SALSA WEBSITE HELP

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Prepared For: Kentucky Transportation Cabinet
Division of Traffic Operations

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1.0 TRAFFIC MAST DESIGN

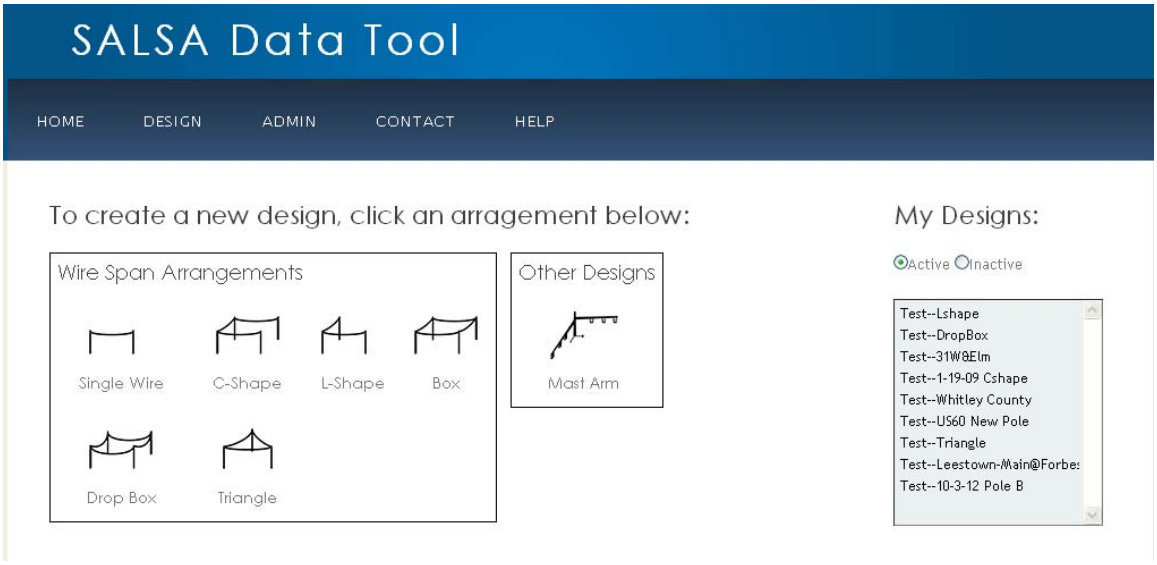
This website has been developed to aid in the design of traffic strain poles and the associated foundations, high mast foundations and mast arm pole foundations. Analysis on the website is based on AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaire and Traffic Signals, 2009 5th Edition.

For wire span structures, the website provides an estimate of the tensions forces in the wires and the resulting loads acting at the base of the structure due to these tensions. For mast arm and high mast structures, the website provides an estimate of the ground line moment caused by the loading of the structure for use in the design of the foundations.

The website does not take into consideration the weight of fittings, bolts, and plates that are used to attach the different poles. All units used in the website are English.

1.1 DESIGN

The design screen is divided into 3 different structures: Wire Span Arrangements, Traffic Mast Arm Design, and High Mast Design. To create a new job, simply click on the button corresponding to the structure and configuration desired to analyze. Previously created designs are listed in the My Designs dock. To return to the design screen at any time, click on the design tab.



1.1.1. Wire Span Arrangements

The wire span arrangements section is divided into 6 different configurations: Single Wire, C-Shape, L-Shape, Box, Drop Box, and Triangle. These configurations are shown above by the corresponding button. Choosing one of these options will allow input for a

wire span arrangement and provide the wire tensions and ground line reactions. This information will be used for wire strength selection, stockpiled pole selection, and foundation selection.

1.1.2. Traffic Mast Arm Design

Choosing this option will allow input for a mast arm traffic pole and provide the ground line moment to be used in the foundation design.

