21. All loops in ACP pavement shall be sealed with an approved crack filler. All loops in concrete pavement or asphaltic concrete, the loop shall be sealed with an approved hot rubber sealant or a two-part epoxy or similar sealant. Sealants shall be in a manner that is consistent with the manufacturer’s instructions, these drawings, and the specifications. The sealant shall seal the loop wire and fill the slot accordingly without gaps or voids and to the specified minimum cover.

22. Loop sealants and piezo gravel shall be handled in a safe manner. This includes the use of personal protection equipment such as safety glasses, gloves, and respirators if necessary. Excessive or waste materials shall be handled and disposed of in an approved fashion.

23. Loops or piezos shall not be installed when the weather does not conform with conditions recommended by the sealant manufacturer.

24. Loops shall be protected from traffic until the sealant has had sufficient time to dry, cool or cure so no tracking of sealant is possible.

25. Once the loops and lead-in wires have been installed, the contractor shall perform the following tests on each loop in the presence of the Engineer before and after the sealant has been placed:

- **Insulation Resistance to Ground** (Insulation Resistance): The insulation resistance to ground for each loop shall be measured with a megger meter connected to each lead-in and to the nearest reliable electrical ground. The measurement shall be made with a test lead, or to a metal stud driven one foot into the ground between the roadway and the pull box. The insulation resistance to ground shall not measure less than 500 megohms at 500 volts DC. A high resistance of greater than 1000 megohms is desired.

- **Series Resistance**: The series resistance of each wire shall be measured by an ohmmeter, setting the resistance shall be less than 0.5 ohms and the maximum resistance of any size wire, including lead-ins, shall typically be less than 5 ohms but not more than 100 ohms.

26. Before and after the piezo sensors have been installed and the gravel has been spread, the contractor shall perform the following tests on each piezo sensor in the presence of the Engineer or his designee:

- **Capacitance**: The capacitance of the sensor shall be measured from the ends of the attached lead-in cable. The measured reading should be within 20% of the value given in the sensor’s data sheet provided by the manufacturer. The meter should be set on a 20pF range. The red probe shall be connected to the center conductor of the cable and the black probe shall be connected to the outer conductor. During the measurement, hands shall not hold or contact across the two connections.

- **Resistance**: The resistance shall be measured across the sensor. The meter should be set on the 20MΩ setting. The meter should read in excess of 20MΩ.

27. The loop lead-in cable from the pull box back to the controller cabinet shall conform to the applicable requirements of AASHTO Specification 50-2 with the exception that the cable can include up to 4 twisted pairs, not just one. The wire size shall be #4SC copper stranded. The cable burial and the lead-in cable shall be grounded at only one end (in the controller cabinet). The loop lead-in cable shall run continuously between the pull box and the controller cabinet without splices.

28. Lead-in cable to loop detector connections shall be bonded using an appropriate resin core solder. The solder connection shall then be made completely liquid-tight with an approved heat-shrink connection kit that is specifically applicable to loop detector applications. Core shall be taken to heat the connection kit to the correct temperature without damaging the loop wire or lead-in wire insulation. Other types of connection are allowable if approved by the Engineer.

29. The lead-in access hole shall be backfilled and patched according to the detail shown on sheet 4. The contractor shall patch the existing pavement with an approved patch material (PMP) or approved equal in an acceptable manner. Core shall be taken to heat the loop wire on end loop wires. The patch shall be at least 12-inch but not more than 12-inch higher than existing pavement or it can be compacted.

30. The contractor shall leave no less than 36 inches and no more than 48 inches of loop lead-in cable and piezo lead-in cable in the cabinet. The contractor shall label each lead-in cable (loop and piezo) with the lane number and the orientation (leading or lagging). Lane numbers shall be assigned in ascending order starting in the cardinal direction (North or East) beginning from the slow lane towards the median/centerline. Lane numbers in the non-cardinal direction (South or West) shall continue in the ascending order starting from the slow lane towards the median/centerline. The contractor shall install cramped spade terminals to the end of all lead-in cable terminated in the cabinet. The contractor shall use a 16-14 AWG (600V) vinyl insulated spade for all loop lead-in wire and all outer braid of the piezo lead-in wire. The contractor shall use a 16-14 AWG (600V) vinyl insulated spade for all center conductor wire of the piezo lead-in cable. The contractor shall be sure to not damage the outer braid of the lead-in cable when separating it from the center conductor.