Ohio Department of Transportation Research Project Fact Sheet

Title	Inlet Protection Comparison for Sediment Control on Roadway Construction
Researcher(s)	Anil Tangirala, PE, CFM, ENV SP Justin Kerns, PE, CPESC Ryan Winston, PhD, PE Andrew Tirpak PhD, PE Alec Grimm
Agency	ms consultants, inc. The Ohio State University
Report Date	March 2023
Project ID Number	109458

The Problem

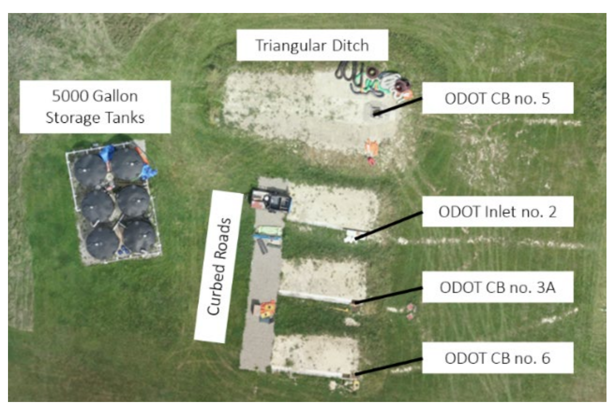
Ohio Department of Transportation (ODOT) construction projects require erosion and sediment controls to reduce sediment-laden discharge to receiving waters and meet environmental regulations. One of the most widely used sediment controls on roadway construction projects are inlet protection devices (IPDs). The Ohio Environmental Protection Agency (EPA) provides guidance for various inlet protection configurations through Ohio's Rainwater and Land Development Manual. However, these practices may be impractical for roadway projects, due to water ponding concerns and maintenance needs.

Proprietary, manufactured IPDs aim to address these common roadway concerns. However, due to the large number of manufactured devices on the market, it can be difficult for designers, contractors, owners, and regulatory agencies to know which products are appropriate for use.

The Inlet Protection Comparison for Sediment Control on Roadway Construction research project collected data necessary for ODOT to determine which manufactured IPDs are sufficient to meet Ohio EPA permit obligations for inlet protection on construction projects while still meeting roadway-specific safety criteria.

Research Approach

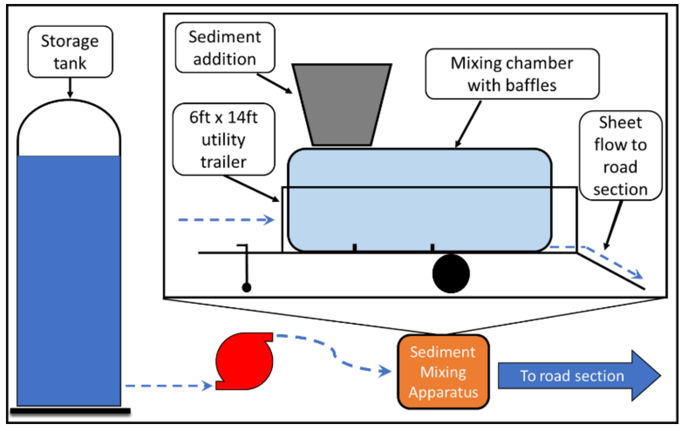
The research team constructed a full-scale testing facility on Ohio State's University's campus to simulate stormwater runoff and sediment loading of a typical roadway construction project. Three 30-ft by 12-ft mock curbed road sections and one 60-ft long triangular ditch were used to evaluate IPDs for various inlet configurations and site conditions. The surfaces of the road and ditch sections were left as bare earth to simulate a worst-case scenario for sediment and erosion control.



To access copies of the final report, visit:* *www.dot.state.oh.us/research

This research was sponsored by the Ohio Department of Transportation and the Federal Highway Administration.

Simulated construction site runoff was applied via six 5,000-gallon storage tanks and a sediment mixing apparatus positioned at the upstream end of each road or ditch section. A flow meter was used to monitor and adjust influent flow rates to match target values. Sediment was added in predetermined quantities to the influent stream in the high turbulence mixing chamber to ensure adequate mixing over each 30-min test. A perforated plywood baffle was installed in the mixing chamber to dissipate energy and allow the runoff to spill onto the road section via sheet flow.



Triplicate performance testing was conducted on 28 IPDs to compare the functionality of commonly available manufactured products to the Ohio EPA approved practices based on key performance criteria, including sediment removal capability, level of ponding, ease of installation, etc. Further longevity testing was conducted on a sub-set of 15 products by simulating repeated storm events without replacement or maintenance, in order to assess long-term performance, maintenance frequency, failure thresholds, etc.

Findings

The research team found that most proprietary IPDs provided comparable sediment removal as Ohio EPA approved IPDs. Results of performance testing also emphasized the importance of a proper fit between the device and the drainage inlet – as a poor fit often led to higher effluent TSS and turbidity levels. Higher sediment removal was observed during tests of devices which minimized untreated bypass. Furthermore, the research team noted a correlation between peak ponding depths and effluent water quality, suggesting that sedimentation, or the process of sediment settling out of the runoff, acts as an effective primary mechanism for sediment removal. Finally, installation becomes more complex and effluent water quality levels deteriorate when excavation, which results in loose sediment easily conveyed in subsequent runoff events, is required for IPD installation.

Longevity testing revealed that clogging of the filter material led to increased peak ponding depths, dewatering times, and occurrences of overflow. Sediment removal performance was also found to decline significantly after two consecutive simulated storm events, equivalent to 0.48” of rainfall.

Recommendations

The research team identified key properties and metrics that correlated with the product’s ability to remove sediment and function properly. These findings were used to develop a procedure for ODOT to evaluate a product’s suitability for inclusion in a qualified products list (QPL), along with a process for assessing future devices for suitability on ODOT construction projects. Key properties include tensile strength, elongation, puncture strength, tear strength, apparent opening size, permittivity, flow rate, and ultraviolet resistance.

In addition to material specification thresholds, the research team identified specific product characteristics and features which increase the likelihood that devices will perform at a suitable level. IPD standard construction drawings were developed to prescribe how proprietary IPDs should be installed on various inlet configurations. These drawings will help improve installation methods of IPDs and improve sediment removal by reducing the chance of untreated bypass. The research team also recommended maintenance practices and intervals to help ensure long-term performance of IPDs.

To access copies of the final report, visit: www.dot.state.oh.us/research

This research was sponsored by the Ohio Department of Transportation and the Federal Highway Administration.