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MDP (MACHINE DRIVE POWER) INTELLIGENT COMPACTION TECHNOLOGY

THE NEED

On-board Intelligent Compaction (IC) technology was developed on vibratory soil compactors to help the operator consistently produce uniform compaction that meets the specified density. The technologies developed by various manufacturers all rely upon an accelerometer that measures the ground response to energy from the vibrating drum.

Caterpillar developed MDP (Machine Drive Power) technology to fill this gap. Rather than an accelerometer and vibratory drum, it uses the principle of rolling resistance to provide indications of soil stiffness. This allows it to perform more reliably on cohesive and granular soils with less variability than accelerometer systems. It also means that the technology can be used on both vibratory and static drum compactors, which are often used on larger sites. While the technology is quite useful on its own, it is even better as a complementary technology to the existing accelerometer-based systems. Contractors who use vibratory soil compactors equipped with MDP and accelerometer-based measurement systems enjoy the widest application range, able to ensure uniform, high quality compaction on nearly any soil type.



FIGURE 1 PADFOOT VIBRATORY SOIL COMPACTOR USING MDP TECHNOLOGY ON COHESIVE SOILS – IOWA USA



THE TECHNOLOGY

Machine Drive Power (MDP) is a technology that measures indicators of soil stiffness to help the operator perform high quality soil compaction work efficiently. It works on the principle of rolling resistance: it takes more effort (energy) to propel over terrain that is loose than over terrain that is compact. Sensors measure the amount of energy the compactor requires to move forward and converts that measurement to a unitless value. The operator is able to monitor this value, watching as it progresses toward a target value (the relative value established in situ that represents compaction to meet specification). When the measured value reaches within a certain percent of the target value, the operator can deduce that the compaction specification has been reached. Similar to accelerometer measurement technology, it can be integrated with GPS mapping systems to provide visual, real time maps of the work that can be used to guide the operator as well as viewed remotely by site managers to monitor progress and work quality.

MDP OFFERS WIDER APPLICATION RANGE

Traditional accelerometer-based systems rely on the vibratory drum to make measurements. This means that they are blind if the vibration is not active. This is difficult to do with padfoot drums, which by nature do not consistently displace soil or contact the ground.

MDP is different. When soil is uncompacted, the compactor sinks into the soil. Energy is required for the compactor to “crawl” out of the depression and move forward. As the compactor works over the ground, it becomes more compact, so the compactor sinks less deeply and subsequent passes require less energy. The system notes this change and converts the measured energy values into the unitless values.

MDP works with vibration or without. This means the technology can be used on static drum compactors as well. It also increases the application range by allowing the technology to function in situations where drum vibration is undesirable; near existing structures, for example. Using rolling resistance as the basis for measurement also provides more reliable measurements on cohesive soils. And because the MDP system does not attempt to calculate drum displacement or contact with the soil, it can be used on smooth drum or padfoot drum machines with equal efficacy.

MDP measures about 30-60 cm deep, which is less than accelerometer-based systems that measure about 1-1.2 m deep. This is important because compaction progresses by compacting one layer (called a “lift”) of soil at a time, layer by layer. The thickness of the lift can vary, but is typically around 30-60 cm. This means that when MDP is used, it is measuring the soil that it is working to compact. Because accelerometer systems measure much deeper, the measurement you are getting is an average of the working layer plus



additional soil already worked. So MDP is giving you information about the soil you are working NOW, not an average of several layers.



FIGURE 2 GPS MAPPING SYSTEMS CAN HELP OPERATORS VISUALIZE THE WORK IN REAL TIME

THE BENEFITS

- Wider application range – all soil types and machine configurations
- Works in sensitive areas or in high production areas
- Measurement depth is close to that of a typical lift.
- Can be combined with accelerometer measurement technology on the same machine for the widest application range. (available only on certain models)

STATUS

Exclusively available on all 10 ton+ Cat® smooth drum and padfoot drum vibratory soil compactor models, as well as certain static drum large soil compactors.



POINTS OF CONTACT

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REFERENCES

1. None. Detailed brochures available on request.

REVIEWERS

Peer reviewed as emerging construction technology

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