1.1.3. High Mast Design

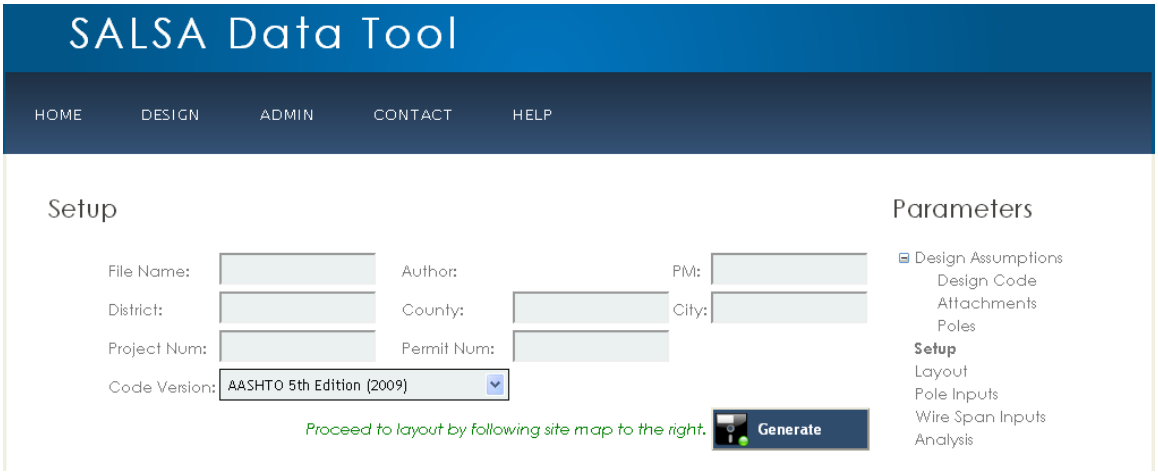
Choosing this option will allow input for high mast and provide the ground line moment to be used in the foundation design.

2.0 WIRE SPAN DESIGN

Depending on the type of configuration selected, the input pages will vary slightly. This is based on the number of wires and arrangement to one another. The following will be a discussion of the different parts of the input tabs.

2.1. Setup

After selecting a design, the user will be taken to the setup page. This page allows for the input of general job information. This information will also be transferred to the output after the program is run and will be printed out along with the results. After entering information, the user will click the generate button if in a new design or the update button if modifying existing information of a previous design. This will allow access to the rest of the input tabs.



2.2. Design Assumptions

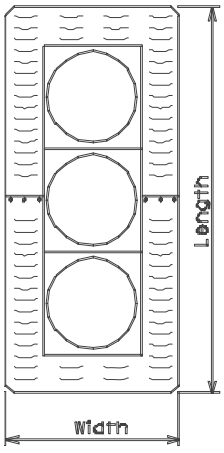
The calculations make several assumptions based off the AASHTO code and from client feedback. These assumptions can be modified by the user in the design assumptions section.

2.2.1. Design Code

The default design code is the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaire and Traffic Signals, 2009 5th Edition. Parameters associated with that code are assumed. These values can be modified by the user if a case presents itself. For Wire Span structures, the default values correspond to a 50 yr design but for Mast Arm design the values correspond to a 25 yr design.

2.2.2. Attachments

Default signal, sign and other dimensions are displayed under the attachments section. If the type of attachment needed is not found, the user can create a custom attachment by clicking the  icon. Input dimensions require the length, width, thickness, weight and drag coefficient of the signal. Length is associated with the height of the signal. Below shows a picture of the length and width dimensions. Thickness is the "into page" dimension of the picture shown below. Sign attachments will need a value of zero assigned to the thickness.

