

# Vehicle Detector Loop Installation guide

An inductive loop vehicle detection installation consists of three components:

- A buried coil of wire (loop) in the roadway
- Vehicle detector electronic module
- Controlled device such as gate or boom gate

## 1. The inductive loop

The inductive loop is simply a coil of insulated copper wire (loop wire) located in the roadway such that a vehicle passes directly over it. The coil has a number of turns of wire and the ends of this coil are normally left long enough to reach the location of the vehicle detector module without the need for jointing the cable.

In existing road surfaces the loop wire is normally installed by cutting a narrow slot in the pavement with a concrete cutter, winding the loop conductors into the slot and filling the slot with bitumen or epoxy to exclude any water entering the slot and preventing any movement of the conductors. In new road surfaces the coil may be constructed in PVC conduit and buried in the wet concrete at time of pouring.

The characteristics of the inductive loop determine the effectiveness (sensitivity) of the loop in detecting the passage of vehicles above it. These characteristics relate to the size, shape and number of turns of wire and are detailed below.

## 2. The vehicle detector

The vehicle detector is a electronic module in a small enclosure complete with electrical connections for inputs and outputs. The detector needs to be housed in a protective enclosure. This unit is powered with either mains voltage or low voltage ac/dc power depending on model type.

The detector provides visual indicators for power and output relay status. A number of switch settings optimise the performance of the detector to site conditions.

The detector electronics energises the inductive loop with an AC signal that causes a magnetic field around the loop conductors. Changes in this magnetic field due to the passage of a vehicle are processed by the electronics to provide vehicle detection.

The control outputs from the detector are via output relays providing either normally open or closed relay contacts.

Refer to the vehicle detector User Guide for more details

## 3. Sensing Loop Geometry

Sensing loops should, unless site conditions prohibit, be rectangular in shape and should normally be installed with the longest sides at right angle to the direction of traffic movement. These sides should ideally be 1-2 metres apart. Note that small loops restrict the available detection height, causing problems when detecting high bed vehicles and some SUV's

The length of the loop will be determined by the width of the roadway to be monitored. The loop should reach to within 300mm of each edge of the roadway.

In general, loops having a circumference measurement in excess of 10 metres should be installed using two turns of wire, while loops of less than 10 metres in circumference, should have three turns or more. Loops having a circumference measurement less than 6 metre should have four turns. It is good practice at time of installation to construct adjacent loops with alternate three and four turn windings.

If the loop installation is in a concrete see Item 5.1 before deciding on the number of loop turns.

#### 4. Loop Installation

All permanent loop installations should be installed in the roadway by cutting slots with a masonry cutting disc or similar device. A 45° crosscut should be made across the loop corners to reduce the chance of damage that can be caused to the loop wire insulation at right angle corners.

NOMINAL SLOT WIDTH: 4 - 5mm NOMINAL SLOT DEPTH: 30mm to 50mm

A slot must also be cut from the loop circumference at one corner of the loop to the roadway edge to accommodate the feeder.

A continuous loop and feeder is obtained by leaving a tail long enough to reach the detector before inserting the cable into the loop slot. Once the required number of turns of wire is wound into the slot around the loop circumference, the wire is routed again via the feeder slot to the roadway edge. A similar length is allowed to reach the detector and these two free ends must be twisted together to ensure they remain in close proximity to one another. (Minimum 20 turns per metre) Maximum recommended feeder length is 100 metres. It should be noted that the loop sensitivity decreases as the feeder length increases, so ideally the feeder cable should be kept as short as possible.

The loops are sealed using “quick-set” black epoxy compound or hot bitumen mastic to blend with the roadway surface.

**WARNING: Cutting into post tensioned concrete slabs can have catastrophic consequences. As a general rule 30mm is the deepest slot depth allowable in such cases. When any doubt exists the structural engineer’s approval must be sought prior to commencement.**

