KALAMAZOO BANNER WORKS

CONSORT DISPLAY GROUP

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Important Topics Concerning Banner Hardware

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Also know as:
The Kalamazoo Banner Works General Guideline on the Use of Vertical Street Banners and Hardware on Light and Utility Poles

The following is a general discussion of banner brackets for use with vertical street banners, which are typically installed in communities on utility or light poles. We have invested considerable time and money in the testing of our banners and brackets, which includes four separate wind tunnel tests. This document is a result of that knowledge base and is intended to be a narrative for customers, engineers, utility companies and public works officials and briefly explains our products, our testing and what, in general, we know from experience about vertical banners on light poles. This is by no means all-inclusive of the information available but touches mostly on the structural aspect, including wind load information. For more information, please go to our website to view all the banner bracket models offered as well as banner options and other information. Also, please contact your Consort KBW sales representative by phone or email with any questions or concerns.

The "Banner Issue" with Communities and Power Companies

Many municipalities and power companies are at odds these days over the use of vertical banners that cities have installed and /or want to install on downtown light poles. The questions of what type of banner hardware is best, how strong poles need to be, how big should, or can, the banners be and who should be allowed to use the poles and banner brackets are among the issues being discussed.

These banners are becoming more common across North America in downtown areas, shopping centers, special neighborhood districts and so on and usually promote the area or community and non-profit organizations and events. Often, they are looked upon by the sponsoring group as an effective medium to show community pride, promote community attributes and events (such as museums and sporting events) and to welcome visitors.

In many cities, the power companies own the utility poles on which the city has placed or wishes to place banners. In our experience, the majority of power companies involved have been either readily willing to be part of the communities' promotion-through-banner efforts or have reluctantly, but successfully worked with the cities to make the banner programs possible. In other cases the power companies have been uncooperative and/or unwilling to get involved.

As a leading outdoor banner products innovator and manufacturer we, of course, would like to see the two entities work together for the good and vitality of the community. This certainly includes the safety of the community as a whole. For this reason, we have compiled data to assist power companies and communities to select the proper poles, brackets, banners and banner sizes that would be appropriate for long-term banner display.

Banner Wind Loads

It's not hard to understand the concern that the utilities have with banners. Wind load pressures are considerably different on poles that have, essentially, "sails" mounted to them than on poles without banners. Of course, some traffic signs mounted on poles catch wind as well but the signs are usually not as big and are generally not mounted as high above the ground as banners. Pole integrity is the immediate topic

of concern. The strength of poles is affected by potentially undersized cross-sections, age and integrity of base connections and pole materials. As a banner hardware manufacturer we advise the installing city to get the full cooperation and consent from the local utility or pole owner prior to the installation of banners on light poles. Our instructions suggest that poles be inspected and approved for the extra wind loads. In most cases this appears to be a matter easily handled. And, we have technical wind load data, as noted below, that we supply upon request.

Because power companies require banner wind load information in order to help determine pole suitability, we have conducted wind load tests in actual wind tunnels as well as wind load or aeronautic computer simulations of banner installations; also we have done lab testing and computer diagnostic testing on our banner hardware components. This information not only allows us to warrant and improve our products but also is the kind of information on which power companies or pole owners can base their determination of individual pole suitability. The data that we have is proprietary to our BannerFlex brand brackets and should not be used as indicative of strength and/or performance of any other hardware produced by other manufacturers.

Banner Bracket Design

What is the best design for light pole banner brackets? Since 1983 KBW has spent considerable resources being the innovator in this field. Through the mentioned testing we designed the original BannerFlex bracket in 1984, the first vertical street banner bracket to incorporate the use of fiberglass arms. That bracket was totally redesigned and patented in 1988 and modified in 1997. The materials are 356-T6 aluminum castings (a base plate and an arm casting) and a pultruded fiberglass rod, along with four Dacromet-coated setscrews to allow adjustability. The arms are manufactured with a "set" or cant of from 2 to 4 degrees (depending on the specific BannerFlex model) such that when there is no banner present, the top arm angles up and the bottom arm angles down (note that the arms may be removed if no banner is installed). Also, the arms may be removed from the Main Casting if no banner is displayed and the Main Casting remains on the pole until it is again needed.

