

Enhanced Drilling Performance with Complex42™

CHEMFORCE



BRC - BK2 Data Centre – May/June 2024

Summary of results Soilmec SR105 drill rig using 0.8% Complex42™ though slightly weathered basalt

Parameter	Soilmec SR105 Pair 1	Soilmec SR105 (Complex42™) Pair 1	Soilmec SR105 Pair 2	Soilmec SR105 (Complex42™) Pair 2
Pile No. (900mm)	52	41	407	395
Total Depth	5300mm	5570mm	16000mm	13040mm
Duration/Hole	144 minutes	116 minutes	258 minutes	163 minutes
Rate of penetration	36.8 mm/min	48 mm/min	62.0 mm/min	80 mm/min
Fuel Consumed/Hole	114.4 Litres	76.92 Litres	177.59 Litres	110.9 Litres
Teeth Consumed	11	0	1	0
Hard facing Consumed	0.71mm	0.1mm	N/A	N/A

*Data extracted from Soilmec DMS Software.

*Note this includes idle time when not drilling.

*On the second pair, the reference marks wore of the drill and a measurement was not taken.

Introduction

In this case study, we compare the performance and cost-effectiveness of the Soilmec SR105 drilling rig using conventional methods against the same rig utilising Complex42™. The objective was to highlight the significant savings in fuel consumption, duration per hole, and wear on equipment achieved by using only 3 to 4 litres of Complex42™, per hole.

Methodology

Separate trials in close proximity were conducted using the Soilmec SR105 rig to evaluate the effectiveness of Complex42™. The first trial used conventional drilling methods, while the second trial incorporated Complex42™ at a concentration of 0.8% in a water tank (Furfey). The made-up solution was gravity-fed into the hole whilst drilling. This process was repeated near the end of the pad in less competent ground. Key performance indicators measured included total depth, duration per hole, rate of penetration, fuel consumption per hole, teeth consumed, and hard facing consumed.

The trials were conducted in two pairs:

- **Pair 1:** Standard ground conditions.
- **Pair 2:** Less competent ground conditions, very sticky clay.

1. **Total Depth:** The overall depth achieved by the drilling rig during each trial.
2. **Duration per Hole:** The time taken to drill each hole from start to finish.
3. **Fuel Consumption per Hole:** The amount of diesel fuel consumed during the drilling of each hole.
4. **Number of Teeth Consumed:** The wear and tear on the drilling teeth, indicated by the number of teeth that needed replacement.
5. **Hardfacing Worn Off the Drill:** The extent of wear on the hardfacing of the drill bit, which is crucial for understanding the longevity and maintenance needs of the drilling equipment.

These indicators were carefully recorded to provide a comprehensive comparison between the conventional drilling method and the method incorporating Complex42™. The trials aimed to quantify the efficiency gains, cost savings, and environmental benefits achieved by using Complex42™.



Teeth consumed on Pile 52 – NO Complex42™

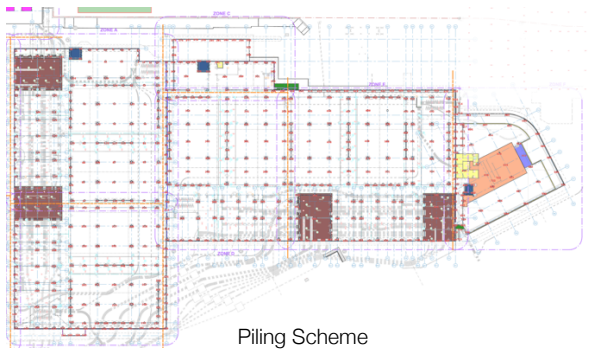


Hardfacing measurements before and after 5570mm of drilling – With **Complex42™**

Reference location marks in barrel for measuring the height of the hardfacing

Project Details:

- A construction site for data centre
- Approximately 750 pile holes 600mm and 900mm in diameter.
- Ground composition: Predominantly slightly weathered basalt



Key Findings:

Based on the trials conducted using the Soilmec SR105 rig with conventional drilling methods and with Complex42™, the following key findings were observed:

Cost Analysis and Savings

Fuel Consumption:

- Conventional Method (Pair 1): 114.4 litres per hole
- Complex42™ Method (Pair 1): 76.92 litres per hole
- Conventional Method (Pair 2): 177.59 litres per hole
- Complex42™ Method (Pair 2): 110.9 litres per hole

Cost per litre of diesel: \$2.50 (Delivered on site)

1. Fuel Cost Savings (Pair 1):

- Conventional: 114.4 litres * \$2.50/litre = \$286 per hole
- Complex42™: 76.92 litres * \$2.50/litre = \$192.30 per hole
- **Savings per hole: \$286 - \$192.30 = \$93.70**

2. Fuel Cost Savings (Pair 2):

- Conventional: 177.59 litres * \$2.50/litre = \$443.975 per hole
- Complex42™: 110.9 litres * \$2.50/litre = \$277.25 per hole
- **Savings per hole:** \$443.975 - \$277.25 = \$166.725

Operator Cost:

Operator and offsider cost per hour: \$150

1. Operator Cost Savings (Pair 1):

- Conventional: 144 minutes = 2.4 hours * \$150/hour = \$360 per hole
- Complex42™: 116 minutes = 1.933 hours * \$150/hour = \$289.95 per hole
- **Savings per hole:** \$360 - \$289.95 = \$70.05

2. Operator Cost Savings (Pair 2):

- Conventional: 258 minutes = 4.3 hours * \$150/hour = \$645 per hole
- Complex42™: 163 minutes = 2.717 hours * \$150/hour = \$407.55 per hole
- **Savings per hole:** \$645 - \$407.55 = \$237.45

