Make the following Section a part of the Standard Specifications:

"SECTION 661 - WEIGH-IN-MOTION SCALE SYSTEM

661.01 Description. The work of this section shall consist of furnishing and installing new sensors for the Weigh-In-Motion (WIM) scale system on Honoapiilani Highway (Route 30), Baseline Station 164+00± including; installing and testing piezoelectric sensor, vehicle detector loops, in-road temperature sensor, cables, installing conduits and pullbox, installing warning signs, demolition and removal of existing sensor and appurtenances, salvage of existing cabinet and solar panel, reinstallation of existing cabinet and performing testing of the completed system. The WIM scale system will be used to monitor and to capture traffic data inbound and outbound lanes such as: vehicle volume; vehicle speed; vehicle axle and total weights; and vehicle classification by number of axles, axle spacing, and vehicle length. All work shall be in accordance with the requirements specified herein and as indicated in the Contract Plans, or as directed by the Engineer.

The Contractor shall notify the Highway Planning Engineer at 808-587-1838 at least two weeks prior to demolition of the existing WIM scale system at mile post 28.37 for the State to remove and salvage the traffic counting equipment and electronics inside the cabinet. The Contractor shall carefully remove and reinstall the existing cabinet to the new location. The Contractor shall also salvage the existing solar panel and deliver to the Highways Division Maui District baseyard.

(A) Definitions.

(1) Bit. The elementary unit of electronic data storage.

(2) Byte. A unit of data storage equal to eight (8) bits.

(3) Distribution. The directional distribution of traffic compared to the traffic in two directions during a period, usually peak hour, and expressed in percent.

(4) Equipment. The word "equipment" is an all-inclusive term which refers either to individual machines or components or to a complete data processing system.

(5) IFP. Invitation For Proposal (or Bid).

(6) K. The ratio of the traffic volume during the design hour (DHV), t o the 24-hour volume and expressed in percent. For the State of Hawaii, Department of Transportation, Highways Division, the peak hour is used.

(7) Kilobyte (KB). One thousand bytes; in reference to memory storage systems, one kilobyte equals 1,024 bytes.

(8) Megabyte (MB). One million bytes; in reference to memory storage systems, one megabyte equals 1,048,576 bytes.

(9) Peak-Hour. The one hour period which constitutes the highest total volume for consecutive intervals within a period of an hour. For surveys conducted at quarter hour intervals, the peak hour is based on the highest four (4) consecutive interval volumes within a one hour period.

(10) Peak-Hour Factor (PHF). The peak-hour factor is determined by the following expression:

[n] multiplied by the [the highest interval volume during the peakhour] divided by [the peak-hour volume],

where [n] is the number of intervals surveyed during the hour. For example, n = 4 for quarter hour intervals.

(11) Polling. Dial-up and retrieval of traffic data stored in the field station recorder.

(12) Static. Method of weighing trucks, whereby the truck being weighed must stop on the scale in order to weigh individual axles or tandem axle groups.

(13) Weigh-In-Motion Scale System. Method of weighing trucks, whereby the truck being weighed can be moving at highway speeds over the scale in order to weigh individual axles.

(B) Submittals. Working drawings and documentation for the Weigh-In Motion Scale System shall be submitted in accordance with Subsection 105.02 - Contract Plans and Working and Shop Drawings.

(1) Working Drawings.

(a) Equipment Assembly Drawings

(b) UL Listing

(c) Wiring Diagrams, Interconnect Diagrams, Schedules, and Schematics.

(d) Block Diagrams

(e) As-Built Drawings

(2) Materials Lists.

(3) Testing Schedule.

(4) Inventory List.

(5) O&M Manuals.

(6) Test Procedures.

(7) Test Report.

(C) Design Requirements. The design work for equipment procured under this contract shall include the selecting, packaging, installing, wiring, interconnecting, testing, and documenting of the equipment and materials such that the final equipment installation results in a Weigh-In-Motion scale system that meets or exceeds all of the requirements defined herein as well as all other requirements of the contract.

(1) Design, Construction, Patents and Warranty.

