

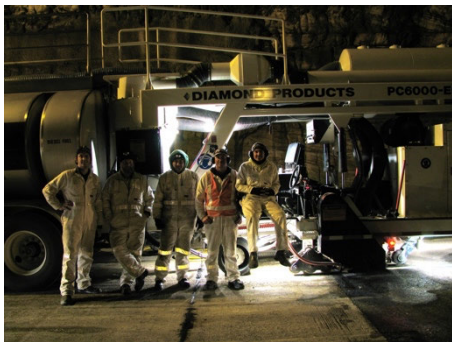
C-Complex™

Trial – PC6000



Project	F3 Freeway Road Profiling
Substrate	High MPA Concrete
Place	F3 Freeway NSW Australia
Date	August 2009
Stakeholders	Downer EDI Works - Diamond Profiling Diamond Products - Supplier of the PC6000 Tyrolit - Diamond Blade Supplier
Machine	Diamond Products PC6000
Blades	Tyrolit 18" Diamond blades x 200

SUMMARY OF RESULTS



WITHOUT	WITH C-COMPLEX™
Feed rate	
27 to 30ft / minute	40 to 45ft / minute
Additional Advantages Extended Blade Life Reduced Fuel Consumption Less vibration Significantly less wear on the machine	

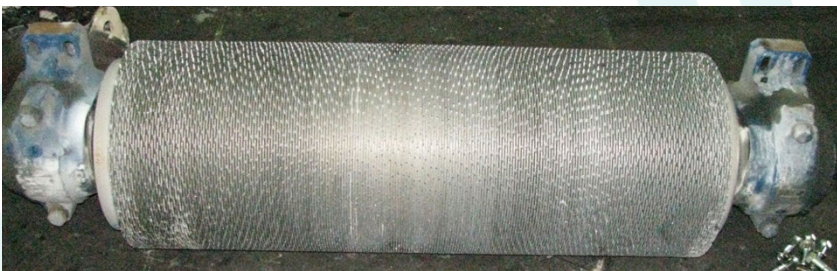
Trial - Adding C-Complex™ Diamond Tool Performance Additive as a cutting aid for road profiling

In a collaboration with Downer EDI Works, Chemforce performed a road profiling trial using the **C-Complex™**, additive with a Diamond Products PC6000 PC Road profiling grinder.

Through Chemforce's extensive research into the wear of sintered diamond tooling we have been able to set the following realistic and achievable objectives:

Overall objective – significant increase in productivity of the machine per shift

- Increased cutting speed ft / min or m / min
- Maintaining the cutting ability of the machine through the various stages of wear on the cutting head.
- Extended life of the cutting head
- More consistent and uniform cutting.
- Reduced load on the machine, less wear and tear
- Reduced fuel consumption



PART 1 – Meeting the relevant stakeholders to establish expectations

Stakeholders:

- Downer EDI Works - Diamond Profiling
- Diamond Products - Supplier of the PC6000
- Tyrolit - Diamond Blade Supplier



Agenda:

- Stakeholders were made aware of the expected properties and expected benefits and efficiencies from adding **C-Complex™** into the lubricating water.
- Also discussed was the foaming that occurs in the cement slurry with **C-Complex™**, especially when it is agitated.
- How, how much and when **C-Complex™** would be added and directed to the cutting edge of the profiling blades.

PART 2 – Profiling with C-Complex™

- 1st Pass was made with 1.4% concentration of C-Complex™.
- The C-Complex™ was added to the 10,500L tank located at the rear of the PC6000, followed by the water from a water tanker. The logic behind this sequence was to ensure thorough mixing but led to excess foaming. Also, when the machine was at idle with the water set @ 5psi, the cutting head would produce foam and fill the cyclone and de-misting system. This in turn expelled foam onto the road



PART 3 – Rectification of Foaming

The foam on the road abated when the machine was grinding. Over the 2 weeks of the profiling project, the amount of **C-Complex™** was continually reduced to find the lowest dosage giving maximum efficiency. The final working dosage of **C-Complex™** was 0.4% - at this concentration there is no extreme foaming.

PC6000 Performance Issues

Prior to the trial, the PC6000 was plagued with breakdowns that were directly attributable to excessive vibration caused by “blunt” blades and excessive speed. To remedy the machine’s underperformance, a representative of Diamond Products, Skip travelled from the US to instruct the operators.

Skip noted that the blades were “closed”- one of the causes leading to excessive vibration. At that time the PC6000 was running a hard diamond matrix that was not exposing fresh diamonds at a sufficient rate relative to its operating speed. The machine was going *too fast* for that bond of diamond matrix.

The effective hardness of the diamond blades is directly related to the peripheral speed of the blade. By altering the feed rate and the RPM of the machine the operator can optimize the performance and rate of wear on the blades.

To “sharpen” the blades and expose fresh diamonds Skip slowed the machine down to around 12 to 15 feet per minute. This speed was maintained until the vibration abated and fresh diamonds were exposed. This took several shifts to achieve.

