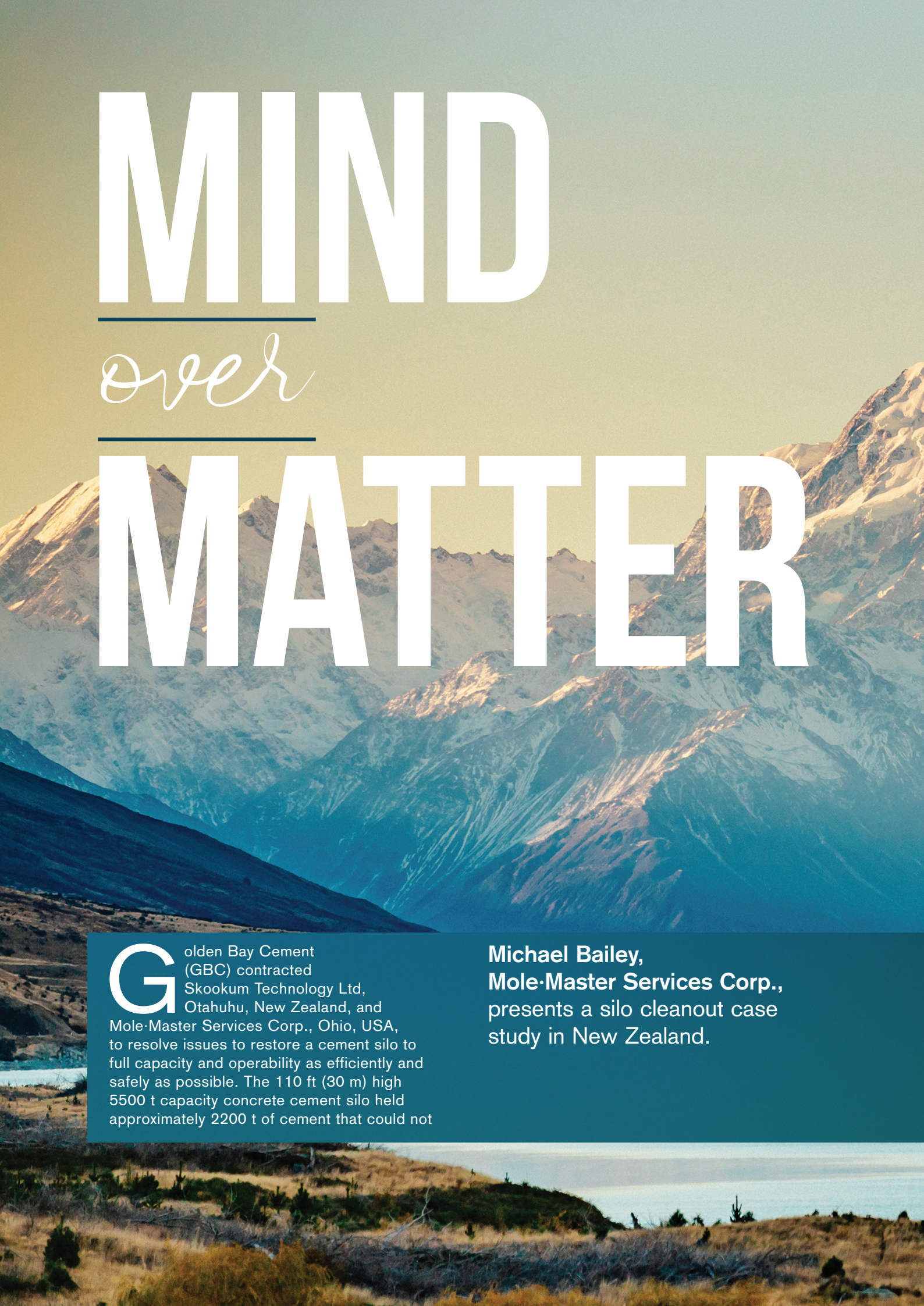
MIND *over* MATTER



Golden Bay Cement (GBC) contracted Skookum Technology Ltd, Otahuhu, New Zealand, and Mole·Master Services Corp., Ohio, USA, to resolve issues to restore a cement silo to full capacity and operability as efficiently and safely as possible. The 110 ft (30 m) high 5500 t capacity concrete cement silo held approximately 2200 t of cement that could not

