Summary of Environment Canada report on:

Effectiveness of Street Sweeping in Stormwater Pollution Source Control; A Summary of the 2004, 2005 & 2006 Field Seasons, Markham Road, Toronto.

Q. Rochfort, K. Exall, J. Marsalek, J. P'ng, V. Shi, V. Stevanovic-Briatico & S. Kok
Water Science and Technology Directorate, Environment Canada
867 Lakeshore Rd., Burlington, ON. L7R 4A6

Urban impervious surfaces accumulate various pollutants, which may be partly or fully washed off by rainfall and runoff. This process of pollutant accumulation/washoff suggests that controls of accumulations, for example by street sweeping, should enhance the quality of stormwater running off swept surfaces. During the past 40 years, numerous studies of street sweeping effects on urban runoff quality have been conducted, but mostly with non-conclusive results. A new impetus for revisiting this issue is given by continuing advances in street sweeping technology. New regenerative air sweepers can collect the finest particulate (including PM10 particles) from test surfaces under controlled conditions. However, it is quite a challenge to demonstrate such effectiveness and the resulting improvement in street runoff quality under typical field conditions, which was the main objective of this study.

The effectiveness of street sweeping as a pollutant source control improving stormwater quality was studied at experimental sites in an industrial area in Scarborough (Toronto). During the various phases of the study from 2004 to 2006, different types of sweepers were made available for such investigations: an older model regenerative air, a conventional mechanical and new-technology regenerative air sweepers. The study site along Markham Road (Scarborough) was characterized by a traffic volume of 26,000 vehicles / day (13,000 vehicles / day in each direction). A paired-plot experimental design was employed; in the curb lane, reference plots (80 m^2) were left unswept and the following (in the traffic direction) treated plots were swept by the available sweeper. Immediately after the sweeper passed, the solids left on the street surface were evaluated (sampled) by two techniques: (a) Washing off a 20 m section of curb lane (80 m^2) and (b) Cleaning a similar area of 80 m^2 by an industrial vacuum cleaner. A total of 30 pairs (swept / unswept) of wet samples and 25 pairs of dry samples were collected during the three field seasons between 2004 and 2006. Differences in samples from swept (treated) and unswept (untreated) plots were assessed by measuring the following parameters: (a) toxicity, conventional water quality parameters, and particle sizes in wet samples, and (b) conventional sediment quality parameters, total residue mass, and particle sizes for dry samples. The results from both wet and dry sampling were highly variable and only one-third of the paired comparisons produced statistically significant differences; in some instances showing measurable improvements between swept and unswept plots, and in other cases no improvement, or even slight worsening. Analysis of the data indicates that the new regenerative air sweeper provided the greatest environmental benefits by reducing the total mass of road deposited sediment after sweeping, in the soutbound lane with much higher accumulation of sediment, by up to two thirds of the total sediment mass. At the same time, the mean particle size of solids was also reduced (by 40-50%) and some dissolved metal burdens in the washoff (e.g., Zn) were also reduced by about 60%. The plots with low sediment accumulations (in the northbound lane) did not show any statistically significant benefits. The observed benefits would need to be assessed against those of other control measures by benefit–costs analysis.