

The Polished Mortar Value Test

MTO Evaluates the Frictional Properties of Natural Sands used in Concrete Pavements

Since the late 1960's, the Ontario Ministry of Transportation (MTO) has sought to measure and improve the frictional properties of pavements in Ontario. Currently, MTO is investigating new methods of testing fine aggregates used in Ontario concrete pavements to ensure that only aggregates that provide an appropriate level of friction are used on Ontario roads.

Establishing a desirable level of road surface friction is an important factor in pavement design and construction. Good friction characteristics in pavements reduce wet-skid related accidents. Aggregates are a significant component of the pavement and affect the texture and frictional properties of the road surface. Natural sands play an important role in maintaining the frictional capabilities of concrete pavement surfaces, which are found on major freeways in southern Ontario, including Highways 115, 401, 402, 404, 407, 410, 417 and 427.

Historically, MTO aggregate testing focussed primarily on frictional properties of coarse aggregates in asphalt pavements but MTO recognized that more research related to improving the frictional properties of fine aggregate in concrete pavement in Ontario was warranted.

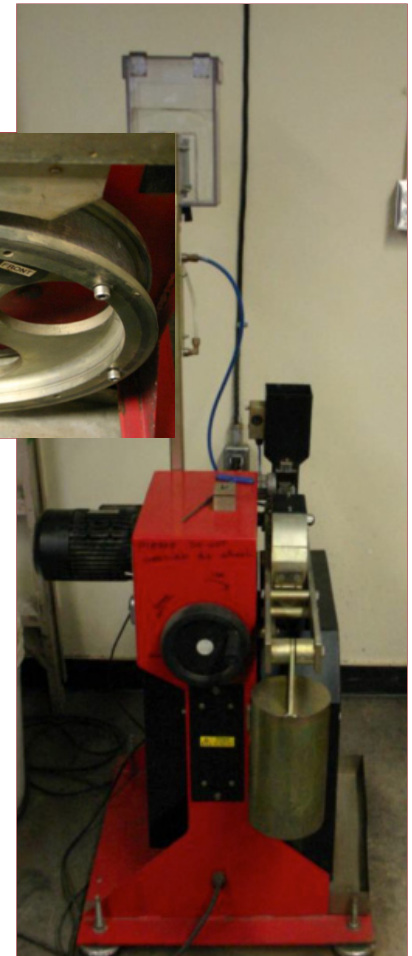
In 2011, MTO staff performed a study using the Polished Mortar Value (PMV) Test, to evaluate the frictional properties of naturally occurring sands used in Ontario concrete pavements. Originally developed by the United Kingdom's Transport and Road Research Laboratory, the PMV test measures the polishing and wear characteristics of fine aggregates. As part of this study, MTO modified this test, adapting it to British Wheel test equipment currently used for evaluating the Polished Stone Value (PSV) of coarse aggregates for hot mix asphalt (Figure 1). The PMV test was a first for the ministry.

Both the PMV and the PSV test involve the use of an accelerated polishing machine that replicates the effects of road-wear on pavement surfaces through the action of fine emery abrasives at the contact between a rotating rubber tire and the aggregate in the presence of water. This machine consists of a sample wheel, Figure 2, rotated at high speed under a weighted rubber tire. Following six hours of polishing

Figure 1: Accelerated Polishing Machine (front view) >



^ Figure 2: PSV machine, side view showing wheel onto which the sample coupons are mounted



with emery grit, test coupons are tested for frictional resistance on a British Pendulum Friction Tester, Figure 3.

Although similar in testing, the methods used to prepare sample coupons differ between the PSV and the PMV. PSV test coupons are prepared by placing a layer of coarse aggregates in the base of a mould, Figure 4. The mould is then filled with a polyester resin to keep the individual aggregate particles in place. The PMV test uses coupons composed entirely of a cement mortar made using the sampled sand, Figure 5.

