Mikros Systems (Pty) Ltd

Installation of Fixed Capacitive HSWIM Sensors

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Author: JRS

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Mikros Systems contact details

P.O. Box 75034
Lynnwood Ridge
0040
South Africa

www.mikros.co.za

e-mail: mikros@mikros.co.za

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Important notes

- Refer to the Mikros Systems loop installation document.
- The terms HSWIM (High Speed Weighing In Motion) and WIM (Weighing In Motion) are used interchangeably throughout this document.
- All procedures stipulated in the loop installation document are relevant to the installation of WIM sensors.
- Adhere to the required safety and quality assurance procedures.
- Install only on an adequate road surface.
- Consult a pavement specialist before deciding on the appropriate installation method.
- Install the width and the breadth of the sensor, level with and parallel to the road surface using the bottom of the frame as reference and not the frame sides.
- Set the frame 2-3mm below the pavement surface.
- Keep water from penetrating to the sub-base.
- Only use Mikros Systems supplied feeder wire.
- When positioning a sensor, make sure that the middle of the sensor coincides with a wheel track.
- Although this document refers mainly to the 2m WIM sensor all the same procedures are valid when installing a 1,5m sensor.

Background information

This document should be used in conjunction with “MS001-96200-52 Installation of Loops for Traffic Logging Stations”, which describes in detail the basics for any type and configuration of Traffic Logging installations. An in-depth knowledge of this document is a prerequisite.

Site selection is the key factor in a successful High Speed Weighing-In-Motion (HSWIM) station installation and performance. For the requirements of a HSWIM site refer to the document “MS001-00005-41 WIM Site Requirements”.

For a proper installation what is of utmost importance is:

- Pavement (road conditions)
  - Flatness (flushness)
  - Smoothness (riding quality)
  - Evenness (surface quality)
- Traffic behaviour
  - Uniform flow
  - Lane discipline

To maintain these qualities of installation over a long term only high quality pavements of ample thickness that are structurally sound should be selected. In lesser pavements the integrity of WIM data will be compromised. Mikros Systems cannot be held accountable for the poor performance of a WIM installation that is done in sub-standard conditions.

Mikros Systems recommends that the user of HSWIM equipment also refers to the US Federal High Way Associations specification document for HSWIM systems, called "ASTM E1318-94 Standard Specification for Highway Weigh-In Motion (WIM) Systems with User Requirement and Test Method".

Figure 1 (see Annexure A) illustrates the general principle of installing a Mikros Systems Capacitive WIM Sensor.
1 **Installation types (permanent and semi-permanent)**

Two general installation types are available. The first type is a fixed (permanent) installation, which is described in this document. The second type is a semi-permanent installation.

The only difference between the two types is that semi-permanent installations make provision for dummy sensors to replace sensors so that the sensors can be moved to other sites.

The following conditions must be adhered to with the provision of semi-permanent installations:

- Sensors must be easily removed from the mounting frame. No sealant should be used on the inside of the frame.
- Lead-in cables are sealed into the slots with a soft silicone sealant.
- Lead-in cables should be placed in ducts with ample room to pull them out (and in) again.

2 **Sensor configuration**

- The actual configuration depends on the application for which the HSWIM installation will be used. Some sample configurations are illustrated in Figures 3 – 6 (Page 24).
- The purpose of HSWIM systems is mainly to collect statistical data and to pre-select overloaded vehicles. The user requirements for each of these applications differ.

3 **Installation methods**

- Two types of installation methods are described in this instruction manual. The first applies to pavements of adequate thickness and strength. In these cases the installation frame can be directly mounted in the surface. The second applies to thin pavements.
- The installation frame is secured to the road surface by cutting a recess into the surface and grouting the frame into the road with an epoxy grout. The frame is further secured by a number of road anchors, grouted into holes that are deeper than the cut recess.
- In the event of thin pavements, a small concrete block is cast directly below the frame. The frame is secured with epoxy grout and anchors.
Traffic accommodation is a major factor when installing HSWIM sensors. Limited time is available for installations. Normally a single lane can be installed within 6 hours. Installation can therefore take place during off-peak hours. At least two days are required when a concrete support slab has to be provided. One day is needed for the casting of the support slab and another for the installation. A fast curing concrete mix should be used, to ensure that installation could proceed on the second day. The concrete mix design should be such that compression strength of at least 30 Mpa is reached within 24 hours.

The recess could be covered with a steel plate when traffic conditions dictate that the lane has to be opened and the slab has not cured yet. This procedure should be carried out carefully and only by experienced contractors. (This procedure is sometimes used when repairing bridge expansion joints).

There is a possibility of differential settlement if a concrete support slab has been provided. This could be corrected by installing the sensor frame below the road surface with the sensor shimmed to the correct height. Shims can be removed from underneath the sensor, if the pavement next to the sensor sags. More shims can be added underneath the sensor if the support slab itself sags.

Shims could also compensate for a slight unevenness in the road surface. Shims are used in both installation methods.

For a successful installation, water must never be allowed to penetrate to the sub-base. To prevent water penetration, the excavation must be sealed properly before casting the slab. The area surrounding the frame must also be sealed at all times. This could be achieved by using a bitumen emulsion sealant in the excavation and a sealant that remains flexible directly around the frame. As part of a long-term maintenance plan, the seal should always be checked and repaired if required.
4 Selecting the sensor position

In an open road application, the sensor(s) must be placed in such a way that the middle of the sensor lines up with the middle of the wheel track. The wheel track is the darker track that is usually clearly visible on the road surface (Figure 3, Annexure A on page 24).

For installations where dual sensors are used per lane (e.g. screening lanes), the middle of the vehicles should travel over the position where the two sensors butt (Figure 4, Annexure A).

For more details on sensor positions, refer to Figure 5 & 6 (Annexure A) on page 26. The sensor position depends on the project. This document outlines the general principles that are important when placing the sensors.

4.1 Lead-out (or feeder) cables

The following points should be considered when planning the position of the feeder cables:

- For a HSWIM site the loop feeders should be on the outside of the loops. This leaves the inside clear for the placement of the WIM sensors (Figure 6, Annexure A on page 27).
- Place the WIM sensors off-centre of the loops. This will allow for possible future configuration change (adding or replacing of a sensor).
- The lead-out cables of the WIM sensors should all be on the same side (Figure 2, Annexure A on page 22).
- Parallel saw-cuts should be at least 100mm apart to prevent possible local pavement failure.

