

Superior quality ballast ensures extended track life

The type of ballast used in the rail industry has to conform to very clearly defined specifications. It is important that suppliers liaise closely with customers, to ensure that their exact requirements are fully understood and precisely fulfilled.

Having supplied Transnet Freight Rail, Metrorail and numerous private sector customers over many years, AfriSam - a leading supplier of ballast for railway purposes - was chosen to provide ballast for Gautrain. Stability and longevity of both track and ballast come under particular pressure with this project, which is to operate 24 four-coach trainsets at speeds up to 160km/hr for 18 hours a day. Sourcing precisely the right type of ballast was obviously crucial.

High quality 73mm dolomitic and doleritic aggregate for Gautrain ballasting is sourced from AfriSam's Olifantsfontein and Rooikraal quarries. As a matter of fact, production of ballast at Olifantsfontein was started specifically to meet Gautrain's special needs. The company's ferro quarry in north-east Pretoria supplies ballast for general usage to Transnet and other parastatals. In addition, its quarry in Witbank supplies felsite ballast to the national railway.

"Ballast must be able to bear loads properly without breaking down," explains AfriSam aggregates product technical manager Ray Bonser. "It must be of sufficient depth and closely packed beneath the sleeper, otherwise the sleepers will tend to move up and down as the wheels of the train pass over them, eventually causing the sub-grade to be disturbed." This effect is particularly severe when concrete, rather than wooden, sleepers are used.

Ballast of the correct depth enhances the stability of the track, protects the sub-grade and resists abrasion and degradation caused by intermittent traffic loads.

MEETING ALL THE SPECIFICATIONS

"Ballast must be free-draining," Bonser continues. "This is measured by minimum percentage (40%) voids. It must be hard, strong, stable, easy to clean, workable, resistant to deformation, easily available and reasonably inexpensive. Angular stones are preferable to rounded ones since they interlock more readily, to inhibit track movement." It stands to reason that softer materials, such as limestone, are not very suitable since they degrade under load when wet.

"However, fulfilling the correct specifications will be inadequate if the ballast is not properly deposited," Bonser emphasises. "It must be piled as high as the top of the sleepers, with allowance for a substantial 'shoulder' to be placed at their ends. This shoulder - the only thing restraining lateral movement of the track - should be at least 150mm wide."

Ballast aggregate is laid in its pure state with no additives to support it. Consequently, when supplying ballast to specific requirements, tight control must be exercised to ensure consistency in the quality of the stone. AfriSam uses appropriate screens to monitor the size and consistency of the aggregate.

"Ballast quality must be consistent, meeting stringent test requirements," Bonser points out. His customers are provided with samples of aggregates for testing, such as grading, to check that the correct distribution of particle sizes is achieved.

Gautrain construction: ballast on the main-line.





Ballast at the Gautrain Midrand Depot (north end looking south).



Ballast being compacted during the mainline construction.

Numerous tests are carried out to check different qualities of the aggregate, including the Flakiness Index, the Relative Density Test, the Los Angeles Abrasion Test, the Plasticity Index and the soundness tests.

MAINTENANCE

High ballast pressures combined with dynamic traffic loads cause frictional wear of the stones, leading to the fracture of individual stones and a resultant loss of stability.

Tamping is one of the methods used to maintain rail lines. Unfortunately it can lead to an increase in the percentage of fine ballast particles (fines). An excess of fines, known as fouling, contributes to ballast degradation, and cleaning these fines becomes vital. Badly fouled ballast results in clogging and a reduced ability to drain properly. Debris is then sucked up from the sub-ballast, causing yet more fouling.

"It is not always necessary to replace all the fouled ballast, nor remove it for cleaning," Bonser says. "Removing and cleaning ballast from the shoulder is often sufficient, provided that the shoulder ballast is removed to the correct depth."

This cleaning, however, can be undertaken only a certain number of times before the ballast suffers damage to the extent that it cannot be re-used. When fouled track ballast cannot be corrected by shoulder cleaning, it must be replaced altogether. Thus, regular inspection of the shoulder is important.

Maintenance activities such as replacing sleepers, tamping and ballast cleaning may upset the stability of the shoulder, so after such maintenance, trains should run at reduced speed. Alternatively, machinery must be used to compact the shoulder again.

"The supply, installation and subsequent maintenance of the ballast should be a joint venture between the supplier and its customers," Bonser stresses. Afrisam draws on decades of in-depth expertise in sourcing, manufacturing and supplying ballast that will promote the safety and stability of rail track over long periods of time without breaking down. As demonstrated in the case of Gautrain, the company is committed to finding specific solutions for its customers' needs and is justly proud of its reputation for quality assurance and reliability.



Ballast being loaded.