An Introduction to OLE

*The first part of what will hopefully become a regular series on Overhead Line Equipment by **Jim Smith-Wright** with the help of **Kevin Bruce.***

Above: ***The view looking north from Cheddington in 2002. Chances are this view has changed since then.*** *Photo Tim Horn*

Where to begin?

My own layout master plan will require Overhead Line Equipment (OLE) and a lot of it. The problem is that information on this subject just doesn't seem to exist and I have doubts about the very little that does. An example in one article quotes the minimum height of the contact wire as lower than the roof of a coach! Hardly inspires a lot of confidence does it? Reasoning that i need the info and i don't want to wait (and hope) that someone else will do it for me i decided to research the subject myself. It is with a great deal of luck that i came across Kevin Bruce who designs the stuff for a living and it is to him that i owe a great debt of thanks for his assistance.

Glossary

There are some terms to which it is a good idea to familiarise ourselves with. They are:

Catenary wire - the uppermost wire of the system. It is this wire that carries the weight of the…

Contact wire - It is this wire on which the pantograph runs. Whilst the Catenary wire is braided the Contact wire is solid. It can best be described as having a figure 8 profile (although not an exact figure 8) and looks quite a bit heavier than the Catenary wire. The two wires are connected via

Droppers - Of a lighter construction than both of the above. The number of droppers is variable depending on the individual requirements of the site.

Auxiliary catenary wire - Same type of wire as the Catenary wire. Some types of OLE have 3 wires not 2. It is this wire that makes the difference. OLE of this type is called Compound Catenary.

Mast - The simplest way of holding everything up. Usually a H section of steel measuring 150 or 200mm. Certain areas such as colchester use a round post instead but the size remains the same.

Cantilevers - the collection of poles, brackets and insulators that connects the mast to the wires. The poles are typically 2 inches in diameter.

Registration arm - the final link between the Cantilevers and the contact wire.

Portals - some heavy duty looking steelwork used to span multiple tracks and shown in the picture above.

Headspan - a very lightweight version of a portal - using tensioned wires to span multiple tracks.

Insulators - fairly obvious as to what they are but there are 3 types. The first were pretty big bits of kit (known as ball breakers to the crews who built or maintain OLE. They are made of porcelain and appear reddish/brown in colour most of the time but use is made of grey ones in certain areas. The second design is similar but smaller. More recently polymeric insulators are being used which are smaller and lighter. These are grey or clear.

Mark 1 or Mark 3?

To keep things simple there are 2 basic types of OLE. Mark 1 is the earlier style used on the West Coast Mainline and the Great Eastern (as far as Colchester). Originally used compound catenary for main lines and 2 wire (or simple) catenary for lesser lines. On Mk 1 catenary the masts are painted and the wires are made from copper. The cantilevers are also copper plated giving the OLE its distinctive green tinge. Mk 1 OLE makes use of Portals.

Mk 3 OLE was introduced on the Bedpan electrification scheme and since used on the GE (from Colchester) and the East coast main line. This system uses galvanised masts and aluminium cantilevers. Mk 3 OLE makes use of headspans.

How to really tell the difference?

With Mk1 OLE being slowly renewed with lighter weight replacements (called UK1) is there a way to distinguish the 2? Yes there is, Mk 1 and Mk 3 OLE does have one very distinguishable difference and this is what's known as the encumbrance. It is the distance between the catenary wire and the contact wire where it is mounted on to the cantilevers. In the case of Mk 1 this measurement is 1800mm and in the case of Mk 3 it is only 900mm. It is this difference that will set the location of your layout just as much as the trains you run. Oh, a quick word on Mk2 OLE - there isn't any! (if anyone knows why i would be interested to know.)

Above: ***It may well be that there is no such thing as a standard OLE mast. This pair are at Dudley Port and show the early design MK1 mast on the right. This is a 3 wire system but the auxiliary catenary wire is unrestrained by the cantilevers. Compare the positioning of the earth wire with the drawing on page 34.*** *Photo Jim Smith-Wright*

The way the contact wire changes height is also governed by rules. The contact wire must be graded at 1 in 5 x linespeed (in mph) but never less than 1 in 400 (relative to the track).

