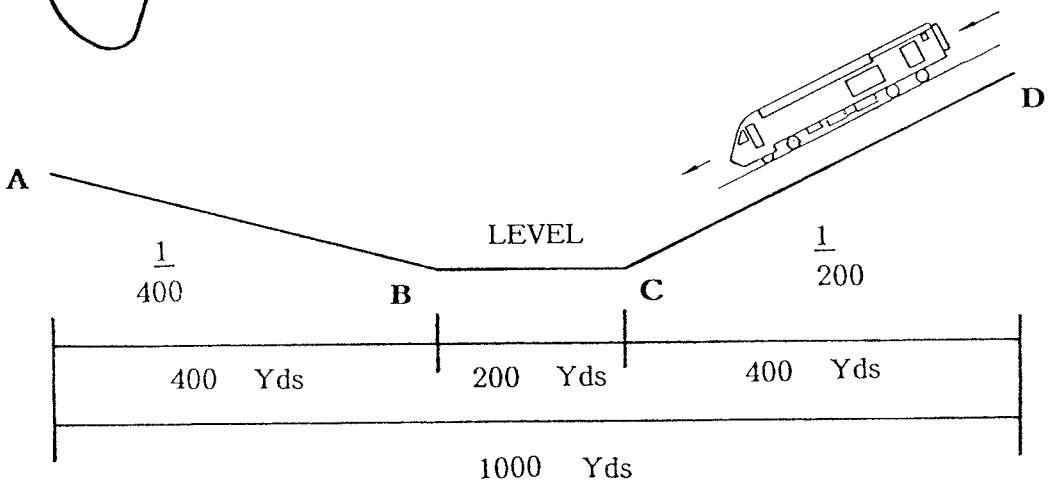
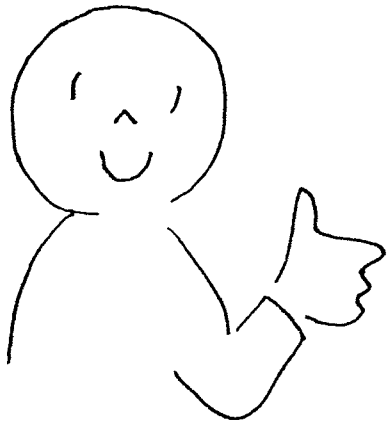
DIRECTOR OF S & T ENGINEERING.
WEST MIDLANDS PROJECTS GROUP.

