



INTERNATIONAL ROAD DYNAMICS INC.

Installation Manual PAT Weighpad and Frame

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INTERNATIONAL ROAD DYNAMICS INC.

QUALITY IN MOTION

Installation Manual PAT Weighpad and Frame

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For further information or assistance, call IRD's Customer Service Hotline
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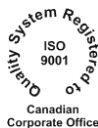
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1.0 INTRODUCTION

This manual describes the installation procedures for the following IRD PAT Traffic Weighpad frames set in epoxy grout:

- 1.75 meter Weighpad imperial frame (Drawing no. 813005-01),
- 1.75 meter Weighpad metric frame (Drawing no. 813005-03),
- 1.55 meter Weighpad metric frame (Drawing no. 813005-08),
- 1.25 meter Weighpad metric frame (Drawing no. 813005-09).

The IRD PAT Traffic Weighpad scales are designed for use in a Weigh-In-Motion system with medium and high speed applications. The weighpads of Weigh-In-Motion scales are subject to severe conditions in normal traffic such as abrupt load changes, temperature fluctuations, water, sunlight, etc. For the system to operate correctly and without failures, it is important to install the frames and weighpads very carefully in accordance with these instructions.

IMPORTANT: It is recommended that the installation of all Weigh-Motion systems be performed under the supervision of a qualified IRD representative.

In a typical installation, there are two weighpads used per lane of traffic, one for each wheel path. The two weighpads per lane of traffic determine individual weights for both the left and right tires of each axle on a vehicle. The weighpad is designed to detect and measure the amount of bending that occurs in the metal plate of the scale when the tires of a vehicle passes over it. This bending strain is then translated into a weight measurement by the electronics. The weighpad is approximately 1 inch (25 mm) thick and is mounted on supports within the frame. The strain gages are mounted in a machined groove on the underside of each vulcanized steel weighpad.

The frames are secured into a shallow excavation in existing pavements by means of an epoxy adhesive and angled anchor bars. The anchors are inserted into 1" (25 mm) diameter holes bored approximately 8" (200 mm) into the pavement base. The weighpads are shimmed to the correct height in the frames and the weighpads are held in place with retaining bars fastened to the frames. The complete frame and weighpad assembly has a total depth of 2.25" (60mm). All connections within the weighpad are sealed, forming a water-resistant scale. The signal cable comes attached to the weighpad as a single length of shielded cable that is sealed at the cable entrance. After installation, silicone sealant is applied to all open holes on the surface and the gap between the scale platform and the scale frame.

Note: In case of reinforced concrete pavement, consult the construction or field engineer before cutting.

IMPORTANT: This frame is designed for use in normal Asphalt pavement or Portland Cement Concrete (PCC) roadways with a thickness of 300 mm (10 in) or greater. For applications in roadways less than 300 mm (10 in) thickness, additional support under the frame must be provided before frame installation; this can be done using one of the following installation methods:

- cast in place concrete frame, IRD Drawing no. 813005-04
- concrete base for an epoxy grout installation, IRD Drawing no. 813005-05
- pre-cast vault installation, IRD Drawing no. 813005-07.

1.1 CHOOSING THE INSTALLATION SITE

The following aspects have to be observed when choosing the installation site for the Weighpads:

- Traffic flow should be smooth and continuous. Vehicles to be measured must be able to pass over the weighpads without accelerating or braking.
- The roadway is part of the WIM system and therefore must be as flat and uniform as possible for a minimum of 200' (60 M) before and 50' (15 M) after the weighpad. The entire measuring distance must be straight, with no curves or grades. The longitudinal slope must not exceed 3% for statistical traffic data collection or 1% for weigh stations. A transverse slope of approximately 1% at weigh stations is desirable. For increased accuracy requirements, the road surface must meet ASTM E1318 specifications.
- Wheel grooves or rutting existing in the measuring area must be removed. The surface must be smooth and even enough that a 6" (15 cm) diameter circular plate of .25" (6 mm) thickness cannot be passed under a 20' (6m) straightedge.
- It is possible for water to penetrate into the frame or under installed weighpads. This leads to false axle load measurements, especially in the winter when water freezes under the weighpads. Therefore, it is necessary to install a drain pipe at the lowest point of the frame recess. The drain should be 1.5"- 4" (4 cm - 10 cm) diameter and sloping into an existing drainage system, a coarse gravel well (French drain), or a protected daylight drain outlet, as shown in the installation drawing.
- When passing the measuring spot, trucks must not have any bounce (dynamic loading) caused by irregularities in the road surface. Profilograph records do not always show the long wave repeating unevenness, which can create high dynamic axle weight variations.

In case of doubt, contact International Road Dynamics Inc. for verification. IRD reserves the right to refuse a site installation or guarantee performance if the above conditions are not met.

1.2 INITIAL PARTS INSPECTION

When the weighpad scales arrive at the receiving depot, they should be unpacked to make sure all the required parts have been received (refer to section 2.4.2).

Inspect all parts for possible shipping damage. Lay each frame on a flat surface and check if it has been bent by laying the straightedge on the support rail along the full length of the frame adjacent to the studs. Minor distortions can be corrected by cold setting the frame either in a press or by other mechanical means.

1.2.1 WEIGHPAD ELECTRICAL CHECK

Measure electrical proprieties of each weighpad. Perform test measurements at the cable ends to check that the weighpads are within tolerances listed in the table below:

Size of weighpad (m)	Input Resistance (GRN - YEL)	(+/-)	Output Resistance (BRN - WHT)	(+/-)	Insulation Resistance
1.25	675 Ω	10 Ω	600 Ω	10 Ω	>250 M Ω
1.55	795 Ω	20 Ω	720 Ω	10 Ω	>250 M Ω
1.75	975 Ω	20 Ω	840 Ω	10 Ω	>250 M Ω
1.95	1092 Ω	20 Ω	960 Ω	10 Ω	>250 M Ω

The zero point should also be checked and should be less than 0+/-5 mV for a new pad and up to +/-10 mV for a used pad when 5 VDC is applied to the excitation. If a weighpad fails any of these checks then it is likely not working well and should be replaced.

2.0 CONSTRUCTION TOOLS REQUIRED FOR INSTALLATION

To avoid unnecessary waiting periods during installation, it is important to check that all construction tools listed below are available and in good operating condition before beginning. This is particularly important if there is a time limit for the lane closure.

2.1 HEAVY EQUIPMENT

2.1.1 CONTRACTOR SUPPLIED

Item	Quantity	Description
1	1	Air Compressor, 160CFM @ 90 PSI minimum.
2	1	Air driven Rock Drill or electric Hammer drill, with a bit 1"(25mm) in diameter and approximately 20"(500mm) long.
3	1	Air driven jackhammer (typically 60 lbs. (25 kg), or electric chipping hammer with 1" chisel and 3" - 4" spade bits, and appropriate safety equipment.
4	1	Air blower wand for blowing away debris and drying the slot.
5	1	Concrete saw (recommend 11 or more horsepower) with diamond blades to cut up to 4" (100mm) depth
6	1	Ditch digger or Backhoe for conduit trenches.
7	1	AC Generator (recommend 4KW or larger) and 150' (50m) extension cables.
8	1	Water Tank with water for concrete cutting and wash down.
9	1	If installing below 50 °F (10 °C), a gas space heater or torpedo heater and two sheets 4'x8' plywood.
10	1 set	Conduit cutting and threading tools, up to the maximum size of conduit specified.