(a) Codes and Standards. The equipment covered by this specification and the materials of construction shall be designed, fabricated, inspected and tested in accordance with, but not limited to, the following listed codes and as listed in **Subsection 101.02 - Abbreviations**, standards, specifications and guidelines, including all addenda in effect at the time the purchase order is placed, unless otherwise stated in this specification:

ASME - American Society of Mechanical Engineers
ANSI - American National Standards Institute
ASTM - American Society for Testing and Materials
AISC - American Institute for Steel Construction
AWS - American Welding Society
AFBMA - Antifriction Bearing Manufacturers Association
ANSI -American National Standards Institute
IBC - International Building Code
ISA - Instrument Society of America
IEEE - Institute for Electrical and Electronics Engineers
NBS - National Bureau of Standards
NEC - National Electric Code
NEMA - National Electrical Manufacturers Association
OSHA - Occupational Safety and Health Administration
SMA - Scale Manufacturers Association
UBC - Uniform Building Code
SSPC - Steel Structures Painting Council

These codes and standards set forth the minimum requirements which may be exceeded by the Contractor if, in his judgment and with the Engineer's approval, superior designs or materials are required for successful and continuous operation of the Contractor's equipment as required by the Contract Documents.

The Contractor agrees, represents and warrants that all services, designs, equipment and material sold or otherwise provided to the Owner by the Contractor comply with all applicable Federal, State or local laws, resolutions, codes, specifications and standards including those specified above.

The Contractor represents and warrants to the Owner that the material and services hereunder comply with the latest revisions of the Occupational Safety and Health Act of 1970 (OSHA and all applicable standards there under).

In the event of any apparent conflict among standards, codes or this specification, the Contractor shall refer the conflict to the Owner for written resolution.

The Owner shall have the option to incorporate requirements resulting from changes in codes, standards and regulations between the date of the execution of the contract and the date the Contractor initiates fabrication. Advising the Owner of resulting effect is the Contractor's responsibility.

(b) General Design and Construction Considerations.

These general provisions shall apply to all items of mechanical equipment supplied under this specification.

Every item of equipment in the design, construction, and operation of equipment for the purposed required, and; who shall have furnished such equipment for at least two (2) years to be able to show a record of successful operation.

All parts and components of mechanical equipment shall be designed for satisfactory service in continuous duty without excessive wear, under the specified operating conditions, for a period of not less than one year. Any part of the mechanical equipment that shows undue or excessive wear, or that fails due to normal operating conditions within the first year of operation after final acceptance, shall be considered as evidencing defective material or defective workmanship.

All parts of mechanical equipment shall be amply proportioned for all stresses that may occur during operations, and for any additional stresses that may occur during fabrication and erection. Iron castings shall be tough, close-grained gray iron in accordance with ASTM A 48. Structural steel shall conform to ASTM A 36.

All equipment and machinery furnished under this Contract shall be the latest improved design suitable for the service specified. All equipment and machinery shall be designed and constructed to operate under the specified requirements with a minimum of maintenance, renewals, and repairs. The design and construction of all equipment and machinery shall be such as to permit operation with minimum wear, vibration and noise when properly installed.

All lubrication fittings, if applicable, shall be brought to the outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housings, or guards and without requiring unusual or hazardous access platforms. Lubrication fittings shall be mounted together wherever possible. Pressure grease lubricated fittings shall be "Zerk" hydraulic type.

(c) Patents. The Contractor shall hold harmless, indemnify, defend and where appropriate, insure and save the Owner, its officers, agents, servants, and employees from any liability of any nature or kind for or on account of the use of any copyrighted composition, secret process, patented or unpatented invention, article or appliance furnished or used in the performance of this contract.

(d) Warranty. Materials and equipment furnished by the Contractor shall be of first class and new. The Contractor shall secure from the manufacturer or manufacturers of all the equipment furnished and delivered, a warranty or warranties guaranteeing all equipment from defects in materials, design and workmanship for a period of not less than 12 months from the date of acceptance. Such warranty or warranties shall be assigned to the Owner.

