

## Measuring Dust Exposure, Vibration and Force – Simultaneously

### **A Test Bench System for Concrete Drills**

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#### **Overview**

This study designed and built a test bench system for concrete hammer drills that can simultaneously measure the health outcomes of respirable silica dust, handle vibration, and handle force in order to systematically compare hammer drills, bits, dust capture systems, and drilling methods. It automatically advanced an active drill into concrete blocks while health outcome measures were recorded. Reliability of the system was assessed by comparing health outcome measures associated with multiple drilled holes (minimum of 11) using 2 different drills and 2 different sized bits. Validity was evaluated by comparing handle vibration and force using the system to drilling holes by hand. Reliability of the system on productivity, handle vibration, applied force, and respirable dust was good and validity of the system was good. This study looked at the new test bench system to systematically compare different hammer drills, bits, dust capture systems, and levels of applied force on the health outcomes.

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#### **Key Findings**

- A test bench system for hammer drills was able to automatically drill multiple holes into concrete block under force control while handle vibration, applied force and respirable dust levels were collected. This is the first system to measure these health outcomes simultaneously.
- The designed test system had good reliability on handle vibration, applied force and respirable dust.
- The designed test system had good validity on handle vibration and force when compared to drilling holes by hand.
- There were important differences in measured handle vibration and respirable dust when drilling with different sized concrete bits and using different hammer drills.
- There were important differences in productivity between different hammer drills when drilling 3/4" holes.



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