



DEICER FREEZE-THAW DATA

Side-by-side comparison per ASTM
C666, Procedure A (Modified)

MELT THE ICE. KEEP THE CONCRETE.

Clear winter roads with less freeze-thaw damage to the concrete underneath.



83–85% RDM RETAINED

E5® Nano Melt beams after 36 freeze-thaw cycles in undiluted product.



BRINE: 14–15%

Salt brine beams. Same concrete, same cycles.



ROCK SALT: UNDER 1%

Rock-salt solution beams. Same concrete, same cycles.



BOTH CEMENTS

Type I and Type IL ranked the three deicers the same way.

Road salt and brine keep winter roads clear, but they are hard on the concrete underneath. We ran E5® Nano Melt against both in a side-by-side freeze-thaw comparison. This guide shows the test, the numbers, and what the test does not cover.

DEICERS ARE HARD ON CONCRETE

Road salt and brine keep winter roads clear. They also contribute to scaling, freeze-thaw damage and rebar corrosion, which shortens the life of pavements and bridge decks.

E5® Nano Melt was developed to do the same job with less damage to the concrete.

We checked that directly. Same concrete, same freeze-thaw cycling, three deicers side by side. The E5® Nano Melt beams lost some stiffness. The salt beams lost nearly all of it.

FREEZE-THAW IS NOT JUST FROZEN WATER

The deicer in the pores changes how, when and where ice forms inside the concrete. Some deicing chemistries also react with the cement paste itself.

THE THREE DEICERS COMPARED

14–15% RDM

SALT BRINE (NaCl)

Sodium chloride in solution. Salt in the pore water adds osmotic and crystallization pressure as the concrete freezes. It also lowers the freezing point, which changes how often the pore water freezes and thaws.

UNDER 1% RDM

ROCK-SALT SOLUTION

The same sodium chloride chemistry, prepared from rock salt. It did the most damage in this test. The beams lost nearly all of their stiffness and scaled down to exposed aggregate.

83–85% RDM

E5® NANO MELT

E5's deicer. The beams kept most of their stiffness and their edges stayed square. Composition and handling information are on the E5® Nano Melt Safety Data Sheet, available on request.

RDM = relative dynamic modulus retained after 36 cycles. Each beam was soaked in its deicer at full strength.

WHAT THE TEST SHOWED

- **Only deicer of the three** to stay above 60% RDM
- **Over five times the stiffness** the brine beams kept
- **Square, intact edges** where the salt beams spalled
- **Same result in both cements**, Type I and Type II

SAME CONCRETE.
SAME CYCLES.
THREE DEICERS.

SAME CONCRETE. THREE DEICERS.

ASTM C666, Procedure A (Modified). E5® Nano Melt, salt brine and rock-salt solution run side by side on the same concrete under the same freeze-thaw cycling.

MIX DESIGN: A DELIBERATELY VULNERABLE CONCRETE

520 lb/yd ³ Cement factor. A plain structural mix with nothing added to help it.	0.50 w/c Moderate water-cement ratio. Capillary pores left open to the deicer.	0% air No air entrainment, so the concrete has no built-in freeze-thaw protection.	Shelby Aggregate source, the same in all six beams.
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Air-entrained concrete resists freeze-thaw because its air voids give freezing water somewhere to go. This mix has none. It does not represent properly air-entrained pavement or bridge-deck concrete. It was chosen so that differences between deicers would show up quickly.

SPECIMEN MATRIX: 6 BEAMS, 2 CEMENTS × 3 DEICERS, ONE BEAM EACH

CEMENT (BUZZI)	E5® NANO MELT	BRINE	ROCK SALT
Type I · Ordinary portland (OPC)	#25	#26	#27
Type IL · Portland-limestone (PLC)	#28	#29	#30

Type IL replaces roughly 5–15% of the clinker with ground limestone. Both cements were tested because Type IL has replaced Type I in much of the U.S. market.

THE MODIFICATION

100%
PRODUCT,
NO DILUTION

Standard C666 Procedure A freezes and thaws beams in water. Here each beam was soaked in its deicer at full strength. All three saw the same severe exposure. This is a comparison, not a standard C666 result. Results are at 36 cycles. The standard runs to 300.

READING THE DATA

RDM = (n₁ / n₀)² × 100

n₀ is the beam's transverse resonant frequency before cycling. n₁ is the frequency after 36 cycles. RDM is the share of dynamic modulus the beam has kept.