4.2 Position of instrument housing

- The position of the instrument housing should be taken into account when ordering the correct feeder length.
- It is not recommended to splice the feeder cable.
- The practical maximum length for a WIM sensor feeder cable is 120m.
4.3 Effective sensing area

Note: The S20 (2m) Capacitive WIM sensor has an effective sensing (active) area of 1815 mm. The S15 (1.5m) sensor has an effective sensing area of 1380 mm. This should be taken into account when planning where to position the sensor.

The possibility of a smaller vehicle straddling the sensor in such a manner that both wheels are on the sensor should be considered when designing the sensor configuration and placement.

Diagram 2: Effective sensing area
5 Chart of main installations steps

- Control and checks on installation material and equipment
- Acquire material and equipment
- Arrange adequate traffic control and lane closure
- Determine site position
- Marking of site
- Construction of site
  - Cutting of recess for frame and feeder route
  - Excavate recess
  - Pour support slab (optional)
  - Prepare frame
    - Mix epoxy
    - Place frame level
    - Fit and shim sensor
    - Place feeder
- Quality Assurance
  - Record keeping
  - Specification conformance
- Site acceptance
  - Compile complete site record set
  - Conform to specification
6 General installation procedure

The same procedure applies, whether installing the Mikros Systems Capacitive WIM Sensor in a “thin” or “thick” pavement. The only difference is that, in the case of thin pavements, a support slab is provided directly under the installation frame.

After the support slab has been provided, the installation procedures are the same in both cases.

Note: The frame is initially set lower than the road surface. The sensor is then shimmed to the desired height. The advantage of setting the frame lower than the road surface is that the sensor could be lowered in the case where upward local pavement settlement forces the frame up. In the case of downward settlement, more shims can be added to lift the sensor.

The main installation steps are:

- Excavating the recess.
- Providing the support slab in the case of thin pavements.
- Grouting the installation frame into the recess.
- Placing and shimming the sensor to be flush with the road surface.
- Final sealing of the sensor and frame.

6.1 Preparing the thin pavement excavation

Pictures 1 – 13 on page 40 (Annexure D) illustrate the excavation and provision of support slabs.

The following points set out the procedure to be followed when preparing the thin pavement excavation:

- Mark the outside of the frame on the pavement (2 040 x 560 mm) and allow for a 5 mm gap on the outside of the frame (Picture 1 on page 40). For the 1,5m sensor the outer dimensions of the frame are (1 560 x 560 mm).
- Cut the outside with a concrete saw, so that the corners are over-cut by half the saw diameter. Cut additional strips in the inside to ease the pavement excavation (Picture 3 on page 40).
- Remove the wearing course (top layer of the pavement) with a breaker.
- Excavate the recess to a depth of 300mm (Picture 4 on page 40).
- Clean the excavation of all loose material (Picture 5 on page 40).
- Cut the sensor feeder cable groove. This must be done beforehand to accommodate the earth wire leading from the frame.
- Seal the excavation with bitumen emulsion (Colas COLSEAL) (Pictures 6&7 on page 40). Refer to Annexure C for the specification sheet of COLSEAL.
- Allow the seal to wind dry.
- Mix the fast setting concrete (Picture 8 on page 41).

Diagram 3: Additional cuts for excavation

- Remove the wearing course (top layer of the pavement) with a breaker.
- Excavate the recess to a depth of 300mm (Picture 4 on page 40).
- Clean the excavation of all loose material (Picture 5 on page 40).
- Cut the sensor feeder cable groove. This must be done beforehand to accommodate the earth wire leading from the frame.
- Seal the excavation with bitumen emulsion (Colas COLSEAL) (Pictures 6&7 on page 40). Refer to Annexure C for the specification sheet of COLSEAL.
- Allow the seal to wind dry.
- Mix the fast setting concrete (Picture 8 on page 41).
About fast curing concrete:

The fast curing concrete mix design has to be done so that compression strength of 30 Mpa will be reached within 24 hours. Various commercially available additives are available for quick setting concrete.

The heat generated by the reaction should be used to speed the curing. To allow for this, insulators such as polystyrene and a 2.5mm thick tarpaulin should cover the excavation.

Keep damp while curing.

To check the desired compression strength, a 150mm test cube should be poured for testing at a concrete lab, after 24 hours.

The mix must be mechanically mixed and during the pour a vibrator (40 – 50 mm) must be used. The mix has a low water content and can only be properly formed by vibration.

- Float the slab to a depth of 45mm below surface (Pictures 10 & 11).

Note: The frame should be set 2-3mm lower than the surface. In cases where the pavement is slightly uneven it might be necessary to make a deeper recess than 45mm to allow for this. Place the frame in the open hole to check the final depth.

6.2 Preparing thick pavement excavation

Pictures 14 – 17 on page 41 (Annexure D) illustrate how the excavation and provision of a support slab is done.

The following points set out the procedure to be followed when preparing the thick pavement excavation:

- Mark the outside of the frame on the pavement (2 040 x 560 mm) and allow for a 5 mm gap on the outside of the frame (Picture 1 on page 40).
- Cut the outside with a concrete saw, so that the corners are over-cut by half the saw diameter. Cut additional strips in the inside to ease the pavement excavation. (Picture 14 on page 41).
- Cut to a depth of 45mm.

Diagram 4: Additional cuts for excavation

- Remove the pavement material with a breaker, to a depth of 45mm (Picture 15 on page 41).
- Place the frame in the excavation to check for high spots (Picture 16 on page 42).
Note: The frame must be set 2-3mm lower than the surface. In cases where the pavement is slightly uneven it might be necessary to make a deeper recess than 45m to allow for this. Place the frame in the open hole to check the final depth.

- Clean the excavation of all the lose material.
- Cut in the sensor feeder cable groove. This must be done beforehand to accommodate the earth wire leading from the frame.
- Mask the edges of the excavation (Picture 15 on page 41).

### 6.3 Drilling of anchor holes

Diagram 5 illustrates the frames that road anchors hook on. Note the direction of the hook when drilling the hole. The holes are drilled using a 25mm masonry drill bit, at an angle of approximately 45° to the horizontal position. Holes are drilled to a depth of 200mm to allow for the anchor. Pictures 12 & 17 on page 41 of the Picture gallery (Annexure D) illustrate how these holes are drilled.

