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Light Poles

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Richard Briden, PE

A guide to their selection, installation and maintenance including the cause and effects of pole vibration

1.1 General

Lighting standards, also called light poles or lampposts, are 'engineered' structures designed to support single or multiple luminaires. They may also be used to support signs, pennants, banners, flower pots, and other decorative items.

1.2 Function

Their primary function is to resist the physical forces of luminaire weight, ice and wind loads which the poles may encounter over their expected design life. Along with the foundation system, the primary force a pole must withstand is from wind. Because of the variety of pole shapes, heights, size and quantity of luminaires to be supported (including other items that may be attached to the pole), an engineering analysis must be done to ensure the customer will receive a pole adequate to the task. It must be capable of providing a long service life, be relatively maintenance free, and pleasing in appearance. Due to unforeseen loadings and wind events which may occur, it is advisable to select a pole with an ample margin of structural capacity.

1.3 Definitions

(Common Pole Terminology used throughout this paper with abbreviations)

- **Cd (Coefficient of Drag)**

The ratio of the 'apparent' wind area to the actual silhouette area of an object or luminaire. Streamlined objects have lower Cds than blunt or flat sided objects. (See Commentary)

- **EPA (Effective Projected Area)**

Light fixtures or luminaires are rated in EPA (effective projected area stated in square feet) that refers to the apparent wind profile of a fixture or object based on its' geometric shape. For example, a round fixture being more streamlined has a lower EPA than a flat sided fixture of the same silhouette. For convenience, poles are rated in terms of their EPA capacity at several wind speeds. (80, 90, 100 and 110 mph)

EPA = Actual Wind Silhouette of an Object x Cd.

- **MH (Mounting Height in feet)**

The height at which a fixture is mounted measured from the pole base, not the length of the pole.

For example, floodlights may be mounted on brackets which may locate the fixtures above the top of the pole.

- **OTM (Over-Turning Bending Moment in foot-pounds)**

The bending moment (force times distance) caused by the wind force acting on the pole and fixtures which tend to topple the pole or foundation. (See Figure 6)

- **CSR (Combined Stress Ratio)**

The ratio of the applied stresses imposed on a pole to the allowed stresses.

These would include the bending stress (due to the OTM), shear and torsion stresses, and the axial stresses (from pole and luminaire weights). The combination of all these stresses shall not exceed a CSR value of 1.0.

- **Torsion**

Forces on a pole caused by the location of fixtures times the horizontal distance as measured from the centerline of the pole (measured in pound-feet).

- **Vibration**

A condition which may occur under certain wind conditions causing the pole to vibrate.

There are several modes of vibration. Vibration may cause fatigue stresses severe enough to eventually cause damage to the pole and/or luminaire. (see Figure 3)

- **Pole Geometry**

The dimensional and physical shape of the pole.

The basic characteristics are height, shape (round and square x-sections), diameter, (or square size), wall thickness, taper (if any), material, and weight.

- **Height above Grade**

Height above the surrounding terrain to the pole base. (example: a pole located on a parking deck or bridge).

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This is important as the wind velocity increases with elevation (altitude).

- **Breakaway Requirements**

Breakaway requirements are usually mandated by the Federal Highway Administration for Federal Interstate and State Highways.

They also may be required on certain county and local road systems. Common breakaway devices are slip bases, certain cast aluminum T-Bases, and breakaway couplings. To prevent injury to the occupants, these devices are installed between the pole base and the foundation and slip or fracture (breakaway) upon impact by automobiles.

2. Factors Affecting Pole Selection

It is advisable to create a work sheet and list all the required data in order to determine the pole requirements. (See Data Work Sheet for Poles)

- **Mounting Height (MH)**

Usually determined by the lighting survey which will also includes the number of poles, luminaire model number(s) and the quantity of luminaires per pole.

- **Luminaire Selection**

The type and luminaire model may be determined by the lighting survey or recommended by a lighting consultant. Note should be taken as to its EPA, weight, mounting method, (side mount, top mount, floodlight brackets etc.) and the distance from the center-line of the pole to the luminaire center.

- **Brackets and Arms**

Brackets, when used, also have weight and EPA ratings and should be listed.

- **Wind Speed (in mph)**

It is critical that the proper wind speed be determined for the job site. For convenience, an iso-tach wind map is located in the lighting catalog. This map is based on the 1994 AASHTO code and the ASCE 7-93 (fastest mile) wind map. Should the job site fall near or between two wind zones, the higher value shall be used. The '50 year mean recurrence interval' wind map is recommended. In 'special wind regions', local authorities should be consulted for the correct wind speed data.

When a customer specifies or requests a wind speed requirement other than from the ASCE 7-93 (fastest mile) wind map, it should be noted as to the source of the wind speed. Other wind maps have been produced by the ASCE, and it is important that this is known in order to apply the correct wind force formulas, such that correct pole size can be selected. For more information, See the Commentary' Wind Maps and Wind Pressure Formulas**'**

- **Terrain and Special Wind Areas**

Flat and open terrain may cause wind induced pole vibrations that may require special attention. (See Section 7 for more information) In 'special wind zones' such as mountain passes where hills and local topography may create a funnel affect, or other anomalies, it would be advisable to contact local authorities for wind speed values.

- **Pole Material**

The designer or owner may select the pole material to be used. Common materials are steel, aluminum and fiberglass, with steel being the most common. Poles are also made from concrete, cast iron and wood.

- **Pole Shape and Style**

The most common shapes used for poles are round and square in cross-section. Poles may also be tapered. Some customers may request special designs such as ornamental and 'nostalgia' period poles.

