SURFACE PRODUCTION – Mark Cooper, Jeff Flahive, Jim Hutchins

Mark Cooper, Je- Flahive and Jim Hutchins were the development team for Vermeer to introduce its rst Terrain Leveler® surface excavation machine (SEM) in 2002. The company says "the innovative Vermeer® T1255III Terrain Leveler SEM o-ers superior production in a variety of applications, including surface mining. Depending on the model, a Terrain Leveler SEM can cut areas up to 4.6 m wide and up to 813 mm deep in a single pass." A patented, industry-exclusive tilting cutter drum with two-direction levelling on the SEM aids production by keeping the drum level or allowing it to follow an orebody in 3D — allowing the unit to take on jobs that were not possible before — regardless of ground conditions. It also o-ers the ability to use GPS/laser guidance to control grade. Featuring heavy-duty CAT engines ranging from 261 kW to 447.4 kW, these units have ample power to grind through some of the toughest material at a mine. Greater rock penetration is achieved with a top-down cutting system, TECTM Plus technology, and a host of other features that contribute to the e-ectiveness of the Terrain Leveler SEM. Top-down cutting allows the cutter teeth to achieve greater rock penetration. When the machine travels forward, the teeth on top of the drum are positioned over the top of the rock surface. As contact is made, the teeth instantly cut the rock. The Terrain Leveler technology is designed to eliminate the need for primary crushers, large loaders, large haul trucks and associated permits, in addition to rippers and vertical drills and explosives.

As well as mining material, the Terrain Leveler SEM can perform site preparation and excavation, stabilise contaminated soil and break up concrete roads. At a copper mine in the Democratic Republic of the Congo, for example, the mining sequence begins by identifying ore and waste. A 100 mm wide cut is made across the strike of the ore zones with a Vermeer rock saw. The trench cuttings are sampled in 2.5 m intervals between rock units. Samples are sent to the laboratory where total and acid soluble grades and gangue acid consumption are determined. The assays from the lab are used to develop an ore control model from which the ore zones can be designed. Surveyors stake the outlines of the ore zones in the eld after the surface miner has fragmented the rock. The mine has ve Vermeer T1255 Terrain Leveler SEMs that cut the ore zones rst. The SEMs are used to fragment ore and some waste. Careful planning is essential at the interface of the 5 m waste bench mining and the 0.625 m ore cuts to minimise issues with access and interference from blasting in the waste. The mine has found that surface miners can be at least four times as selective in rock fragmentation compared with drilling and blasting. They avoid the mixing and displacement issues inherent in blasting and eliminate the need for a crusher. Based upon operational experience to-date the current expectation is that the surface miners will produce, on average, 650 t/h with an overall availability of 70% and utilisation is 70% for a combined overall asset e ciency of 70% x 70% = 49%. In 2012, Vermeer introduced the next generation of the Terrain Leveler SEM line — and the largest machine Vermeer has ever engineered. The 200-t T1655III stands an impressive 5.2 m high when the cab is fully extended. Two CAT C18 engines provide 895 kW of power. The dual engine conguration provides power to a common pump drive so that each engine provides

power equally to the machine; however, if one engine is not operational, the machine is still able to function on a single engine. The T1655 SEM was designed specically for precision mining and deployed to Western Australia for use in the iron ore mines in the Pilbara. Fortescue Metals Group (FMG) uses both the T1255 and T1655 at its Christmas Creek mine.

The T1655 SEM was initially tested in Western Australia, where the top-down cutting technology provides FMG the ability to control mineral extraction and develop uniform size product by either increasing tooth penetration or decreasing tooth penetration to reduce the material size. Producing small-sized material in a uniform conguration allows minerals to be handled more e ciently than product produced by drilling and blasting. The uniform product size also allows more e cient settings on secondary and tertiary crushing systems, savings that can continue well past the primary crushing stage. Since the introduction of the Terrain Leveler SEM, Vermeer has worked to increase its productivity and e ciency. Early in 2014, the company introduced a remote control system that enables the operator to control the SEM from a remote location up to 152 m away. Vermeer also redesigned the T1655 cutter drum with patent-pending quick change tooling, which reduces time spent repairing and replacing worn teeth. An ergonomic bolt-on design means teeth can be replaced by hand instead of requiring welding equipment. The new design increases overall cutting productivity of the drum. Also notable is the next generation of the Vermeer exclusive TEC Plus system. SmartTEC is an onboard performance monitoring system that continually monitors the performance of the machine. The system uses visual displays to aid the operator in adjusting the SEM controls in order to maximise performance. It also records daily performance and provides operational data on a daily, weekly or monthly basis —or over the life of the machine. The purpose of the software is to provide condence to the machine operator and mine operators that they are getting the most productivity out of the Vermeer Terrain Leveler SEMs.