



Excel Technology Co Pty Ltd

The Significance of 'Q' of in an In-pavement Loop

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The 'Q' of an in-pavement detector loop.

The 'Q' of a loop is critical to its vehicle classification function as classification is dependent on field interaction to accurately determine length and metal mass concentrations within the vehicle passing through the loops electromagnetic field.

Scientific Explanation of 'Q'

The following information is a scientific explanation of 'Q', however like all things at a lower Q, detection will occur (but a little inconsistent where in the loop). In a higher 'Q' loop, the detection position/point is more consistent and the determination of speed and vehicle length is more accurate.

Q or the performance of the loop is effectively the relationship between inductance of the loop and resistance / impedance in the feeder cable hence longer feeders (higher impedance/resistance) need more inductance in the loop for compensation.

The following formula and reference gives it a scientific presence:

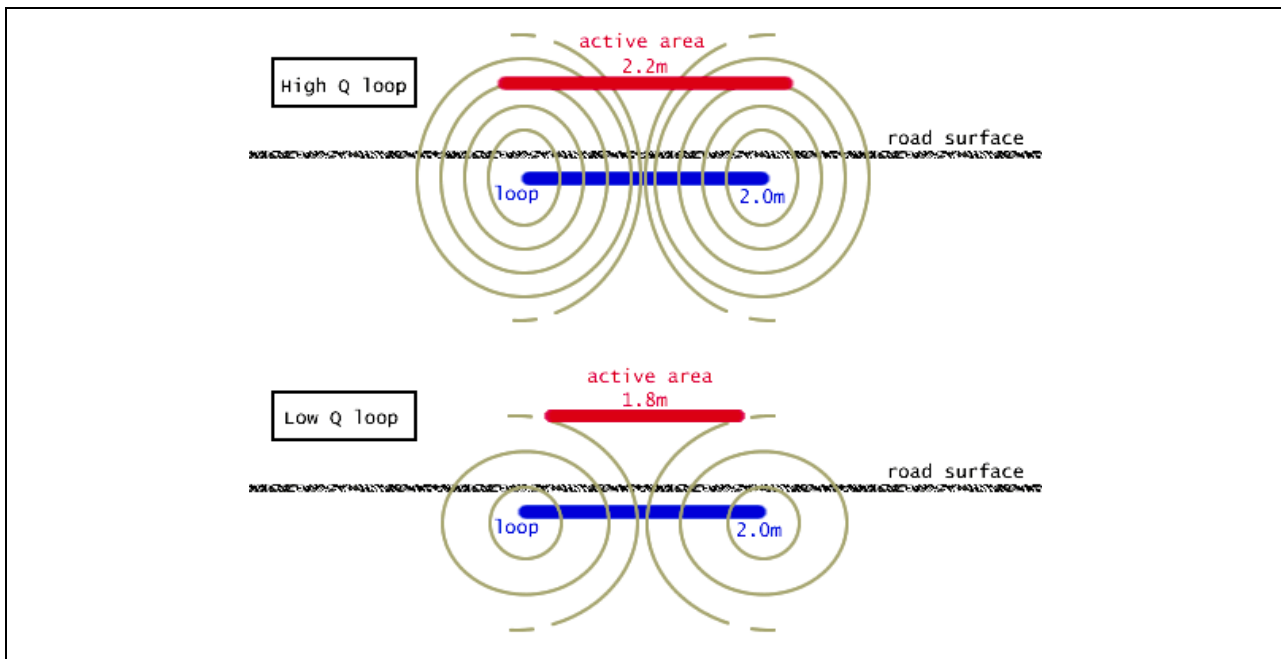
$$Q = \frac{2\pi \times \text{frequency (Hz)} \times \text{inductance (H)}}{\text{resistance } (\Omega)}$$

** Where Radians = 2 (multiplied) pi (multiplied) hz

Good reference: *Electronics A Top-down approach to computer-aided circuit design* by Hamley 1994 P904-908

General Description of 'Q'

Loop length is the length of the active area of the loop in the direction of travel. The active area is size of the loop electromagnetic field in which a vehicle will change the inductance of the loop above the detection threshold. The size of the active area is determined by the sensitivity of the loop (Q), the depth of the loop, and the sensitivity of the detector.



For loops installed according to the specifications referred to in the Detector Manual (typically 2 mt square with 4 turns) the active area of the loop should be close to the physical loop size. For other loop variations with low Q the active area may be diminished similarly to the loop being physically smaller than the measurement entered into the detector. The error in the loop length directly affects the error in the vehicle length. Simply stated, if there is an error in the loop length of -0.4m then vehicles will be reported as being 0.4m shorter than they actually are measured.