When the banner is installed, the canted fiberglass arms conform to the rectangular shape of the banner by bending down slightly at the top of the banner and slightly up at the bottom. The final appearance is a tight, trim banner installation. This canting puts the outside edge of the banner in tension and allows the wind load to be immediately transferred to the fiberglass arms which, depending on the wind velocity will flex back and toward the center of the banner, thereby spilling wind and while also absorbing some of the shock stress that gusting wind produces. This, in turn, puts less stress on the banner fabric promoting longer banner life and putting less vibration stress on the luminaire.

The new BannerFlex Airow® banner bracket, which is discussed again under the Wind Load Test Results section, is installed essentially the same way and the banner reacts essentially the same by taking on a tight, trim and rectangular shape. But, due to the eccentrically cut shape of the fiberglass arm it will spill considerable more wind force than the original BannerFlex brackets or any bracket manufactured by others that attempt to mimic the original bracket. This bracket also has a UV powdercoat coating for longer life. See the KBW Wind Force Calculator at www.kalamazoobanner.com/windforce.html for specific wind load data.

Banner size and quantity (one banner or two banners per pole?) are certainly factors in this discussion. For banners of smaller than about 28" wide by 48" long the wind force is considerable less than the typically "full-size" 30" x 94" or 30" by 96" banner. Smaller banners do not proportionately spill as much wind due to significantly decreased wind loads on hardware that is designed for heavier loads. And, if a banner presentation is two side-by-side banners, in lieu of only one banner on a pole, the loads are doubled.

For poles that are deemed not strong enough for banners to be attached with horizontal arms both top and bottom but which may be strong enough for half the wind load there is an alternative. Wind loads can be halved by attaching the lower pole-side corner with a cable tie or bungee to an anchored "tie down" and letting the outside bottom edge fly free (no bottom arm). KBW manufactures a Tie-Down Mount specifically for this purpose. This method is extremely effective but will limit the life of a banner to 3 to 6 months versus 5 to 8 years (for marine acrylic textile fabric banners). Digital banners on vinyl fabric should only be mounted this way on a temporary basis, that is, for display approximately one to three months due to the fact that

typical vinyl banner materials are not as flexible as the woven marine acrylic (such as Sunbrella®) that we use for our screen printed banners.

Because it is not possible for us to personally determine if a customer's utility pole or light pole is suitably strong enough for any particular size or quantity of banners we provide engineering data for local engineers and utilities to assist in making that determination.

Other Types of Banner Brackets, in General

What about "Breakaway" and "Spring-Loaded" banner brackets? Since 1984 we have done research and development on these other types of concepts without successful results. As industrial designers and innovators, who also hire structural engineer consultants and freelance designers, we have designed and researched systems that fit into the two mentioned categories. But, none of those designs, we feel, perform in a reliable or long-term mode. Nor have we found brackets manufactured by others that perform adequately for the long term that also fit into the breakaway or spring-loaded category. In comparison, virtually all of our original BannerFlex brackets from 1984 are still in service and working properly with literally no maintenance. This is not to deny that most any reasonable bracket will work for a few months or even a few years. But for all the years that the City of Kalamazoo, Michigan, for example, has enjoyed its banner brackets, a non-mechanical system is necessary.

Of course, it goes without saying that not only must a bracket be strong; it must also be resilient and extremely durable. In many installation locations the wind is a constant factor. For example, near major coastlines, prevailing breezes and winds are rarely less than 24 hours a day. Brackets should not only be designed to spill some amount of wind, they should also be compatible with the banner fabric, that is, flex and move with the banner to keep sewn hems intact, and they should dampen vibration that might affect the luminaire.

As we head further into this discussion I think it is important to note that our BannerFlex system is currently in use, with top and bottom arms, in over 300,000 installations globally.

