

Pollution from roads - Road sweepings – Addenbrooke's Road - Analysis Results

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Mike Foley supplied a sample of road sweepings for analysis from Addenbrooke's Road. I took a homogenised 500g sub-sample and carried out a rudimentary **Particle Size Analysis**.

I screened off the largest (>10mm) clasts first. This fraction contained flints and quartz pebbles. I then screened off the >2mm fraction. I subsequently used the <2mm fraction for the LOI and chemical analyses below.

I was also able to quantify the finer fractions.

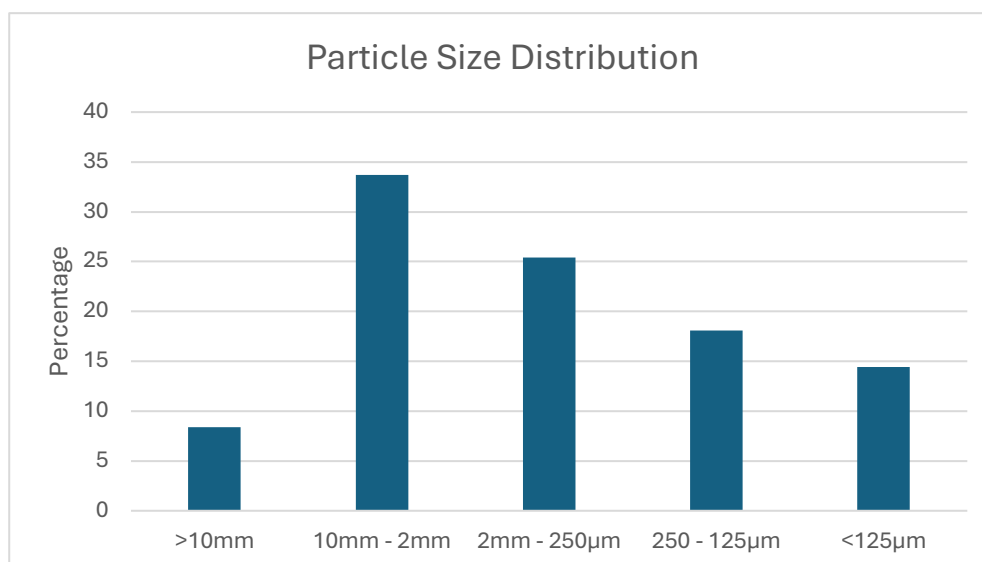
Medium-coarse sand (2mm - 250µm) comprised ca.40% by weight and the larger clasts (>2mm & >10mm) comprised ca.25%, leaving the fines (<250µm) at ca.35%.

I also used a Neodymium magnet to remove and quantify the Magnetic Component from each fraction. Some of this appeared to be rust debris from vehicles. Whilst the Magnetic Component was ca.10% overall, it was most common in the 10mm - 2mm fraction, which contained a metal screw.

Radioactivity was measured for each fraction but was not above the background level.

Particle Size Analysis

<i>Fraction</i>	<i>All Clasts</i>		<i>Magnetic Component</i>		
	<i>Weight (g)</i>	<i>Percentage</i>	<i>Weight (g)</i>	<i>Percentage</i>	
>10mm	41.99	8.40	0.00	0.00	
10mm - 2mm	168.46	33.69	17.26	3.45	
2mm - 250µm	127.00	25.40	4.60	2.91	
250 - 125µm	90.51	18.10	2.90	2.02	
<125µm	72.04	14.41	2.75	1.53	
TOTAL	500.00		27.51	9.91	%



Loss-on-ignition (LOI) analysis was carried out on the <2mm fraction.

This process involves heating a dried sample of known weight in a crucible to 550°C and then 950°C, and measuring the loss in mass at each temperature.

Silicate residue comprised almost 76% of the sample, and Chalk (CaCO₃) made up over 20%. Organic material was present at almost 4%.

Loss-on-ignition Analysis of Road Sweepings

<i>% Organic</i>	<i>%CaCO₃</i>	<i>% Silicate residue</i>
3.9	20.4	75.8

Chemical analysis was carried out on the supernatant formed by mixing 10ml of the <2mm fraction with 30ml of de-ionised water. Measurements were taken after 10 minutes settling.

The pH measurement was surprisingly alkaline at 8.42, and the Electrical Conductivity was very high (3540µS/cm) suggesting a loading of de-icing salt and other ionic solutes. It was surprising to discover that the Dissolved Oxygen had fallen to below 50%. A reference beaker of de-ionised water was measured at 100%.

Analysis using the Hanna IRIS meter gave a low Nitrate-N reading of just 0.9mg/l. However, the Phosphate-P reading was very high (1.56mg/l) and the Ammonia-N reading was also elevated (1.62/l). The original attempt to measure Turbidity failed, but a 1:10 dilution gave a high reading of 111 FTU. A Petrifilm incubation for E. coli/coliforms produced 109 cfu/ml.

Chemistry

pH	8.42
Electrical Conductivity	
µS/cm	3540
Dissolved Oxygen %	48.1
Nitrate-N mg/l	0.90
Phosphate-P mg/l	1.56
Ammonia-N mg/l	1.62
Turbidity 1:10 dilution FTU	111
E. coli/coliforms per ml	109

In summary:

The relatively large amount of magnetic material in the road sweepings was an interesting result. The high potential for causing turbidity and low oxygen on the receiving watercourse is an important finding. The potential Phosphate and Ammonia loadings were an unforeseen outcome. The material was also contaminated with faecal coliform bacteria.

Low-power microscope photos of different fractions of the Road Sweepings from Addenbrooke's Road.

The black ticks are 1mm apart.



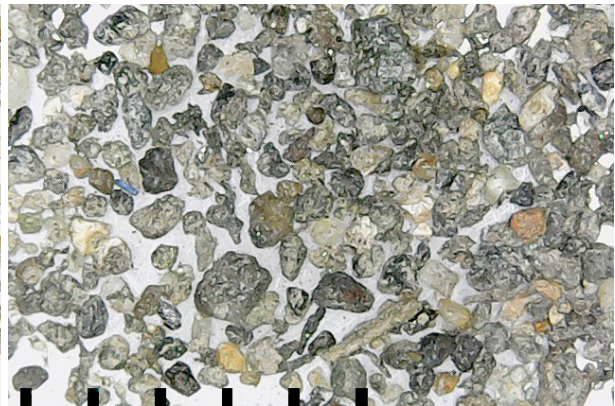
>2mm clasts (quartz, flint, stone)



>2mm magnetic component



>250µm clasts (quartz, flint, stone)



>250µm magnetic component



>125µm clasts (quartz, flint, stone)



>250µm magnetic component