Should any defect be encountered during the warranty period, the manufacturer will be notified and he shall promptly correct such defect at no additional cost to the Owner. If the defect requires factory correction, the manufacturer shall so inform the owner, who will then transport the defective equipment to the manufacturer or the manufacturer's representative's office. The manufacturer shall repair or replace the defective

equipment within three (3) weeks from the date of receipt of such defective equipment. Bidders shall include a copy of their warranty covering the proposed equipment as part of the bid requirements. Repair or replacement of in-road sensor(s) during the warranty period shall require acceptance testing as detailed in section 661.03(F) - Inspection and Testing, at no additional cost to the State. The cost of warranty or warranties shall be incidental to the contract.

(e) National Transportation Communications for ITS Protocol. In the interest of providing and/or upgrading equipment and maintaining compatibility with and any future WIM data collection and communications equipment standards, the Contractor shall ensure compatibility with the National Transportation Communications for ITS Protocol (NTCPIP) standard 1206 at this WIM site. Pursuant to the requirements of NTCIP 1206, all data collection, communications, and data processing equipment provided for under this project shall conform to NTCIP 1206. Furthermore, all relevant equipment provided as part of this WIM project or any repairs prior to acceptance shall also conform to this standard.

(2) Delivery. The Contractor shall coordinate delivery of the WIM system with the Engineer. The WIM equipment Contractor shall provide supervision for the installation of the system in the roadway to the Owner's roadway construction Contractor.

661.02 Materials.

(A) Weigh-In-Motion (WIM) Scale System. The WIM scale system is intended to perform vehicle axle weight and classification, including but not, limited to the thirteen (13) FHWA vehicle types, and data for environmental impact analysis per FHWA requirements.

(1) General Requirements. The WIM scale system shall be installed in each lane at the location shown on the Contract Plans. The WIM scale system contains a set of piezoelectric sensor and magnetic loop detectors. The WIM scale system will be used to determine the weight of each axle of the vehicles, measure vehicle speed, and classify the number of axles in accordance with FHWA requirements.

The WIM Scale system shall also be capable of monitoring traffic volume data using one or more magnetic induction vehicle detector loops. Such loops shall be installed as called for in the contract plans.

(2) WIM Scale System Components. The installation and setup of all sensors, lead-in cables, and related components shall be installed per the manufacturer's recommendation.

The Contractor may also propose an alternate arrangement or spacing of the loop and piezo sensors if such arrangement is deemed to be superior to the standard HDOT configuration for this project. Such proposal shall be submitted a minimum of one month, to the Engineer for review and acceptance. Any proposed changes in the sensor arrangement must be accepted by the Engineer prior to installation.

(a) Traffic Axle Weight and Classification Data System Requirements.

1. In-Road Piezo Axle Weight and Classification Sensor System. A Piezo Sensor System is the type of axle weight and classification sensor system required for this project.

(i) The piezo sensors shall have an operating life of a minimum of one (1) year from the date of acceptance. Sensor failure during this period shall require replacement of the faulty unit at the Contractor's expense for furnishing, delivering and installing the replacement equipment, system, and components including any traffic control measures required for the safe installation of the replacement sensor.

(ii) The piezo sensors shall be installed by the Contractor under the supervision of the manufacturer's representative for the Piezo system. All necessary components, process, system modifications, and installation requirements shall be provided as incidentals to the system.

(iii) Piezo Sensor System: The following are requirements for the Piezoelectric Sensor system:

a) Configuration: Piezoelectric sensors shall be installed in the roadway for each lane in both traffic directions.

b) Class 1 BL unencapsulated piezo-electric sensors must be supplied complete with custom length lead-in coaxial cable with pre-made termination connectors. The sensor design and installation technique must have been proven reliable in conditions (soil and environmental), similar to those in Hawaii.

c) Piezo Sensor shall be Class I Weigh in Motion Sensor, 12-foot length, complete with coaxial lead cable (non-spliced). The sensor shall have 16 gauge flat braided silver plated copper wire center core with highly compressed piezoelectric copolymer P(VDF-TrFE) and outer sheath of 0.16-inch thick brass meeting CDA-260 and ASTM B87-88 requirements. The sensor shall be approximately 0.26-inches wide with a maximum thickness of 0.063-inches (plus/minus 0.05 inches). Insulation resistance between core and shield shall be greater than 500M ohms. Piezoelectric coefficient shall be greater or equal to 20 pC/N nominal.