Spring-loaded systems

A spring-loaded system is, by its very nature, a mechanical system in the sense of a "machine". For the short term (a few months to a year or two, perhaps) this type of system will probably require little or no maintenance. But, as anyone knows who owns an automobile or lawnmower (or a boat!) mechanical systems eventually fail. Through competitive use, such as moving constantly with prevailing winds, normal wear and tear will change metal parts, change tolerances, affect the level of performance at the very least and eventually demand maintenance or replacement.

Also, spring-loaded banner arms that we have prototyped and other manufacturers' products that we have tested may have a tendency to react to violent wind gust forces where the fabric is put into stresses that may bounce and twist the banner, thereby stressing the hems and seams. If these kinds of forces are prevalent in your area, banners could be damaged and non-proactive maintenance procedures may result in damage to other components on the bracket or pole or pole accessories, such as the luminaire.

In short, because of the mechanical nature of a spring-loaded system, we caution their long-term use in public areas.

Break-away systems

Breakaway type products are, in our opinion, to be avoided at all costs. From our experience and testing, there is no possible way to have a banner arm breakaway when "it is supposed to". Physics just doesn't allow it. And, when and if it does breakaway the real problems begin.

Let me explain. With a top and bottom arm installation, where the banner is stretched between two horizontal supports, enough strength needs to be built into the system to allow normal, daily wind loads and sudden

non-cataclysmic gusting without breaking the connections. Some breakaway systems are built on the idea of fatiguing a certain connection when high loads occur. However, fatigue can and will occur over time with daily and prevailing winds with a fatigue system. We've all broken a paperclip or wire by bending back and forth. This is the same idea.

Other breakaway systems are built on more flexible components, such as fiberglass, that are simply undersized. That is, when certain stresses are applied, they break. It's a great concept except for two things. One is that, in layman's terms, broken things start flying around or dangling around and above people (and cars) for an indeterminate length of time (until the installation is repaired). Second, they may often break during normally, non-troubling gusting as mentioned above. If these banner arms were computerized, which is absurd of course, they would be programmed to know when the wind is serious and when it is just a bit odd and rough.

What's wrong with a breakaway that breaks when it is supposed to break and also when it isn't? Again, broken things flying around can be very dangerous. If they are tethered, which they should be, the tether will only last so long before fatiguing. And, in the meantime the light pole and the banner are being subjected to damaging forces by the dangling and banging around of whatever arm component has let go.

Again, I can't stress enough that breakaway systems should be avoided.

Wind Holes in Banners

We are often asked for our recommendation on the topic of wind holes or slits in banners that are meant to allow wind to pass through banners thereby to, hopefully, reduce total banner wind load. In both of our full-size wind tunnel tests, in 1984 and 2002, we tested banner with wind holes on our BannerFlex hardware as well as non-vented banners. In both cases, it was visually obvious that these wind holes became, in fact, detrimental to the banners due to vibration and fabric stress within the banner and they tended to increase the wind load rather than reduce it.

How can they increase load? The holes allowed the fabric to ripple and catch more wind which increases the drag factor. The fiberglass arms deflected more rather than less indicating more force on the system with the holes than without. Also, again, the banners vibrated considerably more at 60 mph to 100 mph with the holes than without the vents.

Also, the typical hole pattern that we are asked by unknowing customers to cut into the banners and which we see on many non-KBW banners do not allow enough wind relief to make a difference regardless of the rippling effect. For example if 3 –6"diameter "half-moons" are cut into a 30" x 94" banner those holes only represent 1.5% of the surface area. Even twice that number of holes, which is more than normally seen, is only 3% of the surface area.

Therefore, with our BannerFlex fiberglass arm system, we do not recommend wind holes or slits to our customers. For maximum wind reduction, specify the new KBW BannerFlex Airow banner bracket.

