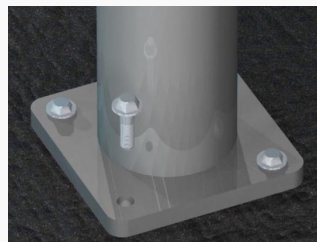


AAG has developed the BoltHold family of asphalt anchors. These anchors are totally different from concrete expansion anchors, and if properly applied, can yield amazing hold forces in asphalt.

The anchors use a special grout to bond the anchors to the asphalt layers, including the gravel under the asphalt and the compacted sand under the gravel.

Each of the BoltHold anchor model has a pull rating which specified the maximum force that the anchors are likely to hold. These ratings have a caveat -- if multiple anchors are used, the distance between them must be 12" or more.

This application note addresses the case when a number of anchors are to be installed in close proximity to each other ("cluster"). This is often the case when installing fences, bike racks or road signs which have a small plate at the bottom with 2, 3 or 4 holes as shown in the picture on the right.



Failure Mode

When we test anchors pull force, we stop the test when the asphalt crowns (rises) by 1/2". The asphalt crowns at the anchor point, with a gentle slope to about 6-8" all around where the asphalt is undisturbed. It stands to reason, therefore, that in the case where a second anchor is installed within this crown area, its ability to resist pull will be reduced from the self-standing pull rating of the anchor.

Cluster of 2 anchors Force De-rating

AAG has developed a guide for the derating of the second anchor in the case of clustering of 2 anchors. The simplified formula shows that the rating of the second anchor is reduced by 6%

for every inch that the anchor is closer to the first one, than 12". The table below shows the force ratings in lbs., for a *second* anchor, as a function of the distance from the first anchor. It is assumed that the force rating for the first anchor is unaffected by the second, for the purpose of this calculation.

Distance	SP10	SP12	SP18
12"	1,500	2,000	2,500
10"	1320	1760	2200
8"	1140	1520	1900
6"	960	1280	1600
5"	870	1160	1450
4"	780	1040	1300

Thus, the total pull resistance of 2 SP12 anchors located 6" apart would be 2,000 + 1280 = 3,280 lb.

Cluster of 3 or more

How is the force affected in a cluster of 3 or more anchors? In essence, one needs to use the *minimum* distance between the anchors to compute the pull rating for the latest addition to the cluster.

Example: Use 3 anchors on a plate with 4 holes 4" x 5". Using the SP10 anchors, the total force will be (1500 + 870 + 780) = 3,150 lb.

Example: Use 4 anchors on the plate above, using the SP10 anchors. The total force will be (1500 + 870 + 780 + 780) = 3,930 lb.

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