1) The piezo sensors shall be embedded in a grout with clips for mounting at 6" intervals. The sensors shall be of the type suitable for the application. The piezo lead-in cables and piezo sensors shall be installed in slots cut in the road surface, at a minimum of 3/4 inch by 2-inch deep and provided with supporting clips at 6-inch centers.

2) The sensor shall be laid in the groove at 3/8-inch below the surface of the roadway. The sensor shall be secured in place along the entire length of the sensor in the slot by quick setting grout clips.

3) Sensor shall be manufactured to produce uniform, high amplitude piezoelectric output with signal to noise ratio of 10:1 minimum.

4) Groove shall be constructed in strict accordance with specifications of the manufacturer. Sensor shall be installed straight and flat in groove.

5) The voids of the groove shall be epoxy filled. The epoxy grout fill shall be prepared in accordance with the manufacturer's instructions, pre-mix the resin before combining, and trowel finish to match finished grade. Hot tar shall not be used. When the epoxy is fully cured, grind finish the grout to insure a flat and level finish, without concave portions. The grout curing requirements of the manufacturer shall be complied with and traffic loading shall not be permitted until the grout is fully cured.

6) Passive signal cable shall be RG 58 rated for underground direct burial, with outer jacket of 0.187-inch outside diameter and nominal capacitance of 27 pF/Ft, with factory termination to sensor and BNC connector. Each cable shall have field measured custom length to suit the installation conditions. In the event that the cables provided have insufficient length to reach the equipment harness, the cables shall be rejected and splicing to lengthen the cable will not be allowed.

7) Sensor shall be installed in clean saw cut grooves in strict conformance to the sensor manufacturer's installation requirements.

8) Hot tar shall not be used. Installation of encapsulating material shall be allowed to cure, shall be ground flat, and no concave portions shall be accepted.

9) Traffic shall not be allowed on the completed system until the manufacturer's representative approves all conditions of the installation with the acceptance by the Engineer. Thereafter, testing in accordance with the manufacturer's requirements shall be completed before public traffic is allowed.

10) Grooves shall be made by wet cutting. Dry cutting shall not be allowed.

11) Overall length of the passive cable shall be 300-feet maximum. Provide loop of 5-feet in handhole for each cable.

12) In the event that heating of the encapsulating material is allowed by the Engineer, the temperature of the material shall not be allowed to exceed 170 degrees F. In the event that the temperature exceeds the maximum allowed, the entire sensor system installed shall be replaced.

13) Provide adequate power for all test equipment to meet the detailed and specific requirements of the manufacturer for all tests required for certification and acceptance. Provide all necessary equipment to perform the required tests.

d) The sensors shall at a minimum meet the requirements for class 1 piezoelectric sensors as outlined in FHWA Report No. DP-88-76-006.

e) At least two (2) 12-foot piezoelectric sensors must be supplied for each lane for both directions at the site specified herein.

f) The sensors shall be able to withstand at least one million cycles and interface with the counting equipment to perform the above mentioned, applications.

g) The sensors shall include all mounting hardware and installation grout. The supplied installation grout must be suitable for installation in both asphalt and Portland cement pavements. The installation grout must require no special equipment to facilitate installation. The grout must have a short curing time (less than 75 minutes) to minimize lane closure time. The grout should be of sufficient consistency to prevent "running" when being applied on road surfaces with a drainage cross-slope. Particulate matter within the grout must not separate or settle. The grout must not shrink during the curing process.

h) An appropriate in-road temperature sensor shall be installed to provide temperature correction data for the piezo sensors.

(iv) Sensor (induction) loops shall be furnished and installed in each traffic lane, to measure speed and length of vehicles and also to classify vehicles in conjunction with the axle detectors. Refer to the configuration shown in the construction plans.

