ICPI Technical Note
The Effects of Deicing Chemicals on Interlocking Concrete Pavers
September 2010

Interlocking concrete pavements are a very flexible and durable system that performs successfully in the most demanding applications, conditions and climates. One of the most extreme conditions is deicing chemical which are often necessary where ice buildup occurs on pavements that create conditions for slips, falls and loss of control of vehicles. This Technical Note outlines the physical factors that contribute to the excellent winter service record of interlocking concrete pavers while offering guidelines on how to limit the impact of deicing chemicals on paver durability.

Unit Properties Impacting Paver Durability

Water enters the pore structure of the paver and expands as much as 9% when frozen. Ice which develops within the paver could cause stresses that may lead to degradation. Properly manufactured concrete pavers, however, are very durable and resistant to degradation because the amount of water absorbed is limited and the cement paste strength is sufficient to withstand the stress of ice expansion. The following factors govern the durability of concrete pavers:

- Durable, sound aggregates that will not degrade when subject to freezing and thawing;
- Proper aggregate gradation that allows for high density compaction;
- Sufficient cement paste to coat the aggregate and reduce capillary pores; and
- Sufficient compaction to ensure maximum density and uniformity.

Units manufactured with these characteristics typically yield a high density, low absorption, high strength and durable paver.

Comparison to Ready Mixed Concrete

Properly air-entrained and finished ready-mix concrete can resist freeze-thaw degradation, although driveway slabs that are over-finished or made with concrete that has been retempered with too much water can be susceptible to surface scaling. In comparison to ready-mixed concrete, concrete pavers have the following advantages:

- Stronger aggregate bonding from higher cement content than typically used in pavement quality ready-mix concrete;
- Smaller aggregates (more surface area for the cement to bond);
- Lower water/cement ratio as well as vibration and compaction during the manufacturing process to increase aggregate-cement contact and to eliminate the possibility of over-watering;
- Produced in a highly controlled manufacturing plant leading to lower variation in material properties and the elimination of the chance that the surface may get over-finished; and
- Can be successfully installed in cold weather as they are properly cured before they leave the manufacturing plant.

Guidelines for Limiting Deicing Chemical Exposure:
The key to successfully using deicing materials is to use only as much as needed to do the job. This will maximize their benefits while minimizing any damage to the concrete pavers and surrounding environment. The following guidelines can help limit the exposure of deicing chemicals while maintaining a safe environment:

- Limit the use of deicing chemicals by combining them with a traction aid such as sand. Sand is visible and can be felt underfoot as a tangible medium aiding foot traffic.
- Do not over apply deicing chemicals, follow the recommended dosage.
- Do not use deicing chemicals in place of snow removal but reserve them for melting ice formed by freezing precipitation or freezing snow melt.
- Once loosened, snow and ice should be promptly removed by plow or shovel to avoid a buildup in concentration of the deicing chemical.
- When using magnesium-based deicing chemicals, ensure the pavement is thoroughly washed in the spring as these deicers will continue to chemically degrade all types of concrete pavement throughout the year.
- Protect vegetation and metal from contact with deicing chemicals as most can impair vegetation and corrode metals.

In addition, use ICPI recommended sand jointing materials to minimize water penetration into the pavers. This will also help keep salts from entering and accumulating in the jointing and bedding sand that can eventually degrade the pavers. ICPI also recommends adequate pavement slopes (typically a minimum of 2%) to facilitate surface water drainage and to help remove deicing materials. While not essential, reduction of water entering jointing sand can be further enhanced with joint sand stabilization materials and/or sealers.

Deicing Chemical Comparison Chart
The following chart compares common deicing chemicals with respect to concrete degradation, their relative effectiveness and the impact on the environment and on human health.

Deicer	Concrete Degradation Impact	Effective* Temperature (ºF / ºC) (1)	Cost ($ per dry lb) (1)	Environmental / Health Impact (1)
NaCl Sodium Chloride	Amplifies freeze thaw damage	15 / -9	0.11	Vegetation impairment
$MgCl_2$ Magnesium Chloride	Amplifies freeze thaw damage, chemical attack	-8 / -22	0.20	Vegetation impairment
$CaCl_2$ Calcium Chloride	Amplifies freeze thaw damage, possible chemical attack	-2 / -19	0.20	Vegetation impairment, eye and skin irritant, toxic
CMA Calcium Magnesium Acetate	Amplifies freeze thaw if Mg ratio is high, possible chemical attack	19 / -7	2.30	Skin irritant, high aquatic impairment
KA Potassium Acetate	Amplifies freeze thaw damage	-11 / -24	1.00	Skin irritant, high aquatic impairment

*Effective temperature is lowest practical temperature of the deicer defined as the lowest temperature at which the relative melting potential (MP) is 0.7 as calculated in reference (1).
(1) Information adapted from National Cooperative Highway Research Program Report 577 “Guidelines for the Selection of Snow and Ice Control Materials to Mitigate Environmental Impacts” © 2007 Transportation Research Board