2.2 POWER TOOLS

2.2.1 CONTRACTOR SUPPLIED

Item	Quantity	Description
1	1	Industrial 3/4" drill, approximately 200 RPM, with heavy duty mixer attachment 16-20" long.
2	1	Angle Grinder with cutoff wheels and grinding wheels for steel and pavement (cupped diamond wheel recommended for pavement), with safety glasses.
3	1	Industrial vacuum cleaner
4	1	Propane gas burner, for drying pavement
5	1	Air or electric impact wrench with 3/4" socket.

2.3 HAND TOOLS

2.3.1 CONTRACTOR SUPPLIED

6	1	Torque wrench with 3/4" socket, rated to at least 100 Ft–Lb.
7	1	Hand tools and accessories: Tin snips, Hack saw, 2-5 lb hammer, Caulking guns
8	2	4' Bubble level to check flatness and position the frame/weighpad
9	1 each	10-15' straight edge, measuring wedge, and 100' tape measure for ASTM smoothness test.
10	1	1 Fish tape, recommend 100' minimum.
11	1	Pick, shovel, broom, spade, trowel, and wheel barrow.
12	1	Digital Volt Meter (DVM)

The items below are consumables that will need to be replenished for each lane installed:

13	3	2" and 4" plastic putty knives, wire bristle brush.
14	1	Chalk, marking paint, and string or light rope
15	per person	Latex gloves, safety glasses, and protective clothing.

2.4 INSTALLATION MATERIAL

2.4.1 CONTRACTOR SUPPLIED

Item	Quantity	Description
1	Per site plans	Galvanized steel conduit as per site plan, for cables and drain water. If there is a possibility of installing the conduit below the frame and road surface prior to road paving, choose a diameter of 2" to 3", for maximum ease of cable installation and to avoid future maintenance issues. If the conduit has to be installed in the road surface, choose a diameter of 1-½" or 2" for crush strength. For the drain water, ABS pipe can be used if crush strength is not a concern. For the electrical conduit, rigid PVC can be used if crush strength is not a concern.
2	Per site plans	Elbows, galvanized, diameter matching conduit above.
3	Per site plans	Conduit grounding bushings for weighpad frames and all junction boxes. Alternately, if PVC conduit is used, a ground rod and connectors.
4	Per site plans	#8 solid copper ground wire
5	Per site plans	Pull boxes. Used traffic load rated boxes if located in exposed areas.
6	80lb per frame	Premixed Portland cement mortar, without rocks. Recommend type is Euclid Chemical Speed Crete Red Line or RapidSet Cement All (Blue Bag)
7	Per site plans	Cable Marking tape (length depending on ditch length). The plastic tape with bright color red and white stripes is inserted before closing the ditches. It is used as a warning in the event of future earthmoving operations.
8	3 per frame	Caulk tubes of silicone sealer.
9	1 oz. per frame	Anti-seize grease
10	2	Rolls of 2" duct tape (about 60' /frame) One roll of 4" if available.
11	4	8 strips of cardboard approximately 6' x 1' (2m x 30 cm) and plastic sheet. These will be used to make a header box to aid pouring the epoxy around the frame
12	1	Spray paint: epoxy primer (black) and cold galvanizing (gray)
13	1' per frame	1" flexible PVC conduit if loop lead-in cables are routed through the weighpad conduits.
14	4 per lane	Cable markers for cable identification
15	10 per frame	4" cable ties or lengths of rebar wire for anchor tie downs
16	1 per frame	1/8" drill bits (required if there are no prefabricated holes in the anchor recess tabs)

2.4.2 IRD SUPPLIED

Reusable frame height gauge kit	Metric frame height gauge assembly (190587) or Imperial frame height gauge assembly (190578)
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IRD PAT Weighpad components, dependant on the width of weighpad:

Description (2 required per lane)	1.75m WP	1.55m WP	1.25m WP
Weighpad WP-S Complete (with lead cable)	PT603013S	100628-XX	PT604430S
Frame BP Metric Comp.	PT603017	116007	PT603016
Frame BP IMP Comp.	116002	N/A	N/A
WP-S Frame Installation Kit*	190566	190613	190614
WP-S 1.75m Frame Installation Kit H/W	190609	190609	190609

*Jig components from this kit are reusable, but should be replaced when components are damaged or contaminated with epoxy so that they do not mount flush with the frame. Kit 190566 contains sufficient hardware to install 4 frames. If the jigs are to be used for more frame installations, additional hardware (sufficient for 4 frames) must be ordered as part no. 190609

Consumables:

Item	Quantity	Description (Part #)
1	4 pails per frame	Epoxy Flexolith redi-pak Kit AS478 (340082). Approximately 12 gallons of two-part filled epoxy per frame. Recommended brand is "Euclid Chemical Flexolith Ready Pack," shipped in 5 gallon pails, each yielding about 3 gallons or 0.4 cubic feet (0.011 cubic meters) with full amount of aggregate. <i>Note that this estimate of quantity assumes the standard excavation dimensions are used. For each extra cm (.25 inch) depth of excavation, approximately one more pail of epoxy mix will be required.</i>
2	1 pail for every 2 feet of trench in pavement	Epoxy Flexolith redi-pak AS478 (340082). Typically at least 4 pails are required to fill the trench across the shoulder if the conduits are not cast into the roadway prior to installation.

2.5 INSTALLATION DRAWINGS

Refer to the installation drawing for the size of weighpad to be installed, as referenced in the table below for assembly and parts details. The drawings also provide key dimensions and the steps for the installation of the frame.

Drawing	IRD P/N
WP 1.75m Imperial Epoxy	813005-01
WP 1.75m Metric Epoxy	813005-03
WP 1.55m Metric Epoxy	813005-08
WP 1.25m Metric Epoxy	813005-09

3.0 INSTALLATION PROCEDURE

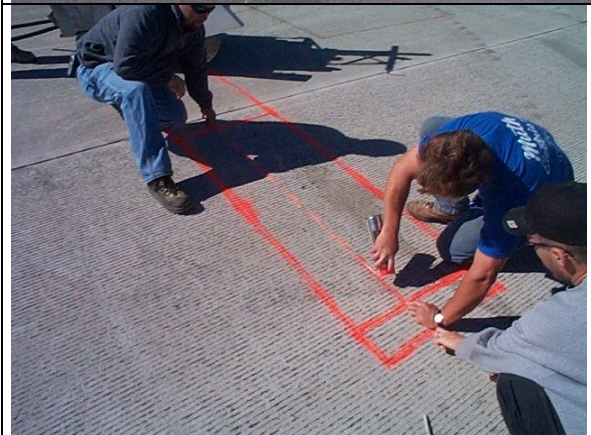
The following steps need to be performed in sequence to install the PAT Weighpad scales.