CALCULATION OF AVERAGE GRADIENTS



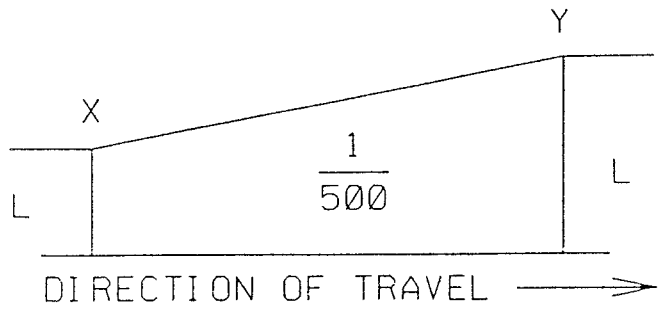
Average Rise = +1

Average Gradient = $\frac{1}{1000}$

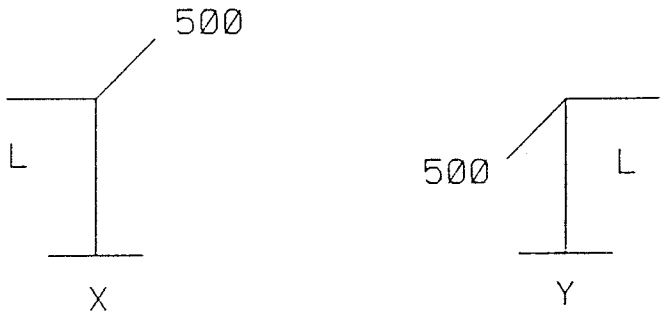


CALCULATION OF AVERAGE GRADIENTS

Gradient profiles are usually shown in this manner:-



OR



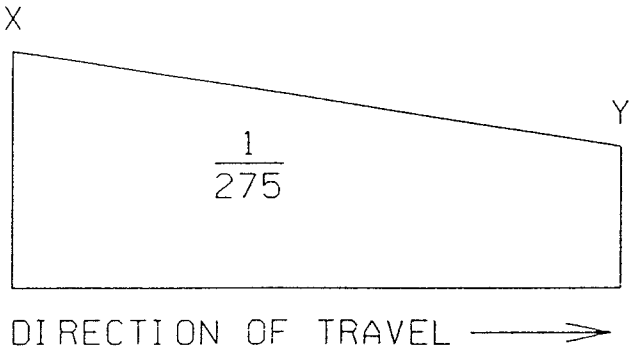
For every 500 inches, feet, yards, centimetres, metres etc. we travel in the direction shown we will rise 1 inch, foot, yard, centimetre or metre respectively depending on the units we are working in.

Therefore in the above example if the distance from x—> y is 500 yards we would rise 1 yard. If the distance between x & y is 250 yards we would rise 0.5 yards and the distance x—> y is 1250 yards we would rise 2.5 yards.

continued

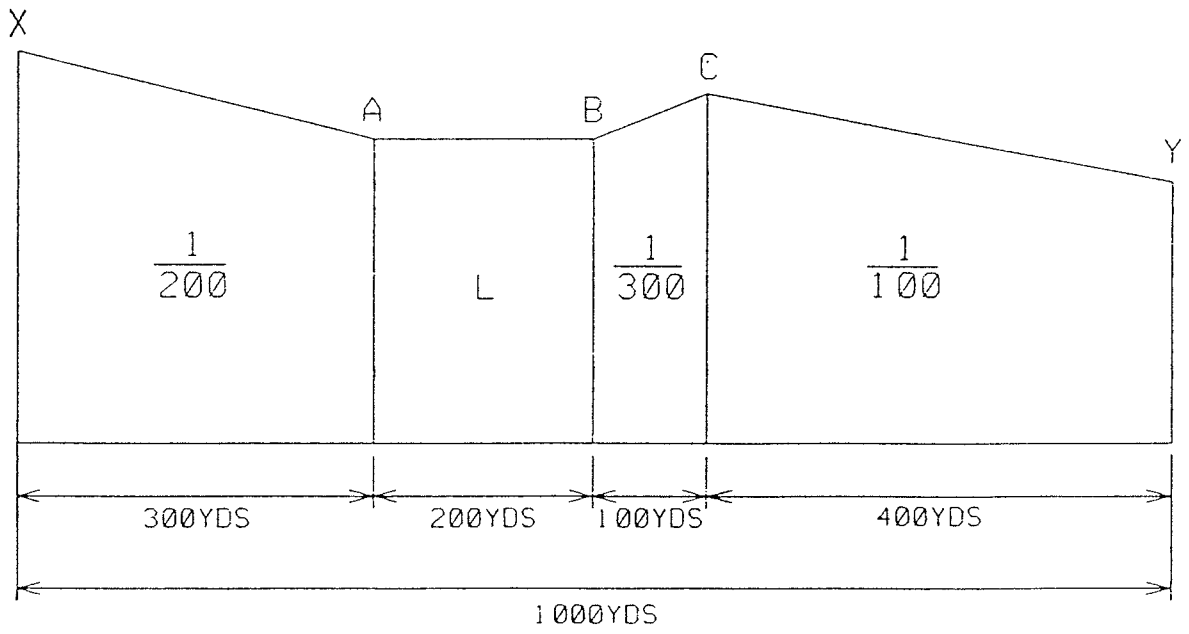
CALCULATION OF AVERAGE GRADIENTS

Consider the following gradient:-



This means for every 275 units travelled a fall of 1 unit will be realised.

Here is a typical Gradient Profile the type that you are likely to see on Signalling Scheme Plans or Sketches, generally there will be a running Mileage or Kilometre reading along the base of the Profile and the profile will be to scale, however for ease of calculating this particular gradient the dimensions are added.



continued

CALCULATION OF AVERAGE GRADIENTS

As you can see there are various Rises and Falls dependant on whether you travel right to left or left to right over the ground.

In order to average this gradient out over the full 1000 yards we have to perform a calculation using the Grid as shown. Assume we are travelling from x to y.

SECTION	DISTANCE IN YARDS	GRADIENT	RISE(YDS) (DIST X GRAD)	FALL(YDS) (DIST X GRAD)
X - A	300	$\frac{1}{200}$	-	1.5
A - B	200	L	-	-
B - C	100	$\frac{1}{300}$	0.333	-
C - Y	400	$\frac{1}{100}$	-	4.0
TOTALS	1000	-	0.333	5.5

We can see we have fallen 5.5 yards and only risen 0.333 yards over the 1000 yards.

