# Section G: WEIGH-IN-MOTION (WIM) SYSTEM



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	SOUTH DAKOTA	IM 0299(74)235	G1	G24

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#### 1. SECTION G - ESTIMATE OF QUANTITIES

Bid Item Number	ltem	Quantity	Unit
009E3500	Weigh-In-Motion System	1	Each
110E0100	Remove Concrete Footing(s)	Lump Sum	LS
110E1100	Remove Concrete Pavement	22.0	SqYd
110E1520	Remove Signal Equipment	Lump Sum	LS
635E5302	Type 2 Electrical Junction Box	5	Each
635E5303	Type 3 Electrical Junction Box	4	Each
635E5410	Controller Cabinet	1	Each
635E7510	Remove and Reset Signal Pole	3	Each
635E8110 1" Rigid Conduit, Schedule 40		194	Ft
635E8120	2" Rigid Conduit, Schedule 40	617	Ft
635E8130	3" Rigid Conduit, Schedule 40	144	Ft
635E8220	2" Rigid Conduit, Schedule 80	102	Ft
635E8230	3" Rigid Conduit, Schedule 80	56	Ft
635E9402	2/C #12 AWG Copper Tray Cable, K2	55	Ft
635E9502	2/C #14 AWG Copper Tray Cable, K2	271	Ft

#### 2. PROJECT OVERVIEW

This section outlines the basic items of work and equipment to be furnished by the Contractor under this contract. This summary is provided to familiarize the prospective bidder with the basic scope of the project. All labor, scheduling, general supervision and equipment necessary for installation is to be supplied by the Contractor.

#### 2.1. SITE DESCRIPTION

The Weigh-in-Motion System consists of:

- one weigh-in-motion scale, an Overheight Detector, and an overhead Automatic Vehicle Identification (AVI) antenna for reading truck transponders installed in the southbound lanes
- two weigh-in-motion scales installed in the northbound lanes

on I-29 Northeast of Sisseton and north of the Sisseton Port of Entry. The existing WIM instrumentation will be removed to permit replacement of aggregate base and concrete pavement. The new Weigh-in-Motion System, which will be composed of new and reused components, will be installed in new concrete pavement.

The reinstalled system and associated equipment shall interface directly with existing Port of Entry equipment. Full documentation, equipment installation, and testing shall be provided.



### 2.2. WIM SYSTEM VENDOR

The Contractor shall contract with the vendor that originally supplied the existing weigh-in-motion system to supply the components and technical assistance required to construct the Weigh-in-Motion System in accordance with the plans and specifications:

International Road Dynamics (IRD) 702 43rd Street East Saskatoon, SK Canada S7K3T9 Phone (306) 653-6600 Fax (306) 242-5599

Locations of IRD-supplied equipment are shown in the plans. IRD shall provide technical instructions and assistance during installation. All equipment and materials shown as supplied or installed by IRD shall be supplied, installed, and paid for under this contract except where indicated otherwise.

All costs associated with the vendor contract, including equipment and technical assistance costs, shall be incidental to the various bid items indicated in the plans.

### 2.3. SCOPE OF WORK

The Contractor shall remove and reset equipment approximately as follows:

- Three lanes of (WIM) Single Load Cell Scales
- Two signal poles for Overheight Detector System
- One Overheight Detector System
- One signal pole for AVI System
- One AVI Reader
- One AVI Antenna
- One AVI cabinet
- Camera, illuminator and power pack hardware
- One type 334 WIM Cabinet
- WIM electronics and other electronic equipment
- Fiber optic cable from WIM Cabinet to existing junction box
- Electrical copper wiring from WIM Cabinet to existing junction box

IRD-supplied equipment under this contract is approximately as follows:

- Two lanes of WIM Single Load Cell frames (two frames per lane, four frames total)
- Three Piezoelectric Axle Sensors
- AVI Cable
- Eight preformed inductive loops
- All fiber optic cable from WIM Cabinet to WIM system

SDDOT will supply the following equipment (which IRD has provided to SDDOT under warranty of the existing WIM system, with an estimated value of \$196,120) to the Contractor for installation:

- Three lanes of WIM Single Load Cell scale platforms (two platforms per lane, six platforms total)
- One lane of WIM Single Load Cell frames (2 frames per lane, two frames total)

### 2.4. DESIGN/MANUFACTURE

All equipment furnished under this contract, including any equipment purchased from other manufacturers, shall be new and of the latest design currently in production. Used equipment or discontinued models shall not be accepted.