3.1 SAW CUT AND EXCAVATION

3.1.1 PREPARATIONS



Ensure sufficient protection of the job site by arranging appropriate traffic control and signage.



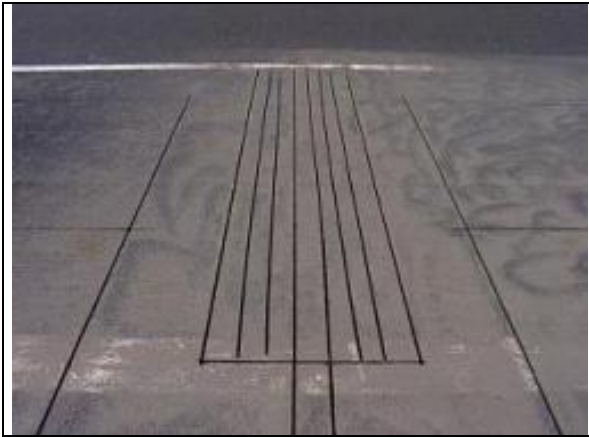
With string line and marking paint, mark exact installation locations for frames (and induction loops), also for cable conduits and drain pipes.

Note: the installation must be square to the direction of traffic; refer to the IRD General Installation Guidelines for Triangle Method for the recommended method of determining the installation layout.

3.1.2 SAW CUT



Cut the marked frame border 2.5" (6.4 cm) deep with the pavement saw; do not cross-cut over corners to avoid risk of future breaking.



Cut area to be excavated into smaller strips to ease the breaking out at the required depth.

Do not cross-cut corners or past the edges of the perimeter cut to avoid risk of future breaking.

Cut trench for water drainage pipe and cable conduit to a total depth of 4" (10 cm).

3.1.3 EXCAVATE



Chip out the strips of pavement with the jackhammer taking care not to damage the vertical wall of the outside of the excavation.



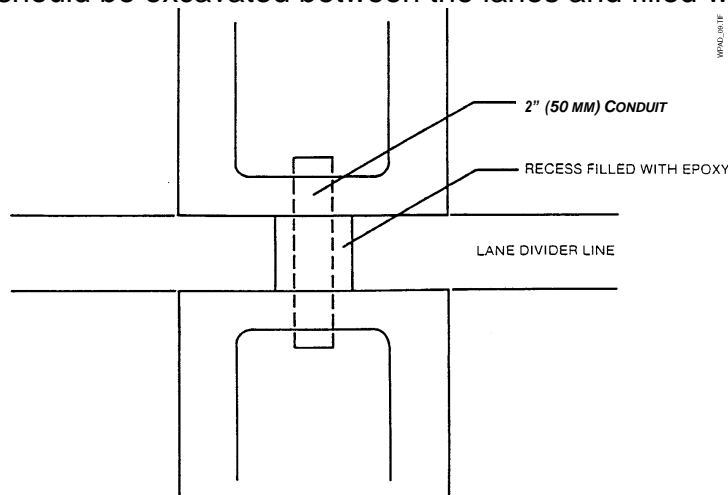
Excavate frame recess evenly with the jack hammer to a depth of 2.5" (6.4 cm) with the 4" (10 cm) deep trench down the center.

Note: care should be taken to maintain the recommended excavation depth. For each extra cm (.25 inch) depth of excavation, approximately one more pail of epoxy mix will be required.

Excavate the conduit/drain trench to the edge of the road or to the next frame.

Frames are normally placed so that the center of each weigh pad will be aligned with the centres of the wheel paths in a lane. Typically the frames for the two weighpads in a lane are installed in a single excavation; there should be a minimum of 8 cm (1 ½ inches) between the frames. If multiple scales are installed in a line across adjacent lanes, then a strip of pavement is normally left between lanes and the excavations are joined by a small trench with 5 cm (2 inch) conduit for cabling, as illustrated below

(minimum recommended width of this strip is 20 cm (8"); if the separation is less than this the pavement should be excavated between the lanes and filled with epoxy grout):

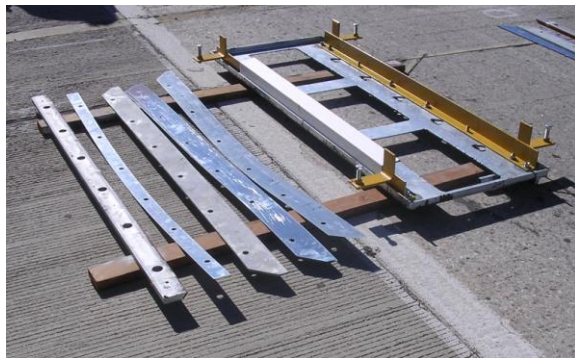


Detail for connection of frames in adjacent lanes

3.2 INITIAL FITTING

3.2.1 FRAME PREPARATION


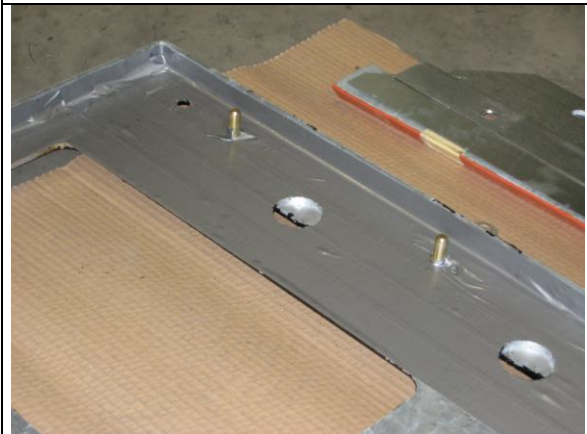


Frame preparation can be done either on site prior to lane closure or in the shop yard, whichever is more convenient.



Unpack the frame and set aside the shims and retaining bar for later use.



Cover the inside of the frame (except the cross rails) with duct tape. This will make cleanup of any epoxy grout that overflows inside the frame much easier.