Fill the holes with a thin epoxy mixture and release all the trapped air before inserting the anchor.
6.4 Preparing frame for grouting

The installation frame is a solid 12mm mild steel plate on to which the WIM sensor is bolted, after it has been grouted into the road surface. Overall dimensions of the installation frame are: 2030 x 555 x 35 mm @ 120Kg. Expanded metal strips are welded to the bottom of the frame to improve adhesion to the epoxy (Picture 18 on page 42). Refer to Figure 7 on page 28 (Annexure A) for details.

The sensor is bolted into the frame with 18 (9 on each side) taped 10mm holes for a 2m sensor.

The installation kit for a 2m sensor (Diagram 6) also contains:

- Twenty (20) 10 x 25 mm high tensile bolts.
- Twelve (12) road anchors.
- Set of galvanized shim plates.
  - 7+2 each of 0.5mm, 1.0mm and 1.6mm thickness.
  - Refer to Figure 8 (Annexure A) for details.
- Length of earth wire (to order length).

![Diagram 6: Sensor frame kit](image)

Pictures 19 – 22 on page 42 of the Picture gallery (Annexure D) illustrates how the installation frame is prepared before being grouted into the pavement recess.

**Frame preparation steps**

Warning: the installation frame is heavy (120Kg). Adequate provision must be made for handling the frame. Lifting brackets and resting blocks should be available.

**Important check:**

Before installing the frame, check the frame itself for flatness in both axes. Incorrect storage and handling may distort the frame. Do not use a distorted frame.
The following steps are taken when preparing a frame:

- Roughen the bottom of the frame with an angle grinder to assist with binding (Picture 18 on page 42).
- Carefully apply release agent to the inside of the frame. A beeswax based polish is recommended. The release agent prevents the epoxy sticking to the inside of the frame. Release agent must only be applied to the inside bottom and edges of the frame. Do not apply release agent to the inside of the pour holes and the outside of the frame (Picture 19 on page 42).
- Clean the outside of the frame with acetone to remove any release agent that has accidentally contaminated these areas (Picture 20 on page 42).
- Block off the 18, 10mm threaded holes to prevent the epoxy from filling them. Cover bolts lightly with release agent and temporarily screw them into the mounting holes (Picture 21 on page 42).
- Fix the installation and alignment-bars to the frame (Picture 22 on page 42).
- Align and set the frame in the recess. The frame must be between 2-3 mm lower than the road surface (the lowest point) (Picture 23 on page 42). Height control is achieved by adjusting the height screws on the installation brackets.
- On granular surfaces flat plates should be used under the adjusting screws to avoid the screws from settling into a local low point. When adjusting always work to the “average” pavement surface height.
- The width and breadth of the frame must be flush with the pavement (long and short direction). Use the bottom of the frame as reference point, not the frame sides.
- Mark the mounting frame’s support points after the frame has been moved. This would ensure that the frame is placed in the same position after height adjustments have been made and epoxy has been applied. (Picture 24 on page 43).

An earth wire is attached to the bottom of the installation frame. This wire must be routed into the same slot as the sensor feeder cable. For this reason the sensor feeder slot must be deep enough to fit in the earth wire, sensor feeder and a minimum of 20mm sealant coverage.

Diagram 7: Picture of the bottom of the installation frame showing the earth wire

Some installation frames do not have a slot cut for the sensor feeder wire to exit. A slot has to be cut with a small angle grinder at the required corner. Ensure that no sharp edges are left that can damage the feeder cable. Cut the slot after the frame has been installed.
6.5 Preparation of epoxy grout

The following points should be considered when preparing epoxy grout:

- Mikros Systems specifies Vivacity Mexapoxy for the installation of its WIM sensors. Refer to Annexure B on page 32 for the product specification details.
- When working with epoxies always wear protective clothing and use gloves to protect hands.
- Epoxies can only be applied under dry conditions.
- Do not attempt to work with epoxy under extreme temperature conditions (under 10° or above 30° C). For cold conditions use the winter grade epoxy.
- In cold conditions the epoxy tins may be pre-heated to 20°. After the epoxy has been applied, the frame may be heated with a butane burner to assist the hardening process.
- In hot conditions the epoxy must be kept out of the sun and stored and mixed in a coldwater tub.
- At least three persons are needed to mix and pour the epoxy. Use a large enough drum to mix up to 20 litres at a time.
- The epoxy must be mechanically mixed, using a large (900 watt or larger) variable speed electric drill fitted with a spiral mixing paddle (Picture 27 on page 43).
- Megapoxy CT allows for a long work-time before it starts to set. Plan the installation around the setting time after pouring. Two to five hours are needed for the epoxy to set under low temperatures. It is advised to arrange traffic accommodation for 24 hours, to be on the safe side.
- The temperature range for CT winter grade is approximately 10°C. For higher temperatures the setting will be faster.
- Adding filler to the epoxy slows the setting time. If no filler is added the setting time is 15 - 20 minutes.
- Silica sand can be used as filler. It must be clean, dry and free of any organic matter.
- A thin and thick mix should be prepared. The “thin” mix should be poured into the anchor holes. It should also be used to prime the inside of the recess.

Recommended mix

If the recess is excavated correctly, a total of 20 liters of epoxy and 15 liters of silica sand are sufficient to install the frame. Approximately, 1 liter of mix is needed below the frame for every 1mm of excavation depth.

First (“thin”) mix.

- Use 5 liters of part A and 5 liters of part B plus 5 liters of silica sand.
- Pour 5 liters of the black component into the mixing bucket (use the shipping bucket). Stir for at least 2 minutes to ensure that the heavy sediment is fully mixed in.
- Continue mixing and add 5 liters of the clear component to the mix (pour in slowly).
• Mix for 10 minutes and then add 5 liters of sand to the mix. Mix for another 5 minutes (occasionally test the temperature of the mixing bucket. The mix is ready if the bucket starts to feel warm).

• Pour the mix into the recess. Works the epoxy into all the anchor holes. Take care not to trap air in the holes. Prime the complete surface (bottom and sides) of the recess using putty knives to spread the epoxy. (Picture 29 & 30 on page 43).

• The epoxy of the first mix can be worked from the low to the high side of the recess, while the second mix is being prepared (not essential).

