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ABOUT US

COMMENTARY

NEWS

LIBRARY

PRODUCT
SHOWCASE

MEDIA KIT

BUYERS'
GUIDE

SUBSCRIBE



Full steam ahead for New Brunswick coastal quarry



A crushed stone operation at the southern tip of New Brunswick has become a significant player in the marine aggregates business, supplying major markets on the U.S. eastern seaboard, the Caribbean and Central America after just three years in operation. Demand for its granite aggregates has so far doubled each year. This very success has created operational challenges in a developing facility where space is at a premium.

Aggregates & Roadbuilding recently visited the site and found that the owners had met these challenges through innovative solutions in several areas including drilling, high capacity portable production spreads, material handling and ship loading systems.

Located at the Bayside Marine Terminal in St. Andrews, N.B., the aggregate operation is a joint venture between Jamer Materials Ltd. and Atlantic Coast Materials Inc. Under the current business structure, Jamer Materials has responsibility for the operational side of the business, while Atlantic Coast Materials handles product sales and distribution. This spring, Jacksonville-based Florida Rock Industries Inc. acquired 50 per cent ownership of both Jamer and

Atlantic Coast.

The operation produces a full range of aggregates to American Society for Testing and Materials (ASTM) specifications. Shipments totalled some 400 000 tonnes in 1998, with about 200 000 tonnes of granite from the quarry and a similar amount of product from the company's speciality sand and gravel operation located some 20 km away. The total increased to 800 000 in 1999, with about 500 000 tonnes of granite and 300 000 tonnes of sand and gravel. Atlantic Coast Materials president Mike Power projects that this year's shipments will rise to 1.5 million tonnes, with 1 million tonnes of granite products together with 500 000 tonnes of sand and gravel.

The concrete and asphalt aggregates are in demand in the 20 million tonnes/y New York City market and are competitive with traditional sources in New Jersey and upstate New York. Other markets include South Carolina, Georgia, Florida and the Caribbean, while a recent order for 250 000 tonnes of railway ballast was shipped to Panama. The current principal carriers for the Bayside Quarry are Canada Steamship Lines International Inc., Montreal, Que. and Tovald Klaveness & Co A/S, Oslo, Norway. Canada Steamship Lines handles approximately 60 per cent of the shipments. During *Aggregates & Roadbuilding's* quarry visit, CSL's Sheila Ann (named after Federal Finance Minister Paul Martin's spouse), a Panamaxclass self-unloader was being loaded with 46 000 tonnes of aggregates for a split delivery to Jacksonville and Nassau, Bahamas.



Svedala H6000 Hydrocone operating as the secondary crusher for plant No. 1.

Production challenge

For Jamer Materials president and general manager Miller Esson and operations manager Mark Clark, this rapid growth meant that choosing the right processing equipment was critical and had to

combine high production capacity and product flexibility with full portability. Production space at the operation is currently limited to developing the extraction area that covers less than ten acres, while the dock area below provides only temporary storage space for finished product prior to shipment.

Their successful solution consists of two new fully portable spreads with a combined capacity of no less than 1000 tonnes/h, utilising a total of nine crushers. The two plants comprise two jaws, one gyratory and six cone crushers teamed with eight screening plants.

The spread makes extensive use of equipment designed and constructed by Miramichi, and N.B.-based MFE Esson Built Aggregate Equipment Ltd., including trailers for the crushing and screening plants as well as all process and stockpile conveyors.

These multi-million dollar spreads are supported by a fleet of five late-model production and stockpile wheel loaders. There are no haul trucks utilised in this operation, reflecting the short haul distances in all material handling areas including primary haul, finished product stockpiling and ship loading.

Quarry development

The first step in the production process is overburden removal. This task is carried out by a Hitachi EX300 excavator with 1.1 m³ bucket, removing typically 1 m to 1.5 m of material, although there are occasional thicker lenses.

The quarry is currently worked in two benches with an upper bench about 13.8 m high and a 10.7 m lower bench. Drilling and blasting is subcontracted to Archibald Drilling and Blasting (1986) Ltd. of Musquodoboit, N.S. Archibald is employing a Komatsu PC120-6 excavator fitted with a down-the-hole (DTH) drill attachment that was designed and manufactured at the contractor's shop. The versatile drill system can reach inaccessible hole positions on rough terrain and is capable of drilling holes ranging from 114 mm to 165 mm in diameter. At Bayside, it is drilling 140 mm diameter holes on 3.8 m x 3.8 m square pattern. Its 4.2 m feed and automatic rod changer give a hole depth capacity of 27.4 m, using 114 mm diameter drill rods with 89 mm diameter API thread. Air for the DTH drill is supplied by a truck-mounted 900/350 Ingersoll-Rand compressor.