(v) If the number and configuration of the in-roadway sensors, and sensor loops, need to be modified from the number and configuration shown in the construction plans, the Contractor shall inform the State at the time of submitting the proposal, or earlier, and submit Shop Drawings of the revised configuration for approval.

(vi) Grout and Epoxy. The sensor manufacturer and the Engineer must approve all grout and epoxy used for the classification and axle sensor installation.

(b) Vehicle Inductive Loops. Two vehicle inductive loops shall be installed per lane for measuring volume, speed and vehicle length. The inductive loops shall be completely tested prior to shipment with no splices and ready to install.

(Note: Due to the sensitivity of the existing equipment in the cabinet, all sensor wires, shall be terminated or properly secured into the existing pull box. The Contractor shall leave sufficient wire lengths to be able to connect wires into the cabinet without splices. HDOT or its representative will make the final connection into the terminal block inside the cabinet, however, the Contractor shall tag the wires clearly to identify traffic direction, lane number, and sequence of loops and piezo sensors in each lane per direction).

Each loop and its two (lead-in-wires shall be one continuous piece of Type 4 Cable to IMSA Specs 51-5 as manufactured by Falcon Fine Wire or approved equal. The loop cable shall be continuous within the roadway. If required, the Contractor shall locate any splices within the pull box. The loop shall include four (4) turns of wire of a size as specified in the contract documents. The Contractor shall twist the lead-in-wires from the same loop in pairs, two (2) turns per foot. The Contractor shall not twist lead-in-wires from one loop pair with another loop pair.

The Contractor shall embed loop and lead-in-wires in a three-eight (3/8) inch minimum width saw-cut in the pavement. Saw cut depth to the top layer of wire shall be at least two (2) inches deep. The saw cut groove shall be air blown to remove debris before Contractor insert the loop cable. The Contractor shall fill the saw cut groove with approved epoxy sealer.

Vehicle Detector Loops shall be installed such that they are centered in the lane relative to the finish lane stripping. Loops not centered in each lane relative to the finish lane stripping shall be replaced at no additional cost to the State.

(c) WIM Controller Cabinet. The existing WIM controller cabinet houses all required communications and control equipment necessary to control the WIM and to remotely communicate with the Department of Transportation, Highways Division, Planning Branch via modem. As specified in the contract documents, the Contractor shall remove and reinstall the existing cabinet to the new location.

(d) Electrical Conductors shall be as follows:

1. Type 1. Home-Run Cable Tie in Loop Detector Stubs to the Cabinet. Polyethylene insulated, Stranded-Tinned-Copper14 AWG; 2 Conductor Cable; Stranded Tinned-Copper Drain Wire; Aluminum Polyester Shielded; Polyethylene Jacketed; 600 Volts Rated; IMSA Spec. 50-2 Certified.

2. Type 2. Detector-Loop Cable for installation into the roadway sawcut; 12 AWG Stranded THHN; 600 Volts; inserted into a Polyethylene Tube, .25" max. dia. IMSA Spec 51-5 Certified. Cable inclusive in the Detector Loop Bid.

3. The remaining cables required for the installation of the WIM station shall be as required by the manufacturer.

(f) Excavation Warning Signs. The Contractor shall furnish and install two (2) warning signs and appropriate mountings on each side of the roadway adjacent to the sensor lead-in cable runs or as close as possible. Signs and mountings shall conform to applicable requirements of Section 750 – Traffic Control Sign and Marker Materials of the Standard Specifications and Standard Plan TE-01 thru TE-04.

Signs shall be a minimum of 12 inches by 18 inches. Sign text shall read as follows:

WARNING
BURIED TRAFFIC SIGNAL LINES
NOTIFY HWY-PLANNING BRANCH AT
(808) 587-6352 BEFORE DIGGING/EXCAVATION

The first line of text shall be a minimum of two (2) inches in height. Subsequent lines of text shall be one (1) inch in height. No border is necessary, but a margin of one-quarter (1/4) inch shall be maintained. For the letters and background, use black and yellow paints, respectively. The first line of text shall be centered. Subsequent lines shall also be centered, however, the Contractor shall have the option to more the wording within these lines to allow for best fit. Furnishing warning signs, mountings, and installation shall be incidental to the Contract.

