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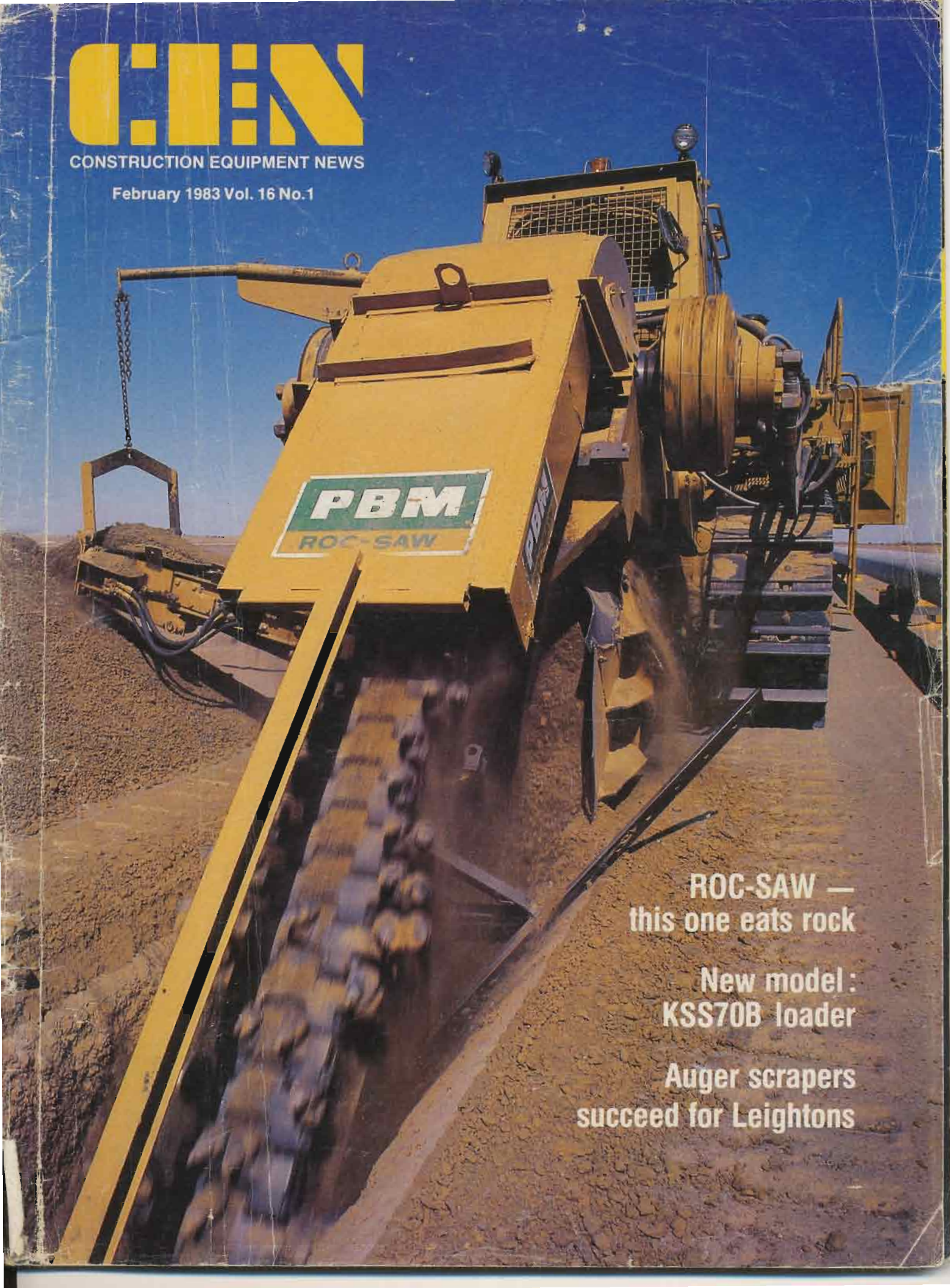

ROC-SAW — this one eats rock

New model: KSS70B loader

Auger scrapers succeed for Leightons

Stand back, this one eats rock

ROC-SAW

Unique in Australia, ROC-SAW is said to offer big savings for long distance trenchers where conditions suit it.

Story and pictures by Barry Ashenhurst

When it comes to cutting trench for a cross country pipeline, contractors are usually left with a choice between drill and blast, a conventional bucketwheel trencher, or hydraulic excavators.

Now there's a fourth alternative, ROC-SAW, a hybrid but effective trencher said to have saved up to 50 per cent where conditions have suited its employment.

Ian Jacka, Prentice Bros and Minson engineer in charge of the ROC-SAW explaned to CEN that his company is not boasting the saw as the last word in ditching but as a viable alternative to conventional methods.

Explaining trenching logistics further, he said that bucketwheel trenchers can only handle the softer materials, cutting fairly cheaply at about $1.25 a lineal metre. When materials become too hard for the bucketwheel, hydraulic excavators are usually called in, these days ditching at a cost of anywhere between $4.50 to $13 a lineal metre, depending on how hard they have to work.