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presents a silo cleanout case study in New Zealand.

be removed. This was generally sloping against one part of the silo's circumference and posed a significant hazard if personnel attempted to enter the silo to systematically remove the buildup. GBC and Skookum recognised that Mole·Master had experience and resources to safely and economically expedite the works to remove the cement buildup from the New Plymouth cement silo.

Trucks were carefully loaded with cement and covered to minimise escaping dust.

Hydrated, hardened cement buildup along the silo's interior wall.

Removing hardened cement chunks from the silo gate to re-establish material flow.

GBC operates New Zealand's only fully integrated cement plant and is the largest cement supplier to the New Zealand market. GBC distributes cement to six marine terminals at ports around the coast in a purpose-built ship and a cement barge. The plant, located near the northern tip of New Zealand, is a precalciner dry process plant that also stores powdered raw meal, which is as susceptible to moisture ingress as cement. GBC's New Plymouth, Port Taranaki cement terminal lies on an exposed west coast foreshore location. Prevailing winds from the open ocean means that moisture-laden salt sea air plays havoc on all equipment and structures.

Constructed in the early 1970s, the 5500 t silo in the port of Taranaki faced multiple issues, including a poorly functioning aeration system, blocked outlets, and buildup of an estimated 2200 t of cement. Crucial to GBC's distribution strategy was the need to restore the cement terminal to full operability to avoid trucking cement to customers some 230 miles (360 km) away.

Cement susceptibility

The storage and handling of cement presents many unique challenges to bulk storage facility (silo) operators. Cement is highly sensitive to moisture ingress. Environmental factors, including humidity, temperature change, and climatic shifts can introduce moisture into the product, which is deleterious to the quality of the commodity. Water ingress into cement storage silos from small leaks in the structures is exacerbated by the silos being under negative pressure (a vacuum) with water. This results from precipitation being drawn into the silo through any minor cracks or fissures in the silo walls and roof. Frequent filling and emptying will facilitate moisture-laden air to be drawn into the silo. Moisture can also be introduced into the stored product from compressed air systems, where compressed air is used to fluidise the stored product to facilitate extraction from the silo. It is not uncommon for large raw meal or cement buildups within silos to severely impact on storage capacity or, at worst, to completely prevent the ability to extract the product from the silo.

Raw meal and cement silos are at risk of plugging, buildup caused by numerous factors, and the ultimately undesirable

adhesion of finished cement, raw meal, or clinker to itself or to interior silo walls. Atmospheric moisture introduced into the silo can cause hydration of the stored material and, consequentially, clogs and buildup.

As New Zealand's largest cement manufacturer and supplier, GBC relies on continuous and uninterrupted material flow to meet the consistent demand of both its New Zealand domestic customers and export market customers in the Pacific Islands.

Boots on the ground

Skookum was commissioned by GBC to manage the silo upgrade and repairs. As a leader in cement transferring equipment and storage in New Zealand, Skookum manufactures and imports materials handling equipment. After evaluating the options available in terms of safety, efficiency, and effectiveness, Skookum contracted Mole·Master to resolve the problem of the silo's cement buildup.

The 8000 mile and 19 hour time difference between Mole·Master headquarters and New Zealand were not new challenges for the company's team of experts charged with the GBC project. Despite the time zone differences, the three parties conferred with each other via telephone conferences to iron out the technical and commercial details of the project.

Mole·Master utilises proprietary tools and methodologies to effectively address bulk materials handling and storage. The company delivers proprietary cleanout equipment that is containerised to ship anywhere in the world. Once these tools reach their destination, they are placed in the experienced hands of a team of experts who understand the variables and intricacies of bulk storage concerns.

