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Dear Friends:

Although the purpose of this communication is to introduce the structural engineer, Nick Pontillo P.E., in some strange fashion I am reminded of the American folklore hero Pecos Bill. Pecos Bill was a cowboy (*Spoiler Alert*: Nick is not a cowboy) who had a strange upbringing. He was reported to have been raised by coyotes until age seventeen, took control of a gang, built the biggest cattle ranch in the Southwest, needed all of New Mexico to raise those cattle, and used Arizona to pasture the cattle. It is said that Bill could ride anything. In fact, he rode a tornado across Texas, New Mexico and Arizona all the while squeezing the rain out of it to save the land from a drought. Bill fell off the tornado and landed in California. At this point, I think it's safe to say that wind had something to do with Bill's travels.

Nicholas K. Pontillo, P.E.

Now comes what some could perceive as analogies between the life of Pecos Bill and Nick. Nick was not raised by coyotes, but did spend his younger years in Orlando, Florida. Orlando is the home of Disney World – a rough place for anyone to vacation with a gang of small children. Nick weathered the civil engineering curriculum storms at the University of Central Florida all the way to graduation. Thereafter, he designed bridges which connected the land. Nick didn't ride a tornado to Kansas City, but March, the windy month, was waiting for him when he arrived on the 14th. He has some big boots to fill . . . and my colleagues and I at Engineering Design & Testing Corp. are excited about his "landing." Welcome aboard, Nick!

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The Ways of Wind

by Nicholas K. Pontillo, P.E.
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As most of us realize, the predominance of storm-related damage is attributable to wind. In this regard, wind storms often generate a two-part question for those involved with root cause investigations:

1) What was the maximum wind speed at the location of interest?
2) Why was damage sustained if the prevailing building code required the building and building components to resist winds greater than the maximum recorded wind speeds?

Wind Speed Data

The determination of maximum wind speed at a given location often requires some interpretation given that weather stations are usually located some distance from a point of interest. Meteorological stations which measure and record wind data are identified and located in one of three ways:

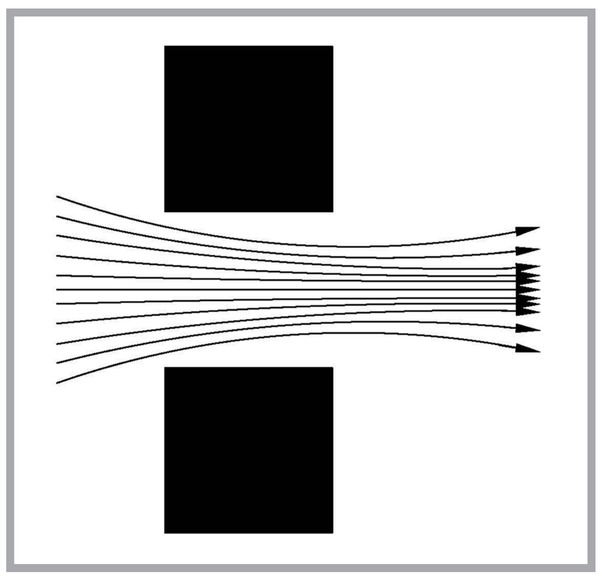
- **A station index number –** assigned by the World Meteorological Organization (WMO)
- **A location indicator –** assigned by the International Civil Aviation Organization (four letter indicators)
- **A location indicator –** assigned by the U.S. Federal Aviation Administration (three letter indicators)

The National Weather Service Telecommunication Operations Center's website provides a means by which to identify a station by index number or location indicators (***www.nws.noaa.gov/tg/siteloc.shtml***). For example, the index number for the station at the Kansas City International Airport is 72446. In Omaha, the Eppley Airfield location indicator is KOMA.

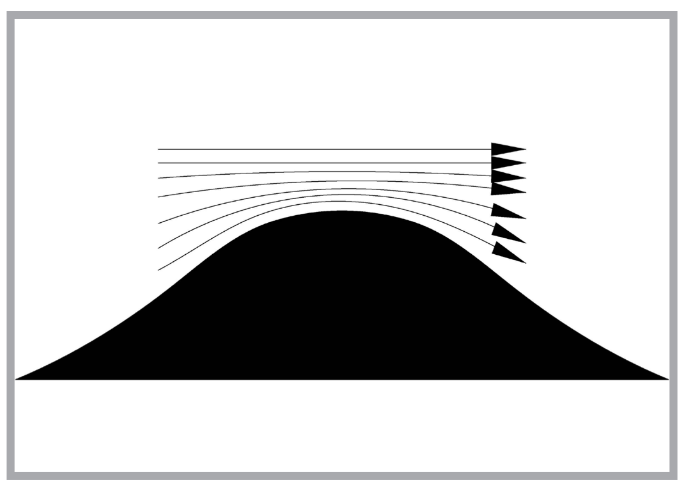
Websites that provide free historical wind-related station information include the following:

www.wunderground.com/history (enter a location and date)
www.ncdc.noaa.gov/oa/climateresearch.html (enter a location and date)
www.spc.noaa.gov/climo/online/ (enter a date)

For a fee, meteorological consulting firms can provide quantifiable, site-specific historical weather reports within a reasonable degree of meteorological certainty.