Second (“thick”) mix

• Use 5 liters of part A and 5 liters of part B plus 10 liters of silica sand. Mix as before.

• Pour the mix into the recess.

6.6 Grouting of installation frame

The frame should have been set to the correct height prior to pouring of the epoxy grout. Make sure to replace the frame in the correct position that has been clearly marked. Do not change the frames orientation.

The following sets out the procedure for grouting the installation frame:

- Temporarily block the feeder saw-cut groove with putty to prevent the epoxy from flowing into the groove.
- Pour all the required epoxy into the recess.
- Work epoxy into all the anchor holes (Picture 30 on page 43).
- Replace the frame at the correct position.
- The weight of the frame will ensure that the excess epoxy seeps through the pour holes (Picture 31 on page 43).
- Feed the earth wire into the feeder groove through the putty and push it towards the bottom of the groove. Keep the groove sealed off.
- Place the frame on its side first, to ensure that no air is trapped under the frame.
- Drop the road anchors in place, push them into the holes and hook the end over the bar that is provided for it (Picture 25 on page 43).
- Work the excess epoxy from the lower regions back to the upper regions; keep filling the pour holes with the epoxy that is being pushed out. Have empty holders at hand to dispose of any excess material. Use spatulas to work the epoxy all around the frame edge (Picture 32 on page 44).
- Wait for the epoxy to set.
- The excess material inside the frame must be scraped off before the epoxy has set completely (i.e. if a finger nail can still cause an indentation) (Picture 33 on page 44).
- Clean out the frame by removing the bolts used for blocking the threads (Picture 34 on page 44).
- Use acetone to clean all traces of release agent.
- Grind the slot into the frame where the sensor feeder must exit (take care to smooth the edges).
- If necessary, use a grinder to level any excess epoxy that may stand out in any of the pour holes.
6.7 **Shimming and placing of sensor**

Shimming allows for the sensor installation to be done as flush as possible. It also allows for future local pavement settlements to be corrected (within limits).

The frame is set lower than the road surface and must be shimmed to the correct height.

*Note that over the length of the sensor no shim step greater than 0.5mm is allowed.*

Ensure that the thread of the mounting holes has been cleaned properly. It is good practice to clean out the thread first with a 10mm cleaning tap to remove all possible remaining epoxy and release agent. Clean with solvent. This has to be done as the bolts must be treated with medium strength “Loctite 243” a bolt locking compound, before finally securing the sensor.

- Clean the mounting holes of all epoxy debris (using a 10mm cleaning tap) and release agent.
- Temporarily bolt down the sensor into the frame.
- Place a 3m straight edge across each bolt position and measure the distance between the straight edge and the top of the sensor. This can be done using a steel rule or a specially graded wedge (Picture 36 on page 44).
- Write down the required shim thickness at each bolt position.
- Prepare the required shims.
- Remove the sensor from the frame.
- Place the required shims at the correct positions (Pictures 37 & 38 on page 44).
- Replace the sensor (Picture 39 on page 44).
- Finally bolt down the sensor.
- Insert all the bolts and start tightening alternatively from the middle outwards. The bolts must be treated with medium strength “Loctite 243”. The recommended fastening torque is 55 N*m.
- Check and record the final sensor height.

Table 8 on page 49 (Annexure E) must be completed to record the shims used and final height of installation.

Figure 5 on page 26 (Annexure A) contains details of the shim sizes.
6.8 Sealing of sensor

It is important to seal the edge of the sensor with a flexible seal to keep water from penetrating between the frame and the pavement. Although the epoxy provides a deep barrier, the expansion between the frame and pavement will cause small cracks to appear next to the frame over time.

A flexible seal is provided directly between the frame and the pavement. For this a number of materials are available (typically bridge expansion joint materials such as Natprolastic, Plyastic and ABE Hot-melt). Refer to Annexure C for a specification sheet of ABE Rock Bitumen hot-melt.

The following sealing method is suggested, to improve the long-term stability of the site:

- After the sensor has been placed, cut a 10 x 8mm deep saw-cut directly next to the frame. Take care not to damage the feeder (Diagram 8).

![Diagram 8: Flexible seal around installation frame](image)

- Clean out the slot and ensure that no epoxy residue remains on the steel of the frame in the slot area.
- The slot must be dry before applying the flexible seal.
- Prepare the flexible sealant. In the case of ABE Hot-melt, heat up the compound until it is soft enough to pour (Picture 40 on page 45).
- Pour the sealant into the slot and the cavity between the sensor and the frame (Diagram 7 & Picture 41 on page 45).
- Note: Mask off the lifting corner of the sensor to prevent sealant from filling the corner (Picture 42 on page 45).
- In the case of ABE Hot-melt, excess material can be removed from the sensor by heating a spatula and scraping it off.
- Do not seal the bolts.

6.9 Finishing off

In the case of a single sensor, the full width of the lane can be painted. This will create the illusion that the sensor spans the full width of the lane. This will enhance the appearance of the sensor and discourage drivers to try and avoid it.

Mask of the area that has to be painted (Picture 44 on page 45). Use a bitumen emulsion (COLSEAL) to paint the area (Picture 45 on page 45).
6.10 Connecting the sensors

The detail of how to connect the capacitive weigh sensors to the Mikros Systems Traffic Event Loggers (RAKTEL) is discussed in Annexure F: Terminating Loop and Capacitive Sensors to RAKTEL.

6.11 Testing and verification of installation

The Capacitive WIM sensor must be tested **before installation**. This will ensure that a correctly functional sensor is installed. It must be tested again **after installation**.

The sensor has to be connected to a Mikros Systems Traffic Event Logger, fitted with the appropriate weigh interfaces for testing. Use a Laptop computer that has the correct version of the Telcom program loaded.

The installer must check the following three parameters:

1. The BASECOUNT of the sensor connected to a logger. The sensor is set at the factory to have a BASECOUNT of 32700 at room temperature. This BASECOUNT is dependant on temperature and will drift as the sensor cools down or heats up. The indicated value must be recorded on the check sheets (Annexure E on page 47.)
2. The indicated SENSOR TEMPERATURE. This value should be within ± 4° of the prevailing temperature. Note that the sensor covers a large area. The temperature check should be as representative as possible. When installed in the road, the sensor is heated by direct sunlight and cooled (or heated) by prevailing pavement conditions. This would influence the temperature of the sensor. The indicated values must be recorded on the check sheets (Annexure E on page 47).
3. The WEIGH-ERROR status. This parameter is an additive indicator as WEIGH-ERRORS occur this parameter increases. Except for the initial connecting condition, no WEIGH-ERRORS are allowed.