- **Height above Grade**

The elevation distance from grade to the pole base. (See 1.3 Definitions Section)

When poles are mounted above grade, please contact the factory for assistance.

- **Environment.**

Consideration should be given to job sites near coastal areas (i.e. salt water corrosion). Sewage treatment plants may also have corrosive conditions. These conditions may require the need for special finishes and coatings.

- **Finish and Color**

Generally the powder coat finishes used today are excellent for most environments. Their endurance and color retention are excellent. The 'Bronze' tone is the most common, bur a variety of other colors are available. See the color chart or check with a customer service representative.

- **Auxiliary Lighting**

Frequently, besides general purpose area lighting, poles may also be used for special task lighting applications such as building or sign illumination. These lights may be mounted at various locations on the pole. The EPA, quantity and MH of these lights should also be entered on the Data Work Sheets for Poles Sheet. Consult the factory for assistance.

- **Special Loadings**

Signs, banners, pennants or holiday decorations are not to be installed on poles without the consent of Cooper Lighting Solutions lighting division. Please contact the factory or a representative and provide the area, size, weight and the pole location of these items such that a pole of sufficient size can be recommended. Pole-to-pole banners are not recommended without a special engineering analysis. Consult the factory.

- **Special Requirements**

For special engineering codes, breakaway requirements, T-Bases, CCTV applications, bridge mounting locations, please consult with the factory.

Pole Selection Examples

(See Data Work Sheet for Poles)

Example 1

Job Name	Forest Mall
Agent	AAA Lighting
Job Location	Raleigh NC
Luminaire Model	Prevail
Quantity/Orientation	2 @ 180 degrees
Pole Height	30 ft
Luminaire Mounting Height (MH)	29.5 ft.
Pole Style	Square Straight Steel (SSS)
Wind Speed	90 mph
Use Wind Map ASCE 7 93 (Fastest Mile) with a 1.3 gust factor applied	50 yr. mean reoccurrence interval
Luminaire EPA (each) sq. ft.	0.75
Luminaire Weight (each) lbs	28
Bracketry EPA	0
Total EPA	1.5 sq. ft.
Luminaire(s) Total Weight	56 lbs.
Bracketry Weight (all)	0 lbs
Total Weight (all luminaires and brackets)	56 lbs

Pole Model No. SSS5A30SFM2 (Pole capacity = 2.0 EPA

There are strong arguments for selecting poles with ample EPA capacities. The cost differential of a slightly larger pole is small when compared to the overall cost of the in-place installation. In addition to safety margins, capacity is left for future (additional) luminaires and decorations.

Example 2

Job Name	Hoosier Mall
Agent	BBB Lighting
Job Location	Indianapolis IN
Luminaire Model	Acura, Large (ALF)
Quantity/Orientation	2 mounted on a T2B Floodlight Bracket
Pole Height	35 ft
Luminaire Mounting Height (MH)	37 ft
Pole Style	Round Tapered Steel (RTS)
Wind Speed	90 mph
(Use Wind Map ASCE 7-93 (Fastest Mile) with a 1.3 gust factor applied	50 yr mean reoccurrence interval
Luminaire EPA (each)	3.7 sq. ft.
Luminaire Weight (each)	71 lbs
Bracketry EPA	0.78 sq. ft.
Total EPA	8.2 sq. ft. 2 feet above pole top
Luminaire(s) Total Weight	142 lbs.
Bracketry Weight	9 lbs.
Total Weight	151 lbs.
(All luminaires and brackets)	
Pole Model No.	RTA8A35SF with T2B Bracket (Pole capacity 12.7 EPA, 400 lbs.)

If the job site is in an area which has had a history of vibration problems, or has open terrain and prevailing winds which likely may cause pole vibration, model number RTA9A35SF would be a better choice.

3. Anchor Bolts and Foundations

3.1 Anchor Bolts

Anchor bolts supplied by Cooper are specifically manufactured for pole foundations and are of a diameter and length for the particular pole as listed in the catalog. Other manufacturers' or existing anchor bolts should not be used without the written consent of an engineer.

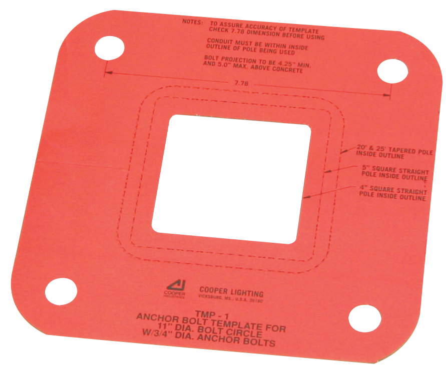
3.2 Bolt Circles

Before pouring a concrete foundation, it is of utmost importance that the anchor bolt circle template conforms to the bolt circle of the pole base. Likewise the same is true for 'precast' foundations. Also, radial orientation of the anchor bolts relative to the handhole and mounting orientation of the luminaires is critical.

3.3 Anchor Bolt Projection

The height the anchor bolt protrudes above the concrete surface.