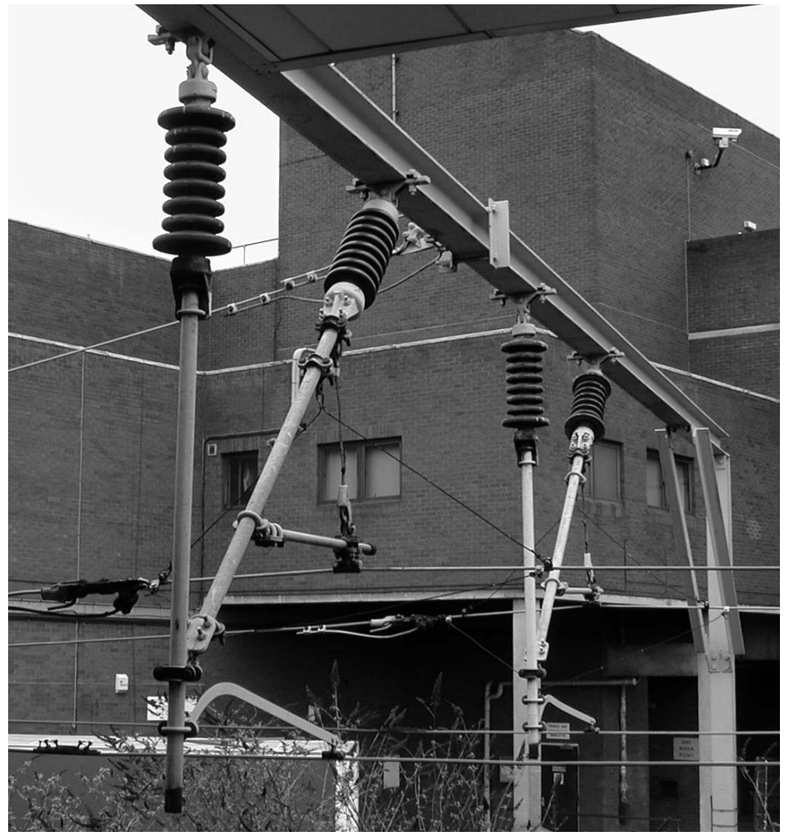
We already know the distance between the catenary and contact wires where they are attached to the cantilevers but what about in the middle of a span? The contact wire is tensioned with heavy weights and held up by the catenary wire so it is pretty much level. Indeed if you are ever on a train that is pacing another giving you the opportunity to watch the movement of the pantograph you will notice it appears rock steady. I have yet to see a model that has been able to replicate this effect. Usually the pantograph will rise and fall as it travels along the OLE. Ok it looks cool but it couldn't be more wrong and spoils the effect.

The catenary wire is a different matter as it droops a fair bit. It will however rarely get any closer to the contact wire than 400mm on plain lines. The subject of what happens under bridges will form an article in its own right.

Some more useful measurements

The problem with OLE is that you can't measure the stuff. Measuring a window on a sprinter will sometimes attract some funny looks but on the upside it wont actually kill you! You can't exactly go waving tape measures around when researching OLE.

The datum point for these measurements is the top of the rails and in the case of superelevated track it is the highest rail from which distances are set. Again there are differences between the 2 types. The normal running height for Mk 1 is 4720mm Mk 3 is 20mm lower. Maximum height for both is typically 5600mm and is used specially for level crossings. Dropping under overbridges the absolute minimum height is 4165mm but this is very rare, 4190mm being a more typical minimum height. In depots and sidings a target height of 5200mm is aimed for but not often reached.



Above: ***Close up of cantilevers at Walsall Although the arrangement of the Cantilevers is highly variable the parts themselves seem pretty standard.*** *Photo Jim Smith-Wright*

Staggering...

If the contact wire remained in a fixed position above a loco or unit it would cause 2 problems, 1 - it would quickly wear a grove into the pantograph and 2 - you wouldn't be able to go around any curves. To overcome this the contact wire is staggered to the tune of 300mm either side if the center line. The stagger effectively sets positions of the masts when going around a curve whilst on straight track the cantilevers can never be further than 75 meters apart - 65 meters being more common.