(B) Other Materials. Concrete shall conform to the requirements of Section 601 - Structural Concrete. Paint shall conform to the requirements of Section 708 - Paints. Other materials shall meet the requirements specified in the following:

Trench Backfill Material	703.21
Paints	708.3
Conduits	712.27
Signs	750
Cables, Conductors, and Wires	770.06 (B) and (D)
Epoxy Sealer	770.07

661.03 Construction Requirements.

(A) Equipment List and Drawings. The bidder shall submit the equipment list according to Subsection 106.13 - Ordering of Certain Materials.

Upon completion of the work, submit an 'As Built' or corrected plan showing in detail the construction changes.

(B) Excavation and Backfill. Excavation and backfill shall conform to Section 206 - Excavation and Backfill for Conduits and Structures. Place the material from the excavation to prevent damage and obstruction to vehicular and pedestrian traffic and interference with surface drainage.

(C) Installation.

(1) The WIM equipment Contractor shall provide supervision for the installation and testing of the WIM scale system.

(a) Install piezo (WIM) sensors and in-road temperature sensor under supervision of WIM scale system Contractor.

(b) Provide other work necessary such that the completed sensors is ready for use by the Owner.

(2) Vehicle Detectors. The vehicle inductive loops shall be installed according to the Contract Plans, or as directed by the Engineer and as required by the WIM scale system Contractor or as recommended by the manufacturer.

(3) Conduits. Conduits, if any, shall be direct burial and concrete encased as shown in the contract. Conduits shall be PVC.

Install the ducts to drain towards either one or both pullboxes. Conduits shall not drain towards the WIM Controller cabinet.

Intake directional changes in the conduits, such as bends and changes to clear obstructions with curved segments using accepted deflection couplings or with short lengths of straight ducts and couplings. The deflection angle between two adjacent lengths of ducts shall not exceed six degrees (6°). The bends shall not have a radius of less than twelve (12) times the nominal size of the conduit. The Contractor may use factory-made ells.

Square and trim the ends after cutting to remove rough edges. The connections shall be of the solvent weld type. Make the solvent weld joints according to the conduit manufacturer's recommendations and as accepted.

Seal the ends of the duct with plugs at the end of each day of work, whenever problems interrupt the duct installation work and whenever ducts are subject to submergence in water.

Keep the conduits clean during construction.

Use only hand shovels in compacting concrete encasements. Cure the concrete for at least 72 hours before permitting vehicular traffic to run over the concrete.

Provide each conduit run with a No. 10 gage flexible, zinc coated pull wire extending through its entire length. Double an additional two feet back into the conduit at each end of the run. Conduits and sleeves entering pullboxes shall end flush in the wall with ends ground smooth. Plug the conduits and sleeves temporarily.

Give the exterior portions of the direct burial steel conduits not encased in concrete two coats of asphaltic base paint.

The entire length of a conduit run between pullboxes or standards shall be of one type of material.

The completed duct lines shall be subject to a field test. Pass a bullet-shaped test mandrel about fourteen (14) inches long with a diameter 0.5 inch less than the inside diameter of the ducts through the entire length of each duct run. The Engineer will consider scouring found on the mandrel deeper than one thirty-seconds inch an indication of burrs and/or obstructions in the duct run. Normal abrasion between the duct line and bottom of mandrel is not an indication of burrs and/or obstructions in the duct run. Remove such burrs and/or obstructions. Pass the test mandrel through again. Repeat the process until the Contractor gets a satisfactory result.

(D) Electric Service. Power at the new WIM site shall be connected from the existing highway lighting system as shown on the plans. The Contractor shall furnish and install a power outlet, a disconnect switch and/or circuit breaker, a 120/240V, 3-wire single phase inside the controller cabinet and provide labor, materials, and incidentals necessary to complete the work and be operational.