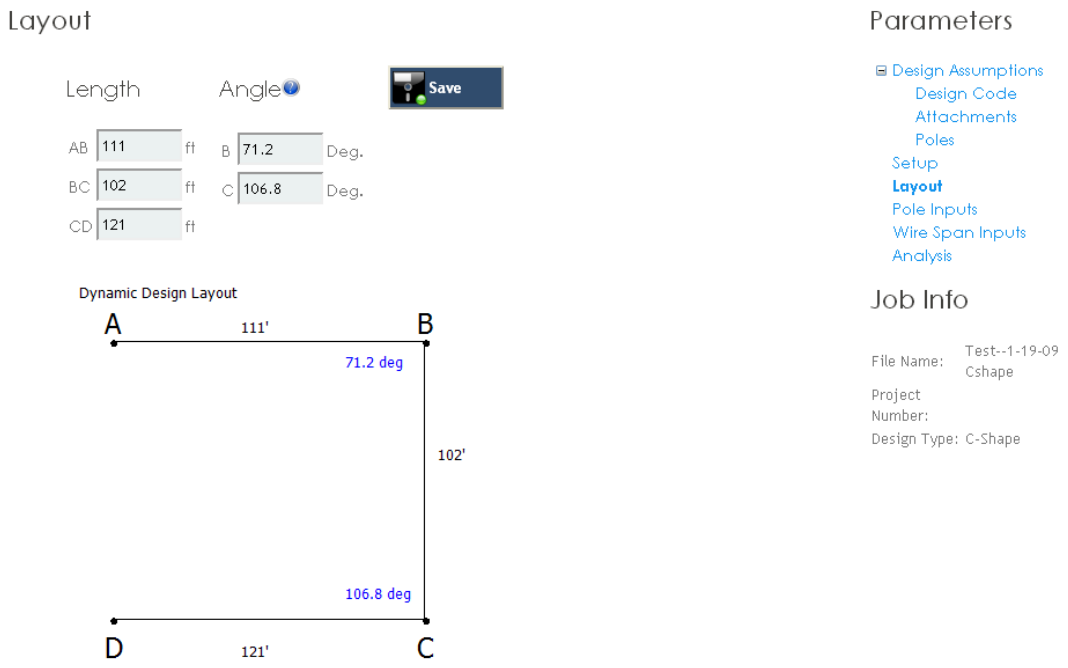


2.2.3. Poles

Default pole dimensions and characteristics are displayed for the user. These poles correspond to the current stockpiled poles in the State's yard. If a custom pole is desired, then the user may create a pole by clicking the add button.

2.3. Layout

Depending on the configuration that is chosen, there will be a certain number of poles and wires available. A schematic of the configuration with poles and wires labeled is created once the user clicks the save button. Configurations follow a clockwise direction with the labeling of the poles and wires.



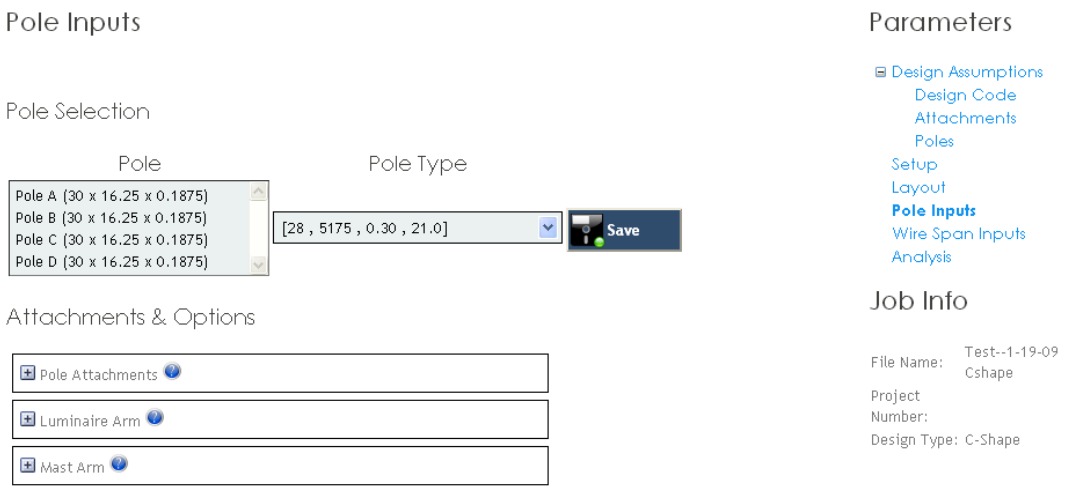
Angles are labeled based on the pole that the wires are attached. For example, Angle A is the angle between the wires at Pole A. Angles must add up to 360 for a Box and Drop Box configuration and 180 for a Triangle configuration.

2.4. Pole Inputs

This section is where the type of pole is chosen and the various attachments to the pole are entered. Each pole may have a separate loading condition.