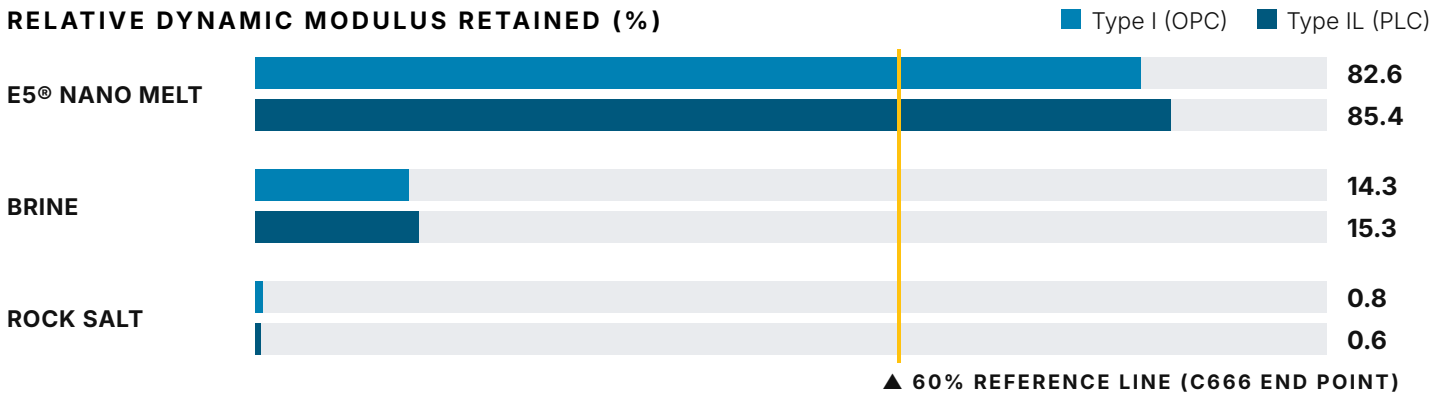
60%

Reference line. ASTM C666 ends a test when a beam drops to 60% of its starting modulus.

STIFFNESS RETAINED AFTER 36 CYCLES



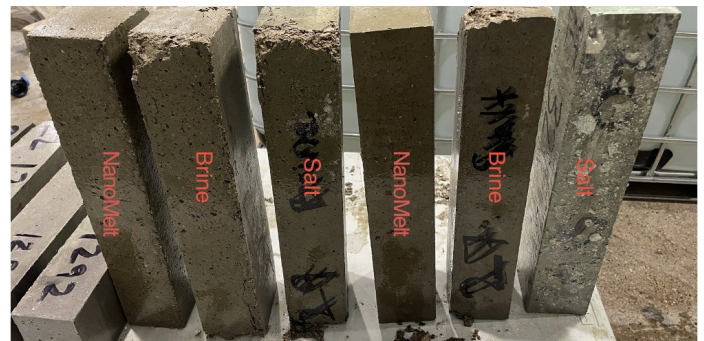
RELATIVE DYNAMIC MODULUS RETAINED (%)



RESONANT FREQUENCY (HZ)

SPECIMEN	INITIAL N ₀	AFTER 36
#25 E5® Nano Melt · I	1,953	1,775
#26 Brine · I	1,997	754
#27 Salt · I	1,997	177
#28 E5® Nano Melt · IL	2,041	1,886
#29 Brine · IL	2,041	799
#30 Salt · IL	2,086	168

PHYSICAL EVIDENCE



After 36 cycles. E5® Nano Melt beams have square, intact edges. Brine and rock-salt beams show heavy spalling, rounded corners and surface loss.

E5® Nano Melt stayed above the 60% line. It was the only one of the three deicers tested to do so. Its beams lost 15 to 17% of their dynamic modulus.

Rock-salt solution did the most damage. RDM fell below 1% in both cements and the beams scaled down to exposed aggregate.

Brine beams fell to 14–15% RDM. Corners spalled, edges rounded, and frequency dropped from about 2,000 Hz to under 800 Hz.

Cement type made little difference. Type I and Type IL ranked the deicers the same way, within three points of each other.

What this test does not show. One beam per deicer and cement, 36 cycles, no air entrainment, and no plain-water control beam. It is a comparison of three deicers, not an ASTM C666 durability factor and not a service-life prediction. Ice-melting performance and corrosion are not covered here.

83–85%

E5® NANO MELT RDM RETAINED

14–15%

BRINE RDM RETAINED

< 1%

ROCK-SALT RDM RETAINED