The anchor bolt projection should be checked. Too little projection, and the pole may not be properly secured; too much and the bolts may be subject to unwanted bending stresses. In addition, the base cover may not fit properly. Consult the catalog for the correct anchor bolt projection. (See Figure 1)



Four Bolt Template

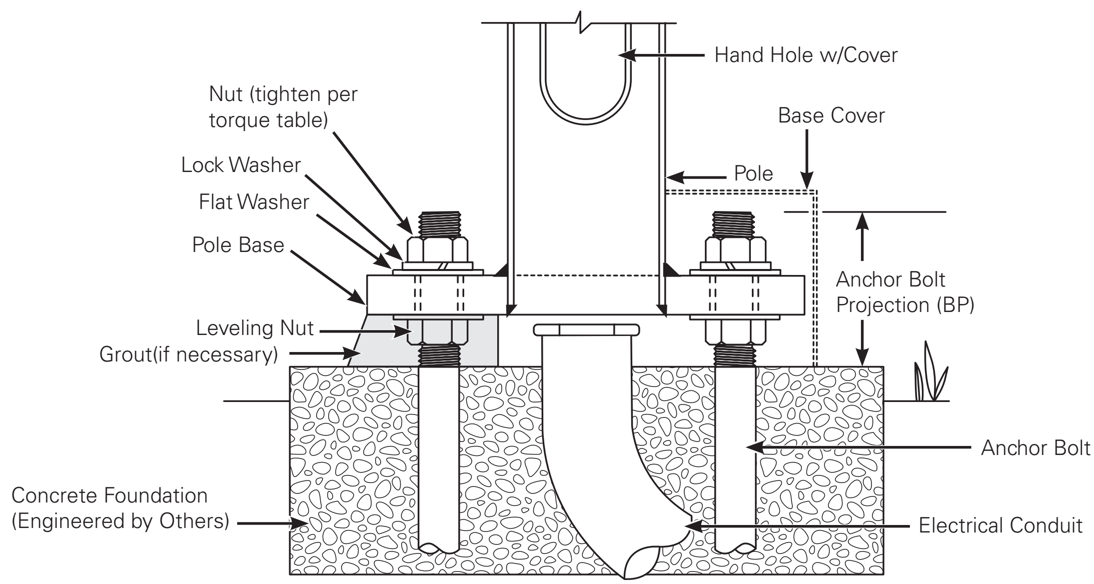


Figure 1.

3.4 Concrete Foundation

The concrete foundation's purpose to support the pole (under the wind loads). It will have a number of steel reinforcing bars of a size to prevent cracking and/or failure of the concrete. The dimensions of the foundation should be large enough for the soil to resist the OTM and other loads. Small, undersized foundations may result in the foundation rotating or leaning. (See Figure 2) The foundation will also have electrical conduit(s) to provide power for the luminaire. If more than one conduit is used, it is important to keep the conduits clustered in the center of the bolt circle as indicated on the template, with minimum protrusion above the surface of the foundation. (See Figure 1) Concrete foundations must be designed by a qualified engineer with knowledge of local soil conditions. Cooper Lighting Solutions can provide the loading conditions to the foundation engineers. (OTM, weights, torsion, and shear loads). Cooper Lighting Solutions does not provide foundation design services.

3.5 Foundation Location Considerations

To protect the pole, foundations should have adequate setbacks from curbs to prevent bumper damage. Within parking lots, large elevated foundations may be employed. Also consideration should be given to snowplowing. When poles are laid out in a grid pattern or in a straight line, it is recommended that they be accurately set as to be aesthetically pleasing in appearance.

4 Installation

4.1 Assembly

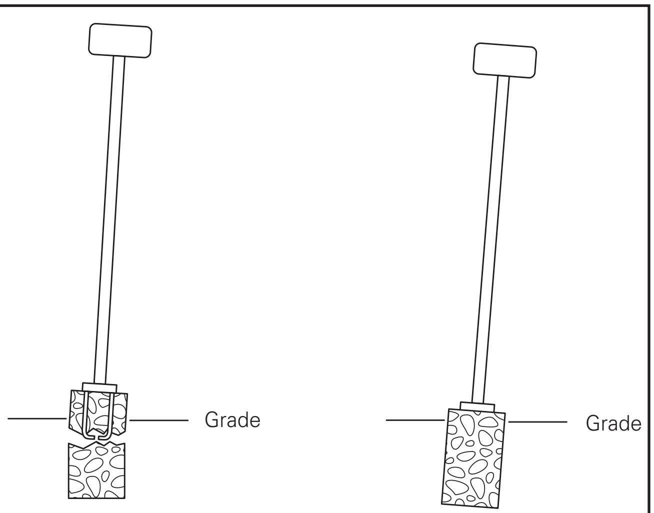
Assembling the poles, brackets, luminaires and wiring is done on the ground before erection. It is not recommended to erect poles without the luminaires.

4.2 Leveling and Plumbing the Poles

When erecting poles, it should be 'plumb' (perfectly vertical). This can be accomplished easily with the leveling nuts and washers provided. An accurate level is recommended for this operation. (See Figure 1)

4.3 Tightening Anchor Bolt Nuts

The anchor bolt nuts must be tightened to the torque values as listed in the catalog. A torque wrench is required for this operation.



FOUNDATION CRACKING
Result of using improper anchor bolts and/or lack of adequate reinforcing bars.

FOUNDATION TIPPING
Result of using inadequate foundation design (too small or too narrow).

Figure 2.

4.4 Electrical Installation

A qualified electrician is required to perform the electrical installation in compliance with the National Electrical Code (NEC) and other local codes which may be required. Proper grounding is a must: an anchor bolt may not be used as a ground! Wire-ways and entrances shall be protected so not to chaff or abrade the conductors. There should be no strain on conductor connections.

4.5 Grout

It is recommended that grout not be used on steel poles.

For the preferred method to install poles, refer to figure 1. The space below the pole base allows for ventilation and keeps moisture from collecting inside the pole. This in turn helps prevent corrosion. Also, by lifting the base cover, visual inspections can easily be made. Although rare, should rodents become a problem (chewing on wire i.e.), a wire screen can be inserted in this space.

If a non- shrink grout is used, air channels must be provided to allow for adequate ventilation to the interior of the pole.