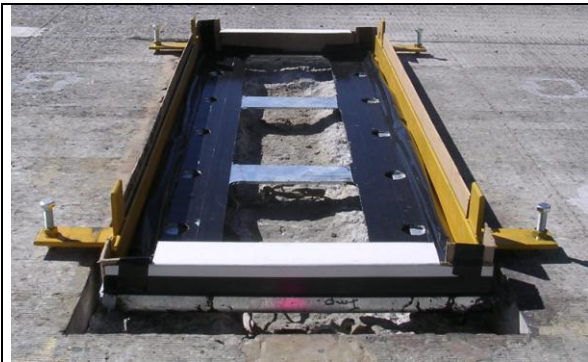
	<p>Cover the inside vertical edges of the frame but make sure there is no tape on the top edge of the frame (where the jig will sit). Push the studs through the tape.</p>
	<p>Cut the tape away from the anchor recesses and the jig end mount holes in the corners of the frame.</p>
	<p>Cover the outside vertical edges of the installation jig side and end pieces with duct tape.</p> <p>Carefully place the installation jig sides over the studs in the frame.</p> <p>Fasten the installation jig sides to the frame with washers and nuts; use the plain nuts (i.e. not the lock nuts) that ship with the frame. Tighten snug plus 1/3 turn.</p>
	<p>Fasten the install jig ends using 2 bolts with a washer for each side and an acorn nut on the bottom. Tighten snug plus 1/3 turn.</p> <p>Note: the acorn nut will remain embedded in the epoxy when the jig is removed; the nut should be clean and free of oil or grease so that the epoxy bonds with it, allowing the bolt to be removed.</p>



Install the height adjustment screws so they protrude about 1" (25 mm) below the top of the angle bracket.

Cover the vertical outside edges of the jig with duct tape. This will prevent the epoxy grout from sticking to the jig so it can be removed more easily after the grout has set.

3.2.2 ANCHORING HOLES



Position frame in the excavation.

Mark the breakout for the cable conduit welded to the underside corner of the frame and ensure that there is adequate depth clearance for it in the excavation.



Ensure the frame does not contact the bottom of the excavation. Chip off any high points.



Mark anchor positions using a marker, paint, or drill.



Remove the frame.

Drill the anchor holes. Initially, start drilling vertical to about 10 mm (1/2 inch) depth and then turn to drill outwards at a 30° angle to match the angle of the anchors. Drill to a depth of 7 1/2" (19 cm).

3.2.3 CLEAN OUT EXCAVATION



Plug the anchor holes with rags.
Clean out the excavation by brushing with wire brush and vacuuming or with a compressed air wand.

Note: *all surfaces in the excavation must be dry and clean. Epoxy will only adhere to a dry and clean surface.*



Remove the plugs from the anchor holes. Clean the anchor holes with compressed air gun, ensuring that no debris gets into any of the other anchor holes.



Check bottom of frame(s). Remove any debris which might adhere to the bituminous coat.



Place the jig and frame into pit, center the frame in position and roughly adjust the height of the top of the frame slightly below the road surface.

Insert anchors for test fit, adjust anchor holes if required.

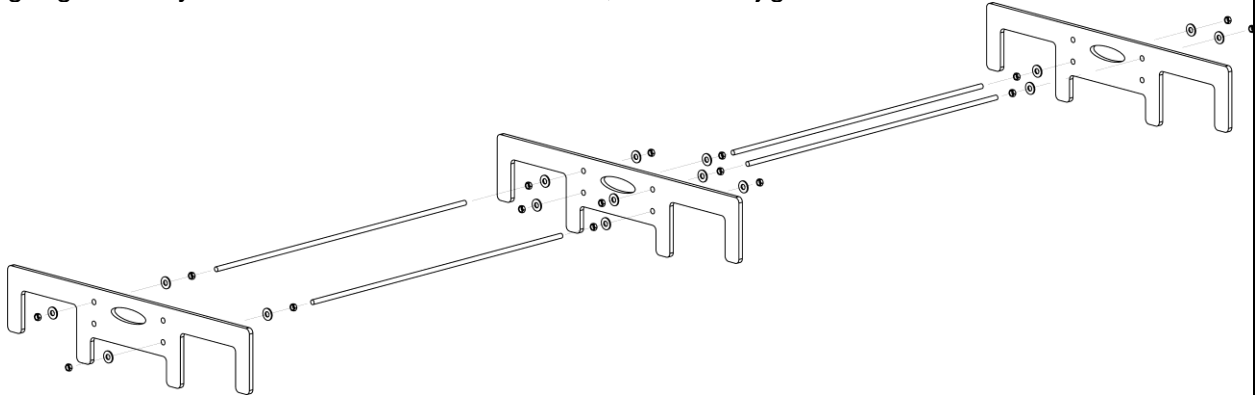


Mark the positions of the height adjustment bolt feet.

3.3 HEIGHT ADJUSTMENT

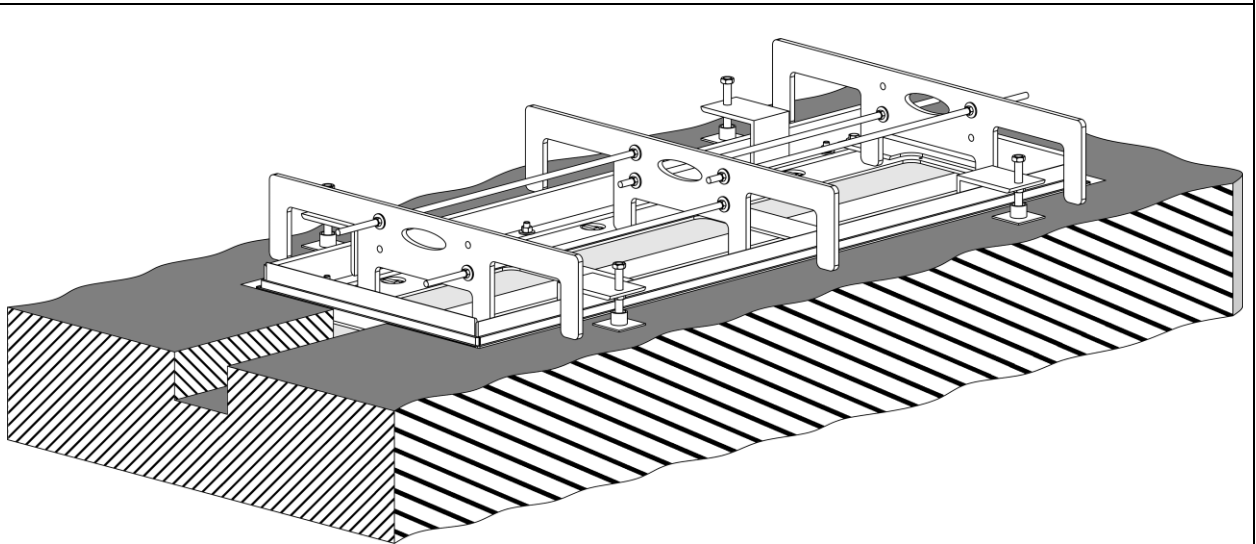
3.3.1 HEIGHT ADJUSTMENT OF FRAME

Assemble the frame height gauge. Set the inside feet of each upright section of the height gauge so they rest on the bottom of the frame, inside the jig rails.