2.4.1. Poles

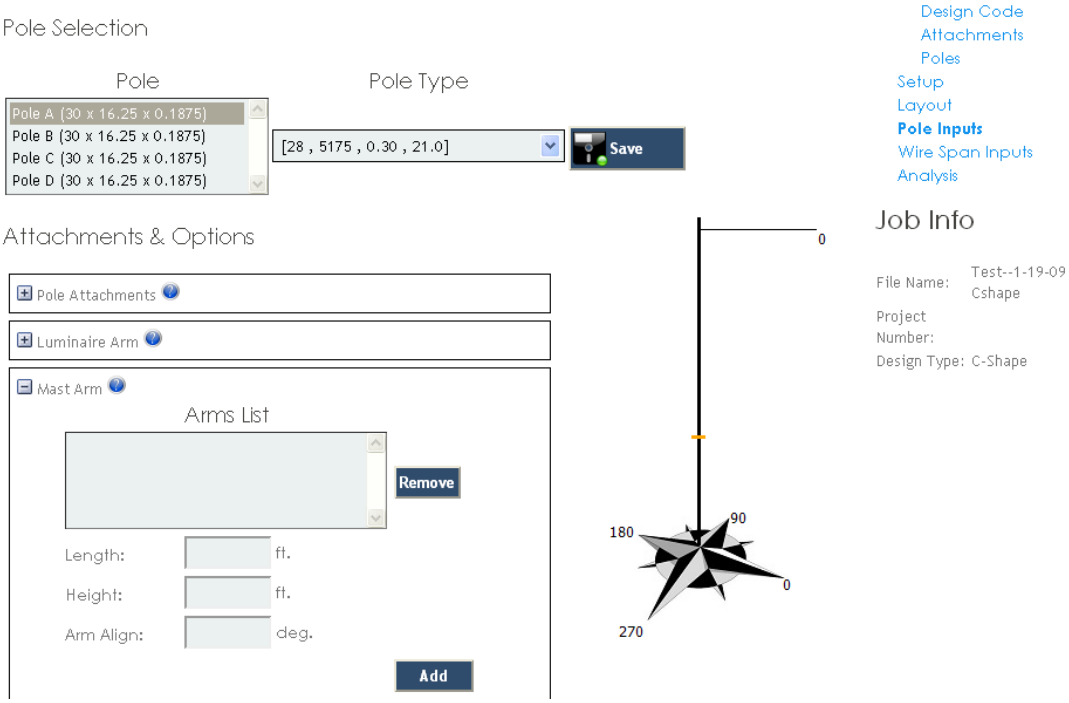
A pole type stored in the design assumptions must be assigned to each pole. Click and highlight the desired pole and then choose the stored pole type from the dropdown box and click the save button to assign the pole type to the pole.



Once all poles have a pole type assigned to them, the user can add attachments and arms to each pole.

2.4.2. Luminaire and Mast Arms

These sections are where any mast or luminaire arms that may be attached to the strain poles. To attach an arm to the pole, the user must first highlight the pole they want to add the arm at the top of the page in the pole box. Then an image will display showing the hard coded wire angle along with a compass at the base of the pole to use to orientate attachments. Using the expandable icons in the Mast and Luminaire arm sections, the user can expand the section and begin inputs.



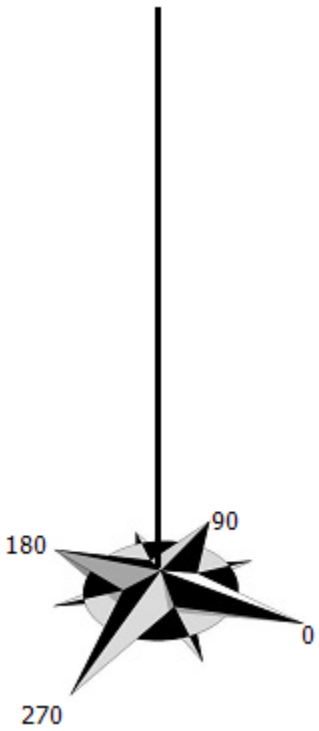
The length of the mast arm, height and angle of orientation are the only inputs needed for the arm. The dimensions of the mast arm are estimated from the length that is specified. After adding the arm, attachments can be placed along its length. To place attachments, select the arm from the arms list and then proceed to pick the attachment type and distance from the face of the pole. As the user inputs the arms and attachments, the image will update showing the placement.

2.4.3. Pole Attachments

Pole attachments work the same way as the Luminaire and Mast Arm attachments. The user will select the pole they want to add the attachment and then specify the type of attachment, height and orientation on the pole.