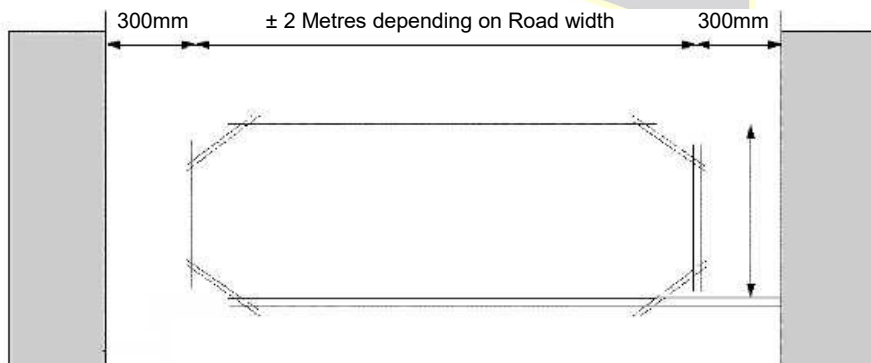


Fig 1 Loop geometry

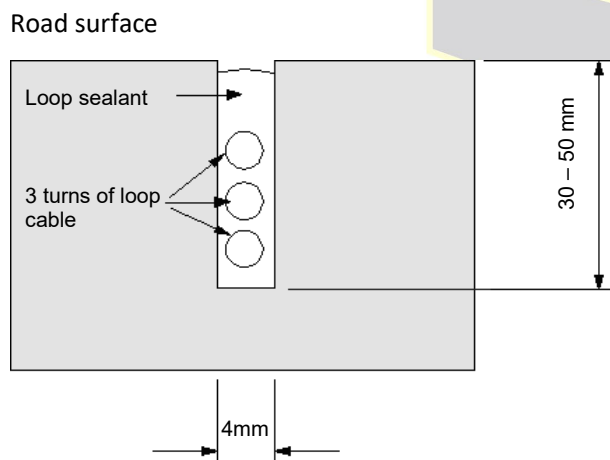


Fig 2 Loop slot detail

## 5. Operational Constraints

### 5.1 Metal Reinforcement in concrete roadways

The existence of reinforced steel below the road surface has the effect of reducing the inductance, and therefore the sensitivity, of the loop detection system.

The effects of reinforcing are greatly dependent on the spacing and if it is a welded mesh, or only reinforcing bars. The best way of minimising the effect is to maximise the separation between the reinforcement and the loop conductors. The ideal minimum spacing between the loop and the cable and steel reinforcing is 150mm, although this is not always practically possible. The slot depth should be kept as shallow as possible, taking care that the cable does not remain exposed after the sealing compound has been applied.

Where reinforcing exists, two additional turns should be added to the normal loop configuration, (see Item 3 above) with a practical maximum of 5 turns only where loop circumference does not exceed 10 metres.

When roadways in excess of 3 metres wide must be covered in areas where significant reinforcement is present, the only effective way to overcome this loss of sensitivity is to reduce the overall loop size. Hence, the use of a dual channel detector and the placement of 2 adjacent loops to cover the same area effectively overcomes this loss of sensitivity.

### 5.2 Multiple loops in close proximity

Multi-lane car park entries or use of additional loops in the same lane to extend performance results in a possibility that loops may interfere with one another.

When two loops are in close proximity, the magnetic fields of one can overlap and disturb the field of the other. This phenomenon, known as crosstalk, can cause false detection and detector lock-up.

Crosstalk only occurs between adjacent loops operating from different detector modules and can usually be eliminated by:

- i. The operating frequency of a detector may be adjusted using the switch settings on the detector faceplate. The closer together the two loops, the further apart the frequencies of operation must be. Change the frequency settings of the detectors to eliminate crosstalk
- ii. Separation between adjacent loops. Where possible a minimum spacing of 2 metres between loops should be adhered to. (See Fig 3 – Page 4)
- iii. Ensure that all loop tails are carefully twisted in pairs with 20 turns per metre from the point the cable leaves the slot in the roadway all the way to the detector terminals.

NOTE: LOOPS CONNECTED TO THE SAME DUAL CHANNEL DETECTOR DO NOT INTERFERE WITH EACH OTHER. FOR THIS REASON DUAL CHANNEL DETECTORS ARE BEST FOR MULTIPLE LOOP INSTALLATIONS. ALWAYS ALLOCATE THE LOOPS WITH THE LEAST PHYSICAL SEPARATION TO THE SAME DUAL CHANNEL DETECTOR UNLESS DIRECTION LOGIC MANDATES OTHER CHOICES.