5. Maintenance

5.1 Visual Inspections- Structural

Inspections should be conducted periodically to check the poles for cracks. Although it is rare, cracks should they appear, are usually located in the vicinity of the base weld. They also may appear around the hand hole or at the corners of square poles. These cracks may be the result of vortex shedding vibration which create fatigue stresses. This rapid flexing of the pole, although small in amplitude, may, over thousands of cycles, produce small cracks in and around weldments. In time, these small cracks will continue to 'grow' and propagate until they become sufficiently long to cause the pole to fail. Cracks may be detected by rust on either side of the crack line. If cracks are detected, remedial action requiring the removal of all poles with cracks. Prudent action would be to install dampers in the remaining poles on the site. (See Section 7)

5.2 Recheck Anchor Bolt Torques

Rechecking should be done as bolt/nut connections may initially 'relax' slightly after the pole has been subject to some wind loadings. Re-tighten according to the recommended torque values. Verify that lockwashers are installed.

5.3 Covers

Check for missing covers and pole caps and replace as necessary. Missing handhole covers must be replaced as soon as possible due to electrical safety concerns.

5.4 Cleanout

The area around and underneath the base should be kept clean of debris in order to help reduce moisture and minimize corrosion.

5.5 Corrosion and Finish

Check the pole for corrosion and deterioration of the finish. Should there be corrosion or deterioration, take remedial action to correct.

5.6 Inspection Frequency

At the minimum, a prudent inspection schedule should be:
a.) one week after installation,
b.) one month after installation, and
c.) one year after installation and

d.) yearly after that. It also would be advisable to check the installation after any major wind event.

6. Pole Vibration

6.1 Vibration General

Light poles are vertical cantilever structures, and under certain conditions will vibrate, and although rare, the vibration can be severe enough to be harmful. They can vibrate in different modes and at different frequencies. Several types of outside forces may 'excite' the pole and start the pole to vibrate. Natural wind is the most common. Poles mounted on bridges may be subject to traffic-induced vibrations from the deck 'bounce'. Wind blasts from passing trailer trucks may also start a pole to vibrate. Once the excitation force is removed the vibration 'decays' and the pole stops vibrating. Vibration in poles of different geometry decay at different rates. Tall slender poles tend to vibrate more easily and 'decay' more slowly. This rate of vibration decay is called the dampening coefficient or damping ratio. When certain conditions exist, poles will vibrate and may sustain the vibration for long periods of time. This is due to the fact that the poles have poor damping properties. (See Commentary) Many factors can cause this. These are pole geometry, prevailing winds, site terrain, and type and weight of the luminaire(s).

Because of the complex combinations and interactions of these variables, it is difficult to predict when, where and which poles will vibrate. However, experience has shown under one or more of the following conditions, poles are more prone to vibrate. When severe enough, pole and/or luminaires failures can occur.

- Open terrain with little or no trees or buildings to break up the wind
- Steady prevailing winds in the 8 to 25 mph range which often occur in the mid-west and prairie states
- Elevated and exposed areas such as parking decks, bridges and overpasses
- Mountain passes
- Poles lengths 20 feet and over
- Poles with very light weighted luminaires (or no luminaires)

6.2 Effects of Vibration

Vibration and its resulting lateral displacement will result in a stress to the pole. The stress is at its maximum at the base of the pole; the greater the movement or displacement, the greater the stress. When these stresses are continually repeated, they are called cyclic or fatigue stresses. These stresses, if sufficient in magnitude, and when applied over time, may lead to stress cracks in the pole. (Pole vibration may also lead to premature failure to lamps and components as well). These pole stresses are amplified at the base plate connection and handholes. (They are called stress concentration points or stress risers). Square poles are more susceptible to fatigue stress cracking due to the high stress concentrations in the corners. Following the initiation of a stress crack or fissure, the crack will continue to grow until the pole is no longer capable of withstanding even a modest wind event.

Pole vibration stress levels are usually not severe enough to cause cracks or failures.

6.3 First Mode Vibration

First mode vibration (sway) starts at moderate wind speeds. Its frequency is low (about 1 cycle per second). The maximum deflection occurs at the top of the pole and is rarely a problem. (See Figure 3). However, under very high gusting conditions, more severe oscillation may result. When gusts occur at very high wind speeds, violent 'whipping' and 'pulsing' may occur, producing violent motion, resulting in high stresses at the pole base. Gale force winds and cold weather fronts with high wind velocities may be accompanied by heavy wet snow. This type of 'perfect storm' can be very destructive.

There have been rare incidences where large populations of poles have failed during a single storm event. Fortunately, these localized weather conditions do not occur frequently and are usually short-lived.