#### 2.5. DELIVERY

The Contractor shall coordinate equipment delivery dates and notify the SDDOT Project Engineer 30 days prior to equipment delivery. The Contractor shall supply four (4) sets of system schematic drawings for review and approval at least 30 days prior to equipment delivery.

#### 2.6. INSTALLATION

The Contractor shall coordinate equipment installation dates and notify the SDDOT Project Engineer 30 days prior to installation. The installation of all equipment shall be the responsibility of the Contractor, and shall integrate directly with the existing Port of Entry equipment. The Contractor shall install all material furnished by IRD and the equipment removed for reset in accordance to IRD specifications and installation instructions. SDDOT personnel must be present to observe and inspect the installation. The Contractor shall coordinate with the manufacturer to correct any defective equipment or other technical problems. If unforeseen technical problems develop with this installation, the Contractor shall provide all engineering and manufacturer's technical assistance needed for proper installation.

#### 2.7. STORAGE

Contractor may use an area designated by the Project Engineer within the Sisseton Port of Entry to store new and reused components of the Weigh-in-Motion System. Any components stored there shall be the responsibility of the Contractor and will not be monitored by Port of Entry personnel.

### 2.8. RISK OF DESTRUCTION OR DAMAGE

The Contractor shall be responsible for any destruction or damage to existing pole footings shown on plans and to equipment purchased or provided by SDDOT under this contract until the equipment has been installed as specified, inspected, and accepted by SDDOT.

### 2.9. INCIDENTAL WORK

Incidental work includes, but is not limited to, the restoration of all disturbed areas to the satisfaction of the Engineer. Contractor shall pull all wiring and terminate all connections. Contractor shall coordinate all material deliveries with IRD. All costs for this incidental work shall be incidental to the contract unit price for "Weigh-In-Motion System".

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### 3. INFORMATION TO BE SUBMITTED

#### 3.1. ITEMS TO BE SUBMITTED

Upon being awarded the project, the Contractor shall submit the following information to the SDDOT Office of Research:

- A technical description, system block diagram, equipment specifications, and an equipment list with model numbers and options of all equipment proposed to be furnished, including any equipment purchased from other manufacturers.
- A method by which replacement parts may be obtained. The WIM vendor must stock system replacement parts for a minimum of ten (10) years from which SDDOT may order.
- A warranty description, including the procedure and authorized warranty service station(s) used to obtain warranty service. The Contractor shall warrant all equipment supplied, including equipment from other manufacturers, against defective materials and workmanship. The minimum warranty shall be as follows:

"During the first 120 days following Installation Acceptance by SDDOT, all repairs, including factory labor and materials necessary to correct any failures shall be made at the Contractor's sole cost. During the following 240 days, the warranty shall be limited to the replacement of any materials including shipping charges. Any labor costs during the 240-day period will be the responsibility of SDDOT. SDDOT, at its discretion, may require that complete replacement modules be supplied."

If the Contractor's normal warranty exceeds the warranty terms specified in this section, the Contractor shall provide a copy of the warranty in his bid proposal.

#### 3.2. AS-BUILT ITEMS TO BE SUBMITTED

If any elements of the Weigh-in-Motion System are constructed differently from what is stated in the plans, the Contractor shall supply as-built plans to IRD to draft onto existing drawings for future reference. The final as-built plans shall be furnished to the SDDOT Office of Research. The as-built plans shall include conduit layouts, wiring diagrams, or other drawings depicting the changes from the original plans.

#### 4. REMOVAL OF EXISTING COMPONENTS

The Contractor shall remove existing WIM system components prior to replacement of aggregate base and concrete pavement.