Height Gauge

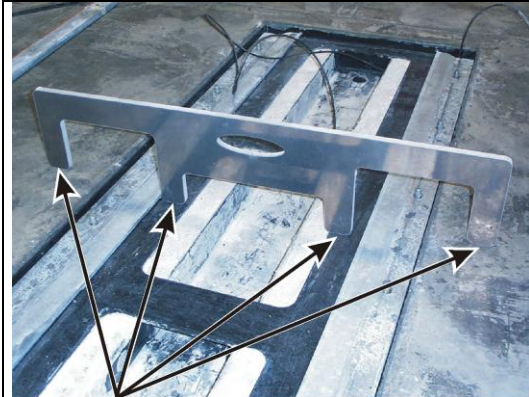
Note: that the nuts on the threaded rods only need to be finger tight to support the upright sections of the gauge; over tightening may distort the gauge.



Assembled frame height gauge and height adjustment jig in position

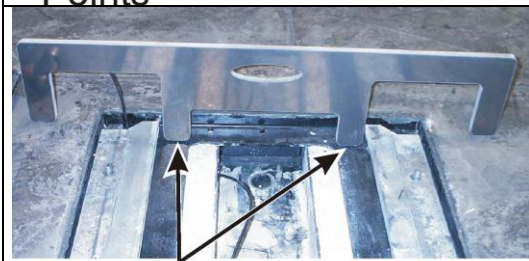
The purpose of adjusting the frame is to set the height of the frame so that when the weighpads are mounted in the frame, they are as close to even with the road surface as possible. The height gauge is constructed so that the top edge of the frame is $\frac{3}{16}$ " (0.1875" or 5 mm) below road surface when the inner gauge tip touches the frame and the outer tip touches the road surface. Because the road surface is usually not perfectly

flat, some compromises may be required to obtain the best fit. The recommended practice is to adjust the height at the wheel path (which is typically at the center of the weighpad and will be the lowest part of the road surface) to match the road surface, and then adjust the rest of the frame to minimize the amounts of misalignment.



Contact
Points

First adjust the center section of the gauge; adjust the frame jig height bolts so that the center gauge two inner contact points are just touching the frame and the two outer contact points are just touching the road surface.



< .1875"
(5 mm)

Next adjust the frame height at each end gauge so that the clearance under the four inner points on the end gauges is as close to the same distance as possible, while maintaining the contact at the center gauge points. The maximum recommended clearance at any of the end gauge points is 3/16" (5 mm).



Check all around the frame using a straightedge; the top edge of the frame should not be above the height of the road surface nor lower than 3/16" (5 mm) below the road surface at any point.

3.4 PLACE PIPES AND BUILD MORTAR DAM

3.4.1 PLACE CONDUIT AND DRAIN PIPE



Install the drainage pipe and cable conduit. The cable conduit entrance must be above the drainage pipe by 1" (25 mm). The drain should slope at least 3% away from the frames. The conduit and drain should be a minimum of 1" below the road surface anywhere along their complete length. (Omit this step if the conduit and drainage have been pre-installed and paved over).

Temporarily seal the openings of the conduit and drain against ingress of mortar or epoxy, using either duct tape, a rag, or a paper plug.

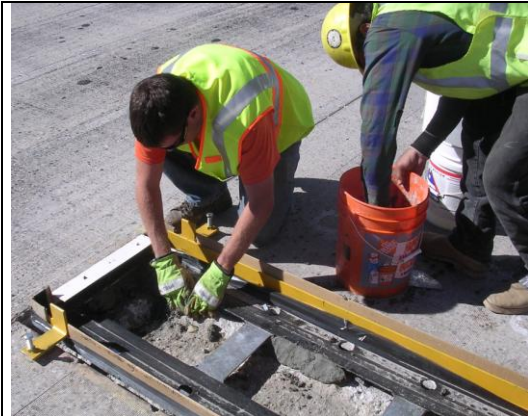


Attach the frame ground wire with the supplied bolt and washer to the tapped hole in the end of the frame.

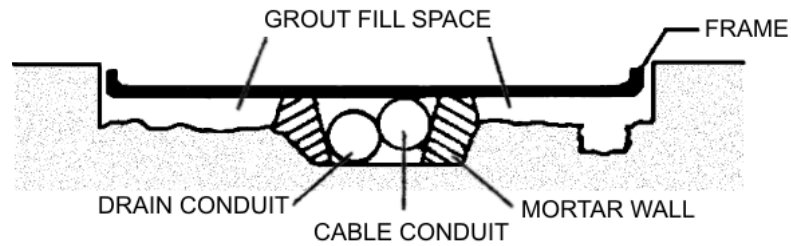
Ground the frame by one of two methods:

1. If using steel conduit, mount the grounding bushings on the end of the conduit and attach the ground wire to the bushing.
2. If using PVC conduit, install a ground rod either in a hole drilled in the road bed, in the shoulder, or in nearest junction box. Attach the ground wire to the ground rod.

3.4.2 FORMING MORTAR BANK



Mix the cement mortar to a moldable putty consistency. Form a retaining wall around the inside perimeter of the frame opening, from the underside of the frame down to the road bed. This will form a cavity under the frame to be filled with epoxy grout. When the grout is poured around the outside of the frame, it will flow under the frame and support it evenly.



Work the mortar under each cross web to form the retaining wall across the underside of each web plate of the frame.



Work the mortar around the conduit and drainage pipes to seal any gaps in the wall. Make sure the ends of the cable conduit and drainage pipe are not blocked (these should be either taped over or have a paper plug).




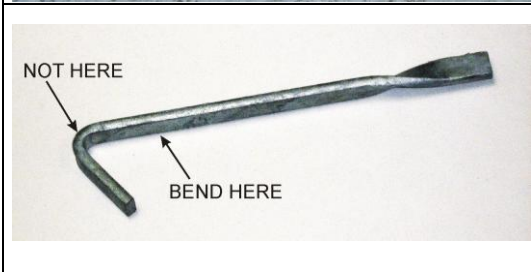
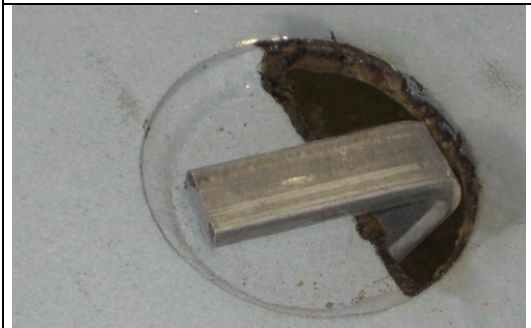
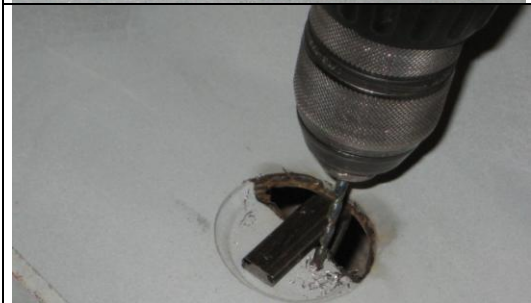
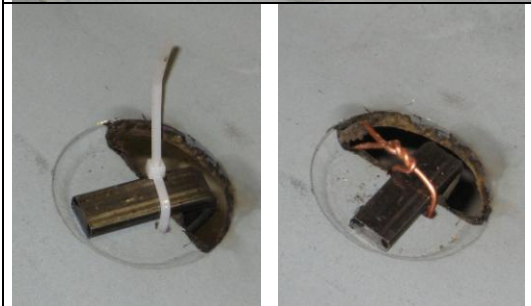
Remove the frame from the excavation; check for gaps in the mortar dam and trim any excess mortar from the area under the frame. The flat contact surface at the top of the dam should extend under the frame no more than 1/2" and the wall that will face the epoxy should be nearly vertical.