Final commissioning and acceptance is part of the calibration procedures that does not form part of this document.

6.12 Regular maintenance

It is recommended that the bolts be regularly checked. After the first installation the bolts must be checked after 3 months to confirm that the sensor has settled in well under traffic (recommended torque is 55 N*m). A minimum of two maintenance visits per year is recommended, but local conditions and prevailing QA procedures might require more regular visits.

The final sensor height should also be checked for possible settlement.

Any cracks that appear around the sensor frame and the feeder slots should be filled with an appropriate low viscous sealant.

These procedures should form part of regular checks that must be included in an operational quality system.

6.13 Shipping and packing information

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<tr>
<th>Item</th>
<th>Description</th>
<th>Dimensions mm (overall)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>S20 Capacitive WIM sensor</td>
<td>2015 x 540 x 16</td>
<td>50</td>
</tr>
<tr>
<td>B</td>
<td>Installation frame for S20 sensor</td>
<td>2030 x 555 x 35</td>
<td>120</td>
</tr>
<tr>
<td>C</td>
<td>Shipping frame for 4 S20 sensors (empty)</td>
<td>2160 x 645 x 160</td>
<td>60</td>
</tr>
</tbody>
</table>
Annexure A: Figures
Figure 1: 2m Capacitive WIM Sensor Installation Elements
Figure 2a: 2m Capacitive WIM Sensor Detail
(Dimensions in mm)

(A) Bevelled corner for lifting out of frame
(B) Lead out feeder cable protected by spiral

Note: Dimensions in mm
All outer dimensions ±2 mm

Total Weight: 50kg
Figure 2b: 2m Capacitive WIM Sensor Installation Frame Detail
(Not for manufacturing detail. Dimensions in mm)

**TOP VIEW**

2030

11 x 60 mm pour holes

18 x 10 pre-tapped mounting holes

**SIDE VIEW**

Expanded metal strips

12 mm mild steel bottom plate: 5mm outer frame

**Note**: Outside of frame is sand-blasted

Dimensions in mm

**Total Weight**: 120kg
Figure 3: Typical Installation Dimensions for Single Sensor and Hard Shoulder
(Dimensions in mm unless otherwise indicated)
Figure 4: Typical Dimensions for Screening Lane
(Dimensions in mm unless otherwise indicated)
Figure 5: Typical Dimensions for a Single Lane with 2m Sensor
(Dimensions in mm unless otherwise indicated)
Figure 6: Sample Site Layout Sketch
(Dimensions in mm unless otherwise indicated)
Holes = 12 mm diameter
All dimensions in mm
Material: Galvanized mild steel
Thickness: 0.5 mm, 1.0 mm & 1.6 mm
Quantity: One set of each thickness: Set = 2 of A & 7 of B (total of 9)

Figure 7: Shim plate detail
(Dimensions in mm unless otherwise indicated)
Annexure B: Required equipment and materials lists

*Note:* These are additional requirements to loop installations as described in that document. All the requirements for loop installations must also be met.

(Installation of Loops for Traffic Data Logging Station MS001-96200-52)
### Material: (nominally for one sensor installation)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Minimum Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Capacitive WIM sensor</td>
<td>As required</td>
</tr>
<tr>
<td>2</td>
<td>Installation frame</td>
<td>As required</td>
</tr>
<tr>
<td>3</td>
<td>Support brackets for installation</td>
<td>1 set</td>
</tr>
<tr>
<td>4</td>
<td>Installation frame kit complete (shims, bolts, anchors, earth wire)</td>
<td>As required</td>
</tr>
<tr>
<td>5</td>
<td>20 liter epoxy kit (10 L part A and 10 L part B) per sensor</td>
<td>As required</td>
</tr>
<tr>
<td>6</td>
<td>50 kg clean dry silica filler sand</td>
<td>As required</td>
</tr>
<tr>
<td>7</td>
<td>5 litre acetone cleaner</td>
<td>As required</td>
</tr>
<tr>
<td>8</td>
<td>Sealing putty (500 gm)</td>
<td>As required</td>
</tr>
<tr>
<td>9</td>
<td>Silicone sealant (one tube)</td>
<td>As required</td>
</tr>
<tr>
<td>10</td>
<td>Loctite 243 medium strength</td>
<td>1 medium</td>
</tr>
<tr>
<td>11</td>
<td>Flexible seal (ABE hot-melt) or equivalent 10 kg</td>
<td>As required</td>
</tr>
<tr>
<td>12</td>
<td>20 spare 10 mm x 20 bolts for blocking mounting holes</td>
<td>As required</td>
</tr>
</tbody>
</table>

### Equipment:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Minimum Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pavement breaker with 20mm and 40mm bit (adequate strength)</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>25mm diameter 300mm long concrete drill bit</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Straight-edge (3m)</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Torque wrench (100 N*m)</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Steel rule and or graded wedge</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Disposable gloves</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>Bucket measure (15 liter)</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Mixing bucket (25 liter minimum) (clean and uncontaminated)</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Tarpaulin (10m x 5m)</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Hilti (Kango) hammer action drill (adequate size)</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>10mm Tap set (with cleaning tap)</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>All equipment as listed in loop installation document</td>
<td></td>
</tr>
</tbody>
</table>

### Test equipment:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Minimum Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mikros Systems Weighing Logger</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Laptop with Telcom</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Infrared thermometer</td>
<td>1</td>
</tr>
</tbody>
</table>
Slab installation material:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Minimum Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total volume of mix (one slab)</td>
<td>500 – 600 L</td>
</tr>
<tr>
<td>2</td>
<td>Water</td>
<td>As required</td>
</tr>
<tr>
<td>3</td>
<td>Ancillary</td>
<td>As required</td>
</tr>
</tbody>
</table>

Slab installation equipment:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Minimum Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40/50 Vibrator</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Power mixer</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Set height float</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Wheel borrow</td>
<td>1</td>
</tr>
</tbody>
</table>
Annexure C: Megapoxy, COLSEAL & ABE Rock Bitumen Specifications

The specification sheets of the product referred to have been included in PDF format. To open these Acrobat Reader 7 or later is recommended. In the PDF version of this document these sheets have been added as attachments.
GROUT MIX SPECIFICATIONS

MEGAPOXY:

High strength resin base for epoxy concrete, structurally compatible with Portland cement, concrete and asphalt concrete. Suitable for deck expansion joint nosings and all structural components in which Portland cement concrete or asphalt concrete and epoxy concrete are in combination.