6.4 Second Mode Vibration

Of first or second mode, second mode vibration is of the most

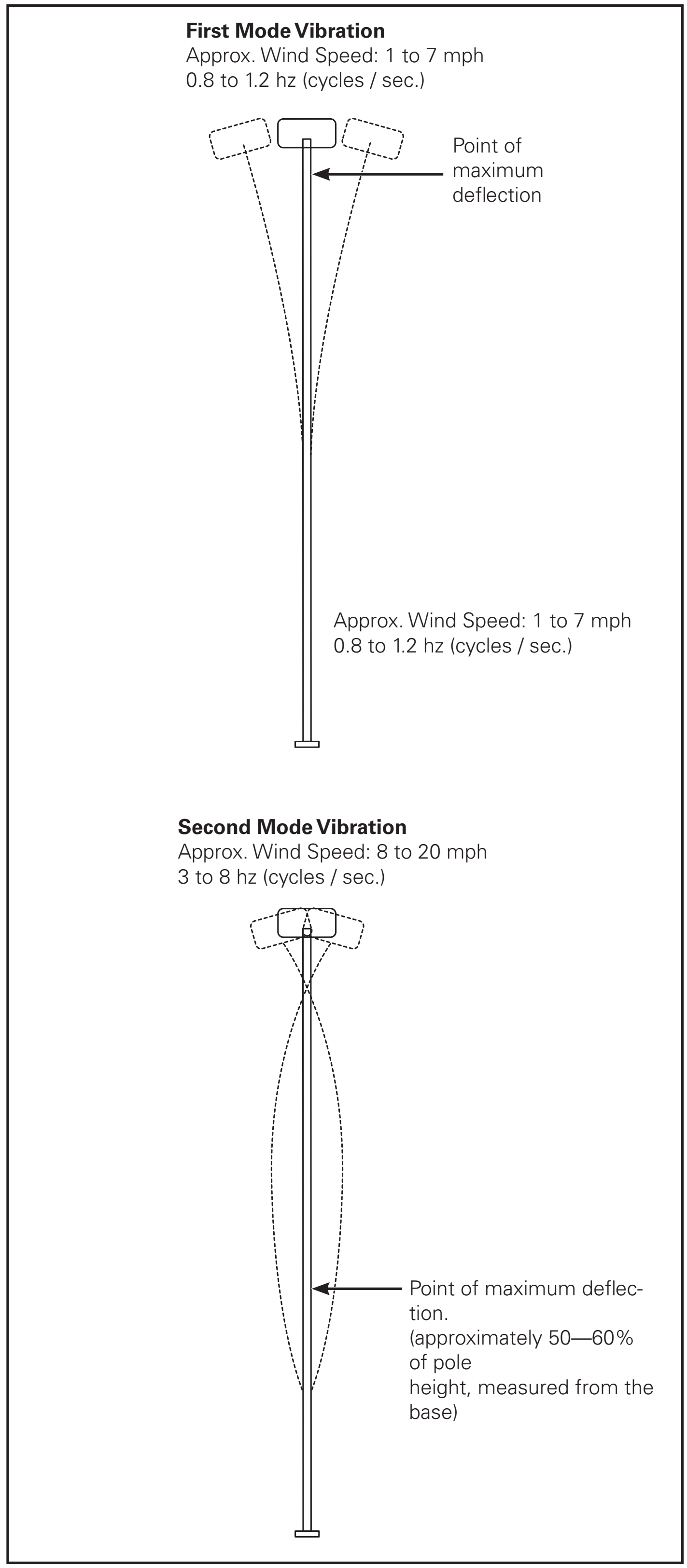


Figure 3.

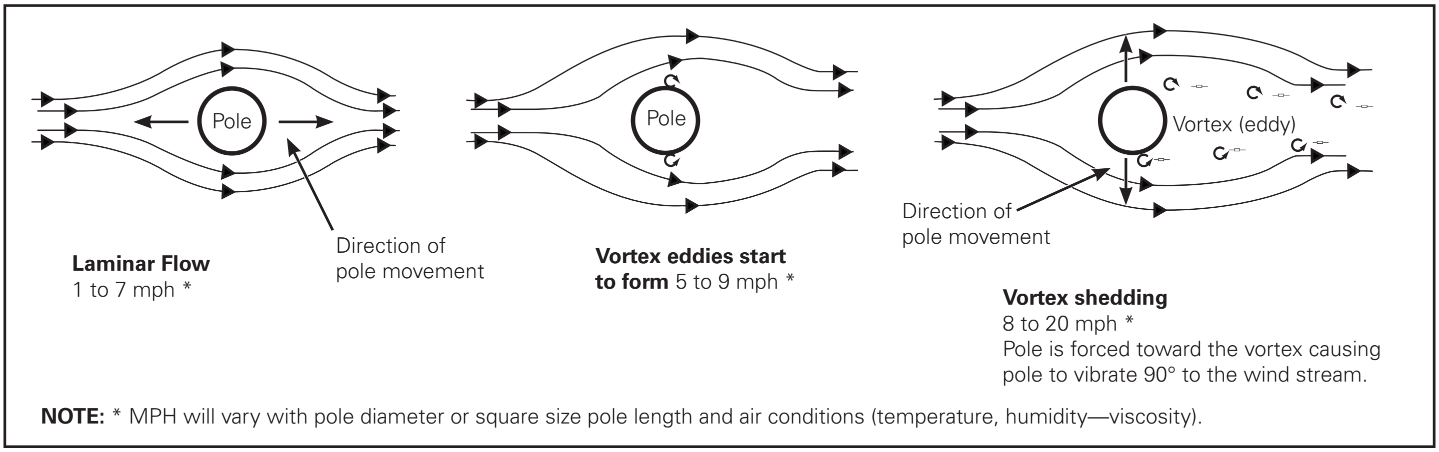


Figure 4.

concern. Second mode vibration is caused by a phenomenon known as vortex shedding. Vortex shedding is the small eddies alternately spinning off the sides of the pole (a canoe paddle creates a vortex at the sides of the blade). Because there is a pressure collapse when a vortex is created, the pole is driven in the direction of the vortex. When that vortex spins off into the wind stream, another vortex forms on the opposite side, causing the pole is driven toward that side. This continues alternately and the pole is forced back and forth, 90 degrees to the wind stream. (See Figure 4). Vortex shedding frequency increases with wind velocity. When the vortex shedding frequency approaches the poles' natural second mode frequency, they become 'locked-in' and the pole vibrates. This resonant condition occurs at wind speed between 8 to 25 mph with frequencies of 3 to 8 cycles per second. Unlike first mode vibration, the location of second mode maximum displacement occurs at or near the middle of the pole.