Teeth Consumption:

Cost per tooth: \$10

1. Teeth Cost Savings (Pair 1):

- Conventional: 11 teeth * \$10/tooth = \$110 per hole
- Complex42™: 0 teeth * \$10/tooth = \$0 per hole
- **Savings per hole:** \$110 - \$0 = \$110

2. Teeth Cost Savings (Pair 2):

- Conventional: 1 tooth * \$10/tooth = \$10 per hole
- Complex42™: 0 teeth * \$10/tooth = \$0 per hole
- **Savings per hole:** \$10 - \$0 = \$10

Hard Facing Consumption:

Not applicable for Pair 2 – Reference marks wore off

1. Hard Facing Savings (Pair 1):

- Conventional: 0.71mm
- Complex42™: 0.1mm
- **Reduction in Hard Facing Consumption:** 0.71mm - 0.1mm = 0.61mm

CO2 Emissions Savings:

- CO2 emissions per litre of diesel: 2.68 kg CO2

1. CO2 Emissions Savings (Pair 1):

- Conventional: 114.4 litres * 2.68 kg CO2/litre = 306.592 kg CO2 per hole

- Complex42™: 76.92 litres * 2.68 kg CO2/litre = 206.1856 kg CO2 per hole
- **Savings per hole:** 306.592 kg CO2 - 206.1856 kg CO2 = 100.4064 kg CO2

2. CO2 Emissions Savings (Pair 2):

- Conventional: 177.59 litres * 2.68 kg CO2/litre = 475.9252 kg CO2 per hole
- Complex42™: 110.9 litres * 2.68 kg CO2/litre = 297.612 kg CO2 per hole
- **Savings per hole:** 475.9252 kg CO2 - 297.612 kg CO2 = 178.3132 kg CO2

Summary of Savings

Total Savings per Hole (Pair 1):

- Fuel Savings: \$93.70
- Operator Cost Savings: \$70.05
- Teeth Cost Savings: \$110
- Total Savings (before Complex42™ cost): \$273.75
- 4 Litres of Complex42™: \$35.60
- TOTAL Saving: \$238.15**

Total Savings per Hole (Pair 2):

- Fuel Cost Savings per Hole: \$166.73
- Operator Cost Savings per Hole: \$237.45
- Teeth Cost Savings per Hole: \$10
- Total Cost Savings per Hole (before Complex42™ cost): \$414.18
- CO2 Emissions Reduction per Hole: 178.31 kg CO2
- 3 Litres of Complex42™: \$26.40
- TOTAL Saving: \$387.78**

Cost of Complex42™: \$8.90/litre, used in higher concentration @ 1% in water.

These findings highlight the substantial economic and environmental benefits of using Complex42™ in drilling operations. The reduction in fuel consumption, operational time, and equipment wear, coupled with the CO2 emissions savings, demonstrates the efficiency and sustainability of Complex42™.

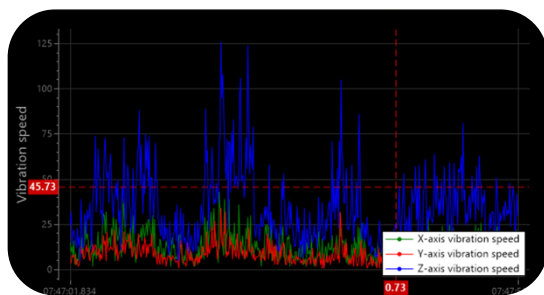
Discussion

Complex42™ enhanced the drilling efficiency, particularly in hard materials, reducing the friction and allowing for smoother operations. The addition of Complex42™ significantly reduced the wear on drill barrels' hard facing, leading to cost savings and amplified operational efficiency.

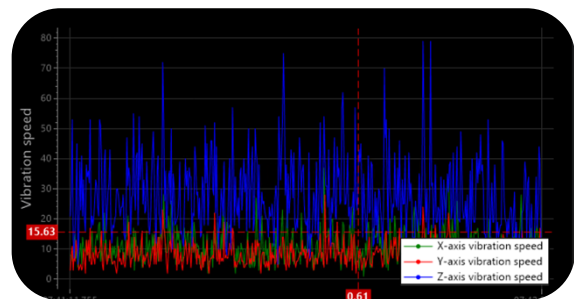
On the first day of familiarising the crew with Complex42™, the results were particularly notable. Over the course of drilling 17.9 metres across 3 piles, the crew consumed approximately 150 litres of fuel and used no drilling teeth. Whilst only using 12 litres of Complex42™ during this operation.

These early results indicate the immediate benefits of Complex42™ in reducing fuel consumption and equipment wear. The smoother drilling operations not only enhanced efficiency but also demonstrated the potential for significant cost savings in terms of both fuel and maintenance. The successful adaptation of Complex42™ by the crew in a short timeframe further underscores its practicality and effectiveness in real-world drilling scenarios.

Furthermore, a preliminary vibration, (with an MIT™ x,y,z accelerometer) and noise study showed a significant reduction in both noise and vibration levels when using Complex42™. This reduction enhances the working environment for the crew and minimises the impact on surrounding areas. Notably, the use of Complex42™ also resulted in almost no dust production, contributing to a cleaner and safer worksite. These additional benefits highlight the comprehensive advantages of integrating Complex42™ into drilling operations, making it an invaluable asset for improving efficiency, reducing environmental impact, and enhancing worker safety.



With out Complex42™



With Complex42™