ABRASION RESISTANCE OF POLYETHYLENE PIPES

Gravel, rocks, sharp stones and acidic effluent or chemicals can all contribute to the erosion and corrosion of your pipes. In scientific testing polyethylene piping has shown strong abrasion resistance, with considerably reduced wear rates compared to other materials.

Pipe surfaces can be worn away over time by corrosive substances and abrasive bed loads containing gravel, rocks or sharp stones.

ABRASION RATES

Abrasion rates increase with fluid velocity and pipe diameter, and depend on a number of factors including:

- flow rate
- fluid velocity
- size and shape of debris/particles.

Storm drainage systems often carry both acidic and abrasive effluent. A combination of abrasive bed loads with acidic effluent can accelerate abrasion rates, and abrasion is most common in the invert or base interior level of the pipe.

For farm and road drainage applications, such as culverts and surface water drains, velocities are typically less than six metres per second (6m/s) and in sewer pipes flow is slower and less abrasive.

With the corrugated polyethylene used for agricultural drainage, flow rates are usually very slow but the deposits of silt can be very abrasive.

LABORATORY-TESTED ABRASION RESISTANCE

Polyethylene has been proven to be resistant against abrasion in several documented studies designed to test the wear rates of different pipe materials.

In the Darmstadt Test[1], developed in Germany, a one-metre section of pipe was tilted back and forth at 21.6 cycles/min while containing an abrasive slurry of quartz sand (particle size 0-30mm) in water. The resultant velocity over the surface of the pipe was 0.36m/s.

The findings: the Darmstadt Test showed that polyethylene and polypropylene outperformed clay and concrete pipe.

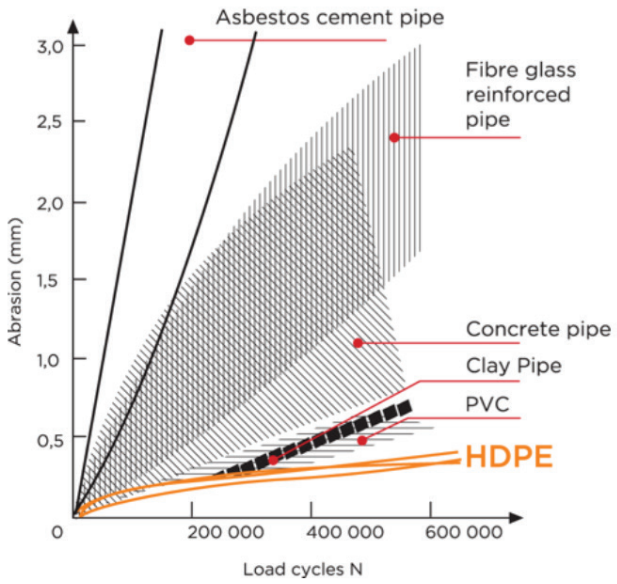
In the Erosion Study conducted by the Saskatchewan Research Council[2], the abrasion performance of plastic pipe was compared to the performance of steel and aluminium pipes.

The set-up for the Erosion Study consisted of a closed loop of test pipe with a sand slurry continuously circulated by a pump. Different particle sizes and velocities were tested.

The findings: the Saskatchewan Research Council's Erosion Study showed wear rates for polyethylene were significantly less than for steel and aluminium.

Scientific studies have also confirmed the superior abrasion resistance of High Density Polyethylene (HDPE) pipe. The Ontario Ministry of Transportation's "Gravity Pipe Design Guidelines"[3] states: "The long-chain molecules that make up the polymer chain are able to resist the impact of heavy bed loads" or abrasive fluids.

FIGURE 1. **Average Abrasion Values for Pipes Made of Various Materials (2)**



References:

1. Kirschmer, O., "Problems of Abrasion in Pipes", Steinzeugin Formationen, 1966, No. 1, pp 3-13.
2. Hass, D.B. and Smith, L.G., "Erosion Studies – A Report to Dupont of Canada Ltd.", Saskatchewan Research Council, E75-7, September, 1975.
3. Ontario Ministry of Transportation "Gravity Pipe Design Guidelines", April 2014.