Should a contractor be unfortunate enough to strike materials too hard for excavators to work unaided, then the material has to be loosened by fairly well spaced shots, or massive drill and blast operations.

"And this is where ROC-SAW fits in" explains Jacka.

"As soon as a contractor gets into hydraulic excavator-type operations around the $4 a lineal metre mark, ROC-SAW becomes immediately competitive and will outperform hydraulic excavators in almost every way.

"In terms of dollar performance, if ROC-RAW can't offer potential saving over a long distance cut of at least 15 per cent then we won't chase the job", he said.

At the time this report was being written the saw was cutting a trench in Moomba, South Australia, far cry from the frigid tundra of the Alyeska fuel/gas pipeline for which it originally was developed.

A bloody great chain saw

In 1973, Bechtel, construction consultants for the Alyeska project were having the devil's own trouble with drill and blast, environmentalists, and the almost impenetrable thermo-frost, a fractured, frozen barrier to trenching momentum.

In frustration, Bechtel advertised in newspapers and trade journals for any bright spark who could come up with a way to get the ditch cut, and Bechtel's withering schedules back on time. BorTunco (Boring and Tunnelling Company of America) put forward a proposal with one if the most unusual hybrid machines the construction industry has seen, ROC-SAW, a tracked D9 dozer with what has accurately been described as a "bloody great chain saw" on the back.

BorTunco's proposals were accepted and four ROC-SAWs were developed over two years on the pipeline, cutting about 240 kilometres of trench.

When the Alyeska project finished, BorTunco bought back the rights of ROC-SAW from Bechtel. They then began developing the saw for world-wide application in all types of rock.

PBM (Prentice Bros and Minson) bought the machine for $1.1M and admit that "all types of rock" is something of an exaggeration.

In really hard materials such as bluestone, daceite, and so on, ROC-SAW just sits there and appears to be going nowhere. It cuts quarzite quite well but the greater the compressive strength and less jointing of the material, the less rapidly the saw cuts.

"Then again, that's not what the saw was designed for", continues Jacka.

"Materials it's really designed to work in are those that have been formed in a layering process such as sandstone, siltstone and shales. In the Flinders Ranges where we worked on the SANTOS fluids pipeline from Moomba to Stoney Point, ROC-SAW cut 47 km of material ranging from sandstone and quarzite through shale - a whole range of materials. In fact the advantage of the saw at Moomba wasn't what it cut but that it did the work of six drill and blast crews, lifting the progress expectations of the entire job.

"On another PBM project at Moomba, rather than the pipe lowering crew aiming for 1.5 km a day they geared up for two km because they knew that's what the saw would cut", he said.

Hybrid machines often have bitchy temperaments because of their jumbled genes, but the Australian ROC-SAW has not laboured its owners with unreasonable downtime, thanks to good foundation equipment, essentially Caterpillar. Because of the complexity of the saw, downtime is necessarily lengthy but is always scheduled, seldom interrupting productivity.

ROC-SAW is built on a Cat Da dozer that has had its undercarriage modified. The original engine has been yanked out and replaced with a Cat D348 motor, lifting engine output from about 238 to 634 kW.

The torque converter has been removed and the engine now drives forward into a series of hydraulic pumps, rather than back through the transmission. One of the hydraulic pumps feeds an hydraulic motor which "plugs into" the transmission. This means that transmission control is maintained in each gear, but with infinite speed variation.

All the controls are rheostat-type. The well cared for operator sits in an air-conditioned ROPS cab, making incremental adjustments rather than guiding the machine with conventional dozer controls. The saw is guided by sight poles set along the trench or by a standard laser-plane guidance system. Keeping the saw on the straight and narrow is no real challenge; weighing 75 tonnes it's disinclined to wander.

There are seven different hydraulic circuits; the main circuits; cooling systems; tractor drive; two separate

circuits to the chain drive - about 450 kW is delivered to the chain drive - and there's a conveyor circuit as well.

The engine feeds into a pair of gearboxes and from each of these an hydraulic motor is driven. Power then drives to the saw on the back of the machine. The saw is fitted with a central cutting bar not unlike a chain saw's. The chain is something like that on the D10 dozer, specially fabricated, and weighing about seven tonnes.

The chain is joined in a series of pinned links. Basic link width is 46 cm (18 in.). In some the links go together in patterns of 11. There are six sequences of these, 11 on each chain. Of these 11, six are 46 cm wide and five are 61 cm (24 in.) wide. To hold the tungsten carbide cutting tips, sockets are welded to the chain segments.

The cutting chain revolves at a constant speed of about 228 m a minute, pulling the dirt up under the machine, into a hopper then onto a conveyor. Excavated material is deposited in a neat windrow beside the trench making backfilling a simple job for a grader.