#### 4.1. REMOVE CONCRETE FOOTING

The Contractor shall remove the existing concrete footings for the WIM Cabinet and the existing WIM scale vaults. All work associated with removing the concrete footing and scale vaults shall be incidental to the contract unit price per Lump Sum for "Remove Concrete Footing".

#### **REMOVE CONCRETE FOOTING**

Station	Description
395+97.0 - 52' L	NB Scale Vault
395+95.0 - 58' R	SB Scale Vault
395+94.8 - 83' R	WIM Cabinet Base

#### 4.2. REMOVE SIGNAL EQUIPMENT

The Contractor shall disconnect all electrical and fiber optic cabling prior to removal of any equipment. Weigh-In Motion equipment indicated on the Existing Removal Layouts shall be removed for reset. The list of signal equipment items to be removed for reset shall include, but is not limited to, WIM Scales, WIM Cabinet, Overheight Detectors, AVI Antenna, AVI Cabinet, Camera, Illuminator, Illuminator Cabinet, Fiber Optic Cable, and Electrical Copper Wire. The Fiber Optic Cable and Electrical Copper Wire shall be disconnected at the WIM Cabinet and pulled back to the junction boxes shown on the Existing Removal Layouts. The WIM equipment shall be stored at a safe location to protect equipment prior to resetting.

Contractor shall provide the six removed WIM Scale platforms to IRD without charge, in exchange for the six platforms IRD supplied to SDDOT under warranty of the existing WIM system.

The Contractor shall remove all existing conduit shown on the Existing Removal Layouts.

All costs to remove the existing conduit and to remove the WIM equipment for reset, disconnect all wiring, pull the existing fiber optic cables and electrical copper wires, and store the equipment prior to reset shall be incidental to the contract lump sum price for "Remove Signal Equipment".

#### 4.3. REMOVE SIGNAL POLES

The Contractor shall remove the existing signal poles shown in the plans. After the poles have been removed for reset they shall be stored at a safe location to protect equipment prior to resetting. The storage location shall be approved by the Project Engineer prior to removal of poles.

All work involved in removing, storing, and resetting of the existing poles shall be incidental to the contract unit price for "Remove and Reset Signal Poles".

### 4.4. REMOVE NEW CONCRETE PAVEMENT

The Contractor shall remove sections of the new mainline paving section in the southbound driving lane and both northbound lanes to permit the installation of WIM Scales. The concrete shall be sawcut the full depth of paving and shall be incidental to the contract unit price per Square Yard for "Remove Concrete Pavement".

The 300-foot section containing the WIM shall be blanket ground to meet ASTM E1318 smoothness specifications for weigh-in-motion sites before cutting out the pavement to install the WIM vaults for the single load cell scales.



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### 5. SENSOR INSTALLATION

The Contractor shall install sensors for detecting vehicle overheight, vehicle presence, vehicle identification, vehicle speed, axle spacing, axle count, and axle weight.

#### 5.1. INSTALL WIM SCALES

Contractor shall reset the IRD Weigh-In-Motion (WIM) Scales at approximately Station 395+95 SBL I-29, Station 395+97 NBL I-29 in accordance with IRD Single Load Cell Scale installation instructions and drawings. Contractor shall supply and install scale vaults including rebar, concrete, and conduit. The concrete used for the WIM Scale shall be Class M6 concrete per section 462.3 of the Standard Specifications. Contractor shall submit mix design to IRD and SDDOT for approval prior to construction. Contractor shall remove and reset the existing Precast Concrete Headwalls required for scale drain pipes.

In each lane, the WIM scale shall be constructed of two independent weighing platforms placed side-by-side across the lane. Each platform shall incorporate load transfer torque tubes to transfer all loading on the weighing surface to the single load cell so scale accuracy is not affected by the location of the truck's tires on the platform.

The WIM system shall conform to ASTM E1318 "Standard Specification for Highway Weigh-in-Motion (WIM) System with User Requirements and Test Method" accuracy requirements for a Type III system in all lanes.

Each load cell shall be serviceable and removable from the scale module without the need to remove the scale mechanism. The load cell removal shall require only one person with normal tools and shall be accomplished within 30 minutes.

