

MONTANA DEPARTMENT OF TRANSPORTATION
Helena, Montana 59620-1001

MEMORANDUM

To: Concrete Scaling Committee

From: Susan C. Sillick
Manager, Research Program

Date: February 8, 2002

Subject: Meeting Minutes, January 28, 2002

A committee met on January 28, 2002 to discuss the concrete scaling issue. Attendees were Jim Walther/Engineering Division, Kent Barnes/Materials Bureau, Nigel Mendis/Bridge Bureau, Mike Lynch/Materials Bureau, Mike Bousliman/Maintenance Division, Dan Williams/Maintenance Division, Craig Abernathy/Research Section, and Sue Sillick/Research Section. The purpose of this meeting was to take a step back from the on-going effort to ensure involvement of all appropriate MDT staff, a clear definition of the problem, and a survey of the literature. In taking this step back, the committee can reevaluate the need for research so that whatever is done, is done the right way the first time.

The committee first discussed the problem. This problem is limited to concrete scaling, a surface defect characterized by flaking, peeling, or pitting of the concrete surface. For the most part this has only been seen in residential concrete. The extent of concrete scaling in residential areas is unknown; however, it seems to have increased over the past few years.

The committee then discussed the literature. It is clear concrete must have sufficient strength, and proper air entrainment and placement to prevent concrete scaling. These factors can be achieved through proper concrete mix design (including, but not limited to appropriate cement content, aggregate gradation, and addition of admixtures), appropriate air entrainment, proper placement, low water to cement ratio, and sufficient curing. Deicing chemicals and inadequate drainage can exacerbate the scaling of concrete, especially concrete without sufficient strength or air entrainment. Sealing the concrete can help to prevent concrete scaling. Many good resources in addition to the published literature are available on this topic, some containing more specific guidelines - see <http://www.beaverconcrete.com/corner2.html>, <http://www.prmconcrete.com/scaling.htm>, and http://www.lafargecorp.com/ttt_sur.htm. The Idaho Department of Transportation (ITD) also supports this opinion. ITD sampled and tested cores of scaled concrete. These cores all exhibited low air entrainment.

The committee feels that scaling is occurring on residential concrete rather than roads built and maintained by MDT because the Department has strict standards for design and construction. In addition, the committee feels that this phenomenon is not occurring all of a sudden, rather, it appears to be a cumulative effect in a couple of different ways. First, it should be expected to

take homeowners a certain period of time and discussion with other homeowners to realize that the concrete scaling they are seeing is not an isolated event, but an event that others are also seeing. Second, MDT and homeowners have increased use of deicing chemicals over the last five years or so. As mentioned above, deicing chemicals can exacerbate the scaling of poorly produced or improperly placed concrete. Before deicing chemicals reach residential concrete, mixing with snow, mud, etc has diluted them. Over time, this continual application of these dilute chemicals may enhance scaling. Finally, older concrete does not seem to be exhibiting concrete scaling. The answer seems to be that before the industry knew how to engineer concrete, it contained an unusually high content of cement. Also, the older concrete has had additional time for the cement to hydrate and the concrete to gain strength. A high cement content in concrete can overcome many flaws. Finally, concrete placed many years ago that was not good has since been removed.

It is the opinion of this committee that there are too many causal factors and not enough documentation of concrete design and construction in residential areas, as well as application of materials, such as deicing chemical (both residual MDT chemicals and personal application) to determine why the concrete is scaling. In addition, there are many more causal factors such that what causes scaling in one driveway may not be the same causal factor for another driveway. It is clear that concrete with sufficient strength and proper air entrainment can prevent concrete scaling.

MDT moved to the use of deicers due to air quality and safety issues. Use of deicers is not a panacea. Winter maintenance is a balance and safety has always been MDT's utmost concern. The issue is to maximize safety and to minimize the detrimental effects of MDT's winter maintenance practices, while not decreasing safety. Given this, the Maintenance Division needs to continually evaluate application rates, new potential deicing chemicals, and other potential practices through literature, field trials, etc to minimize the detrimental effects of their use.

This committee recommends a number of actions.

- A public relations campaign
 - ❖ MDT needs to inform the public of its deicing strategy and needs to make it clear that the safest roads come at a cost.
 - ❖ MCA should take a proactive approach to educate residential concrete contractors and the public with regards to designing and constructing concrete with the proper strength and air entrainment for the intended use.
- MDT should participate in the South Dakota Department of Transportation's (SDDOT) pooled-fund study investigating the effects of deicing chemicals on concrete.
- MDT Maintenance needs to continually evaluate best management practices (BMP's) on application rates, new potential deicing chemicals, and other potential practices through literature, field trials, etc., to maximize the beneficial aspect of these products as well to minimize the detrimental effects of their use.