In the past several decades, shield machines have undergone many improvements, making them the most common boring apparatus for tunneling projects. Kawasaki delivered its first roof shield tunneling machine for a post-war subway construction project in Japan. This marked the beginning of the company’s evolution into a technological leader in reflecting technological advancements in this sector. Today, they are still first tunnel boring roof shield for a post-war subway construction project in Japan, mechanizing, upsizing, and automating shield machines.

There are two main construction methods for underground tunnels: 1) the cut-and-cover tunneling method, in which the ground is excavated from the surface down, and 2) the shield tunneling method, in which a vertical shaft is excavated first (without further excavation from the surface) and then lateral excavation is performed from the vertical shaft.

The latter method uses a shield machine, which is an excavator guarded by an outer frame (shield) strong enough to withstand the pressure from earth and water during construction. The machine excavates the ground with a rotating cutter in the front. In this double-headed machine, the tunnel walls are built to the rear of the shield machine as it moves forward. Thanks to these features, the shield tunneling method is less susceptible to effects caused by groundwater, both during and after construction. Various types of shield machines are used, depending on the properties of the soil: a basic shield machine is used for soft ground, a TBM for hard rock, and a full-shield TBM for both soft and hard soil are present.

Kawasaki first entered the tunnel boring market in 1957, when it delivered a roof shield to Toho Rapid Transit Authority (present-day Tokyo Metro Co., Ltd.) for its project to construct the Marunouchi Subway Line. The roof shield was originally designed for manual boring. As mechanization of the boring process was progressing at that time, Kawasaki developed a mechanized shield machine, using its heavy-industry expertise. Since then, the company has been leading the industry by developing innovative boring equipment to respond to emerging needs. These requirements included larger bores, automation, optimization of the excavation cross section, reduction of vertical shafts, and accommodation for significantly deeper construction sites and excavations covering longer distances.

These behind-the-scenes machines are actually the main players in tunnel boring. To date, Kawasaki has delivered 1,400 units for both domestic and international tunnel projects.