Crossarm loads

Issue date 21 May 2016

There are two loads that can be considered for crossarms – the load on the kingbolt due to all conductor loads on the crossarm, and the bending moment at the kingbolt position on the crossarm due to conductors loads on the two ends of the arm, which may be different.

1 Load on kingbolt

The easiest way to analyse this loading is using the tipload module.

1. create a new tipload project and add the conductors attached to the cross arm being examined.
2. Set the conductor attachment height to the top of the pole. This means the tipload result is not reduced due to the ratio of attachment height / pole height.
3. Ensure wind on pole is zero. You can do this by making the pole diameter zero or setting wind pressure to zero.

Perform the calculation. The resultant tipload is the load applied to the kingbolt of that construction.

2 Bending moment on crossarm

Three loads act on a insulator/crossarm due to the conductor: longitudinal (along the conductor due to conductor tension), transverse (wind blowing sideways on the conductor) and vertical (conductor weight). These loads can be considered separately[1].

The transverse load can be ignored because it is usually relatively small and also the flexibility of the conductor means the load is effectively acting along the long axis of the crossarm.

The tipload module adds together vectorally all the forces so it is hard to work out the load on the crossarm from the tipload results. It is easier to work from first principles for this.

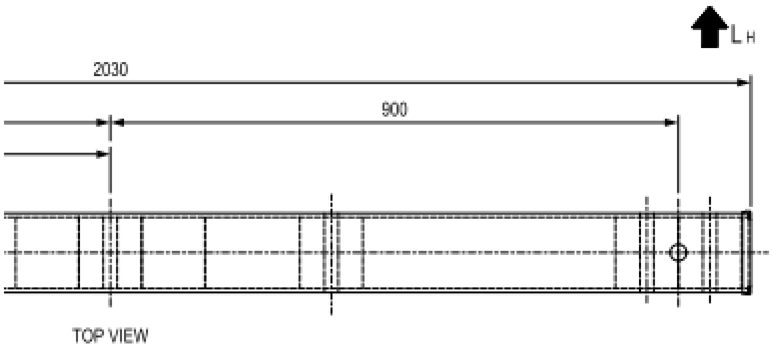
2.1 Crossarm strength

The crossarm under consideration will have a rating. The details of a crossarm shown below are from Essential Energy's design manual.

1 AS7000:2016 section 7.3.1

5. Design Limits

	SINGLE CROSSARM		
	VERTICAL LOAD LV ONLY	HORIZONTAL LOAD LH ONLY	ULTIMATE MOMENT CAPACITY AT 'X'
ULTIMATE CAPACITY	35.6kN (3630kg)	35.6kN (3630kg)	33.8kNm
SHORT TERM CAPACITY	28.1kN (2865kg)	28.1kN (2865kg)	
SUSTAINED CAPACITY	11.4kN (1162kg)	11.4kN (1162kg)	



This load converts to a bending moment by multiplying it by the application distance from the pivot point. For a crossarm this is the kingbolt. The diagram shows the application point as 0.95m from the kingbolt.

For the single crossarm the bending capacity about the kingbolt is

$$BM_c = 28.1\text{kN} \times 0.95\text{m} = 26.7\text{kN.m}$$

2.2 Conductor loads

Use the sag-tension module to calculate the load applied to the crossarm due to conductors.

In this example there is one Hydrogen conductor at the insulator position 350mm from the kingbolt and one conductor 900mm from the kingbolt.

Other parameters:

span length	231m
tension	17%CBL
wind load	900Pa
MES	120m
actual temperature	5°

standard temperature 5°

limit state load factor F_t 1.25

The sag-tension module gives the result of 11.99kN actual tension for one conductor for these load conditions. So the horizontal bending moment on the crossarm due to the two conductors is

$$BM_t = 1.25 \times (11.99 \times 0.35 + 11.99 \times 0.9) = 18.7\text{kN.m}$$

This is below the bending moment capacity.

The same approach can be used for the vertical loads.

Revision history

Rev No.	Date	Details
A	28/08/15	Initial issue
B	20/05/16	New section 1.1. Formatting.