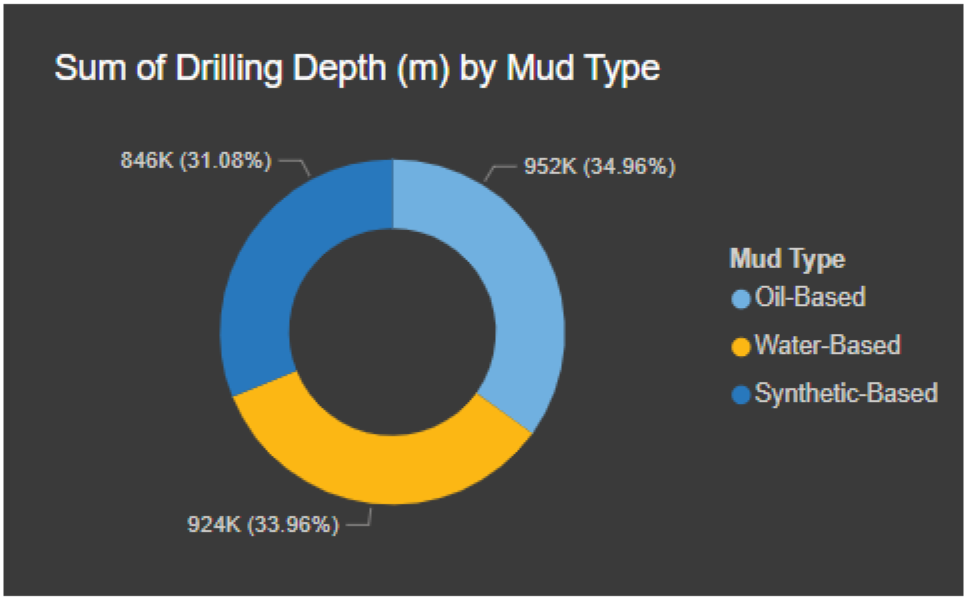
3. Average Rate of Penetration (ROP) (17.47 m/h)
The ROP refers to how quickly the drill bit penetrates the geological formations, measured in meters per hour (m/h). An average of 17.47 m/h suggests relatively efficient drilling, but this value can vary depending on the type of bit, formation, and other factors.

4. Total Downtime (2.56K hours)
Downtime represents the cumulative hours when the operation was halted due to incidents, maintenance, equipment failure, or other delays. A total of 2.56K hours (or 2560 hours) indicates a significant amount of non-productive time (NPT) that could be further analyzed for improvement.

5. Total Cost (54.81M USD)
The total cost reflects the overall expenditure on drilling operations, including equipment, labor, mud, and other operational costs. This can help in budgeting and tracking cost efficiency across various periods.

Visualizations:

Sum of Drilling Depth by Mud Type

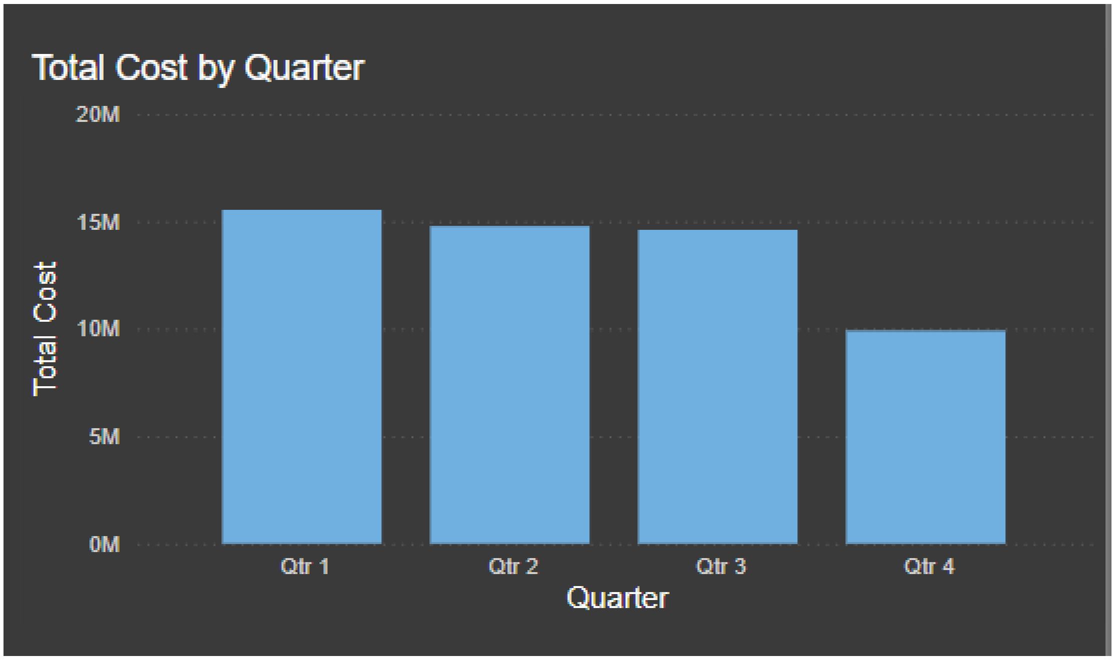


This pie chart shows how drilling depth is distributed based on the type of drilling mud used:

- Oil-Based Mud (34.96%): Responsible for 952K meters of drilling.
- Water-Based Mud (33.96%): Contributed to 924K meters of drilling.
- Synthetic-Based Mud (31.08%): Involved in 846K meters of drilling.

This breakdown allows an analysis of how mud types affect the depth achieved and can indicate which mud is more efficient in different formations.

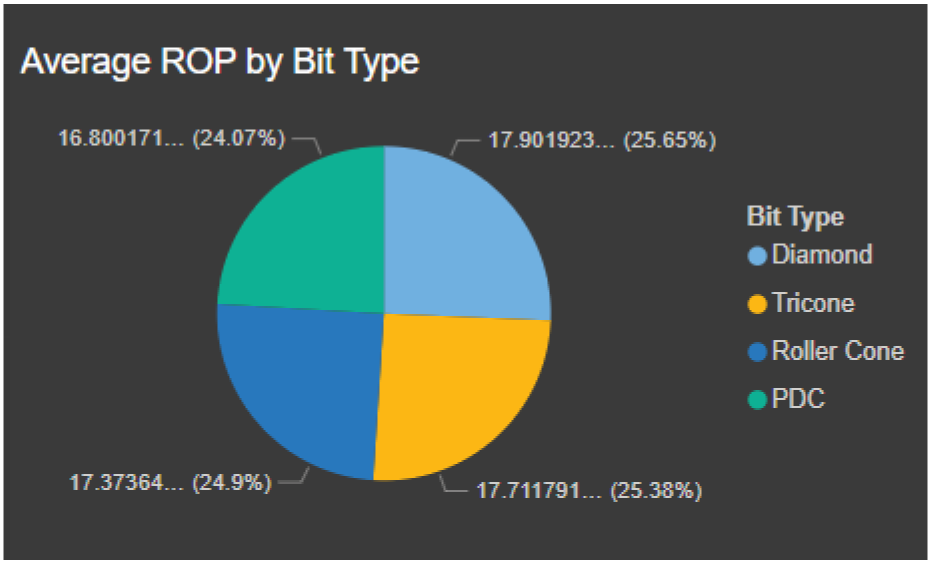
Total Cost by Quarter



The line chart displays the cost incurred over four quarters:

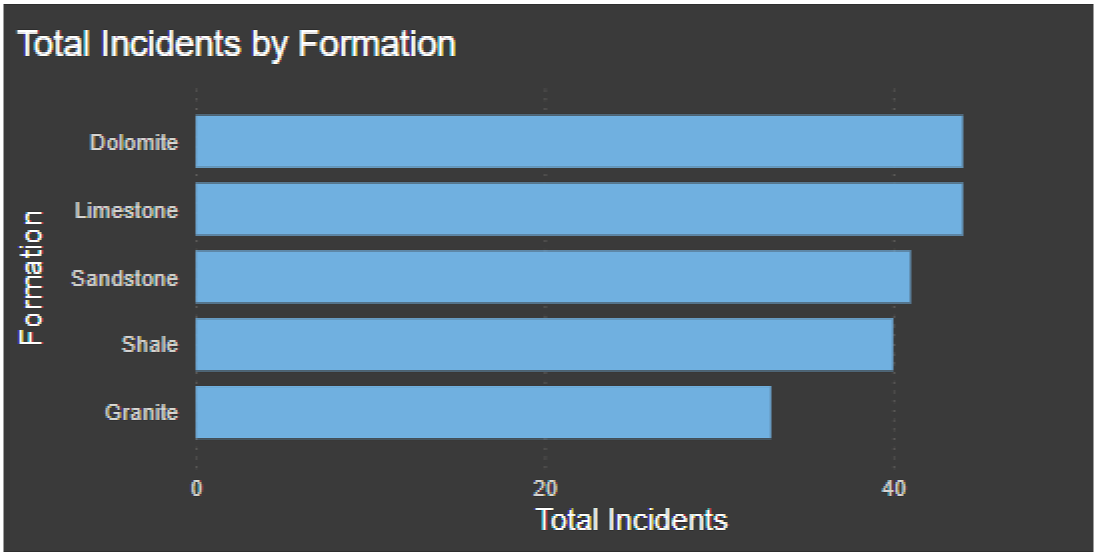
- The cost appears to decrease steadily, starting at around 16M USD in the first quarter and dropping to approximately 12M USD by the fourth quarter.
- This trend may suggest increasing efficiency, cost-saving measures, or a reduction in drilling activity over time.

Average ROP by Bit Type



- This bar chart compares the average ROP for different drill bit types:
  - Diamond Bits (17.90 m/h): The most efficient in terms of penetration speed.
  - Tricone Bits (17.71 m/h): Slightly lower than diamond but still effective.
  - Roller Cone Bits (17.37 m/h): Showing a slightly lower performance.
  - PDC (16.80 m/h): While commonly used, PDC bits show the lowest ROP on average.
- This comparison is crucial for selecting the most effective bit depending on the formation being drilled.

Total Incidents by Formation



- This bar chart breaks down the incidents based on geological formation types:
  - Dolomite, Limestone, Sandstone: All have a relatively higher number of incidents.
  - Shale, Granite: Lower incident rates compared to the other formations.
- This helps in identifying which formations are more prone to issues and can lead to preventive measures when drilling in such formations.

Key Insights:

- High Incident Rate (202 incidents): The total number of incidents highlights the need to focus on operational efficiency and safety improvements.

- Efficiency of Mud Types: The depth drilled using different mud types is quite evenly distributed, but further analysis can reveal which mud performs better in terms of cost and safety.
- Bit Performance: Diamond and Tricone bits seem to offer the highest ROP, suggesting their preference in achieving faster drilling times.
- Formation-Specific Challenges: Some formations (Dolomite, Limestone) have higher incidents, indicating possible challenges when drilling through these types of rock.

This dashboard offers a clear snapshot of drilling performance, operational costs, and incident trends, enabling decision-makers to identify inefficiencies and optimize future operations.

