



PARTICLE SIZE DISTRIBUTION AND GROSS SOLIDS IN OHIO'S STORMWATER RUNOFF

BACKGROUND

The Ohio Department of Transportation (ODOT) is required to treat stormwater from some roads to comply with Ohio Environmental Protection Agency's Construction General Permit. In order to effectively design stormwater controls, quantification of the sediment and trash in stormwater runoff from roads is needed. This work will inform the design of post-construction BMPs in ODOT's Location and Design Manual Volume 2.

RESEARCH CONTEXT

The research was broken into two different field sampling campaigns at 12 ODOT-maintained roads located in Lake, Allen, Franklin, Delaware, Montgomery, Hamilton, and Portage counties. First, we determined the particle size distribution (PSD) and total suspended solids concentrations in stormwater runoff from roads. We also quantified the mass and volume of gross solids, or particles larger than 1/4 inch diameter, in stormwater runoff.



This research provides ODOT with a reliable understanding of the quantity and size of particulates in stormwater runoff from Ohio's roads.

KEY FINDINGS: SEDIMENT

- Median particle diameter was 52 μm
- Mean TSS concentration was 35 mg/L
- Larger particles in summer when rainfall was more intense
- PSD was similar to the NJCAT distribution

KEY FINDINGS: GROSS SOLIDS

- 80% of gross solids mass and volume was vegetation
- 0.94 gallons/ac/day and 0.41 lbs/ac/day of gross solids was observed on average
- More gross solids were observed in the autumn than in other seasons due to leaf drop from deciduous trees.

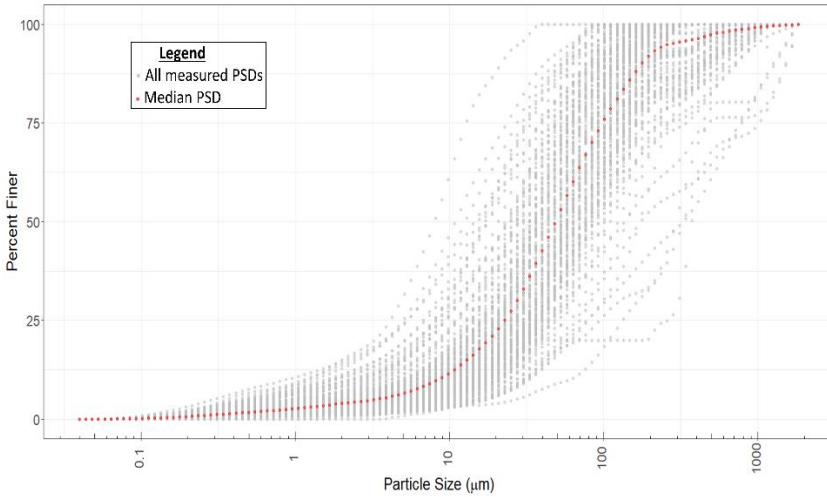
RESEARCH APPROACH

Flow measurement and automated sampling equipment was installed in catch basins and rain gages measured rainfall at each monitoring site. Flow-proportional samples were collected during runoff to determine an event mean concentration of total suspended solids (TSS) and to determine the PSD of particulates in stormwater.

Mesh baskets were inserted into existing catch basins to trap trash and debris larger than 1/4 inch in road runoff. Samples were collected every 11 days on average. Samples were split into nine subcategories (vegetation, plastic, glass, etc) and their weight and volume were measured in the laboratory. 176 and 190 samples were analyzed for PSD and TSS, respectively.

To access the final report, visit the [ODOT Research website](#).



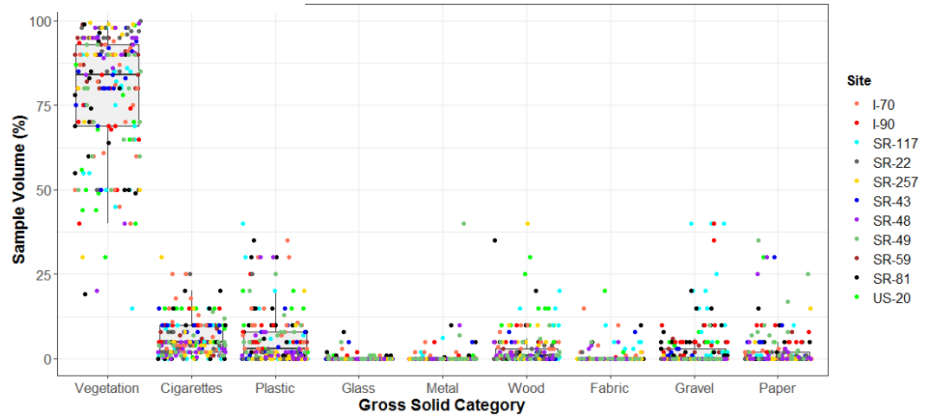


FINDINGS: PSD

All 176 measured PSDs and the average PSD (in red) are presented at left. The median d_{50} across all measured PSDs was 52 μm , or the size of a large silt particle. This was similar to past research on road runoff PSD. Larger particles were observed during summer thunderstorms due to their higher intensity and greater flow rates entraining larger particles. Across the sites, the median PSD was 48.6% sand, 48% silt, and 3.8% clay. The PSD measured in this study was very similar to a standard PSD (the NJCAT distribution) used for laboratory testing of proprietary stormwater treatment technologies.

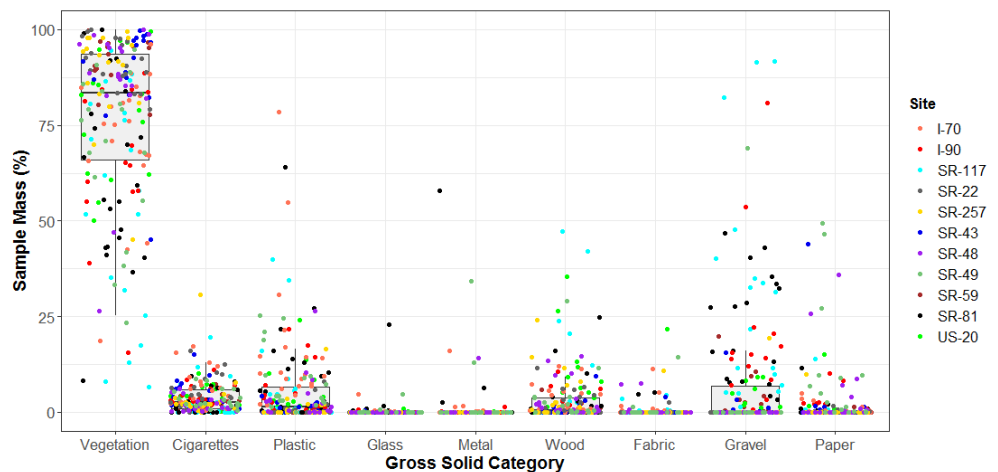
FINDINGS: GROSS SOLIDS

More than 80% of average sample mass and volume was made up of vegetation such as leaves and grass clippings. Cigarettes, plastic, and gravel were secondary contributors to gross solids mass and volume. More gross solids were observed in the autumn, suggesting that maintenance of BMPs that trap gross solids might be seasonal in nature.



CONCLUSIONS

Findings from this study will be used to optimize the selection of BMPs for treatment of solids in ODOT's right-of-way. Gross solids data will be utilized to optimize maintenance resources. Overall, project data can be used to optimize BMP design and location, saving ODOT money in meeting their Construction General Permit requirements.



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