CENTER FOR TRANSPORTATION STUDIES

UNIVERSITY OF MINNESOTA

AirTAP Briefings

A publication of the Airport Technical Assistance Program of the Center for Transportation Studies at the University of Minnesota

Fall 2012

Vol. 12, No. 3

Maintenance key to solving concrete pavement challenges

Although most Minnesota airports do not have much concrete pavement, the concrete they do have can pose special maintenance and rehabilitation challenges. The most common airport features constructed of concrete are parking lots and sidewalks, for which the concrete is typically 4 to 6 inches thick. However, several general aviation airports do have concrete aprons and runways, which are generally constructed out of concrete that is much thicker.

Maintaining any section of pavement, regardless of its size, is important for preserving its condition and optimizing pavement life. Pavement is a significant investment—and one that is always under attack from snow, rain, and freeze-thaw cycles. With proper maintenance, a concrete pavement can last for more than 20 years. Preserving and protecting your concrete pavement will save you time, money, and headaches in the future.

Identifying the problem

Prior to specifying a concrete repair, you need to identify the distress, and more importantly, what is causing it. The primary distresses found in concrete pavement are typically related to weather impacts and not caused by traffic loadings. These distresses are mid-panel cracking, corner breaks, and joint spalling.

Mid-panel cracking usually results from inadequate joint spacing or depth, which causes the concrete to crack between two other joints. It can also indicate a loss of support beneath the concrete pavement or movement of the concrete panel.

A corner break is caused by the same factors as mid-panel cracking but shows up at the corner of the concrete slabs. The corner break intersects the adjacent joints at an approximately 45-degree angle.

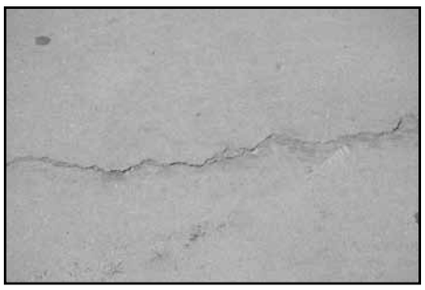
Joint spalling is the cracking, breaking, chipping, or fraying of slab edges within less than one foot from the face of the transverse joint. Joint spalling is caused by poor joint construction.

Rehabilitation

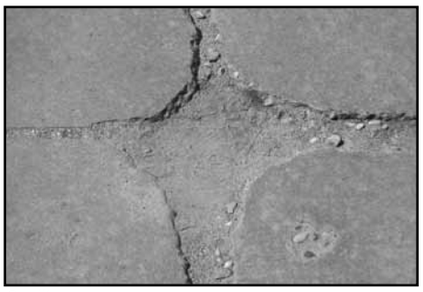
Regardless of the distress, the four types of concrete repairs are:

1. Joint and crack sealing
2. Partial-depth repair
3. Full-depth repair
4. Slab replacement

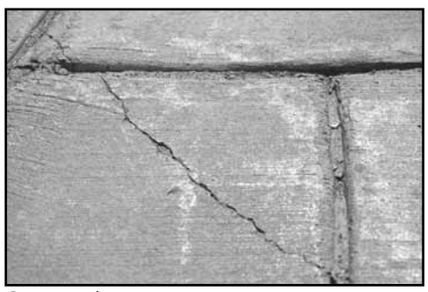
Diamond grinding is another common repair. This repair, used when concrete panels heave as a result of frost action, involves grinding off the pavement surface to smooth the panels to the same elevation.



Mid-panel crack



Spalling



Corner crack

Joint and crack sealing

The most common repair is joint or crack sealing. This is recommended when a concrete panel breaks in an area that has not been jointed, or where a joint sealant has pulled away from the edge of the joint. Many Minnesota airports include crack sealing for asphalt as part of their pavement maintenance program, but sealing concrete cracks is just as important.

Sealing cracks in concrete pavement does two things: it re-establishes and preserves a neatly sawed joint where one was already established, and it prevents moisture from infiltrating the pavement structure in areas where the concrete has cracked. Moisture in the underlying layers is concrete's main enemy: it leads to weakening of the structural underlying layers and is a primary cause of pavement deterioration. Crack sealing can greatly reduce the amount of water that enters the structure, thereby increasing pavement life.

Concrete joint and crack sealing includes sawing and cleaning the concrete joint or crack face to provide a proper surface and shape factor to ensure that the sealer adheres. The procedures are the same whether the joint or crack is in place or re-established. The joint is sawed to a standard shape used in concrete construction and cleaned out by flushing with water. Then, before sealing, the joint or crack is cleaned by sand blasting and air blasting. A product called backer rod—a long tube-shaped foam product that blocks the sealant to prevent it from running down to the bottom of the cracks or joints—is inserted in the crack, and sealant is placed on top of the backer rod to seal the crack.

During a joint or crack repair, a perfectly clean and dry joint face is necessary for good adhesion—which is imperative for a successful joint-sealing project. And a proper joint shape is necessary for the seal to work.

Concrete repairs are specified based on their width and the type of crack. Transverse joints may move more during cold weather, so the sealant used has to be more flexible. Several types of crack treatment materials are available. The principal material families and types are:

- Hot-pour sealant. This works best on wide cracks that contract and expand during fluctuations in weather.
- Silicone sealant. Silicone is used in fueling areas because asphalt sealants can be damaged by jet fuel.

Asphalt cement and liquid asphalt possess little flexibility and are highly susceptible to temperature, so their use is limited to that of fillers in non-working cracks. Additives such as mineral fillers and fibers provide minimal elasticity to asphalt and do not significantly affect temperature susceptibility.

In Minnesota, sealants must be approved by MnDOT. These sealants are listed on the MnDOT Concrete Unit website (www.mrr.dot.state.mn.us/pavement/concrete/products.asp). Only closed-cell backer rod can be used with hot-pour sealants.

Partial-depth repair

A partial-depth repair is specified when concrete shows signs of delamination—a separation of the top layer of concrete pavement from the bottom. The delaminated concrete is removed through milling the concrete pavement; once that milling is completed, the inspector should recheck the slab to ensure that all unsound concrete is removed. Occasionally, removal operations cause some damage that requires additional removal of spalled areas.

Prior to placing the concrete patch, all loose material is removed through sweep-

Concrete continued on page 2