8. Conclusion

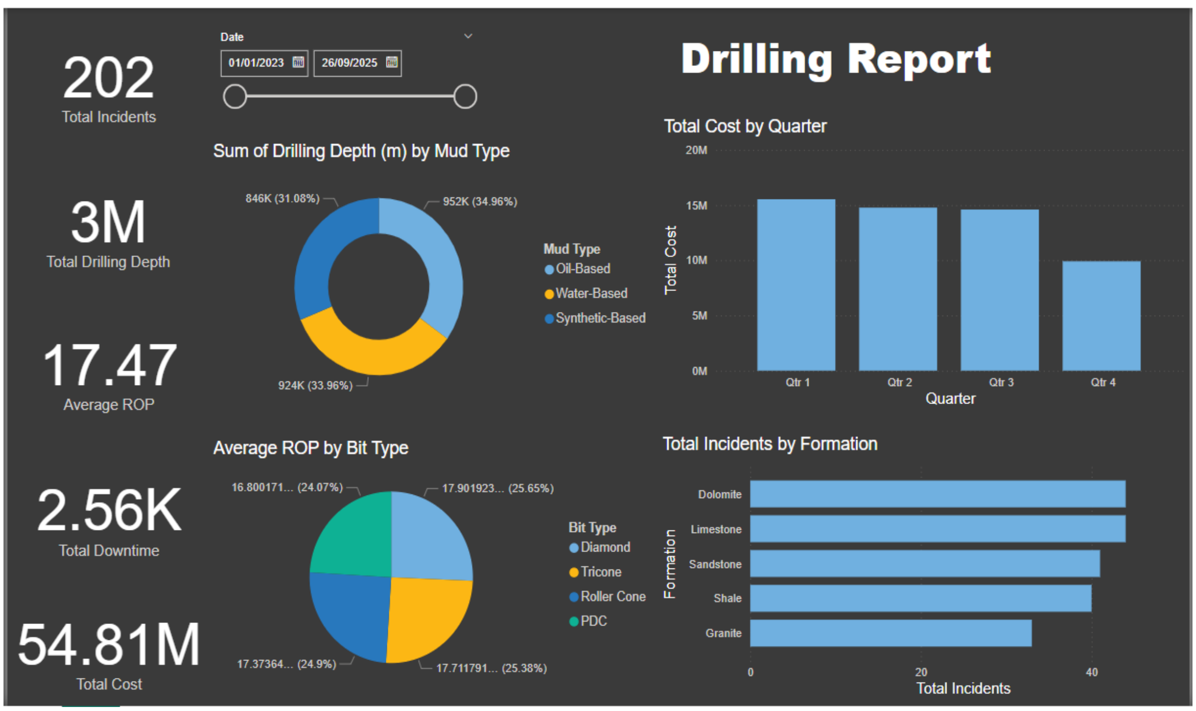
Daily drilling data offers valuable operational insights that can significantly impact performance and costs. For instance, there is a clear correlation between drilling depth and ROP, which influences both downtime and overall costs. Furthermore, the choice of mud type plays a critical role in incident rates—water-based muds, for instance, show higher incident risks when used in challenging formations.

The findings suggest that wells with lower ROP often experience higher costs and downtime, indicating operational inefficiencies that need to be addressed. Companies like Schlumberger, while playing a dominant role in drilling operations, face fluctuating costs, often driven by varying well conditions.

In conclusion, optimizing drilling operations requires a careful balance of performance metrics, cost management, and operational adjustments. By leveraging daily drilling data, companies can improve efficiency, reduce costs, and minimize downtime, ensuring a more productive drilling process.

Click Here to See My PowerBI Dashboard : [Drilling Report Dashboard]

9. Appendix



Measures

- **Average ROP**

  Average ROP = AVERAGE('DrillingReport'[ROP (m/h)])

- **Total Incident**

  ```
  Total Incidents =
  CALCULATE(
      COUNT('DrillingReport'[Incidents]),
      'DrillingReport'[Incidents] <> "None"
  )
  ```

- **Total Cost**

  Total Cost = SUM('DrillingReport'[Cost (USD)])

- **Total Downtime**

  Total Downtime = SUM('DrillingReport'[Downtime (hours)])

- **Total Drilling Depth**

  Total Drilling Depth = SUM('DrillingReport'[Drilling Depth (m)])