

# Setting the right Tone in sonic drilling

Masayoshi Maeda, chairman and COO of Tone Boring, based in Tokyo, Japan, describes the company and its activities in an interview with *GDI*

**Q What is your background and how did you start in your line of business?**

I was born in 1947 in Sapporo, Hokkaido, Japan. I graduated from the mining course of the faculty of engineering of Hokkaido University in 1970 and entered Tone Boring Co Ltd in the same year and worked in the international division. I was appointed director in 1997, president in 1999 and, since 2003, I have served as chairman of the company.

**Q Tone Boring is licensed by the Sonic Drill Corporation to service the Asian marketplace and manufactures the same patented drill head as those manufactured by its developer. How did this come about?**

High-frequency vibrating drilling ranks as a 21st-century engineering method that evolved from a number of drilling methods which existed in the 20th century. I first came across Sonic Drilling Ltd in the magazine *GeoDrilling International*. It attracted

my interest and I contacted the company myself. The company acquired the licence for the high-frequency vibrating drill in 2002 and started the manufacture and sale of the drill in Asian markets as well as in Japan. At the start of the 21st century, there was a significant increase in

**"We are planning local production of the sonic drill in a tie-up with a Chinese partner in the near future. I believe that the introduction of the sonic drill into China will have a major impact on the country"**

experimental projects in geothermal snow-melting in Japan, but a major problem was how to reduce the drilling cost in the total project cost. In particular, the strata in Japan mainly consist of tertiary deposits and it was necessary to develop a rig capable of drilling diverse strata at a depth of 100 m/d. After the introduction of the sonic drill, this hurdle was cleared through drilling tests in various sites in Japan. At the present time, this method is widely used in vertical drilling for geothermal wells, waterwells and large-size deep wells, and in horizontal and inclined drilling for anchoring, groundwater collection and draining wells.



Masayoshi Maeda

**Q What trends in the drilling industry in Japan and in Asia are you currently observing?**

Most noticeably, projects for elevated and underground railroads are being implemented in Japan. The company has succeeded in designing compact civil engineering machines, which are highly valued for work in narrow areas where the emphasis is placed on safety. In addition, overhead piles are becoming larger in diameter and technical innovation by our company has enabled the construction of large piles 2-3m in diameter.

The Chinese market is the largest of the Asian markets surrounding Japan. In this age when a global-scale response to global warming is required, the use of geothermal energy has also started to gain momentum in China, which is a country of mass coal and oil consumption. Water shortages in inland regions of China as a result of abnormal weather worldwide will become a serious problem linked with global warming. We are planning local production of the sonic drill in a tie-up with a Chinese partner in the near future. I believe that the introduction of the sonic drill into China will have a major impact on the country.

The company has also been involved in projects for the supply of safe drinking water in Africa through Official Development Assistance by the Japanese government since 1979 but, notwithstanding our achievements over the past nearly 30 years, there is still a long way to go. I think that the further supply of drinking water is an urgent necessity to improve living conditions in Africa with the assistance of the UN Refugee Agency and UNICEF. I expect that the introduction of the sonic drill, with its ability to drill 100 m/d in such regions, will contribute greatly to the success of projects implemented within a limited time and budget and I hope to demonstrate the effectiveness of this machine in the near future.



Aerial view of the Tone Boring building in Tokyo



Tone Boring's facilities

**Q Who are the most recent additions to your staff and how does the recruitment of such employees and their expertise demonstrate the direction the company is moving?**

Ten employees were taken on in the pile and slurry-wall construction division.

Mainly in their mid-30s, they are expert engineers with 10 years' or more experience ranging from construction planning and design to work supervision. We normally appoint our employees through introductions by university professors with whom we have had a long-term relationship and we select universities and departments according to the type of job.

We are developing a database of the technologies that we have accumulated based on our history and achievements over the years and we are directing our efforts towards training engineering and manufacturing personnel and developing the capabilities of technical personnel.