Wind channeling between two objects



Wind speed increase over a hill

Design Wind Speeds

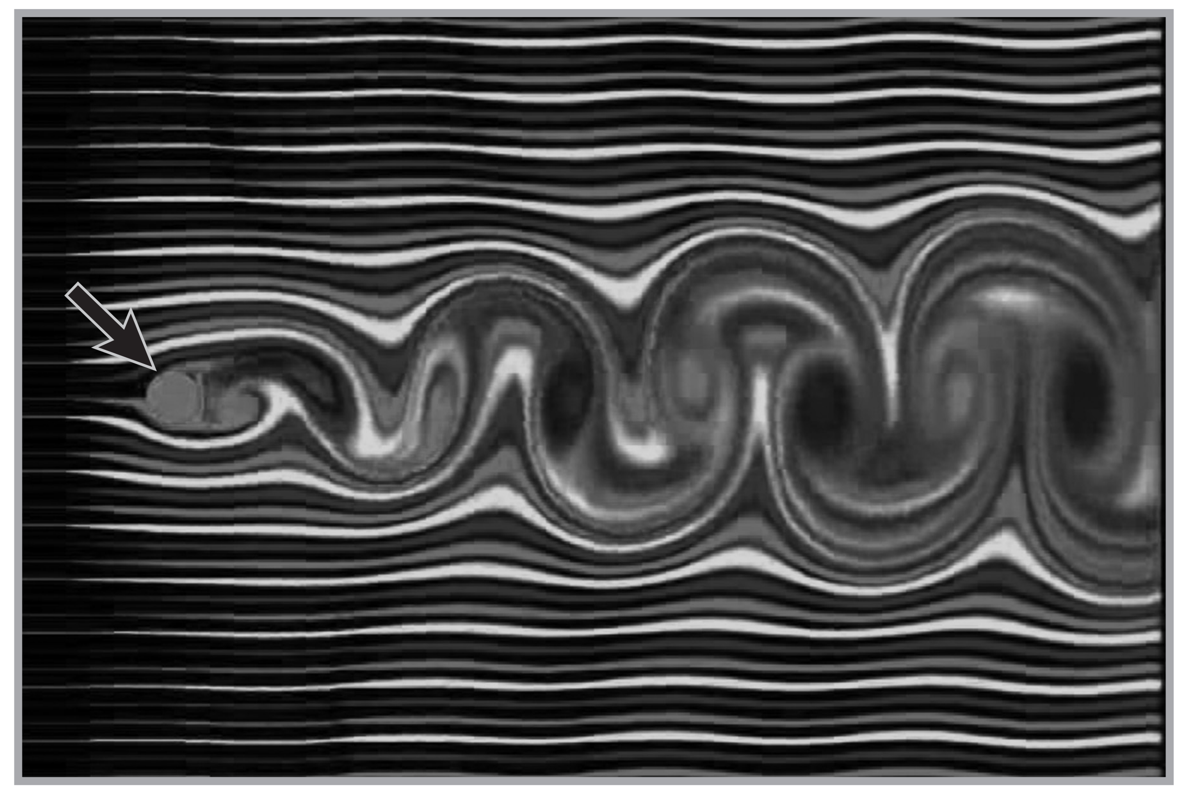
From a building design perspective, and over the years, maps showing basic wind speeds have been published by the American Society of Civil Engineers (ASCE) in the document entitled "Minimum Design Loads for Buildings and Other Structures." The most recent edition, ASCE 7-10, was published in 2010.

Prior to 1995, wind speeds shown on the ASCE maps were based upon the "fastest-mile wind speed." Fastest-mile wind speeds were obtained from anemometers and represented an average of wind data for the time it took the fastest mile of wind to pass the weather station. For a fastest-mile wind speed of 60 miles per hour, interpretation of the wind data would show that one mile of wind passed the anemometer in one minute.

After 1995, and since the National Weather Service discontinued the use of the fastest-mile wind speed, wind speed maps published by ASCE use a 3-second gust speed at 33 feet (10 meters) above the ground. A 3-second gust represents the peak wind gust associated with an average time of 3 seconds. The wind speed maps shown in ASCE 7-10 are based on a 3-second gust with a 50-year reoccurrence interval.

Did Wind Do This?

Buildings and building components can sustain wind-related damage even though the recorded 3-second gust experienced by the building is less than the building's design wind speed. An example of why a wind speed less than the design wind can result in damage is channeling. Channeling is the result of wind that passes through clusters of elevated structures, such as clusters of buildings. Similar to channeling, wind speeds can also increase due to topographical features. For instance, as wind approaches a hill, low-level air is forced upward resulting in a higher wind speeds near the top of the hill. Another such condition is vortex shedding. Vortex shedding creates a problem when the formation of vortices results in repeated fluctuations of a building or structure. A common example to illustrate vortex shedding is the vibration of a stop sign during high winds. Other factors which can contribute to wind-related damage include defective design, poor quality building materials, and/or improper installation.



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Vortex shedding produced by a cylindrical object (see arrow) subject to wind