Lanes Group plc Best Practice Series

Drainage Services: Robotic Cutting

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Robotic Cutting

Robotic cutters are essential tools in a drainage specialist's arsenal of equipment.

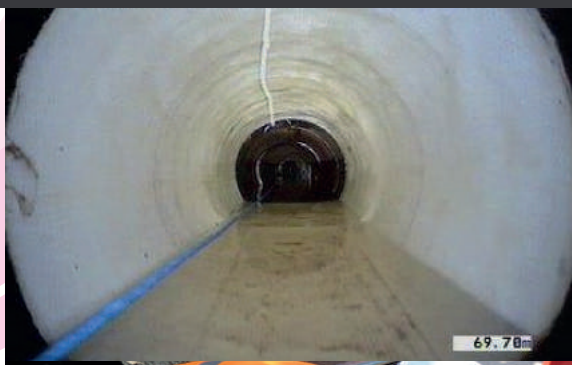
With a host of different models available — hydraulic, pneumatic, battery and electric — robotic cutters are employed in range of drainage applications according to size and capabilities, from pipe rehabilitation to removal of solid materials from a pipe.

This technology avoids the need for disruptive and costly excavation because robotic cutters are controlled remotely from above ground.

Opening lateral connections

Lateral connections are the branch pipes that connect a home, business or other property to the main sewer. Inserting a cured in place pipe (CIPP) is a very effective way to rehabilitate a defective drain. A liner is installed in a drain, using remote-access no-dig technology, to create a new pipe within a pipe. The new lining covers over any lateral connections joining the main sewer. These then have to be opened to re-instate the full drainage system.

Sophisticated CCTV cameras are used to record the exact position of the lateral connections prior to relining. Once the liner has cured (hardened) inside the pipe, the point where each lateral joins the main pipe is cut away, or opened, using modern remote cutters by experienced technicians.



Cutting out solid obstructions

Robotic cutters are also widely used to remove a variety of obstructions from pipes and sewers. These obstructions are usually discovered during a CCTV survey which may be carried out during maintenance, when a reocurring blockage has caused problems on site, or during a survey prior to rehabilitation.

Roots

Root ingress is a common problem. It damages the structural integrity of the drain, and acts as a screen which will catch other debris and potentially result in a blockage. Robotic cutters are ideal for removing tree roots which otherwise would have to be dug out manually.

Example: A recent project to rehabilitate road drains in South West England identified root ingress in four key locations which could have caused flash flooding. This would have been a serious road hazard and a threat to nearby properties. A robotic cutter was used to cut out the roots during pre-scoping works prior to the drains being lined, and a jet vac tanker flushed and vacuumed out the root debris and silt.

Building materials

Building materials, such as tile slurry, cement and concrete, regularly get into the drain and sewer network during construction work.

Example: Careless and sloppy work practices occur more frequently than they should. One utility company in the South found itself facing a major problem after concrete entered its sewers whilst being poured into foundations at a construction site. The situation was so severe that cutting it out took many weeks, causing significant disruption to the public in the meantime.

Any amount of discarded detritus ends up in drains and sewers, causing headaches for the asset owners and potential problems for the public.

These can be costly to remove by excavation, and cannot easily be dislodged using high-pressure water jets normally used to move silt and vegetable matter from drains.

Using a robotic cutter, though, allows the obstruction to be cut out / or ground into smaller manageable pieces that can be vacuumed out, once they have been pushed to the nearest manhole chamber by water jets.

Cables, wooden fencing stakes, and metal foundation spikes are commonly found embedded in drains. Even domestic cutlery has been discovered wedged into pipes. But some situations are more challenging than others.

Example: In Scotland, robotic cutters saved the day after engineers inadvertently drove two steel and concrete foundation piles through a 375mm-diameter culvert during building works. Correcting this mistake was not a straightforward task.

Complex overpumping was required to manage high and unpredictable water flow rates and the location of the piles (67-metres from the culvert entry point) dictated the choice of cutting equipment.

The toughness of the material, limited operating space, the size of the piles, and the need to avoid further damage to the pipe required a combination of precision, patience and expertise. Even then, each pile took a full day to remove using a ProKASRO electric cutter with a diamond milling head.

Why use robotic cutters?

- Safer — fewer risks to operatives than with traditional excavation
- Faster — working remotely from above ground means less disruption and quicker job completion than digging down
- Greener — smaller carbon footprint on site
- Flexible — suitable for all types of location: rural, high traffic and city centre environments
- Cost — cheaper than full excavation to remove some obstructions
- Convenience — less disprution to communities

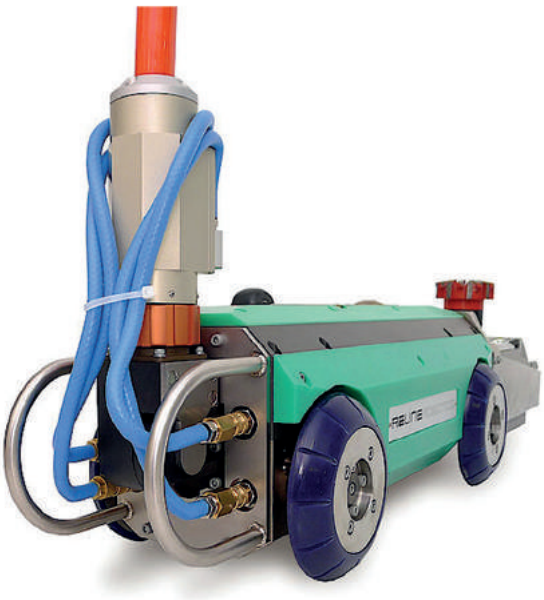
Advances in cutter technology have transformed the possibilities for both pipe rehabilitation techniques and for eradicating problematic deposits.

