Technical Bulletin

Use of OPUS SCM™ in MnROAD Test

About MnROAD

MnROAD is a road pavement test on I-94 made up of various research materials and pavements owned and operated by the Minnesota Department of Transportation (MnDOT). Located near Albertville, Minnesota, MnROAD works in conjunction with MnDOT's Materials & Road Research Lab. It finds ways to make roads last longer, perform better, cost less to build and maintain, be built faster, and have minimal impact on the environment.

In 2022, the National Road Research Alliance (NRRA) placed 19 new concrete test sections at MnROAD.

One test section in the project was made with OPUS SCM™. This required about 200 cubic yards of concrete.

Concrete performance

A performance specification was provided by MnDOT along with a control mix design. Prior to construction a mix design study was conducted to identify the maximum replacement level possible with OPUS SCM™ while meeting the performance target.

A mix with 35% OPUS SCM™ was identified to meet the specification; the highest replacement level of all participating products.

The mix used a type IL (10) cement and had a total cement content of 570 lb per cubic yard of concrete.

Below is a summary of the concrete performance and concrete properties from the pre-construction lab mix design test and from concrete sampled at the construction site. The concrete with OPUS SCM™ set and finished similar to the control mix with 30% fly ash. **All performance targets set for the project were met.**

Test Parameter	Test Standard	Unit	Performance Target	Opus SCM™ @35% (lab mix design test)	Opus SCM™ @35% (field sample)
Unit Weight	ASTM C138	pcf	-	147.3	147.4
Slump	ASTM C143	inch	1-3	2.25	2.50
Air Content	ASTM C231	%	5-8	6.2	5.6
Compressive Strength @28 days	ASTM C39	psi	3000	3990	3190
Flexural Strength @28 days	AASHTO T97	psi	500	585	580

After a year of road use, concrete cores were taken from the shoulder section of the pavement for follow-up compressive strength and durability testing. The concrete with OPUS SCM™ showed further improved strength, low permeability and high resistivity (see table). Performance was similar to that with fly ash (at 30% replacement level).

All concrete testing was conducted by Braun Intertec, an accredited concrete laboratory in Minnesota.

Test Parameter	Test Standard	Unit	Opus SCM™ @35% (field sample)	Fly Ash @30% (field sample)
Compressive Strength @365 days	ASTM C42	psi	5700	6140
Chloride Permeability	ASTM C1202	Coulombs	360	274
Electrical Resistivity	ASTM C1876	Ohm-m	282.5	282.6

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