



## **Record-breaking Rockhead flies through Fifth Tunnel**

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In September 2011, a self-propelled tunneling machine achieved a milestone in Cincinnati, Ohio, USA. The 1.8 m (72 inch) diameter Robbins Double Shield Rockhead bored 614 m (2,014 ft)—a distance that appears to be a world record for a hard rock machine of this diameter.

The fifth and longest of seven tunnels at the Shayler Run Segment C Sewer Replacement Project pushes the limits of small diameter tunneling. "One of the only limitations on distance is ventilation inside the tunnel. Our ventilation has a limited duct diameter due to the small size of the tunnel. We can adequately ventilate 600 m (2,000 ft) tunnels, but we would need larger fans for anything longer," said Steve Abernathy, Vice President of Operations for contractor Midwest Mole, Inc.

The distance of the individual bores is not the only challenge—the vertical alignment changes over the course of tunneling by 54 m (180 ft), resulting in soft shale and limestone at the outset that gives way to harder shale and limestone deeper underground.

Robbins designed the unique tunneling machine for these conditions, with a mixed ground cutterhead for five of the seven bores. A hard rock cutterhead mounted with 11.5 inch disc cutters will be used for the last two in harder rock.

"We finally had to change some of the 6.5 inch diameter cutters on the mixed ground cutterhead during this drive—we haven't had to do that for any of the other bores. The ground is definitely tougher," said Abernathy of the fifth drive. After hole through, the crew switched to the hard rock cutterhead for the sixth, 319 m (1,046 ft) long bore.

As the machine excavates, crews adjust the line and grade continuously from an in-shield operator's console. Articulation cylinders allow for adjustments, while the machine's position is monitored with a laser targeting system. The self-propelled Double Shield Rockhead also allows for installation of a primary liner, in this case ring beam and board, from within the tail shield. Even with liner installation, production rates have been high—up to 21 m (70 ft) in one 12-hour shift, and 12 to 18 m (40 to 60 ft) per shift on average.

The entire 2,870 m (9,416 ft) pipeline is being constructed for the Clermont County, Ohio Water Resources Department. Once complete, the USD \$15 million project will upgrade an exposed sewer system and protect an area surrounding environmentally-sensitive Shayler Creek. All tunneling is expected to be complete in mid-2012.