Each scale module shall incorporate two offscale detectors at the outside edges of the weighing surface. The offscale detectors shall be integrated into the scale assembly to sense any vehicle missing the weighing surface of the scale. The offscale detectors shall be field replaceable.

The WIM scale shall be weather sealed and water tight. There shall be no intrusion of water, ice, snow, salt, debris, dirt, moisture, or sand into the load cell, the load cell wiring compartment, the weighing mechanism, or the entire WIM scale in general.

The WIM scale and frame shall be grounded with ground rods. The load cell and its signal processing electronic components and modules shall be protected against lightning.

Costs of all work including materials, equipment to furnish and install scale vaults, install scales, remove and reset existing Precast Concrete Headwalls, and install drainage systems as detailed in the plans shall be incidental to contract unit price for "Weigh-In-Motion System".

# 5.2. INSTALL LOOP DETECTORS

Contractor shall install IRD-supplied preformed loops at all locations specified in the plans (Refer to Sheet G19 of G24 of the plans, "Section A-A: Loop Detail) and in accordance with IRD installation instructions. Contractor shall coordinate with the paving Contractor to place loops prior to paving.

An IRD representative shall direct installation of loops. The wiring from each lane's instrumentation shall exit the pavement through conduit to a pull box in the nearest shoulder's inslope. Pavement sensor locations shall be determined and all the conduit and pull boxes for sensor cabling shall be installed. The wiring shall then be pulled through conduit from the pull boxes to the cabinet.

All costs to install the loops, pull wire, terminate all connections, and coordinate with paving Contractor shall be incidental to the contract unit price for "Weigh-In-Motion System".

#### 5.3. INSTALL PIEZOELECTRIC SENSORS

Contractor shall install IRD-supplied piezoelectric sensors at all locations specified in sheet G13 of G24 of the plans and in accordance with IRD installation instructions. An IRD representative shall direct installation of sensors. Contractor shall sawcut the sensors as detailed in the plans and seal all sensors with sealant supplied by IRD.

All costs to sawcut and install the piezoelectric sensors, pull wire, and terminate all connections shall be incidental to the contract unit price for "Weigh-In-Motion System".

### 5.5. RESET SIGNAL POLES

shown in the plans.

### PEDESTAL SIGNAL POLE

Station	Pole	Quantity (Each)
395+90.95 - 21.0' R	W1	1
395+90.95 - 83.5' R	W2	1
	Total	2

### SIGNAL POLE WITH 30' MAST ARM

Station	Pole	Quantity (Each)
396+16.6 - 83.5' R	W3	1
	Total	1

Station and offset shown are for reset locations. Offsets are to edge of poles.

Signal Poles".

### 5.6. RESET OVERHEIGHT DETECTOR

Contractor shall reset the Overheight Detector system at the Advanced WIM location. Contractor shall furnish, install, and terminate all electrical wiring in accordance with plans to run power from the junction box to the Overheight Detector System.

The detector shall use pulsed infrared light emitting diodes to reduce the effect of ambient light. The detector and light source shall be pole mounted, one on each side of the roadway. The height of the system shall be installed at 14'-1" and be adjustable plus or minus one foot.

Cables shall enter at the bottom of the support pole. All cables shall exit near the top of the pole through a stress relief connector attached to the pole and flex conduit to the overheight sensor. The flexible conduit shall be long enough to allow the adjustment of the Overheight Detector plus or minus one foot from the installation height of 14'-1".

All costs to furnish electrical wiring, reset Overheight Detector system, pull all wiring, and terminate all connections shall be incidental to the contract unit price for "Weigh-In-Motion System".



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The Contractor shall reset the existing signal poles on the existing footings as

All costs of work involved in removing, storing, and resetting of the existing poles shall be incidental to the contract unit price for "Remove and Reset

#### 5.7. RESET AUTOMATIC VEHICLE IDENTIFICATION (AVI) HARDWARE

The Contractor shall reset the Automatic Vehicle Identification antenna at the Advance WIM location, on the non-rotating mast arm pole W3. Automatic Vehicle Identification antenna shall be aimed by the Contractor using IRDsupplied alignment tool.