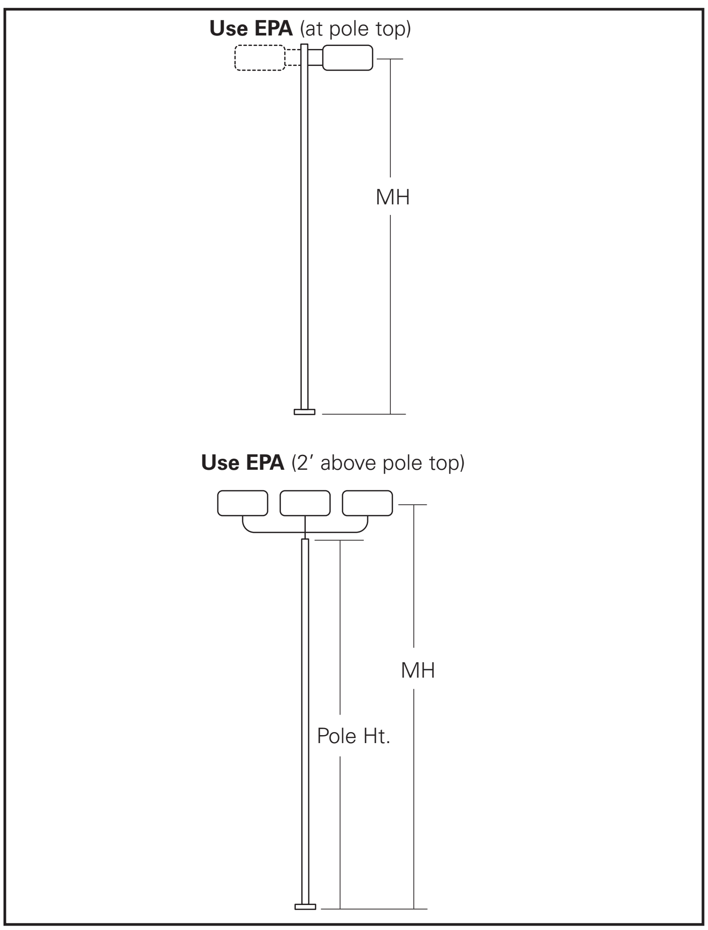


Figure 5.

Although these stresses are low, stress cycles can build rapidly into the thousands and millions over time. If the combination of stress levels and number of cycles are sufficient, they may exceed the metal's fatigue stress 'endurance limit'.

The areas of concern are the base plate weld, areas in the heat-affected-zones (HAZ) of welds, and corners of square poles, handholes, etc. Fatigue cracks may develop and over time grow to the point where the pole fails.

Nearby trees and buildings and wind velocities over 25 mph create turbulence and disrupt the laminar wind flow patterns which cause vortex shedding vibrations.

6.5 Suggestions for Avoiding Vibration

It is best to check the job site prior to ordering a pole. Poles located in flat open terrain or exposed locations (bridge decks, parking garages, etc.) where there are prevailing winds in the 8 to 25 mph range may experience second mode vibration. Where the site conditions indicate the poles may be subject to prolonged periods of vibration, round poles would be a better choice than square poles. Round tapered poles would be a better choice than straight poles, and steel poles would be a better choice than aluminum.

Larger diameter poles with higher EPA capacities than required would be a better choice. These poles are stiffer and have better dampening characteristics. Luminaires should be installed at the time the poles are installed.

6.6 How to Detect Vibration

In first mode, the pole merely sways and can be easily observed. This is usual and not damaging unless excessive. Under high wind and gusting conditions, violent pole top displacement and whipping may occur and can be dangerous.

Second mode vibration caused by vortex shedding may be harder to detect. The amplitude of motion, located near the center of the pole, may be small and difficult to observe. A knowledgeable investigator should be able to assess the situation. He will need to be at the job site when winds are blowing in the 8 to 25 mph range to witness the condition. In addition to seeing the motion, one should be able to 'feel' the vibration. By placing a hand on the pole, one may be able to detect the vibration. There also may be some noise such as conductors slapping the inside of the pole. More sophisticated detection can be accomplished by the use of accelerometers and chart recorders.

All pole vibration is not destructive, but when detected the poles should be monitored on a regular basis for cracks. For poles that are significantly and/or continually vibrating, vibration dampers should be installed.

6.7 Vibration Dampers

When a pole by itself exhibits poor damping characteristics, a vibration damper may be required. Wind energy is the driving force of vibration. This energy needs to be dissipated by the addition of a damper. There are a variety of methods and damping devices employed to reduce vortex shedding vibration. These include mass-tuned vibration dampers, inertia dampers (Stockbridge), viscous dampers and impact dampers. Internal chains suspended from the top of the pole may reduce vibration (however, the size and length of the chain will need to be determined). All dampers function as energy absorbers, canceling the motion of the pole and thus reducing or eliminating vibration.

Dampers may be factory installed for built-to-order poles. There are other types of dampers suited for field installation when required. Some types of field installed dampers are mounted on the exterior of the pole and may detract from its appearance. "Fabreeka' base pads and washers (energy absorbing fabric) are used on bridge and structure mounts.