The cantilevers

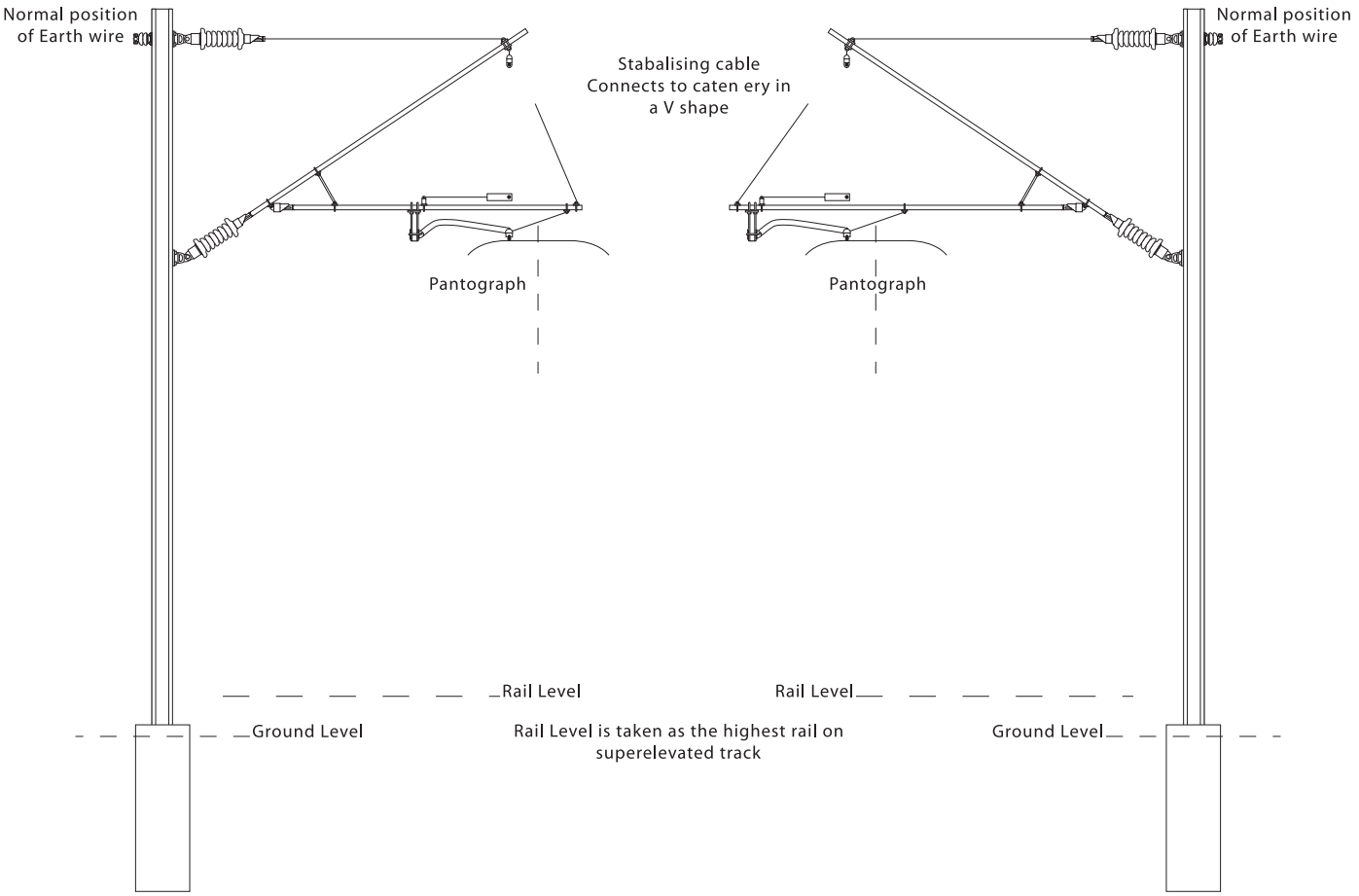
These are perhaps the most variable piece of the whole system. Each being designed to fit a particular site. However the registration arm is governed by yet more rules. It must never be shorter than 900mm. It can be 1100mm or 1300mm where required.

In order to stagger the contact wire the cantilevers will be one of 2 types. Those being "pull on" or "push off".

Please refer to the drawing to see how they work. Masts sited opposite each other on double tracks tend to be pairs as shown in the drawing whereas portals or headspans tend to always have the cantilevers to the same side of the catenary and all either pull on or push off. Masts, portals or headspans alternate as they go down straight track or they all pull on if sited around the outside of a curve. If a mast is sited on the inside of a curve then it will always push off.

Next time a look at MK1 Hybrid and Mk3 masts.

Right: ***Another early design MK1 mast at Stetchford. Whilst this mast is essentially the same as the one pictured at Dudley Port this is a 2 wire system. The Objects attached to the mast about a third of the way up are lights for the construction work taking place and not a part of the mast itself.***
Photo Jim Smith-Wright



Standard Mk1 25KV OLE mast (pull off registration, compound catenary)
Set at normal working height of 4720mm

Standard Mk1 25KV OLE mast (push off registration, compound catenary)
Set at normal working height of 4720mm

Note masts are not drawn at correct spacing from each other as this is highly variable

scale 4mm:1ft