



# Briefings

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

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## 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.

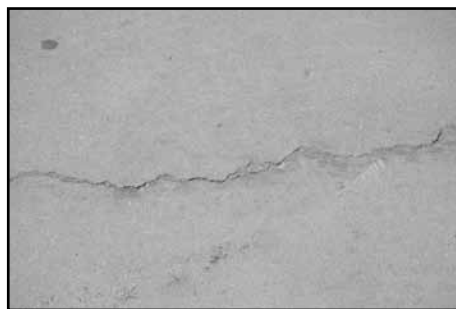
Joint spalling is the cracking, breaking, chipping, or fraying of slab edges within less than one foot from the face of the transverse joint. Joint spalling is caused by poor joint construction.

### Rehabilitation

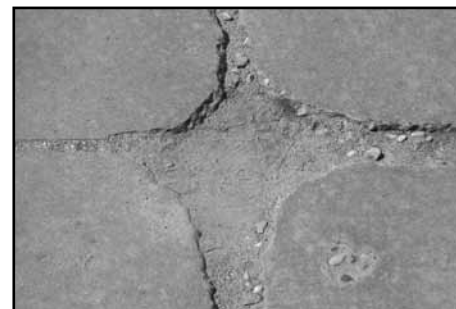
Regardless of the distress, the four types of concrete repairs are:

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

### Joint and crack sealing

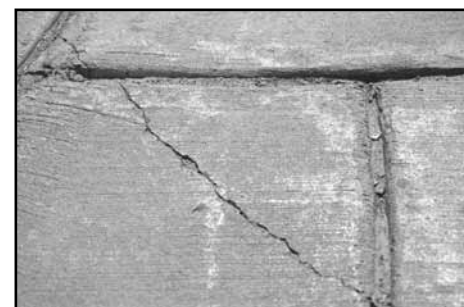
The most common repair is joint or crack sealing. This is recommended when a concrete panel breaks in an area that has not been jointed, or where a joint sealant has pulled away from the edge of the joint. Many Minnesota airports include crack sealing for asphalt as part of their pavement maintenance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



Corner crack

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](http://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

# An airport's story: Park Rapids Municipal Airport

Park Rapids Municipal Airport is known for being the fifth busiest jet airport in Minnesota. Located on the southern edge of Park Rapids on Highway 71, the airport offers services such as tie-downs, refueling, hangar storage, aircraft painting, and avionics installations.

Founded in 1944, the airport was named after 85-year-old Dave Konshok, who has fostered a fervent passion for aviation his entire life and is still on the board of the Minnesota Council of Airports. The current airport manager, Scott Burlingame, has been manager for the past 10 years and says he thoroughly enjoys his job.

The airport has 44 T-hangars, with one main runway stretching 5500 feet north to south. The hangars are available for rent with monthly rates depending on the size

and age of the hangar.

The Park Rapids Municipal Airport serves mostly aviators and aviation traffic. Although the airport currently holds no events, it previously hosted a fly-in for the community and plans to do so again soon.

Known as the Upper Midwest and central Canada distributor for Aerocet Floats, Park Rapids Airnomics, located at the Park Rapids Municipal Airport, offers aircraft sales and different types of aircraft services. Park Rapids Airnomics has been known for the past 10 years as a leader in the float plane industry.

The airport is also home to Park Rapids Avionics, which provides the latest in aviation products and technology with services that include the installation and maintenance of communication systems, custom

instrumentation panels, navigation systems, instrumentation, flight control systems, and weather systems.

Recent additions to the airport include a municipal sewer and water with fire hydrants. The crosswind runway was paved in 2011, making Park Rapids well known for being the smallest town with a paved crosswind runway at its local airport.



**Concrete** continued from page 1

ing or vacuuming. Once the patch area has been checked and cleaned, bonding grout is applied directly to the concrete. New concrete is then placed and finished to grade, slope, and texture. Grout is used to seal the edges, then curing compound is applied. Note that of all the concrete repair methods, partial-depth repair is the operation that depends most on workmanship. Once the new patch is placed, all cracks and joints must be re-established in the exact location as in the original pavement. Curing compound should be placed immediately after concrete placement or shrinkage and debonding will occur.

### Full-depth repairs

For a full-depth repair, the deteriorated area is removed by saw cutting either end and then lifting the slab out. The slab should be removed using pick holes and pins to reduce the possibility of spalling off the edge of the remaining concrete. The base layer beneath the removed panel should be recompacted. Reinforcing steel, such as tie bars or dowel bars, should be installed on each end of the repair by drilling holes and

securing the bars with an approved epoxy or non-shrink grout.

Full-depth repairs are specified based on the size of the concrete panels, their location, and the reinforcement requirements. For example, if a full-depth repair is on an expansion joint, dowels may be required to transfer loads from one panel to the other.

For a slab for which all four corners are broken and need full-depth replacement, no reinforcing steel or dowels are required.

### Slab replacement

Slab replacement is the most extensive repair, requiring complete removal of an entire concrete panel. This repair is used when the area to remove exceeds 13 feet in any dimension.

### Resources

Many good concrete rehabilitation manuals are available online to help you select the best treatment method for your airport's concrete pavement. Following is a partial list.

- *MnDOT State Aid Concrete Pavement Rehabilitation Best Practices Manual*, published in 2006 by the Minnesota

Local Road Research Board. Available online at [www.lrrb.org/pdf/200631.pdf](http://www.lrrb.org/pdf/200631.pdf).

- MnDOT Materials website: [www.dot.state.mn.us/materials/concretrepavement.html](http://www.dot.state.mn.us/materials/concretrepavement.html).
- MnDOT Joint Sealing Guidelines (technical memorandum dated April 29, 2010). Available at [www.dot.state.mn.us/materials/concretedocs/joint\\_sealing\\_guidelines.pdf](http://www.dot.state.mn.us/materials/concretedocs/joint_sealing_guidelines.pdf). Note: The joint designations listed in the table are outlined in the State Aid manual referenced above.
- The Transportation Research Board's *Airport Cooperative Research Program (ACRP) Synthesis 22: Common Airport Pavement Maintenance Practices*, published in 2011. Available online at [www.trb.org/main/blurbs/165167.aspx](http://www.trb.org/main/blurbs/165167.aspx).

*Author's note: Learn more about concrete pavement maintenance at this year's AirTAP Fall Forum, which will feature an on-site discussion during a walking tour of the Mankato Airport.*

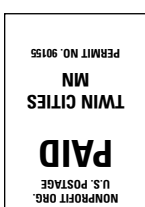
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