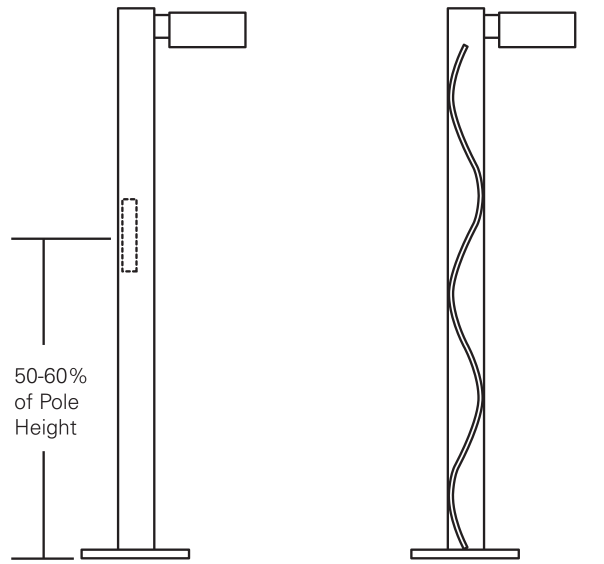


Figure 6.

7. Commentary

- **Cd Coefficient of Drag**

An object's shape and dimensions determines its Cd. Flat signs, for example, may have Cd's as high as 1.7, while racing cars may have Cds in the range of 0.30 to 0.35. Airships have even lower Cds. as low as .05. Nature has provided birds and porpoises with extremely low Cds. Luminaire designers are cognizant of wind drag and moving away from 'boxy' designs.

- **Vibration**

Some examples of structural vibration can be found in two well-known cases. The first is the famous Tacoma Narrows Bridge, also known as 'Galloping Gertie'. Built in 1940, it collapsed in spectacularly fashion four months after its opening, as captured on film. The subsequent investigation of this failure led to the study of wind-induced vibration. The findings helped engineers to gain more understanding of fluid dynamics and wind induced vibration. As a result, a similarly designed bridge in Maine was spared by the addition of structural elements and fairings. The second example is the John Hancock Tower in Boston. In this instance vibration was causing windows to pop out, crashing to the street below. Wind induced vibration was causing the 800 foot building to torque as well as flex. The solution involved the installation two 300 ton mass tuned vibration dampers on the 58th floor. Recently constructed slender hi-rise buildings in New York City have large damper systems.

- **Wind Speed**

It is important to note that the ASCE has subsequently developed additional maps (ASCE 7-05 and ASCE 7-10). These values are different and higher than the 'fastest mile' wind values. The wind pressures are derived by different wind pressure formulas associated with the appropriate wind map (3 second gust vs. 'fastest-mile').

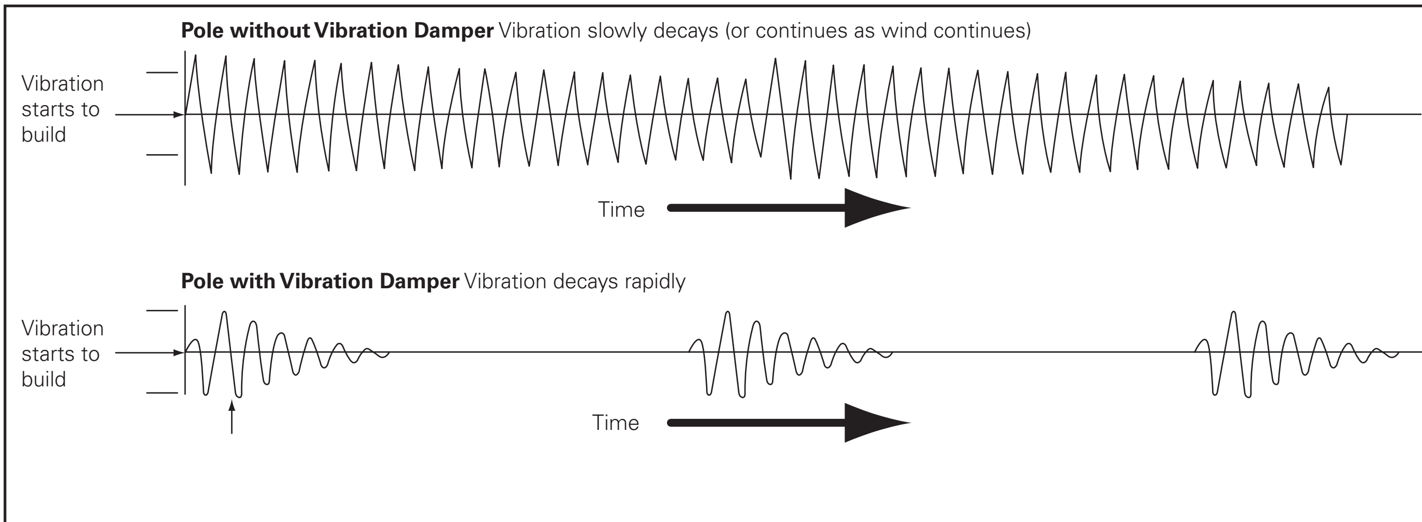


Figure 7.

However, the end result is that the wind pressures for each are relatively the same.

It should be noted which wind map ASCE 7-93 (fastest mile) in the catalog, or ASCE 7-10 (3 second gust) the wind value is taken. ASCE (American Society of Civil Engineers)

- **Wind Maps and Wind Pressure Formulas**

It is important to note from which wind map the wind speed is taken, because of the different wind pressure formulas associated with each map.

The general wind pressure formulas are listed below. Height and Exposure Coefficients, Importance factors, and Coefficient of Drag are assumed to be 1.0

Example: From the Applied Technology Council 'Wind by Location'

For **Albany, New York**

ASCE 7-93 Wind Map (Fastest Mile)	= 70 mph
ASCE 7-05 Wind Map (3 second gust)	= 90 mph
ASCE 7-10 Wind Map (3 second gust)	= 115 mph (Risk Category II)

ASCE - American Society of Civil Engineers

Wp = Wind pressure in psf (pounds per square foot)

Mass density of air = .00256 slugs/ cu. Ft.