(E) Inspection and Testing.

(1) Preliminary Arrangements. The equipment shall be given requisite factory tests as necessary to determine that the workmanship and materials are free from defects and to establish that the design and construction are satisfactory.

The Contractor shall be responsible for arranging for and conducting shop tests of the equipment to establish compliance of the Contract Documents and all applicable codes and standards. The Contractor shall furnish certified reports showing the results of all such tests. Test facilities shall be subject to prior inspection by the Owner. The Contractor shall notify the Owner at least 15 working days before the scheduled start of a test so that the Owner may elect to witness any or all such tests. The Contractor shall be responsible for proper protection of equipment to prevent damage during the test period and shall bear all repair or replacement costs of any item damaged as a result directly or indirectly of the test.

Unless otherwise noted in the Contract Documents, shop testing and inspection of the components or the complete system shall be in accordance with the Bidder's standard practice. The Bidder shall supply a list of all the Bidder's standard testing with the bid. The Owner shall not be charged for any of the preliminary testing.

(2) Inspection. The Owner reserves the right to inspect all material during fabrication and before shipment and shall have access to the manufacturer's or Contractor's plant as required.

(3) Tests.

(a) After installation of piezo sensors, the Contractor shall perform the following tests for each piezo sensor:

1) Resistance: The resistance should be at least 1 MegaOhm.

2) Capacitance: The capacitance should range from 5 to 20 nano Farads.

3) Dissipation Factor: The reading should be less than 0.04.

The Contractor must provide all testing equipment such as BK 875A or equivalent LCR meter, Fluke 75 or higher/equivalent multimeter, Megohmeter, and Scope meter or oscilloscope for the above tests.

(b) After the installation of the inductive loop detectors, the Contractor shall perform the following tests for each inductive loop:

1) Induced voltage (V)

2) f = Frequency of Loop (KHz)

3) L = Inductance of Loop (uH)

4) R = Resistance of Loop (Ohm)

5) Meg Test = Loop insulation resistance should be > 100M ohm

Within one (1) week of the completion of the tests, the Contractor shall furnish written test results to the Engineer documenting the test results for both inductive loops and piezo sensors. The engineer will notify the Contractor in writing of the acceptance or rejection of the test results.

(4) Acceptance of WIM Scale System.

(a) The WIM scale system shall not be accepted and payment shall not be made until the system has successfully met the required testing.

(b) Inspection. The Owner reserves the right to inspect all material during fabrication and before shipment and shall have access to the manufacturer's or Contractor's plant as required.

(5) Restoring Pavements and Other Improvements. Restore the existing pavements and other improvements disturbed by excavation to their original condition according to the contract. Materials used for restoration work shall be equal to or better in quality than the materials the Contractor will replace, and matching in thickness, texture, and color whenever applicable. The grades of the restored surfaces shall conform to the existing graders.

(6) Warranty. Materials and equipment installed for permanent construction shall be new. The contract contemplates the use of first-class material and equipment throughout the performance of the contract.

Secure from the manufacturer(s), a warranty or warranties guaranteeing equipment from defects in materials, design and workmanship for not less than twelve (12) months from the date of acceptance.

When requiring adjustments or repairs during the warranty period, adjust or repair the existing unit within twenty-four (24) hours from the time of notification.

When requiring repairs that need factory corrections during the warranty period, replace the existing unit with an accepted temporary operational replacement unit within twenty-four (24) hours from the time of notification until the Contractor can install the new unit. Install the new, identical non-defective unit within thirty (30) days from the time of notification.

661.04 Measurement. Weigh-In-Motion Scale System Sensor Replacement including all appurtenances will be paid for on a lump sum basis. Measurement for payment will not apply.

661.05 Payment. The Engineer will pay for the accepted Weigh-In-Motion (WIM) system Sensor Replacement on a lump sum basis. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for the following pay item when included in the proposal schedule:

Pay Item	**Pay Unit**
Weigh-In-Motion Scale System Sensor Replacement	Lump Sum"

END OF SECTION 661