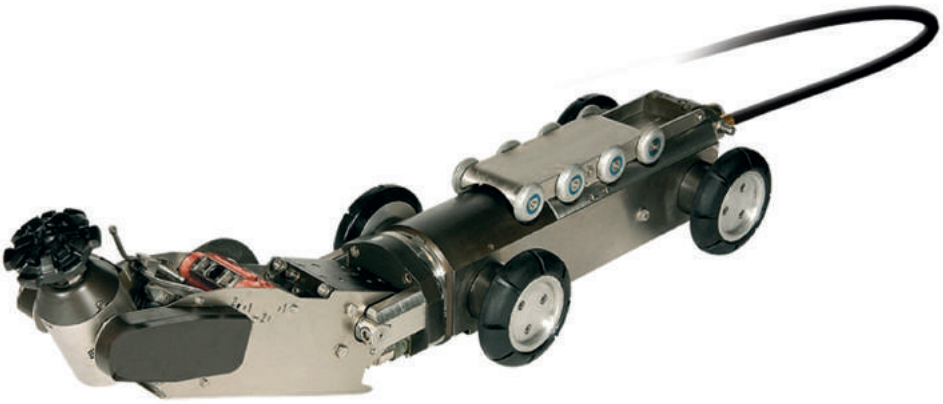
When lining pipes as a means of repairing them was first introduced, it was still necessary to dig down to open up the lateral connections. But excavation is disruptive, can be costly, and is not always an option.

Development of the first 'handlebar' cutters meant excavation could be avoided. However, without a built-in camera, engineers had to introduce a separate camera system from the other end of the pipe to see where they were cutting. This could result in cutting heads spinning out and damaging the camera.

Nowadays, a drainage specialist will have a comprehensive range of cutters, from self propelling, pneumatic, air-driven cutters which can be fed into small gullies with 90º bends or steep inclines, to hydraulic cutters (using oil and electric), others powered by electric and long-lasting lithium batteries, and at the top end, more rugged, all electric, precision cutters.

Expert operators will select the right cutter for the application, depending on the distance to the cutting site, the diameter of pipe, the material to be cut, and other factors.





Handlebar cutters
- 100—225mm diameter pipes

Hachler Climb Robot
- 100—225mm diameter pipes
- Pneumatic, air driven
- Self propelling
- Pneumatic pads climb up inclines and around 90º bends

IMS Auto
- 100—225mm diameter pipes

Picote Maxi Miller Plus
- 100—150mm diameter pipes

ProKASRO Electric Cutter
- 150—850mm diameter pipes
- Virtually silent operation
- Operates up to 110 metres from single access
- Two robots
- Small footprint
- Electric and lithium batteries with 8-hr running time

PMO Cutter
- 150—850mm diameter pipes (including egg-profile)
- Powerful hydraulic cutting and propulsion motors
- Operates up to 90m from single access
- Two robots
- Larger footprint: requires 8.25 tonne truck or LWB van
- Self propelled
- Mainline cutter

Pipetronics Electronic Cutter
- 150—850mm diameter pipes
- Virtually silent operation
- Operates at up to 120 metres from single access
- Small footprint
- Latest long lasting lithium batteries
- More rugged than the PMO and ProKASRO
- All electric

Dos and Don’ts

- Check manholes for flammables with gas monitor before introducing robot
- Attach tape measure to back and take fixed point measurement to stop liner dimpling, and record clock reference for lateral position
- If there is excavation at the access point make sure the measurement is taken from the top of the existing pipe
- Always start the survey outside the pipe: putting the camera inside may miss the first connection
- There is no substitute for an experienced operator – plus effective training
- Regular maintenance and cleaning of cutters is essential. Checking drain plugs for oil leaks as well as change the oil heads once a week
- Use a hoist to get a heavier cutter out of the van, position it and winch directly into the manhole (some weigh up to 100kg)
- Check size of manhole to receive the cutter before specifying a model

A reputable drainage operator will pair trainees with experienced staff for a minimum of 6 months before allowing them to begin simple cutting tasks. To be fully conversant and proficient, a cutter operator could expect to spend two years training.

Manufacturers of new cutters will provide training for technicians.

For more information about robotic cutters telephone Lanes 0800 526 488 to speak to an expert about how robotic cutters are used in drain and sewer rehabilitation and maintenance.

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