Mixing proportions : Equal parts “A” and “B” by weight or volume.

Work time : 15 Minutes

Set time : 1 Hour

Film touch dry time at 25°C : 1½ Hours

Specific gravity : 1.1

Colour when mixed : Black

Compressive strength : 28 Mpa

Tensile strength : 6 MPa

Elongation at break at 25°C : 40%

Impact strength at 25°C : 22.5 kg cm/cm²

SURFACE PREPARATION

Asphaltic concrete : Scrub with water containing detergent, hose and allow to dry.

NOTE : Megapoxy CT will stick to damp surfaces, but it is advisable to completely dry the surface whenever possible.

RAPID SET, HIGH TENSILE CONCRETE:

Megapoxy CT mixed with dry, clean sand and aggregate provides high compressive and tensile strength concrete, suitable for deck expansion joint nosings and other applications where impacts and tensile stresses cause early break up of asphalt and Portland cement based concretes.

MEGAPOXY CT MORTAR:

- 1 Part by volume mixed Megapoxy CT
- 2½ Parts volume epoxy quality sand.

“PLASTIC” HIGH SLUMP MEGAPOXY CT CONCRETE:

- 1 Part by volume mixed Megapoxy CT.
- 2½ Parts by volume epoxy quality sand.
- 4 Parts by volume 5mm diameter dry crushed stone.

LOW SLUMP, DRY PACK MEGAPOXY CT CONCRETE:
• 1 Part by volume Megapoxy CT.
• 2½ Parts by volume epoxy quality sand.
• 4 Parts by volume 5mm diameter dry crushed stone.

CALCULATION OF REQUIREMENTS

Mortar : 1 Liter mixed Megapoxy CT and 2½ liters sand yield 2 500 cubic cm of concrete.

“Plastic” high slump concrete : 1 Liter mixed Megapoxy CT, 2½ liters sand and 2 liters 5 mm crushed stone yield 3 150 cubic cm of concrete.

Low slump, dry pack concrete : 1 Liter mixed Megapoxy CT, 2½ liters sand and 4 liters 5mm crushed stone yield 4 100 cubic cm of concrete.

WEAR AND SKID RESISTANT SURFACES FOR ROADS, PAVEMENTS AND INDUSTRIAL FLOORS

Mix Megapoxy CT Part “A” and Part “B” in equal proportions and apply by squeegee, brush or serrated edge trowel to asphalt or Portland cement concrete surfaces. Cast sharp grit broadly or aggregate over the freshly applied Megapoxy CT and allow setting for approximately 6 hours. Sweep the surface to remove excess aggregate.

RECOMMENDED AGGREGATES

• River sand.
• Carborundum grit.
• Calcined Bauxite.
• Crushed Scoria rock.

APPLICATION

• Remove all grease from the frame’s bonding areas (use grease remover like acetone).
• Pour the mix into the recess and place the frame.
• Follow the prescribed procedure.

NOTE : In cold temperature, Megapoxy CT Winter Grade should be used.
MEGAPOXY CT

TAR EPOXY MAINTENANCE COATING

MEGAPOXY CT is a 100% solids epoxy tar coating, which provides excellent protection against corrosive environment. The coating is tough, resistant to physical damage and will not flow with heat. MEGAPOXY CT is used for the permanent waterproofing of pipes, drains, sewerage works, piles, basements etc.

MEGAPOXY CT can be used for protection of steel against corrosion and other civil engineering applications requiring a black, chemical resistant, epoxy-coal tar coating. MEGAPOXY CT is also available in Winter Grade (Frost Setting).

PROPERTIES UNCURED

<table>
<thead>
<tr>
<th>Standard</th>
<th>Winter Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixing Ratio by volume</td>
<td>1 Part “A” to 1 Part “B”</td>
</tr>
<tr>
<td>Pot life of 1 litre mix</td>
<td>15 minutes at 23°C</td>
</tr>
</tbody>
</table>

PROPERTIES CURED

- Ultimate Compressive Strength: 27 MPa
- Ultimate Tensile Strength: 6 MPa
- Adhesive Strength to Concrete: 1.7 MPa
- Adhesive Strength to Steel: 15 MPa

APPLICATION

MEGAPOXY CT should be applied in two or more coats to give a build-up of 0.25 mm minimum. MEGAPOXY CT can be mixed with epoxy quality sand to make epoxy mortar.

PACKAGING

MEGAPOXY CT is available in 20 litre packs. In each pack Part “A” and Part “B” are premixed in correct proportions for immediate use.

VIVACITY ENGINEERING PTY. LTD.
MATERIAL SAFETY DATA SHEET

COMPANY DETAILS

Company: Vivacity Engineering Pty. Ltd
A.C.N. 001-483-557

Address: 3 Seton Road, Thornleigh, 2120

Phone No: (02) 9875-3044
Fax No: (02) 9875-3665
Emergency Phone No: (02) 9484-7958 (After Hours)

IDENTIFICATION

Product Name: Megapoxy CT - Part A
(Use in conjunction with Megapoxy CT - Part B)

Classification: Classified as hazardous according to criteria of Worksafe
Australia

Dangerous Goods Class: Not classified as dangerous goods.

UN Number: Not applicable.

Hazchem Code: Not applicable.

Poisons Schedule No: S - 5

Packaging Group: Not applicable.

Packaging: 10 litre metal pail

PHYSICAL PROPERTIES

Appearance: Clear to pale liquid.

Boiling Point: More than 203 deg. C.

Thermal Decomposition: More than 203 deg. C.

Vapour Pressure: Less than 0.01 Pa.

Flash Point: More than 200 deg. C. (P.M.C.C Method ASTM D 83)

Specific Gravity: 1.10 - 1.15 @ 25 deg. C.

Solubility in Water: Insoluble in water.