2.4.4. Orientation

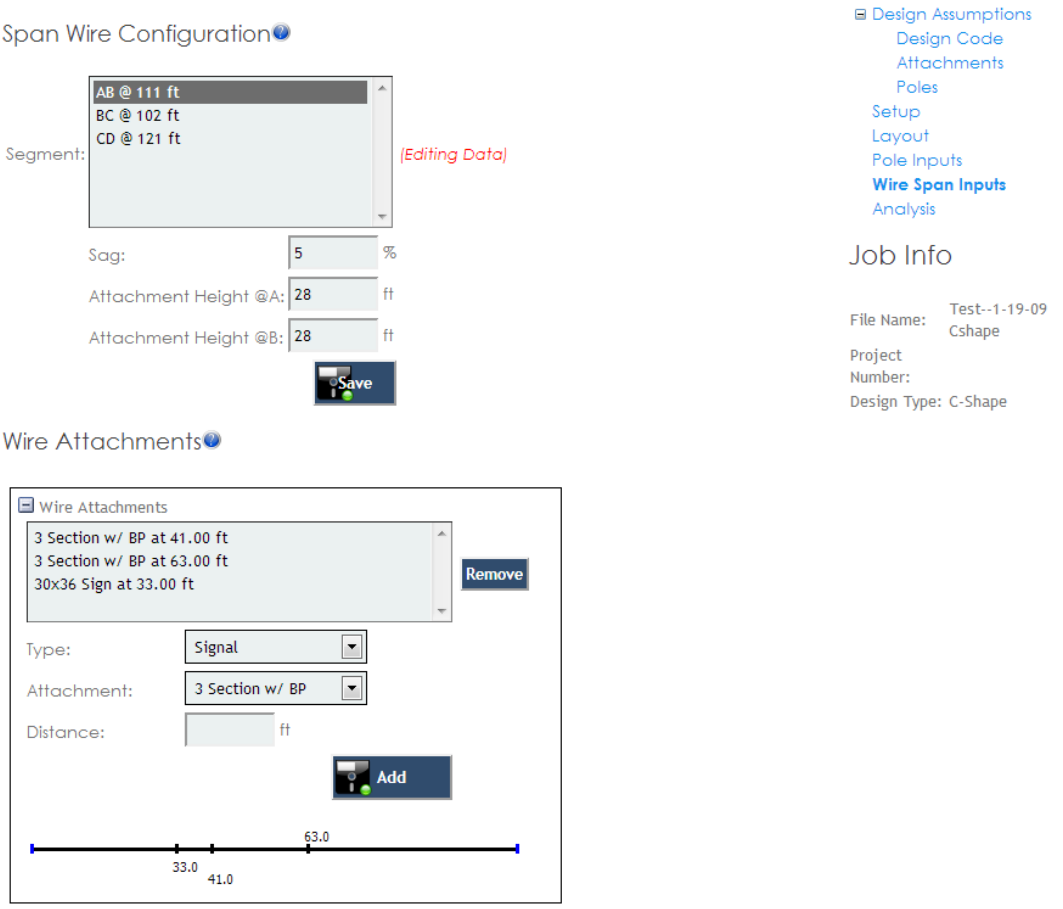
The orientation of the attachments is based off a 360 degree coordinate system. The plane is shown in the schematic located at the base of the pole. The picture below illustrates the coordinate system in relation to the pole.



When wires are attached to the pole, one of the wires will have a hard coded angle applied to it. All attachments should be placed in relation to this wire and the angle that it possesses.

2.5. Wire Span Inputs

The Wire Span Inputs tab is where attachment positions on the wires are entered. Depending on the configurations chosen, the number of wires will change.



To attach items to a wire, first select the desired wire from the segment box and enter its sag and attachment heights. Then expand the wire attachments box and proceed to select an attachment type and distance from the pole whose letter corresponds to the first letter in the wire description. For example, Wire AB will be from Pole A. When a drop box configuration is used, the distance entered will need to include the messenger wire distance. There are circles in the drawing indicating where the bull ring is located that attaches the drop wire to the span wires.

Diameter of the span wire is assumed to be 1 inch and the weight 1 lb/ft in order to account for all the additional electrical wires that are bundled with the span wire. The 1 inch diameter affects the wind load calculations.