Gust Coefficient =1.3

Gust Effect Factor = 1.14

V = mph wind speed

Wind Map		Wind Pressure Formula
ASCE 7-93	'**Fastest Mile**'	Wp = .00256 * (1.3 * V)²
		Wp = .00256 * (1.3 * **70**)² = **21.2 psf**
ASCE 7-05	**'3 second gust'**	Wp = .00256 * 1.14 * V²
		Wp = .00256 * 1.14 *(**90**)² = **23.1 psf**
ASCE 7-10	**'3 second gust'**	Wp= .00256 * 1.14 * (V)² * 0.6
	Risk Category II	Wp = .00256 * 1.14 * (**115**)² * 0.6 = **23.2 psf**

Note: Note that although the wind speeds have increased for the latest ASCE wind maps, the **wind pressure (Wp) values** have virtually stayed the same. When using the appropriate wind pressure formula with the associated wind map, the pole will have the same EPA ratings.

8. References

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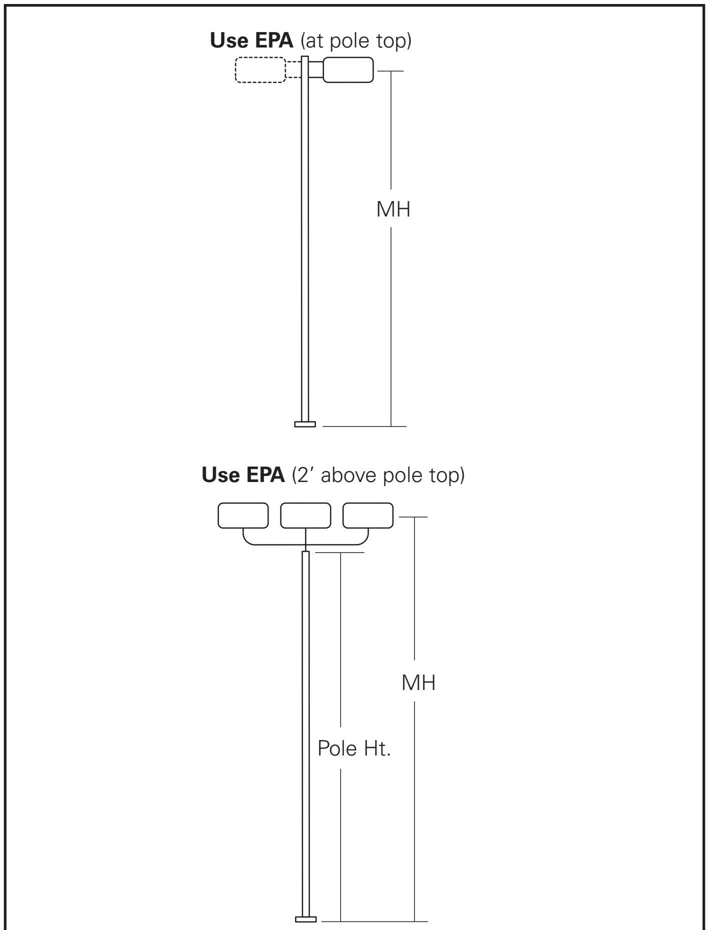

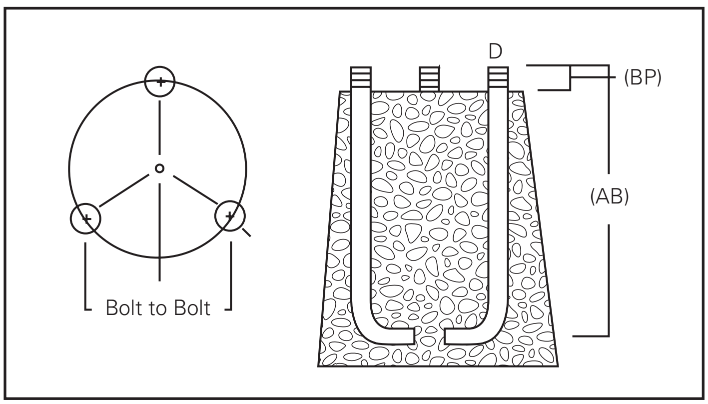

Data Work Sheet for Poles

To ensure the best quality service when ordering / quoting a Cooper Lighting Solutions pole the following information should be collected. If, at any point, you have a question or need further assistance please do not hesitate to contact your Quotations or Technical Support Specialists.

Job Name ______________________________

Agent/ Contact/Tel. No ______________________________

Job Location ______________________________

Luminaire Model ______________________________

Luminaire Quantity per Pole and Orientation (ex. 2 @ 180) ______________________________

Pole Height (ft) ______________________________

Luminaire Mounting Height (measured from pole base) (ft) ______________________________

Pole Style, & Material (ex. RSS, RTS. SSS) ______________________________

Wind Speed (use ASCE 7-93 Wind Map (Fastest Mile) in Catalog (mph) (with 1.3 gust factor applied) When using other maps, contact the factory ______________________________

Luminaire EPA (each) sq. ft. ______________________________

Luminaire Weight (each) lbs ______________________________

Bracket EPA sq. ft. ______________________________

Bracket Weight lbs. ______________________________

Total EPA (all items) sq. ft. ______________________________

Total Weight (all items) sq. ft. ______________________________

Finish, Color, Coating ______________________________

Pole Model Number ______________________________

Cooper Lighting Solutions
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.cooperlighting.com

Canada Sales
5925 McLaughlin Road
Mississauga, Ontario L5R 1B8
P: 905-501-3000
F: 905-501-3172

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