**"We are directing our efforts towards training engineering and manufacturing personnel"**

**Q Describe the process by which you develop your products.**

Development of many of our machines and engineering methods has been made through joint development and joint application for patents with major Japanese general contractors and through the acquisition of construction information on actual work projects from constructors. Our construction division and design division are developing machines to meet the needs of the time. The typical service life of our machines is about 20 years. Until about 2000, core components were manufactured within the company, but, with changes in the market, there is now a marked tendency toward limited production of a wide variety of products. The production of machines such as machine tools has been reduced to cut the maintenance costs of internal production facilities. At present, we use outsourcing, except for the manufacture of boring rods and urgently required parts. We outsource to about 200 companies.

## TIMELINE OF TONE BORING

Toa-Tone Boring was founded by Iwaji Shioda as Shioda Shoten in 1916. The company developed and launched the sale of Japan's first 150 m-class rotary drilling machine in 1926. The company was renamed Tone Boring Co Ltd in 1936. It was the only manufacturer of boring equipment in Japan before the Second World War and was not only one of the leading companies in the boring industry, but it made a major contribution to the development of Japanese industry after the war.

- 1926:** Developed first drilling machine.
- 1936:** Developed 'TNA' tungsten-carbide metal tip featuring higher drilling performance and a long service life.
- 1947:** Adopted a high-tensile cold drawn carbon steel pipe for the drill-rod.
- 1949:** Succeeded in practical use of a diamond bit by mechanical setting.
- 1952:** Succeeded in stable operation of 20.9 kW of geothermal energy using hot spring water.
- 1959:** Jointly developed drill-rod material using heat-treated reinforcement process with Sumitomo Metal Industries Ltd.
- 1966:** Developed slurry-wall excavator (BW long wall drill) and entered the civil engineering field.
- 1973:** Developed truck-mounted waterwell drilling rig TOP-300 and delivered 20 rigs to Greece. After that, delivered more than 200 rigs to many countries in the world through the Official Development Assistance projects of the Japanese government.
- 1986:** Developed the deep slurry wall excavator EM-240, used in the construction of Tokyo Bay Cross Bridge (Aqua-Line).
- 1998:** Embarked on the development of a vibratory rotary drill and launched the sale of environmental investigation drill Eco-Probe in 1999.
- 2002:** Acquired the licence for the high-frequency vibratory rotary Sonic Drill from Sonic Drilling Ltd, Canada and started licensed manufacture and sale in Japan.
- 2007:** Granted the licence for Eco-Probe to Sonic Drilling Systems Ltd, Canada, and started production overseas.

## Case study: Akita

### Thermal characteristics and effects of snow-melting system using geothermal heat in Akita prefecture

IN THE Akita prefecture of northwest Japan, a geothermal grid is being used to keep the entrance to a tunnel bare and dry in the area's high Shirakami mountain range.

A Tone-Sonic drill rig was used to drill the geothermal holes for this project.

The project was commenced in September 2004 and completed in March 2005.

It was ordered and financed by the government of Akita prefecture.

Project scheme	Area A	Area B
<b>Snow-melting area</b>	Road 700 m <sup>2</sup>	Pavement 840 m <sup>2</sup>
<b>Heat flux required</b>	105 W/m <sup>2</sup>	180 W/m <sup>2</sup>
<b>Meteorological conditions</b>		
<b>Snow fall rate</b>	1.7 cm/h	2.4 cm/h
<b>Ambient temperature</b>	-4.2°C	-5°C
<b>Snow temperature</b>	-4.2°C	-5°C
<b>Density of snow</b>	0.08 g/cm <sup>3</sup>	0.07 g/cm <sup>3</sup>
<b>Wind speed</b>	2 m/s	2 m/s
<b>Thermal conductivity of the ground</b>	1.92 W/m-kelvin	1.79 W/m-kelvin
<b>Type of ground heat exchanger</b>	Single U-tube without heat-pump	Double U-tube with 45 kW heat-pump
<b>Heat absorption capacity</b>	27 W/m <sup>2</sup>	94 W/m <sup>2</sup>
<b>Length of heat exchanger</b>	100 m	150 m
<b>Number of heat exchangers</b>	28	10
<b>Type of rock</b>	Andesite	Andesite
<b>Drilling performance</b>	8 in surface casings are installed up to 30 m and drilled by 6 <sup>5</sup> / <sub>8</sub> in Sonic ring bit up to 100 m (six hours)	

Data prepared by Japan Ground Water Development Co Ltd for Cold Region Technology Conference 2005