



ASPHALT ANCHORS 101

by Rudor (Dori) Teich, Designated Parking Corp.

Until a few years ago, if you had to attach a fixture or a structure to asphalt, you had only one choice: Remove the asphalt and pour concrete. Technology has caught up with the need to mount directly to asphalt. Specialty anchors are available in various sizes and ratings that make installation on asphalt surfaces almost as easy as on concrete. But even with these special anchors, there are certain caveats that must be recognized in order to achieve a successful and reliable installation on asphalt.

ABOUT ASPHALT

Asphalt is about 20 times more yielding than concrete. Whereas typical concrete can resist 4,000 psi of pressure, asphalt can only resist 200 psi, and for only short bursts. Asphalt “creeps” under extended periods of pressure, and even more so under a combination of high temperatures and pressures. At pressures that approach the yield point, the creep is noticeable within minutes.

It follows that, in order to mount to asphalt, one cannot use any device or method that applies a constant pressure to the asphalt. Examples of anchors that cannot, under any circumstances, be used on asphalt are expansion or wedge anchors. Wedge anchors are a low cost and very effective method of anchoring to concrete. The anchor expands inside the hole in the concrete as the attaching bolt is tightened. The sideways pressure on the walls of the hole jams the body of the anchor in the hole and keeps the anchor embedded in the material.

The continuous (“static”) pressure exerted on the asphalt walls by the wedge anchors will cause the asphalt to flow, and the anchors will loosen and lose its grip. Wedge anchors can tolerate no “give” from the substrate in which they are installed. There is no spring action involved: The anchor is expanded to the initial dimensions of the hole, and if the hole becomes larger, the anchor will no longer be jammed in the hole. Thus, in asphalt, the wedge anchors will lose their grip in a very short period of time (hours or a few days).

HOW ASPHALT ANCHORS WORK

All anchors that are qualified for use in asphalt are classified as “chemical anchors.” In essence, they use a grout to bond the anchor to the asphalt. The term “grout” is used generically and can include epoxy, resins and cement products.

Installation procedures vary with the manufacturer but follow essentially a similar pattern. To install the BoltHold anchors manufactured by asphaltanchors.com, an oversized hole is drilled in the asphalt. The hole is filled with grout, and the anchor is pushed in until it is flush with the surface. The displaced grout is pushed into the crevices in the asphalt and in the gravel layer below to create a strong bond with the asphalt.

The selection of the grout is quite critical. Among the key considerations is whether the grout shrinks during curing, curing time, range of ambient temperatures when the grout can be installed, grout hardness, adhesion to the anchor and water resistance.

HOW ASPHALT ANCHORS FAIL

Not unlike anchors installed in concrete, asphalt anchors can fail if the forces placed on them exceed their capabilities. The most common force is the pull (axially along the length of the anchor and perpendicular to the surface of the asphalt).

As the pull force approaches the failure point, the asphalt starts to heave radially from the anchor outwards. Cracks appear in the asphalt, and in thinner asphalts, the area centered around the anchor starts to crown, forming a hill. In tests on 2.5” asphalt, the crown recedes as the distance from the anchor increases up to about 6”

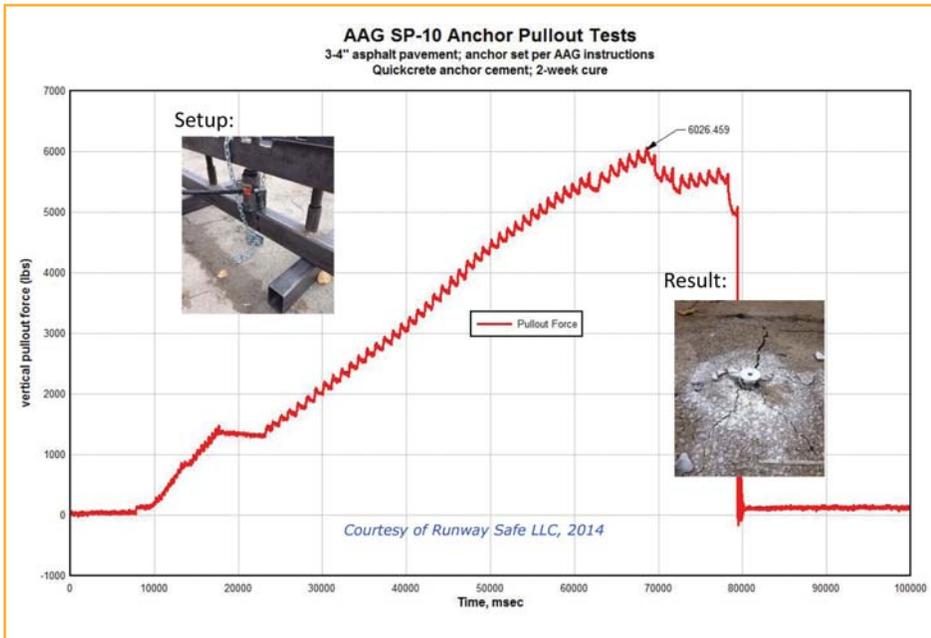
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RUDOR TEICH