Make a mortar plug across the conduit trench. This plug will only be used for initial pouring of epoxy to fill the void under the frame; the plug will be removed before final pour so that the ditch is filled when the epoxy is brought up to road level. (Omit this step if the conduit and drainage have been pre-installed and paved over).

3.5 EPOXY POUR

3.5.1 PREPARATIONS FOR EPOXY GROUT

	<p>Replace the frame. Recheck that the mortar wall around the inside of the frame is complete.</p>
	<p>Insert the anchors. If it is necessary to bend an anchor to get a better fit in the hole, make the new bend on the shaft about an inch below the head. DO NOT REBEND AT THE EXISTING BEND FOR THE HEAD, THIS WILL SERIOUSLY WEAKEN THE ANCHOR AND MAY CAUSE THE HEAD TO BREAK OFF.</p>
	<p>Insert the anchors. The bottom of each anchor head must fit flush to the tab across the bottom of the anchor recess in the frame; the top of the head must not protrude above the frame surface around the recess.</p>
	<p>If there is not a pre-fabricated tie-down hole in the anchor recess tab, drill a 1/8th inch (3mm) hole 1/4 inch (6mm) from the edge of the tab and 1/4 inch (6mm) off center (see illustration).</p>
	<p>Use a small cable tie or a 4" piece of rebar tie wire to firmly tie the anchor down to the anchor tab. Clip off any excess and bend the ends to the side. This tie down keeps the anchor firmly seated on the tab while the grout is being poured. If this is not done, hydraulic pressure may push the anchor up. If this happens the head of the anchor may have to be ground down, weakening it; also there will be a weak layer of grout between the anchor and the frame.</p>



Tape over the anchors; punch a small vent hole in the tape over each anchor.

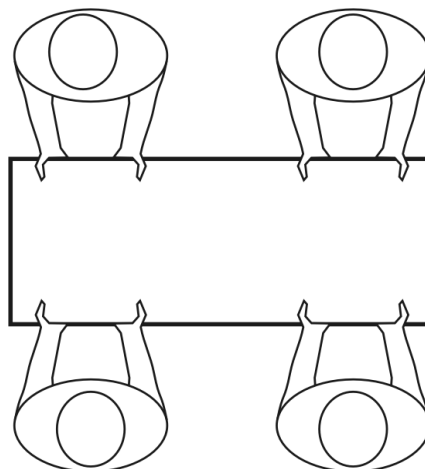


Weigh down frame with a heavy object (50 to 150 kg) to hold the frame in place until the epoxy has set. The weighpad may be used as a weight; put a plastic bucket on each cross web of the frame and place the weighpad on top of the buckets.

After the weights are in place, recheck that the frame is still at the correct height; adjust if necessary.

Note: be careful not to damage the bottom side of weighpad. Keep the weighpad on its shipping case until immediately before it is to be used. NEVER LAY THE UNPACKED WEIGHPAD BOTTOM SIDE DOWN ON THE ROAD. Never pull or twist the cable, avoid loops in the cable.

When lifting by hand, the weighpad should be handled by at least 4 people, one at each corner, as illustrated below:



Moving the weighpad



For ease of cleanup, it is recommended to tape the road surface around perimeter of excavation.

Make up 4" high x 4" deep wedges of cardboard to run the length of each frame. Duct tape them to the road surface about 1/4" (6 mm) from the edge of the excavation. This forms a header box or a "funnel" to pour the grout into and help it flow under the frame.

Note: for clarity of illustration, most of the pictures of the installation that follow do not show the hold down weights on the frame.

3.5.2 MIXING THE EPOXY GROUT

Note: When working with epoxy, wear appropriate protective clothing. Follow all safety precautions on the product label.

It is important to remember that water is harmful to all epoxy resin adhesives. Therefore, the frame and in particular, support areas of the weighing frames and anchor holes, must be completely dry. For further information, see manufacturer's instructions.

At ambient temperatures above 25°C (80°F) or below 10°C (50°F), condition the epoxy for 24 hours by storing in a room with temperature of 22°C (75°F). For installations in extreme temperatures, contact IRD for further instructions.

The epoxy grout will be made up in two batches:

1. The first batch will use only 3/4 of the amount of aggregate included in the grout mixing bucket; this will produce a thinner mixture that will be used to flow underneath the frame. In a normal installation this batch will require two buckets of mix per frame.
2. The second batch will use the full quantity of aggregate in the bucket. In a normal installation this batch will require the other two buckets of mix per frame.



Prior to adding the aggregate filler to each mixing bucket, pre-mix epoxy resin with the hardener. For the first batch of grout, pour the resin and hardener into each bucket and mix for 2 to 3 minutes.



Measure the amount of aggregate required for the thin grout (3/4), add to the mixing bucket and mix another 2-3 minutes, paying particular attention to incorporate the mix around the edges of the container. Repeat for the remaining mixing buckets.

Working time and setting time will vary depending on temperature.

Note: Do not use grout clinging to the edges and bottom of bucket; this has not been mixed thoroughly with the hardener and therefore will not set properly.

3.5.3 POURING PROCESS

Begin the grout pouring process using the thin mix with only 3/4 of the aggregate.

With a large transverse slope, it may be necessary to divide the pour into two parts to avoid overflowing the lower side. If this is the case, mix only half of the first batch and pour the high side first; wait until the epoxy sets a little before mixing the other half of the batch and making a second pour in the lower side.



Begin by applying epoxy with a trowel or spatula to the vertical edges of the pavement cuts to obtain maximum bonding.



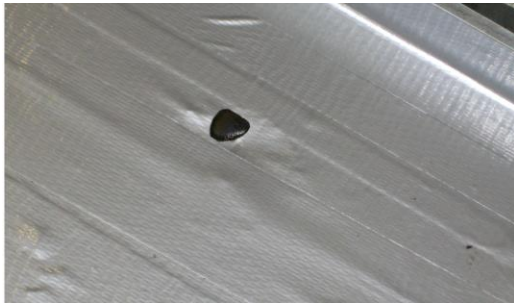
Pour the thin first batch grout into the header box, starting at the highest end of the frame. Fill the volume underneath the frame, including anchor holes, to the level of the bank formed with mortar.