Mole·Master provided a core team of three experienced staff from the US with their specialised equipment to expedite the works. Shipping equipment from Ohio via LA to Auckland and on to New Plymouth took nearly three months. A Mole·Master supervisor arrived in advance of the core team to expedite the preliminary work, which included satisfying the client and the port company of Mole·Master's safety procedures. Other logistical and temporary engineering provisions were also worked through with the supervisor. This preliminary work streamlined the processes for the other staff, who followed two weeks later.

Breaking down buildup

Due to the silo's exposed location and proximity to the ocean, moisture-laden air from the aeration blower hydrated the cement on the silo bottom air pads and blocked these off. The resultant poor flow of cement to extraction points exacerbated by time, temperature, and compaction caused extensive buildup to a point where the silo's live capacity was reduced by 45%.

Several of the 50 year old pipework rubber joints inside the silo had degraded and allowed cement to enter the aeration air pipework and air pads, further aggravating the problems. The elevated peaks that are a common identifying characteristic of ratholing were severely restricting the funnel flow movement of material.

The onsite Mole·Master team utilised the proprietary Big Mole System to breakdown the rathole formation of material. The relevant advantages of this system for the silo cleanout project in the port of Taranaki included its versatility, unmanned entry capabilities, minimised downtime, and dry process material removal method.

The versatility of the Big Mole System negated the need to determine exactly how long the flow of the material had been compromised, or how long the compaction had occurred; these conditions do not affect how the system is used or its level of effectiveness. Because human entry is not required when deploying the system, the Mole·Master crew was able to break up the material remotely. This helped minimise the risk of injury while maximising efficiency. In fact, the Big Mole System can complete jobs that once took months in a matter of days. The 100% dry process of this cleanout system negates the need for water or other liquids that would have interacted with the cement and introduced unnecessary variables and added complexities to the project.

Revealing a silo's secrets

While the buildup estimate provided by GBC was accurate to within 150 t, other details of the project were not possible to ascertain at the time of initial analysis and estimation. As cement was removed, it became apparent that the silo air pads and the network of aeration air pipes were not only non-functional, but had become plugged with hardened hydrated cement.

To supplement the performance of the Big Mole System, the Mole·Master crew also used its Safe-T-Shot cardox method CO_2 blasting system. Capable of blasting away tonnes of material in single shots, the Safe-T-Shot system offers a significant amount of power in concentrated areas for targeted control. This blasting system was employed

to re-establish a functional side opening to affect material movement, and was also used to temporarily supplement the silo's poorly functioning aeration system.

Silo cleanout presents inherent hazards that vary greatly based on project size, scale, and scope. The 5500 t silo at the port in New Plymouth required the elimination of the potential for the collapse of high material and the creation of a safe point of entry for manual material removal.

No issue is more important than safety. Regardless of the country or continent in which a project is located, Mole·Master adheres stringently to an established corporate safety code. This includes always putting worker safety above production and schedule, leading the international industrial cleaning trade in continually improving safety, and ensuring every member of the team is provided the proper training, education, instruction, and personal protective equipment.

The utmost care for the environment is always a primary objective for GBC, Mole·Master, and Skookum; the GBC project presented unique environmental challenges. New Plymouth, where the silo is located, is a designated walking and cycling 'model community'. As such, cement dust or any ambient particulates released in the cleanup process would have been an unacceptable aesthetic and of environmental detriment to the pristine port of Taranaki. To empty the silo as quickly as possible with minimal impact, dust abatement procedures were implemented that expanded on the facility's existing dust collection system with virtually no interruption to the cleanout process.

Conclusion

The 5500 t silo cleanout and restoration project in the port of Taranaki, New Plymouth, presented unique environmental sensitivities and technical challenges, caused by failed dryers, air pads, and cement-clogged pipes, as well as hydrated, compacted cement that resulted in almost 2000 t of buildup. GBC, Skookum, and Mole·Master returned the silo to full capacity and production, safely and efficiently. ■

About the author

Michael Bailey is a Project and Technical Sales Manager for Mole·Master Services Corp. He specialises in complex silo cleanout projects all over the world.

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