Odour: Mild.
Colas COLSEAL™ Specification sheet:

Description

Colas COLSEAL™ is a SBR latex modified mineral filled butyl rubber emulsion cold pour crack sealer.

Uses

Colas COLSEAL™ is suitable for sealing cracks of medium activity with a width of less than 5mm. The product can be applied cold and diluted with water if required.

Properties

Colas COLSEAL™ can easily be applied by hand and requires no heating. The residue is highly elastic and has enhanced rheological binder properties.

Specifications

Colas COLSEAL™ conforms to CO-E1: Specification for modified binder crack sealants.

<table>
<thead>
<tr>
<th>Binder Properties</th>
<th>Requirement</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Softening point, °C</td>
<td>N/A</td>
<td>ASTM D-52</td>
</tr>
<tr>
<td>Penetration @ 25°C, Pas</td>
<td>N/A</td>
<td>ASTM D-4402</td>
</tr>
<tr>
<td>Surface tension, mN/m</td>
<td>N/A</td>
<td>ASTM D-972</td>
</tr>
<tr>
<td>Elastic recovery @ 50°C, %</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Flow @ 60°C, mm</td>
<td>N/A</td>
<td>MS-12</td>
</tr>
<tr>
<td>Binder content, mm³/g</td>
<td>N/A</td>
<td>ASTM D-344</td>
</tr>
</tbody>
</table>

Determined on the residue of the elastomer.

Directions for use

1. Blow out the cracks with high pressure air. Ensure that there is no debris, dust, or other contaminants present on the surface.
2. Pour the COLSEAL™ into the cracks with a small container and allow to dry. The product can be brushed into finer cracks with a soft broom or brush.
3. Surfaces that are extensively aged should be heated with a gas torch to remove any dry residue. Apply a thin coat of COLSEAL™ at a rate of approximately 1.0 litres/m². After applying a 50:50 diluted coat of COLSEAL™ and water should be applied on top of the hot asphalt.
4. If greater penetration is required off finer cracks, the product can be diluted with up to 10% water.
5. If the treated surface is slightly tacky during hot weather conditions, a thinning layer of coarse sand or crushed rock can be applied over the surface.
6. The surface can be opened to traffic as soon as the waxy residue of the product has changed from brown to black.
7. Uptake of water will be affected by the COLSEAL™ temperature of the product.

Colas provides the above data sheet in good faith and is provided without warranty, representation, implied or licent of any kind, as such Colas shall not be liable for cost, damages or losses incurred as a result of reliance on the above information.

http://www.colas.co.za/data_sheet_colseal.htm

2005/01/12
Rock Bitumen

Hot-melt bituminous compound

DESCRIPTION

Used to bond bitumen, AGCS.

USER

For transcription purposes, all data should be saved as text files for easy processing.

APPLICATION

Surface mix batches must be used immediately into the bitumen without delay.

PROPERTIES OF DRY MATERIAL

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosity</td>
<td>Slight</td>
</tr>
<tr>
<td>Water content</td>
<td>0-2%</td>
</tr>
</tbody>
</table>

PROTECTION ON COMPLETION

Not required unless exposed to water or moisture. Avoid exposure to temperatures above 60°C.

TEMPERATURE AND RELATIVE HUMIDITY

Suitable for 40°C and 80% relative humidity.

MODEL SPECIFICATION

Hot-melt bitumen is supplied as a red, semi-fluid, solid in a 100-litre drum.

PACKAGING

This product is supplied by a 100-litre bitumen tank.

SAFETY PRECAUTIONS

Rinsing is confined to a closed premises, strictly observe all safety instructions. Keep out of reach of children.
Annexure D: Picture gallery
Picture 1: Marking of cut-out

Picture 2: Cross cuts

Picture 3: Breaking thin pavement

Picture 4: Excavate recess

Picture 5: Clean excavation

Picture 6: Seal excavation

Picture 7: Close-up of seal
<table>
<thead>
<tr>
<th>Picture 8: Mixing concrete</th>
<th>Picture 9: Pour &amp; vibrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture 10: Float to height</td>
<td>Picture 11: Finished slab</td>
</tr>
<tr>
<td>Picture 12: Drill anchor holes</td>
<td>Picture 13: Mask excavation</td>
</tr>
<tr>
<td>Picture 14: Breaking thick pavement</td>
<td>Picture 15: Excavation in thick pavement</td>
</tr>
</tbody>
</table>
Place frame check for high spots

Drill anchor holes

Roughen frame bottom

Apply release agent

Clean bottom of frame

Block off mounting holes

Fix installation rig

Align and set frame
Picture 24: Prepare frame

Picture 25: Check anchor holes

Picture 26: Two part epoxy grout

Picture 27: Mixing epoxy grout

Picture 28: Adding silica sand filler

Picture 29: Pour grout mix

Picture 30: Pour thin mix in anchor holes

Picture 31: Placing frame in epoxy
<table>
<thead>
<tr>
<th>Picture 32: Work in all epoxy</th>
<th>Picture 33: Scrape out excess epoxy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture 34: Clean out frame</td>
<td>Picture 35: Mark feeder lead out position</td>
</tr>
<tr>
<td>Picture 36: Measure shim requirement</td>
<td>Picture 37: Placing shims</td>
</tr>
<tr>
<td>Picture 38: Aligning holes</td>
<td>Picture 39: Placing sensor on shims</td>
</tr>
<tr>
<td>Picture 40: Preparing hot-melt</td>
<td>Picture 41: Pouring hot-melt</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>Picture 42: Hot-melt on lift corner</td>
<td>Picture 43: Sensor sealed and bolted</td>
</tr>
<tr>
<td>Picture 44: Mask “paint” area</td>
<td>Picture 45: Painted area</td>
</tr>
</tbody>
</table>
Annexure E: Additional sample documentation

*Note:* These are additional documentation to loop installations as described in that document. All the documentation for loop installations must also be completed.

(Installation of Loops for Traffic Data Logging Station MS001-96200-52)
Table 4b: TEL site Capacitive WIM sensor description sheet

<table>
<thead>
<tr>
<th>Lane</th>
<th>Sensor serial number</th>
<th>Position in lane L/R</th>
<th>BC Before</th>
<th>Temperature Before</th>
<th>BC After</th>
<th>Temperature After</th>
<th>Weigh Errors Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3</td>
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<td>3</td>
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<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1: If more than one sensor is installed in a lane indicate where the sensor is positioned relative to the direction of traffic.