### 5.3 Loop stability

It is essential that the loop conductors once installed are stable and do not move during vehicle movements. It is essential that loop slots are carefully filled so no air gaps remain in the loop slots. Loops constructed in plastic conduit for burying in wet concrete must be filled with fine beach sand to prevent conductor movements.

Movement in loop tails that have not been adequately twisted will also result in false (intermittent) detection.

### 5.4 Electrical interference

The magnetic field associated with electrical equipment (such as fork-lift battery chargers) and high voltage cables (>3kV) will interfere with the magnetic field associated with the loop. Where possible choose loop locations that are not close to electrical equipment or high voltage cables and do not route loop tails in conduit with these voltage sources.

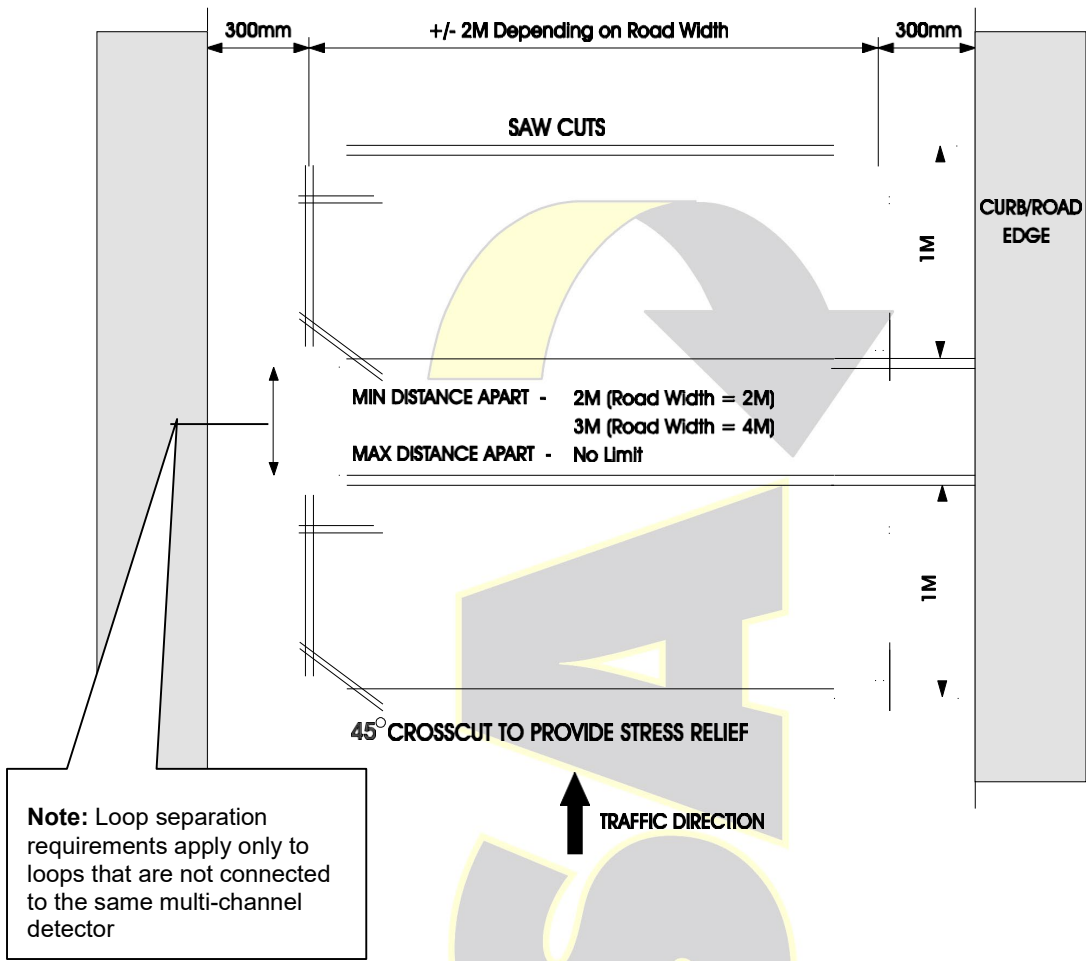


Fig 3 Loop separation requirements for loops not connected to same detector module

**5.5** Loop installation under pavers.

Installing a loop under paving is a matter of following the same rules in terms of size etc. but you run the loops in conduit before replacing the paving. See photo below.