Contractor shall reset the Automatic Vehicle Information cabinet for the Advance WIM scale and terminate all connections. Cabinets and antennas shall be installed on the Automatic Vehicle Identification pole. Contractor shall furnish, install, and terminate all electrical wiring in accordance with plans to run power from the junction box to the AVI Antenna.

The AVI reader shall be able to read and write to transponders at vehicles at operating speeds up to 80 mph and correctly report the transponder ID to the preclearance system with an accuracy of 99.95%.

The AVI reader and antenna shall meet the environmental specifications listed for the WIM system.

All costs to reset the Automatic Vehicle Identification antenna, Automatic Vehicle Identification cabinet, furnish electrical wiring, and wire the system and terminate all connections shall be incidental to the contract unit price for "Weigh-In-Motion System".

#### 5.8. RESET CAMERA

Contractor shall reset camera equipment including camera housing, infrared illuminator, power pack, and brackets/cabling on the Automatic Vehicle Identification pole W3. Contractor shall furnish, install, and terminate all electrical wiring in accordance with plans to run power from the junction box to the camera equipment.

All costs to furnish electrical wiring, reset all camera equipment, pull all wiring, and terminate all connections shall be incidental to the contract unit price for "Weigh-In-Motion System".



#### 6.1. WEIGH-IN-MOTION (WIM) CABINET

The WIM electronics cabinet shall be placed near the ROW line on the west side of southbound I-29 as necessary to interface with the existing system. Contractor shall supply and install base for cabinet including concrete footing. rebar and j-bolts, and shall reset the existing type "334" WIM cabinet onto base. The cabinet pedestal shall be concrete with adequate dimensions to support the supplied cabinet. The base of the cabinet shall stand between one and two feet above the ground. Note requirement for additional conduit stubs in site layout drawings and systems specifications.

**CONTROLLER CABINET** 

Station	Location	Quantity (Each)
395+95.0 - 85' R	Advance WIM	1
	Total	1

Contractor shall install IRD-supplied iSINC WIM electronics in the controller cabinet. Contractor shall terminate all sensor cables at the cabinet.

Connections to all sensors and ancillary equipment must be conveniently located on the system front panel. The system shall provide a minimum of 25W power supply with 12VDC battery backup for extended operation up to 30 days.

All wiring in the cabinet shall use copper conductors (aluminum conductors are not acceptable) and shall be sized in accordance with the applicable sections of the current edition of the National Electrical Code and Section 10 of NEMA Standards Publication TS-1, latest revision, All cabinet wiring shall be neat and firm. All assemblies and panels shall be easily accessible for maintenance purposes. Live or hot parts of any electrical equipment inside the cabinet shall be suitably covered with Plexiglas and a warning label to prevent electrical shock.

An incandescent light fixture and lamp shall be mounted at the top front on the inside of the cabinet to provide illumination of the entire cabinet interior. The light fixture and lamp shall not interfere with the installation and removal of equipment from the cabinet. It shall be possible to easily remove and replace the lamp without interference. The lamp shall be energized by a 2position toggle switch located on the Auxiliary Switch Panel and labeled "CABINET LAMP POWER".

A 120 volt, 60 Hz utility outlet shall be provided in the cabinet. This outlet shall be used to facilitate service and testing and is not intended to provide power to equipment resident to the cabinet.

The Contractor shall supply power to WIM cabinet location, furnish and install all power cabling, roadside junction boxes, conduit, conduit fittings, and apparatus, power conductors, and connection of power conductors to controller cabinet necessary to provide a 240/120 VAC split phase 30 Amp/leg service. This service must maintain 104 VAC for a 33 Amp surge per leg.

Costs of all work including materials, equipment to furnish cabinet base and reset cabinet and WIM electronics shall be incidental to contract unit price for "Controller Cabinet".

#### 6.2. ELECTRONICS

Signal processing electronics shall be located next to the WIM scales in a roadside cabinet. These electronics will be responsible for retrieving vehicle data and communicating it to the station computer in the scale building for further processing.