Note 2: BC indicates the BASECOUNT Capacitive weigh sensor as indicated on Telcom.

Note 3: Record the temperate in degrees Celsius.

Note 4: No sensor should be left installed that indicates Weigh Errors after proper connection has been made and the logger reset.
### Table 7: Laboratory certificate for support slab cubes

Name of site: 
Site number: 
Date of pour: 
Name of Laboratory: 
Name of contractor: 

<table>
<thead>
<tr>
<th>Lane</th>
<th>Cube number</th>
<th>24 hr strength</th>
<th>Date of test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Signatures: 

<table>
<thead>
<tr>
<th>Name</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lab representative: 
Contractor: 

Table 8: Capacitive WIM Installation Shim Usage

<table>
<thead>
<tr>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
<th>P6</th>
<th>P7</th>
<th>P8</th>
<th>P9</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:

- On the initial line record the depth below the surface in mm without shims.
- Fill in the number of each shim required (the final step between positions must be smaller than 0.5mm)
- On the Final line record the installed height with shims.
Table 6b: Acceptance certificate for TEL cap WIM site

<table>
<thead>
<tr>
<th>Description</th>
<th>In Order</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Documentation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Detailed site sketch</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>b. Locality sketch</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>c. Locality information Table 1</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>d. Lane information Table 2</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>e. Approvals Table 3</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>f. Sensor description Table 4 &amp; 4b</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>h. Construction quality report Tab 5</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>2. Physical Appearance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Saw-cuts and sealant</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>b. Trenches</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>c. Mounting block</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>d. Draw boxes</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>e. General</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>3. Loops Table 6 Filed</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>4. Capacitive sensor Table 4b Filed</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>5. Support slab approved</td>
<td>Y/N</td>
<td></td>
</tr>
</tbody>
</table>

Site Acceptable [YES] [NO]  If no attach a snag list.

Signatures:

<table>
<thead>
<tr>
<th>Name</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client representative:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractor:</td>
<td></td>
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</tbody>
</table>

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Note: The tables of this Annexure (plus all the loop installation tables) have been included in PDF format for ease of reproduction for field use. To open these Acrobat Reader 7 or later is recommended. In the PDF version of this document these sheets have been added as attachments.

<table>
<thead>
<tr>
<th>Table 1: TEL site locality information</th>
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</thead>
<tbody>
<tr>
<td>Name of site</td>
</tr>
<tr>
<td>Site number</td>
</tr>
<tr>
<td>Number of lanes</td>
</tr>
<tr>
<td>Type of site</td>
</tr>
<tr>
<td>Client</td>
</tr>
<tr>
<td>Route number</td>
</tr>
<tr>
<td>Road number</td>
</tr>
<tr>
<td>Section number</td>
</tr>
<tr>
<td>Km (post)</td>
</tr>
<tr>
<td>GPS coordinates</td>
</tr>
<tr>
<td>Speed limit direction 1</td>
</tr>
<tr>
<td>Description direction 1</td>
</tr>
<tr>
<td>Speed limit direction 2</td>
</tr>
<tr>
<td>Description direction 2</td>
</tr>
<tr>
<td>Date of construction</td>
</tr>
<tr>
<td>Other information</td>
</tr>
</tbody>
</table>
Annexure F: Terminating Loop and Capacitive Sensors to RAKTEL
General

Termination of all sensor types to Mikros Systems Traffic Event Loggers (TEL) is done with screw terminals. The advantage of this system is that no special tools or connectors are required in the field. Installation and maintenance procedures are simplified and if adhered to the “good practice” procedures set out below contact problems are minimized.

The most common terminal box used is the general purpose sensor terminal box. This box is used for loops, axle piezos, capacitive and bending plate WIM sensors.

The terminal box is connected to the appropriate port on the TEL via a ribbon cable (DB15 male plug). For each application the port ID will be indicated on the terminal box. The type of sensor and sensor set will also be indicated on the terminal box.

For loops the inputs are numbered A to H or the first set of 8 loops and I to P for the second set of 8 loops.

For axle piezos and capacitive or bending plate sensors, the inputs are numbered 1 to 8.

Note that every second connection point is the common signal ground (GND), indicated on the sensor terminal box with a line.

**Picture 1: General Sensor Terminal Box**
Good connection practice

To ensure good long term contact quality the following point must be adhered to:

- Non corrosive approved wire types must be used.
- Strip the ends of the cables neatly without damaging the individual strands.
- Do not solder the wire ends.
  - Flux caused residue that inhibits contact.
  - The effective contact between the wire and screw terminals is reduced.
- Do not use crimp-on connector ferrules.
- Do not twist the striped wire end.
  - Twisting causes the screw terminal to lose contact over the long term as the twist sags.
- Shape the wire ends so that the strands are kept as parallel as possible.
- Avoid loose individual strands that may cause shorts.
- Tighten firmly but not excessive.
- Do not leave the bare ends too long or short. Strip them to a length of about 6mm.
  - The stripped end should be completely in the connector.
  - Guard against screwing down on the insulation when the ends are cut too short.
- Never use unmatched screw terminal “plugs” and “sockets”. (To easily identify the correct type, use only the “light” green screw terminal connectors).

![Loop wire](image1)
![Coaxial wire](image2)

**Picture 2: Wire termination**
Available Sensor Terminal Boxes

**Note:** The terminal boxes are usually mounted on mounting plate inside the instrument housing.

**Loops:**

Loop Terminal ASSY 8 Loops. Part number: MS001-50260

Fitted with active lightning protection unit ZAP1. Part number: MS001-50450

![Loop terminal image]

Ribbon cable to TEL Port  
To 12v red - positive  
Green to earth bar  
Loop wires

**Capacitive sensor:**

Weigh Terminal 8 channel. Part number: MS001-50220

![Capacitive sensor image]

Ribbon cable to TEL Port  
Coax cables to capacitive sensor
Combination Loops & Axle Piezo (RAKTEL):

RAKTEL Terminal ASSY 2 x 8 loops plus 8 Piezo Axle. Part number: MS001-50230

Fitted with active lightning protection unit ZAP1. Part number: MS001-50450

Fitted with active lightning protection unit ZAP2. Part number: MS001-50460