The Secoroc 127 mm hammer utilises 140 mm flat-faced bits that require sharpening after every 91.5 m in this abrasive rock, with a

total life ranging from 762 m to 915 m. Production rates average between 244 m and 274 m per shift.

After drilling, the bottom of each hole is charged with double Orica primers, followed by a full column charge of a 60 per cent emulsion/40 per cent ANFO explosives blend to deal with any wet holes, capped with a 1.8 m collar. Initiation is non-electric, with blast sizes ranging between 30 000 tonnes and 100 000 tonnes. All blasts are monitored by seismographs, and although there are no residents in the neighbourhood, the warehousing and shipping companies in the dock development are currently only about 250 m from the active faces.



Layout of plant No. 2 with a Cat 988F feeding a Svedala 32x42 primary jaw crusher.

Processing operations

Top bench shot rock is carried about 7 m by a Caterpillar 992C fitted with a toothed spade nose bucket and dumped over the lower bench. From there, it is recovered by wheel loaders and fed to the portable spreads that are set up on the quarry floor near the active face of the lower bench. When *Aggregates & Roadbuilding* visited the site in late July, this material was being recovered as feed for plant No. 2, while the smaller plant No. 1 was being fed with shot rock from a recent shot in the lower bench. Plant No. 1 was making two products: ASTM concrete coarse aggregate #57 (25 mm x 4.75 mm) and 6 mm x 0 asphalt fine aggregate. Con-currently, plant No. 2 was turning out the same two products as well as #8 chips (9.5 mm x 2.36 mm), also for asphalt production.

Plant No. 1 is fed by a Caterpillar 980G, carrying the 610 mm minus shot rock just 30 m to a 5.5 m Simplicity single-stage grizzly feeder. The feeder works with a 1999 Svedala 32x42 primary jaw crusher that reduces the shot rock to 150 mm minus. The crusher runs discharges on to a 1066 mm conveyor, feeding a 1999 Svedala H6000 Hydrocone that further reduces the material to 64 mm minus. Material then goes forward to a twin Tyler horizontal screening plant, with two 6x20 triple-deck screens. The first screen is fitted

with screen cloth sizes of 51 mm, 25 mm and 6.4 mm on the top, middle and bottom decks, respectively. Material retained on the bottom deck, as well as screenings passing the same deck are taken out of the circuit as finished products. The 64 mm minus to 25 mm plus stones retained on the middle and top decks are discharged into a 1998 Svedala H6000 Hydrocone which crushes the material to 38 mm minus. The 38 mm minus is conveyed to the second Tyler screen, fitted with 32 mm, 25 mm and 6.4 mm screen cloths.

Again, clear and fine granular product goes forward, while the 25 mm plus material retained on the middle and upper decks, goes back to the second H6000 in a closed circuit.

The plant has an average production rate of 375 tonnes/h in this configuration.

Plant No. 2 is fed by a Caterpillar 988F discharging into a 6.4 m long Simplicity single-stage grizzly feeder positioned ahead of a 1998 Svedala 44x48 primary jaw crusher. A 1219 mm belt, fitted with an Eriez 1066 mm wide magnet, conveys material to a 6x20 Simplicity double-deck inclined screen that is a recent addition to the circuit. This heavy-duty scalping screen has punch plate on the top deck with 89 mm openings and 51 mm wire cloths on the middle deck, dividing the 254 mm minus material from the jaw into 254 mm x 51mm and 51 mm minus fractions. The larger material is conveyed to a 1998 Svedala S4000 gyratory crusher that reduces the material to 89 mm minus. Product from the gyratory is then re-combined with the 51 mm minus material passing through the bottom deck of the scalping screen.

All of the material is then fed by a variable frequency drive plate feeder onto a 1066 mm discharge belt with deep trough idlers in order to carry the plants 590 tonnes/h. The average throughput sometimes ex-ceeds 635 tonnes/h.



To produce final products, Plant No. 2 uses twin Nordberg HP400 tertiary

cone crushers and a Simplicity 6x20 triple-deck horizontal screen plant.