Cutting pressure, the sole influence on forward movement is determined by the forward rate of progress - cutting speed isn't varied, only the pressure in the hydraulic pumps that do all the cutting. That pressure is controlled by how hard the chain is pulled into the bank.

25 to 91 cm cut

The Americans say ROC-SAW will cut trenches in widths anywhere from 25 to 91 cm. For the Moomba cut the saw was fitted to produce a 26 in. trench - "perfect for 14 in. pipe", adds Jacka.

PBM hopes its ROC-SAW can win part of the North West Shelf work for them, and if that eventuates the saw will be built out to cut a one metre trench.

Building-out is disproportionately simple given the complexity of the saw. Increasing cutting width is a matter of increasing chain width and altering the rear-end geometry. Chains 850 mm wide have been fabricated in Melbourne and are being field-tested. A one metre chain is being designed for the Dampier/Perth project.

The North West Shelf project would be an ideal opportunity for PBM's ROC-SAW division to prove its cheaper-in-bulk trenching theories on how much ROC-SAW can save on a long cross country cut. The project contains at least 200 km of limestone,

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On the Moomba cut the Roc-Saw did the work of six drill and blast crews and cut 2 km a day.

When I visited the site the Roc-Saw operator was using site poles to guide the machine. Not bad, is he?

All the controls are rheostat-type. The machine is guided by site poles, or a laser-plane guidance system.

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right up ROC-SAW's gigantic alley, so to speak.

Ian Jacka summarises the financial benefits inherent in ROC-SAW.

"Where the application suits the ROC-SAW, tangible benefits are savings in costs," he said.

"We're not trying to market the machine as doing a better or faster job - although it's unquestionably faster than drilling and blasting - we're offering an alternative which could well save a lot of money.

"The standard cost for drilling and blasting at the moment is somewhere between $20 and $50 a cubic metre. If the materials are too hard for excavation then ROC-SAW can cut it for about $8 a cubic metre. As the material gets harder the cost of the ROC-SAW approaches that of drilling and blasting.

"Of course there are instances where, for environmental reasons for example, as we had on a job at Gladstone where water and electricity services paralleled the trench, it was totally impractical to drill and blast. The ROC-SAW was the best way to do that job.

"In most jobs where I know the saw has an advantage over normal equipment I'll quote on the job, but if I can't expect to save the client at least 15 per cent, I can't afford to discount rates. On some jobs we've saved our clients up to 50 per cent, and that's what the ROC-SAW is all about", he concluded.

As a matter of interest PBM commissioned Harry Butler's conservation group to produce an environmental report on the ROC-SAW. Butler's report concluded:

"The ROC-SAW presents a trenching and cutting tool of particular use in areas of high physical, natural or social environment value.

"The use of the ROC-SAW reduces impact on these environments.

"The cost evaluation on the performance of the ROC-SAW must be presented on the basis of cost of excavation, plus subsequent cost of restoration/rehabilitation, ongoing workforce and potential industrial problems.

"While these are not of concern in some countries, in Australia they have particular significance and must be considered at all times.

"Under any conditions the ROC-SAW is seen to be cost effective but is particularly so where specialised alternative construction techniques, such as ripping, blasting and backhoeing are required.

"We have assessed the performance of the ROC-SAW in a number of countries, particularly the United States of America, and would be happy to recommend its use on environmental grounds in particular to any prospective contractor or owner of a pipeline project, an excavation project or any other form of trenching operation."

Examples of ROC-SAW Performance:

Type of Stone	MOHS Hardness	Compressive Strength	Trench Depth-Width	Performance
Permafrost-silt and gravel, large grain, abrasive	6	6,000 psi (414 bars)	5 ft. – 1.75 ft. (1.524m – 0.533m)	105 to 183 yd^3 (80 to 140 m^3)
Limestone-light chalky, fine ground solid	3	2,000 to 4,000 psi (138 to 276 bars)	9 ft. – 2 ft. (2.743m – 0.610m)	141 to 235 yd^3 (108 to 180 m^3)
Limestone-light brown, fine grained-massive solid	3 to 3.5	6,000 to 8,000 psi (414 to 552 bars)	7 ft. – 2 ft. (2.134m – 0.610m)	59 to 68 yd^3 (45 to 52 m^3)
Limestone, brown buff – very fine grained solid, caprock	3.5	14,000 to 16,000 psi (966 to 1104 bars)	9 ft. – 1.75 ft. (2.743m – 0.533m)	33 to 39 yd^3 (25 to 30 m^3)
Quartzite, grey, fine to middle grain, massive	7	8550 psi (590 bars)	9 ft. – 0.83 ft. (2.743m – 0.253m)	12 to 24 yd^3 (9 to 18 m3)
Shale – grey black, fine grain horizontal planes		2,000 to 4,000 psi (138 to 276 bars)	9 ft. – 2 ft. (2.743m – 0.610m)	131 to 164 yd^3 (100 to 125 m^3)