2.6. Analysis

Once all inputs are completed, the user can proceed to the analysis tab and run the analysis for the design. After analysis the user will be presented options for output. A

detailed analysis will contain all inputs and detailed output. A Summary output will contain pictures of the layout and the controlling cases.

2.7. Output

Under Wire Load, the tension force in the wire is provided for the controlling load case. Load cases analyzed are Groups I, II, and III as stated in AASHTO. Group I is dead load only, Group II is dead and wind load and Group III is dead and ice loads with half of the wind load. The service wire tension outputs the controlling load case with no factors applied. Load factors for the wire are 3 for Group I and 2.25 for Groups II and III due to a 1.33 overstress allowance. Finally, the factored wire tension is output, which is the service tension multiplied by the load factor. The factored load is the load used for selection of wire size and strength to go on the pole. Kentucky mainly uses a 10.8 kip strength wire and a 15.4 kip strength wire. A note is displayed beside the factored load telling which wire to use or to use a special wire if a stronger wire is needed.

In drop box configurations, an extra set of outputs are displayed. These outputs handle the drop wire that extends from the pole to the drop box. This wire handles the resultant force of both connecting wires. Much like for the individual wires, the service and factored loads are given. The note that is displayed in this configuration provides the strength of wire needed for the drop wire.

Under Pole Load, axial, shear and moment forces at the base of the pole are output. Like the wire load, load Groups I, II, and III are analyzed. The outputs are the controlling load case with no factors applied. Then the moment is compared to the allowable moment found from the manufacturer's calculations. Group I has an allowable moment less than Group II and III due to the overstress allowance for the latter groups.

Serviceability is also a concern in pole selection. AASHTO states that pole deflection need not exceed 2.5% of the pole height under dead load only conditions. Therefore, this is checked with the deflection rate. Each pole has an associated deflection rate associated with it that is given in inches deflected per 100 lbs of force. Therefore, the deflection given by multiplying the pole deflection rate by the dead load only pole tension must be less than 2.5% of the pole height. This is checked in the output by rearranging the formula and as long as the calculated maximum deflection rate is greater than the pole's deflection rate, serviceability is satisfied.

The moment is also used for foundation selection. This value is used to go into the foundation charts provided to the State of Kentucky for selection of the correct shaft design.

The tether box displays the maximum extra stringing tension force that can be applied to a pole. Therefore, if a tether wire is to be used, then the maximum a combination of tether wires can be strung on a pole is listed. This value should be used by the contractor in conjunction with some sort of tension measuring devise in order to not exceed the force.

3.0 TRAFFIC MAST ARM DESIGN

This design was developed to give an estimate of the loads acting at the base of a mast arm support structure. The website does not take into consideration the weight of fittings, bolts, and plates that are used to attach the different poles. Below is an outline of how to use the website.

3.1. Setup

After selecting a design, the user will be taken to the setup page. This page allows for the input of general job information. This information will also be transferred to the output after the program is run and will be printed out along with the results. After entering information, the user will click the generate button if in a new design or the update button if modifying existing information of a previous design. This will allow access to the rest of the input tabs.

3.2. Pole Inputs

Pole Inputs will follow the same process as described in the Wire Span Pole Inputs section. See above.

4.0 HIGH MAST DESIGN

This design was developed to give an estimate of the loads acting at the base of a high mast support structure. The website does not take into consideration the weight of fittings, bolts, and plates that are used to attach the different pole sections. Below is an outline of how to use the website.

4.1. Setup

After selecting a design, the user will be taken to the setup page. This page allows for the input of general job information. This information will also be transferred to the output after the program is run and will be printed out along with the results. After entering information, the user will click the generate button if in a new design or the update button if modifying existing information of a previous design. This will allow access to the rest of the input tabs.

4.2. Material Selection

The pole material is the first input and is located at the top of the page. A radio button is presented to choose between steel and aluminum.

4.3. Pole Sections

High masts are usually composed of different sections as the pole gets progressively taller. Therefore, three sections are allowed for input in this website as shown below.

Base diameter, top diameter, length and thickness of each section will be needed for input. The same drag coefficient is used for all sections and is assumed from the AASHTO specifications.

4.4. Attachments

The attachments section allows for the input of the luminaire characteristics. High mast luminaires are described by their weight and effective projected area (EPA). This input section is shown below.