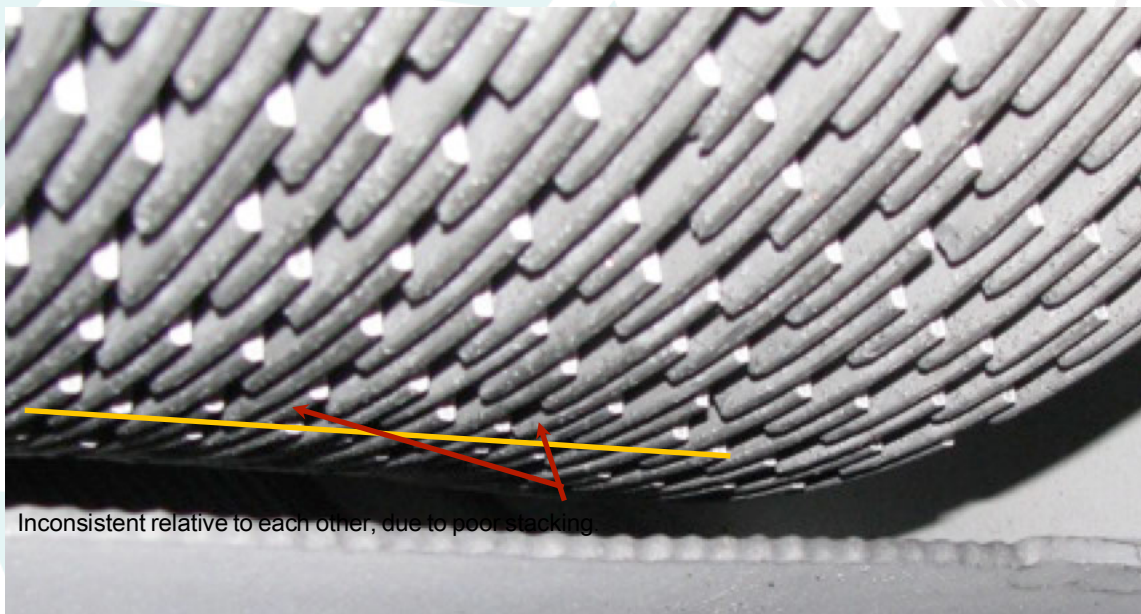
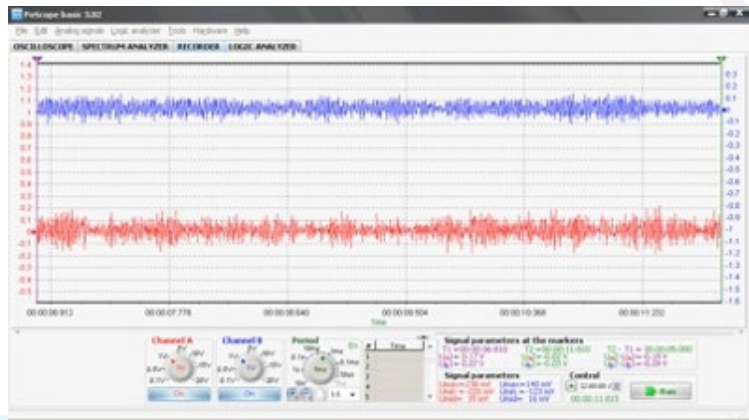
Another easily misconstrued cause of vibration described by Skip were the “out of round blades”. These were in fact inconsistencies in the diamond blades relative to the drive shaft. This inconsistency in the diamond blades resulted in an out of balance cutting head, that required sufficient grinding to attain a uniform level across the cutting-head. This was also achieved by slowing the feed rate of the machine reducing productivity over multiple shifts.

PC6000 Vibration Issues

During our discovery period we were able to identify several factors that were inhibiting the reliability and performance of the PC6000. It was noted that the onset of excessive vibration was indicative of the condition of the cutting head. The vibration was also deemed to be the main inhibiting factor reducing the production of the PC6000.

To quantify the vibration of the machine, a set of custom-made vibration sensors and an oscilloscope connected to a laptop; were used to accurately measure and record the harmonics of the machine. It was proposed that the machine would be driven to the point of excessive vibration, noting the grinding speed and RPM before excessive vibration set in. This would be measured subsequently with the **C-Complex™** for comparison.

In the process of testing the vibration sensors we were also able to unequivocally demonstrate that the “out of round” blades were the major source of the vibration. By raising the cutting head and free spinning the blades at 1800, 1900, 2000 and 2100 rpm we were able to clearly measure the onset of the vibration, observing the evidential harmonics of an out of balance cutting head.



Inconsistent relative to each other, due to poor stacking

PART 4 – Fit PC 6000 with tanks and dosing pump

After our initial success, the PC6000 was fitted with a dosing pump (Dosatron) and 2 x 200 Litre tanks to hold the **C-Complex™**. This would allow us to adjust the concentrate on the fly, as well as avoiding waste at wash down.



Results

During the trial the machine was typically running 27 to 30ft/min per shift. With the addition of **C-Complex™** the PC 6000 could comfortably run @ 40ft/min. With the last 1km of the trial run at 45ft/min The blades also stayed much sharper.

With C-Complex™



Without