All fine aggregate used in concrete pavements in Ontario must conform to the physical property requirements, including particle size distribution and mineralogy, as set out in Ontario Provincial Standard Specification 1002. Twenty-nine Ontario sands derived from naturally occurring glacial deposits were used in the evaluation of the PMV test method. The selected sands have all been used historically >

The Polished Mortar Value Test, *continued*

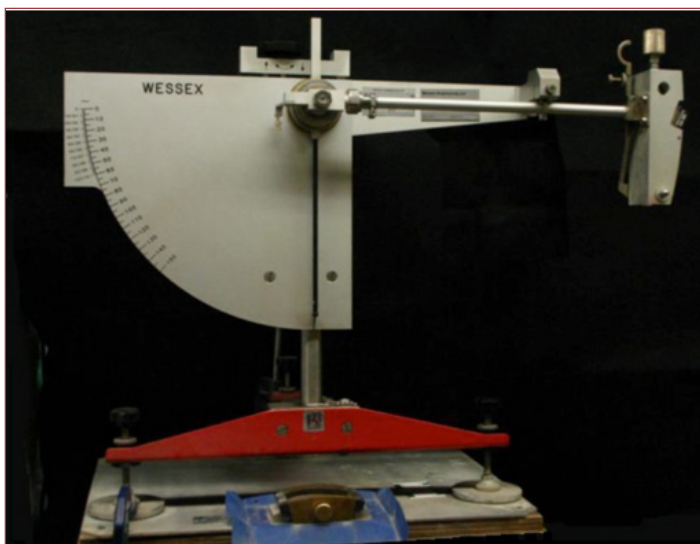


Figure 3: British Pendulum Skid Resistance Testing Apparatus

in Ontario concrete pavements, and have a diverse range of physical properties. Results from the ministry's 2011 study are preliminary. In order to obtain more PMV data, the ministry anticipates conducting more laboratory testing of concrete sands.

While more data is required to make conclusions about the properties of sands used in concrete pavements, the PMV method provides a suitable initial assessment of potential sands for use in concrete roadways. This initial study provides a foundation for continuing the development of fine aggregates testing for Ontario concrete pavements, with the goal of ensuring that only aggregates that are able to provide an appropriate level of friction are used in roadway surfaces to keep Ontario roads safe. ●

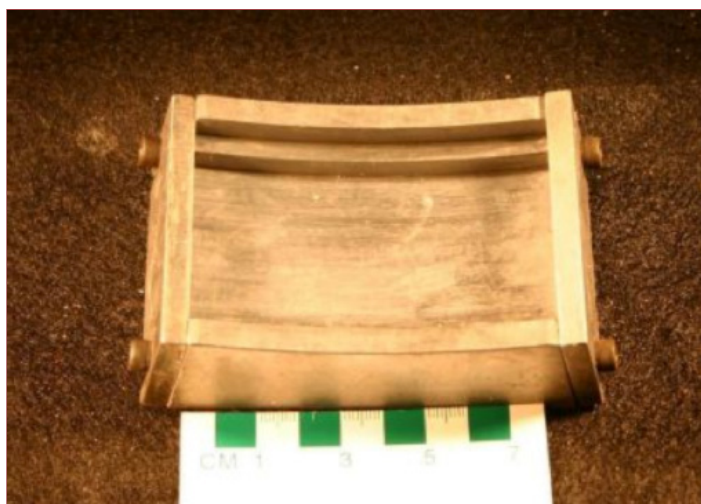


Figure 4: PSV / PMV mould for making sample coupons

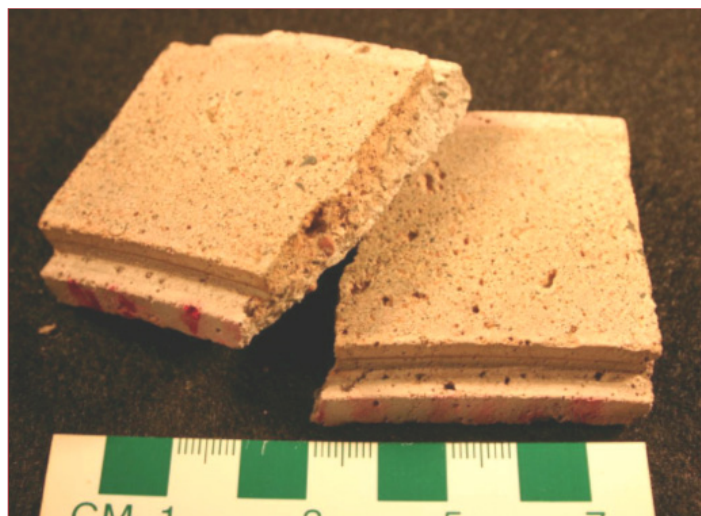


Figure 5: A typical PMV coupon (cured sand-cement mixture), split to show cross-section.

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