Therefore point y is (5.5 - 0.333) yards lower than point x.

ie. in 1000 yards the resultant fall is 5.167 yards.

The average distance for 1 yard fall is = 1000/5.167 = 193.54 yards.

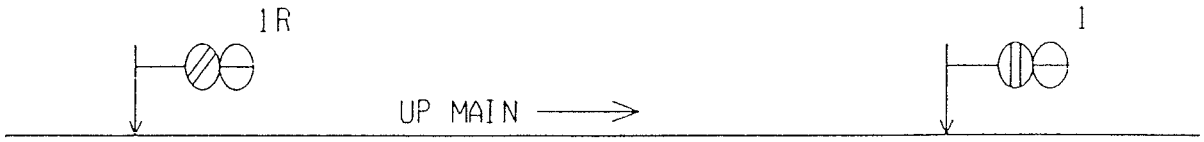
Therefore the average gradient from x to y = 1/194 **FALLING**.

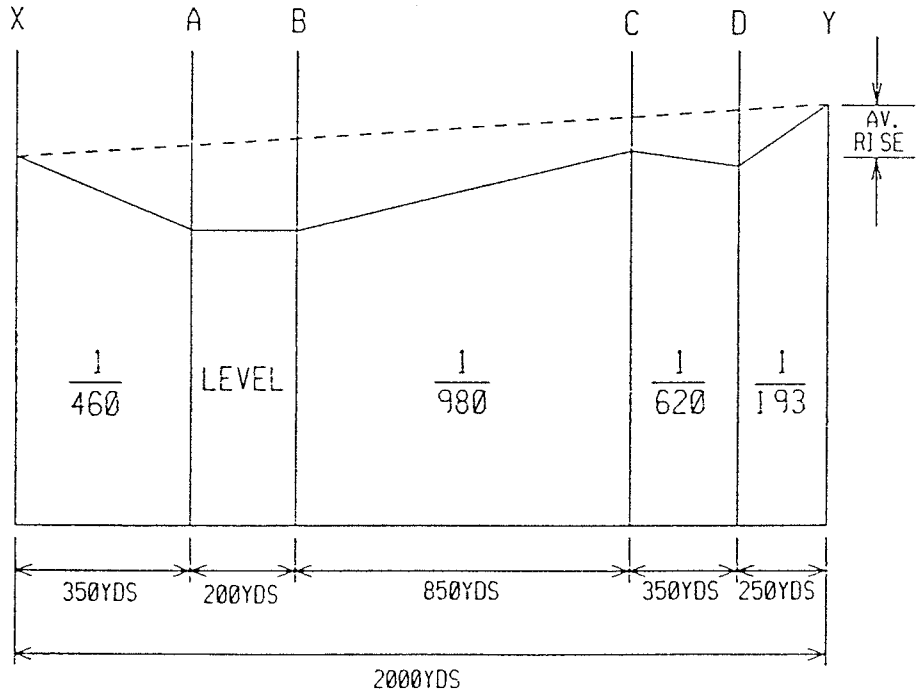
continued

CALCULATION OF AVERAGE GRADIENTS

Consider the following gradient profile this time looking at a typical signalling situation showing an existing colour light Home signal and it's associated Distant signal.

The gradient profile is shown for the stretch of line between these two signals and is calculated as follows:-





continued

CALCULATION OF AVERAGE GRADIENTS

SECTION	DISTANCE IN YARDS*	GRADIENT	RISE(YDS)* (DIST X GRAD)	FALL(YDS)* (DIST X GRAD)
X - A	350	$\frac{1}{460}$	-	0.761
A - B	200	L	-	-
B - C	850	$\frac{1}{980}$	0.867	-
C - D	350	$\frac{1}{620}$	-	0.565
D - Y	250	$\frac{1}{193}$	1.295	-
TOTALS	2000	-	2.162	1.326

* Dependant On The Units You Are Working In (Feet, Metres, etc)

Point y is (2.162 - 1.326) yards higher than point x.

ie. in 2000 yards the resultant rise is 0.836 yards.

The average distance for 1 yard rise is = 2000/0.836 = 2390 yards.

Therefore the average gradient from x to y = 1/2390 **RISING**.

end