The BannerFlex Banner Bracket Wind Load Tests

Consort has conducted a total of four wind tunnel tests. Two were in full size tunnels, the first in 1984 at the GM Aeronautical Laboratory in Detroit and our most recent full-size test at Jacobs-Sverdrup facilities in Allen Park, Michigan in July, 2002. Two smaller tests were conducted at the University of Michigan tunnels in early 2002.

The wind force and wind reduction information included with this report and included in our online Wind Force Calculator Program are a result of those tests along with data gathered from our strength testing conducted at the Consort manufacturing facility and computer modeling carried out by our structural engineering consultants, Nehil-Sivak, PC of Kalamazoo, Michigan.

The data that seems to be the requested most often is the "EPA" for various size banner installations at various wind velocities. EPA or Effective Projected Area is a value given to outdoor pole-mounted equipment,

such as lighting fixtures, signs and banners, based on the sum of the pole and attached fixture(s) surface area and shape, in square feet. For banners mounted with flexible arm brackets the EPA will change (get smaller) with increasing wind loads. A good way to envision the EPA of wind-loaded banners is as the deflected shape of the banner projected onto a flat surface. That is, the less shadow the resulting banner would project, the less the EPA.

Below are examples of some of that type of data, simplified for general discussion purposes. The first section is for our standard BannerFlex D-3 utilizing a solid pultruded fiberglass arm and the second section is for our new BannerFlex Airow utilizing an eccentrically milled pultruded fiberglass arm. Both models are shown on the online Wind Force Calculator. All the calculations given below are for single banner installations or one banner per utility pole. For double banner installations you would double the EPA numbers.

The BannerFlex D-3: At 70 mph, one 30" x 94" banner (area = 19.575 sq ft before the wind blows) has an "Effective Projected Area" of 16.45 sq ft which means that about 16%* of the wind is spilled due to fiberglass arm deflection. At 90 mph the EPA is 15.7 sq ft and the wind reduction is about 19.83%* and, at 100 mph the EPA is 15.2 sq ft and the wind reduction is 22.38%*.

*Note that the effective projected area calculation does not take into account the wind spilled due to the "billowing" of the fabric, which actually decreases even further the wind load that is transferred to the poles. This reduction has not been calculated due of the complexity; however, suffice it to say that it would show all of these wind loads to be less than shown here.

The new BannerFlex Airow: At 70 mph, one 30" x 94" banner (area = 19.575 sq ft before the wind blows) has an "Effective Projected Area" of 11.90 sq ft which means that about 32%* of the wind is spilled due to fiberglass arm deflection. At 90 mph the EPA is 10.4 sq ft and the wind reduction is about 46.9%* and, at 100 mph the EPA is 9.5 sq ft and the wind reduction is 51.49%*.

Other wind load information, such as pounds per square foot exerted at various velocities on various size banners, is available on the Wind Force Calculator and by contacting your Consort KBW sales representative.

The Wind Load Effect on Smaller Banners

The banner installations that we tested in the tunnels were all double 30" x 94" banners, which represent the largest of our stock sizes and therefore the highest winds loads with which we typically deal. Smaller banners and installations of only one banner per pole will decrease loads significantly. If banners are desired on utility poles that will not handle the larger banners, even with the benefits of the new Airow configuration, we encourage the customer to consider the 30"x60" or 18"x36" sizes in single or double installations. The BannerFlex system deflects less with these smaller sizes because of the significantly lower wind loads but the action of the fiberglass arm moving with the banner promotes longer banner life due to decreased stress on the fabric and the hems.

Need Further Information?

Contact your Consort KBW sales representative for any additional information or if anything within this document is unclear.

And Finally: The All-Important, Official Consort KBW Disclaimer

Consort provides this data for customer convenience. Consort does not assume any liability associated with use of this data by anyone. It is the customer's responsibility to determine to his/her own satisfaction that the structures (light poles, buildings, etc.) are able to withstand the increased wind load generated by the installation of one or more banners of a particular size on that structure using Consort banner brackets. Consort always recommends that the pole manufacturer or a structural engineer be consulted in making that determination.