Pour to fill the header box up to level with the road surface and then let the grout run under the frame.



Working from the high end of the frame, continue mixing and pouring the first batch of grout until the whole volume underneath the frame is filled.

Make sure frame rests completely on epoxy mix. **If air pockets are suspected underneath frame, tap with a hammer and push in more epoxy with a trowel.**



The frame is well embedded if the epoxy protrudes from the vent in the tape at every anchor hole.



Pour any remainder of the first batch into the conduit ditch. Weight the conduits every foot or two to keep them from floating up out of the grout mix.



Once the initial batch of thin epoxy grout has begun to set, mix the second batch, again pre-mixing the resin and hardener and then mixing in the full amount of aggregate



Fill the space around the frame with grout level to the road surface.
Remove any epoxy that has overflowed onto the frame immediately.



The temporary dam in the conduit trench holds back the first batch of flowable grout. After the first batch has partially set, remove the dam and fill the conduit trench with thicker second batch grout.

3.6 CLEAN UP FRAME

3.6.1 REMOVE THE INSTALLATION JIG



Remove the weights holding the frame down, the cardboard header box, tape, and conduit plugs after epoxy has set (after about 1-4 hours depending on temperature).

Note: if the weighpads were used as weights to hold down the frame, take care not to damage bottom side of weighpad. Replace the weighpad on its shipping case or onto wooden supports next to the frame. NEVER LAY WEIGHPADS ON THE PAVEMENT.

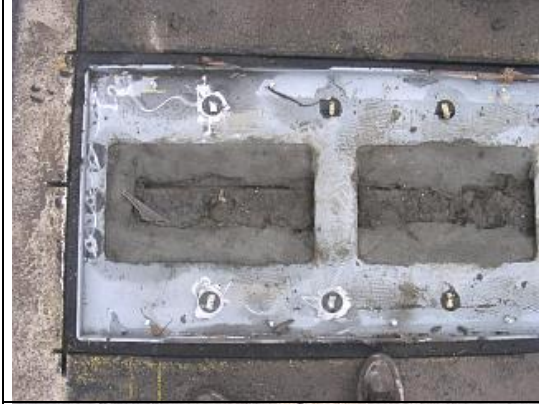


Unbolt and remove the installation jig.



Clean up the inside of the frame. Strip off the duct tape. Grind off any epoxy compound, anchor tie downs and/or any portions of any anchor that protrudes above its recess to ensure a flat surface inside the frame for the weigh pad to rest on.

Note: do not use the grinder to clean epoxy on or near the mounting studs. A nick in these high strength studs can lead to premature failure.



Clean frame with a vacuum to remove all debris.



Spray all grinding abrasions with cold galvanizing (zinc-rich) spray paint.

3.7 INSTALL THE WEIGHPADS

3.7.1 WEIGHPAD PREPARATION



Set each weighpad onto wooden supports close to their frame. Carefully pull the connecting cable through the cable conduit, leaving plenty of slack for moving the weighpads during installation.

3.7.2 SHIM WEIGHPAD TO ROAD SURFACE



The weighpads must be installed at a height to match the surface of the surrounding roadway as closely as possible. Shims with thicknesses of 1/32" (0.8 mm) and 1/16" (1.6mm) are provided to adjust the depth of the base that the weighpads will rest on.

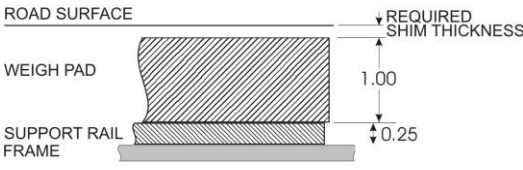

The first step will be to shim the weighpads so that they are even with the road surface at the location of the wheel track (usually this will be the middle of the frame)

Note: in the corner with cable conduit, the shim must have the corner cut out to allow cable clearance.

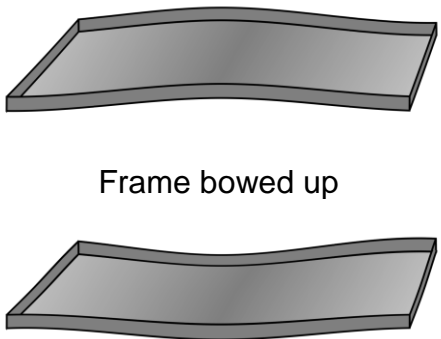


Using a straightedge across the frame and positioned in the center of the wheel track, measure the distance from the road surface down to the top face of the frame and record the measurement to the nearest 1/32" (.8 mm).

Note: make sure that the road surface under the straightedge is as clean as possible; any sand, grit or small debris can have a significant affect on the measurement.

 <p>ROAD SURFACE</p> <p>WEIGH PAD</p> <p>SUPPORT RAIL FRAME</p> <p>REQUIRED SHIM THICKNESS</p> <p>1.00</p> <p>0.25</p>	<p>The thickness of the weighpad is approximately 1.00 inch (25.4 mm) and the thickness of the support rail is .25 inch (6.4 mm), so the shim thickness required to bring the top of the weighpad even with the road surface is the distance from the road surface to the top face of the bottom of the frame minus 1.25" (31.8 mm).</p> <p>Subtract 1.25" (32 mm) from the measurement taken in the previous step. When rounded to the nearest 1/32" (0.8 mm) this will give the required shim thickness to make the weighpad even with the road surface in the wheel track.</p>
	<p>A normal installation is illustrated to the left the road surface is worn down in the wheel track and the frame is straight.</p> <p>For this installation, only full length shims are required; the shim thickness is that needed to bring the weighpad even with the road surface in the wheelpath as described above. The road surface will be slightly higher than the weighpad at the ends of the frame.</p>

3.7.3 SHIMMING TO CORRECT FRAME DISTORTION

 <p>Frame bowed up</p> <p>Frame bowed down</p>	<p>Although the installation jig will usually ensure that the frame is installed at the correct depth and free from distortion, there is a possibility that the frame has been warped either in shipping or during installation. Once the frame has been installed, it must be checked for bowing distortion. Minor distortions can be corrected using shims to provide a flat base for the weighpad to rest on.</p> <p>The additional shims must be cut to produce a flat base. The following rules must be followed when cutting and installing shims:</p> <ol style="list-style-type: none"> 1. <i>The greatest difference in shim thickness allowed between any two adjacent studs is 1/16" (1.6 mm).</i> 2. <i>A shim may only be cut midway between stud holes.</i> 3. <i>In a stack of shims, there can be only one cut end of a shim between any two adjacent studs.</i>
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Check for bowing by using the support rail as a straightedge across the full length of the frame adjacent to the studs. If the frame is bowed up, then the center will be higher than the ends; if the frame is bowed down then the ends will be higher than the center.

If the frame is bowed up, hold one end of the straightedge down onto the frame and measure and record the gap between the straightedge and the frame at the end stud position at the other end. Additional shims will be added at the ends of the scale. The shim thickness at the end studs will be the center shim thickness plus one-half the gap measured at the ends; the shim thickness at the studs second from the ends will be the center shim thickness plus one-quarter the measured gap.