Material then discharges onto a 1999 Simplicity 6x20 triple-deck horizontal screen fitted with 51 mm, 38 mm and 8 mm screen cloths that separate the material into three fractions. Material larger than 38 mm (retained on the top and middle decks) is fed to a matched pair of Svedala H4000 Hydrocone crushers, while material retained on the bottom deck (38 mm x 8 mm) goes to a matched pair of Nordberg HP400 cone crushers.

Each pair of crushers is set up in closed circuit with twin finishing screens. Product from the H4000 cones discharges onto a 1999 Simplicity 6x20 triple-deck horizontal screen plant where oversize is returned to the crushers in closed circuit. Likewise, the HP400's are set up in a closed circuit with a 2000 Simplicity 6x20 triple-deck horizontal screen plant. Crusher settings and screen cloth sizes in these circuits are adjusted to suit product demand. In late July, the H4000 cones were producing ASTM #57 and 6 mm minus while the HP400 machines were turning out ASTM #8 and 6 mm minus.

Each spread is controlled from a trailer van featuring an El-Russ hydraulically raised control tower, and both have conventional push button controls and interlocks on key components.

A Caterpillar 3412 engine teamed with a Cat 800 kW generator provides power for plant No.1 while plant No. 2 is powered by three Caterpillar 3412 engines driving 635, 685 and 725 kW generators. Fuel storage for all this generating power includes 400 gallons in each generator set trailer and a separate 250 gallon reserve tank. Bulk diesel is delivered to both plants on a daily basis.

Miller Esson points out that the very hard, abrasive nature of this rock was a factor in crusher selection and layout. His experience in dealing with the highly variable geology of the Maritime region suggested that jaw, gyratory and cone crushers would be more effective than impact or roll crushers in this application.

Micro-Deval tests for abrasion loss yield results below 4 per cent compared to, for instance, the maximum loss of 13 per cent allowed for aggregates used in concrete pavement by Ontario's OPSS 1001. Results for the Los Angeles abrasion test show equally impressive numbers in the 13 to 15 per cent range. Samples of this rock also frequently yield a Petrographic Number (PN) of 100, the best possible score, while a PN number of 102, still an excellent result, is the least favourable on record. While certainly good for business, these numbers also mean high equipment wear rates for the

operations team, with Esson reporting 400 hours as the typical wear life for crusher liners as an example.

Other process equipment on site includes a portable Ortnier wash plant, utilized when customers require washed #8's or washed screenings. Mobile support equipment includes a Caterpillar 235 excavator fitted with a Teledyne TB1425X breaker for relieving jaw plugs and a Thomas 135S skid steer loader on clean up duty.



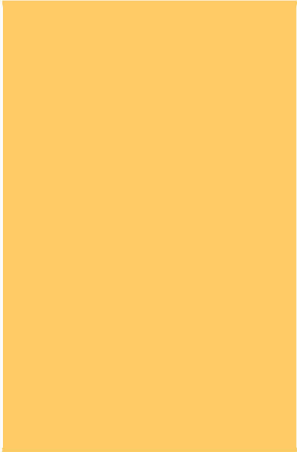
Pant leg feeds Svedala H4000 secondary cone.

Environmental measures include a tree screen that effectively shields the operation from observers looking across the Passamaquoddy Bay from either New Brunswick or Maine. In addition, fugitive dust generation is minimised by spray bars fitted to the screens as well as water sprays in the primary jaw crushers.

Finished product is hauled to the edge of the extraction area and stockpiled against the dock's back wall by a fleet of wheel loaders including a Caterpillar 988F and two 980G's. In the days before loading, inventory is built up here and in the dock area itself.

Once the vessel arrives, speed is essential to minimise loading costs and avoid demurrage (penalty charges) for loading delays. Two Caterpillar 992's, with 9.2 m³ buckets, load material at an average rate of 1500 tonnes/h, while a third 992 is kept on standby. Product is fed to three 40 tonne capacity hoppers with divided sections to facilitate multiple product loading, as well as a drive-over underground hopper with grizzly bars. These hoppers discharge onto a 1219 mm x 30 m dock conveyor linked to the 1371 mm x 52 ship-loading conveyor. Extra dock conveyors are added to reach all parts of the vessel. This year, the loading process will be repeated some 40 to 45 times on vessels carrying an average of 35 000 tonnes.

While at sea, these travel at about 15 knots, giving a travel time of



two days to New York in normal weather conditions. Overall, the future looks bright for this business, combining accessibility to major markets, a high quality natural deposit and a versatile approach to production.

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