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away. Note that the anchor and the grout stay attached to the asphalt.

If the pull force continues to increase, eventually the asphalt ruptures, and the anchor/grout combination start to lift out of the ground.

The graph above plots the pull force vs. time when a BoltHold SPI0 anchor was pulled out of a 3-4" asphalt runway in Midway airport in Chicago (see story below). The force is gradually increased until about 6,000 lb., at which point the force drop indicates that the anchor started to pull out, followed a second later by a major movement in the anchor, which was no longer able to resist the pull force. It is noteworthy

that the SPI0, which is rated for 1,500 lb. pull, withstood 6,000 lb.

Anchors can also fail if subjected to excessive shear forces or to excessive torque when tightening the bolts. Shear failures are more likely if the length of the bolt above the anchor is close to, or higher than, the length of the bolt threaded into the anchor. In shear-prone applications such as plastic speed bumps, the strength of the bolt is often the weak link, and an anchor model that accepts larger diameter bolts is indicated, such as BoltHold SPI8.

Torque failures occur during installation when uncontrolled torque is applied, usually through larger impact wrenches. The

excessive torque can damage the integrity of the anchor itself, and it can rotate the entire anchor by breaking the bond between the anchor and the grout and the bond between the grout and the asphalt.

ASPHALT ANCHORS: A RELIABLE, ECONOMIC SOLUTION

Properly sized and installed, asphalt anchors have proven their reliability over thousands of demanding applications. Anchors manufactured by Toge in Germany have been certified for the installation of crash barriers on German highways. BoltHold anchors have been used to secure plane-arresting traps designed to bring planes to a stop if they overrun the runway and secure heavy equipment and shelves against earthquakes in Hawaii. These anchors allow installation directly into asphalt, without the intermediate steps of removal of patches of asphalt, pouring of concrete, waiting 24 hours for the concrete to cure, then returning, drilling and installing wedge anchors.

HISTORY

The BoltHold asphalt anchors were developed in 2004 when Designated Parking Corp. needed a method to attach its parking barriers to asphalt surfaces. By 2009, wide interest in the product led to the formation of a separate subsidiary, Asphalt Anchors Group (AAG), to design, manufacture and market these anchors. The company now offers three models with various pull ratings.



ANCHORS HELP STOP RUNAWAY AIRLINERS

Midway airport in Chicago has short runways. It was the scene of a deadly overrun in 2005, and last year it installed an airplane arresting system. The system can bring an airplane to a stop from 80 miles per hour.

The sketch above, courtesy of the **Chicago Tribune**, shows the key element in the system—the arrestor bed. The bed is comprised of lightweight glass rocks, which crumble to absorb the planes energy. The rocks need to be kept in place even under jet blasts from planes taking off from that runway.

The design called for a metal grid to contain the rocks. BoltHold SP10 anchors were selected to secure the grid to the runway after confirming their pull characteristics met or exceeded the manufacturer's rating (see graph in article). About 4,000 anchors were used.

Since arrestor beds were first installed in the U.S., they have proved their worth in nine incidents involving 243 passengers and crewmembers, according to a **Chicago Tribune** article. Previous arrestors suffered from damage from jet air blasts that this new generation of arrestors is expected to overcome.