If the frame is bowed down, measure and record the gap between the straightedge and the frame at the wheel path position. Additional shims will be added to the center part of the scale.



Example: Frame bowed up

Measuring at the wheel path gives a depth to the frame of 1 and 11/32 inches. From this, the shim thickness at the wheel path is calculated as: $1 - 11/32$ minus $1 - 1/4 = 3/32$ ".


A straightedge test reveals the frame is bowed up; holding one end of the straightedge flush to the frame gives a gap of 3/8 of an inch next to the stud at the other end. The frame distortion at the ends will be half of this gap, 3/16; the distortion at the second from the end studs will be one quarter of the gap, of this gap, 3/32. This yields the following set of ideal shim of thicknesses at each stud position:

9/32"	3/16"	3/32"	3/32"	3/16"	9/32"
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In order to follow the shimming rules stated in the previous step, and using the available 1/16 and 1/32 inch shims, the closest fit set of shims will be:

1/16					1/16
1/16	1/16			1/16	1/16"
1/32"	1/32"	1/32"	1/32"	1/32"	1/32"
1/16"	1/16"	1/16"	1/16"	1/16"	1/16"


This will have the weighpad even with the road surface in the wheel path, 1/32 inch low at the intermediate studs and 1/16 inch low at the ends.

	<p>Cut the shims to length (midway between holes and only one cut end between holes in the stack). Position the longest shims first and add progressively shorter shims until all are in place.</p> <p>A frame that is bowed down would be corrected in a similar fashion but with the thickest part of the shim stack in the center.</p>
	<p>After the shims have been positioned, installed the support rails (galvanized 1/4" (6 mm) strips) on top of the shims.</p>

3.7.4 ELECTRICAL RE-CHECK

Retest the electrical properties of each weighpad as described in section 1.2.1..

3.7.5 WEIGHPAD INSTALLATION

	<p>Begin installing the weighpads in the frame starting with the weighpad farthest from the pull box. Place a support block (in the illustration they are using a shovel; a short 2x4 might be better) next to the frame along the edge where the cable will go. Move the weighpad to the frame and set it down on edge on the support block, with the cable positioned next to where it will go into the frame; pull the excess cable though the conduit, leaving 18 to 24 inches (.5 to .7 m) of slack underneath frame.</p> <p>Note: Make sure the cable is not twisted, does not form any loops, and is not bent.</p>
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Lift the weighpad and set the edge of the weighpad just inside the mounting studs in the frame; be careful not to pinch the cable.



Rotate the weighpad down until the edge is a few inches from the frame. As the pad is rotated, check to make sure the cable is not pinched.

When the weighpad is almost in place, either use a count of three to release the weighpad or rest it on a support (such as a shovel blade) and then pull the support clear to drop the weighpad the last few inches into the frame.



Check that the weighpad is even with the road surface at the wheel path; adjust shims if necessary.

3.7.6 FASTENING THE RETAINING BARS



Insert retaining bar shims and retaining bars
Temporarily tighten nuts to test height. Add or remove retaining bar shims as required. **Allowable tolerance is +/- 1/32 (0.8 mm)**; this is especially important on roads where snow-plows will be used.

Remove and apply anti-seize compound to the edge of the weighpad. Reinstall the retaining bar.

Verify that weighpad is even with the roadway over entire width by means of a straight edge. If weighpad is lower or higher by more than 1/32", adjust shims accordingly and check again.

Allowable tolerance is +/- 1/32 (0.8 mm).



Apply anti-seize compound to the studs.

Install the cupped disc spring washers.

Note: *Install the washer with disk cup facing down (as shown in illustration to the left) – the lower rim of the washer should rest on the retaining bar and the nut should contact the raised centre portion of the washer when installed.*

Install the nuts and start the first few turns by hand to be sure the nuts aren't cross threaded.



Tighten down to snug, starting in the middle of the weighpad and alternating from side to side (use caution if using an electric or air powered impact wrench – **DO NOT** over tighten the nuts).

The recommended tightening sequence is:

●	●	●	●	●	●
9	5	1	3	7	11
10	6	2	4	8	12
●	●	●	●	●	●



Use a good quality torque wrench to set the final torque for the 1/2x20 UNF lock nuts to 85 ft-lbs [115N-m] and M12x1.5 lock nuts to 60 ft-lbs [81 N-m] Apply torque with a smooth, steady pull (don't jerk the wrench). Torque the nuts down in the same sequence shown above.

3.7.7 APPLY SILICONE



Place silicone sealant around the recessed nut holes.



Seal the joints between the weighpads and frame, and between securing rails and frame with silicone sealant. Pay particular attention to sealing around the cable connection.

3.7.8 CONNECTIONS AND FINAL CLEAN UP



Pull the cabling to the cabinet and repeat the electrical checks described in section 3.7.4.

Terminate the weighpads to the electronics.



Clean up all equipment and debris from the road.

Open the roadway to traffic after the epoxy, silicone, and loop sealant have cured sufficiently. See the appropriate data sheets for cure time charts. This is usually one to five hours, depending on temperature.

A.0 SAFE WORK PROCEDURES

Facility: General Installation	Written By: THa	Approved By:	Date Created: 07/20/2009	Date of Last Review: N/A
Hazards Present: Traffic Dust and Debris Power Tools Noise Epoxy Adhesives Loop sealant	Personal Protective Equipment (PPE) required: Hard Hat Safety Glasses CSA Approved Footwear Hearing Protection Dust Masks Gloves High-Visibility Vest		Additional Training Requirements: Work Zone Safety Training ATSSA	
<p>Safe Work Procedure:</p> <ol style="list-style-type: none"> 1. Setup appropriate traffic controls as per local standards. 2. Mark out all saw cuts for frame and lead-in cable with highly visible paint that will not wash away with water. 3. Start saw cutting for excavation with spotter watching for traffic; hearing protection should be worn by everyone. 4. Excavate pavement to the required depth. Hearing protection should be worn by everyone. Safety glasses and dust masks should be worn by anyone in the area of the excavation work. 5. Clean the excavation of any debris using compressed air. When using compressed air, direct air away from eyes and skin and always wear safety glasses. Ensure other workers in the area are protected from exposure to the airstream and any airborne materials or particles. 6. Install frame and scale as described in this manual. Appropriate safety precautions must be taken and safety gear worn; refer to General Reference Manual 69027701. 7. Clean up work area and remove traffic controls. 				
Guidance Documents / Standards / MSDS / Applicable Legislation:			MSDS: Epoxy Flexolith (p/n) 340082) 3M Loop Sealant Sausage Pack (p/n 340131)	
General Reference Manual (p/n 69027701)				
This safe work procedure will be reviewed any time the task, equipment, or materials change and at a minimum every 3 years				
Signed:				Date:

