WORKING KNOWLEDGE WITH TERRY MACKENZIE HOY

HOW POWER LINES ARE DESIGNED AND BUILT

You've seen power line poles leaning to one side, insulators on cross arms which 'nod' at an angle off vertical, and power line cross arms which seem to be skew on the pole. People think these are due to a storm, high winds or some shift in the ground. But the reason is much simpler – the power line structure was not built correctly. Generally, this is because not many contractors (and very few consulting engineers) know how power lines are designed and built.

Power line conductors are almost always made from Aluminium Steel Core Reinforced conductor, which is abbreviated as ASCR. Aluminium is wrapped in a spiral around a flexible steel cable to create the conductor. The steel cable is there so that if the conductor is just aluminium, it will stretch when spanned between two poles and will sag. In fact, all conductors when spanned between poles will sag, but the height of the conductor above ground should not be less than 6 m (by regulations) and thus too much sag is not desirable.

The conductor is not firmly tied to every pole; it is clipped into an insulator and can move back and forth through the clip. This is a very important construction feature. In general, power line poles are set at a distance (called the 'effective span') which is the distance between the poles on a level piece of ground. When you have a situation where the one pole is set higher than the one before it, the distance between the poles becomes less. Provided the conductor is free to move back and forth on the insulator clips, the sag of the span between the uneven height poles will become a different length from the even height poles as the tension in the conductor evens out. If this does not happen then the 'nodding insulator' situation occurs.

Turning now to poles, medium voltage distribution poles in South Africa are nearly always *pinus radiata* or pine tree poles which have been treated in a solution that makes them impervious to insects. They are sold at lengths of between 12 m and 18 m and are defined by the dimensions of the pole top and the pole bottom. Since the pole starts as a pine tree, the diameter of the bottom is more than that of the top. So a typical pole will be described as a 210/180 pole which means that the bottom diameter will be at least 210 mm and the top diameter at least 180 mm. Thinner poles are also available. When the pole is planted in the ground, the hole must be at least 2 m deep. Thus, for a 12 m pole you will have 10 m sticking out of the ground. If you can't dig a 2 m deep hole then you dig as much as you can and then, when the pole is in the hole, fill up the hole with cement mixed with sand (around eight parts sand to one of cement).

Remembering that conductors sag, you have to decide how high the cross arm will be. On a 100 m effective span, the sag will be about 1 m in very cold temperature and 2 m in very warm temperatures (here we are talking about conductor temperature, not air temperature). You don't have to guess the temperatures – you can get the sags from manufacturer's charts – but you must remember that a conductor can be at high temperature in mid-winter. So, first off you must put the cross arm at least 2 m from the pole top (8 m) since 10-2 = 8 m and 8 m – 2 m (sag) = 6 m ground clearance. It happens that pole spacing on uneven ground is determined by the minimum sag; if the sag is low in cold temperatures then care must be taken such that the resulting tension doesn't pull the pole out of line, which is the 'skew cross arm' or 'leaning pole' effect. There's a lot more to this topic but I hope you can see that it's really not simple at all.

This system, which reduces the risk of tripping over data cables, is also ideal for keeping multiple cable types separate. The seam in the base is used for efficiently snapping cables. These protectors are cut easily on-site, to exact requirements.

The range of CablePRO HD cable protectors encompasses two heavy-duty indoor and outdoor options for areas with extreme pedestrian movement or the hazard of tripping associated with larger cables. Tough ramped-edges are designed to protect cables from wheeled traffic, such as cars and forklifts and 23 mm diameter channels accommodate larger, heavy-duty cables. These protectors can withstand traffic of up to six tons.

The CablePRO indoor mat (0,4 m x 1,2 m) with a total weight of approximately 3,95 kg/m² and height of 11,4 mm, is laid over cables for protection against tripping hazards associated with loose cables on floor surfaces. This anti-static mat has a durable nylon surface, with a cleated non-slip backing made from nitrile rubber and an integrated cable run. As an additional warning to pedestrians, the edge has a highly visible hazardous stripe. These mats are UV and light-resistant and are also suitable for use over underfloor heating.

All CablePRO systems are manufactured from a flexible, flame-retardant PVC extrusion compound. Properties include a 1 500 kg/m³ density, hardness of 85 Shore 'A', a tensile strength of 14,0 MPa and elongation at break of 250%.

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