The electronics shall include interfaces for the following components:

- Weigh in motion scales
- Axle sensors
- Loops
- Offscale detectors
- Overheight Detectors
- AVI Reader and Writer

The WIM system electronics must provide a facility for viewing vehicle records and sensor diagnostics directly, without ancillary equipment. The system must be of a modular design to aid in system maintenance, troubleshooting and in-field servicing. The system must be of a durable, industrial design and construction and must enable continuous operation with automated startup in the event of a power outage.

### 6.3. COMMUNICATIONS

The system electronics must support the following technologies:

- Ethernet network interface

- Remote file download via FTP

### 6.4 ENVIRONMENTAL

The system electronics shall be designed to operate reliably in a temperature range of -40 °C to 70 °C / -40 °F to 158 °F. If necessary, temperature control devices shall be installed in the cabinet to maintain the WIM system at allowable operating temperatures.



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• Two RS-232 interfaces, one for external communications, one for local Local user interface for system configuration and fault diagnosis Wireless connection capabilities for configuration and maintenance Remote administration via Telnet, PPP

### 6.5. CIRCUIT PROTECTION

Contractor shall provide protection against lightning, electrostatic discharge, and other transient high voltage surges as listed below. The surge protection equipment shall meet all applicable surge test requirements of latest IEEE Test Standards, and shall operate under the specified environment conditions.

## A. AC LINE PROTECTOR

An AC Line Protector Unit shall be provided for the 120 volts, 60 Hz power source. The Protector Unit shall include a thermal circuit breaker, and EMI/RFI noise suppression for diverting and clamping high voltage surges to limit the maximum voltage reaching the sensitive electronic equipment during a transient pulse. The unit shall be approved by Underwriter Laboratories (UL).

The AC Line Protector shall provide protection against transients that may enter electronic equipment through Line to Neutral paths (Differential Mode) or through Line or Neutral to Ground paths (Common Mode).

The AC Line Protector shall be contained in a single enclosure with appropriate terminations for interconnecting cables to those assemblies requiring 120 volts, 60 Hz protected power.

### B. DATA LINE PROTECTOR

A Data Line Protector Unit shall be provided at the Field Station telephone line termination and shall protect the electronic equipment from the hazardous and damaging effects of over-voltage transients induced on the data line (telephone line). The unit shall have a protection clamping time of less than 10 nanoseconds and a maximum clamping voltage of 150 volts peak, and shall protect in both the Common Mode and Differential Mode.

The Data Line Protector shall be contained in a single enclosure with appropriate terminations for interconnecting cables to the telephone line and Automatic-Answer Modem, and provisions for connecting a minimum No. 6 AWG copper ground wire to equipment ground.

### C. DETECTOR AMPLIFIER INPUT PROTECTOR

If applicable, Detector Amplifier Input Protector circuitry shall be provided at the input of each Loop Detector Amplifier unit to electrically isolate the loop from the detector amplifier circuitry and protect the circuitry from lightning and other electrical surges.

### D. GROUNDING

All bonding and grounding shall be in accordance with the National Electrical Code and with the manufacturers' instructions. In addition, one ground rod shall be placed at the foundation pad. The ground rod shall be 3/4 inch diameter by 8 feet long. Connection of ground rods shall be with No. 1/0 AWG copper wire bonded to the control cabinet.



### 6.6. CONDUIT INSTALLATION

The Contractor shall supply and install all cabling, conduit, conduit fittings, junction boxes and apparatus necessary for cabling from:

- Advance WIM/AVI site to existing junction boxes shown on plan sheets.
- AVI antennas to the WIM cabinet at the advance WIM/AVI site.
- All loops, overheight poles, and piezoelectric sensors from the Advance WIM location to the WIM cabinet.

The conduit shall be buried at a minimum depth of 4 feet beneath the roadway surface and a minimum of 3 feet under all other areas within the ROW such that it will not be damaged.

Contractor shall use rigid, schedule 80 conduit under all roadways and all conduit under roads shall be bored. The following table lists approximate locations shall be bored under existing roadway.

BORING LOCATIONS				
Station	to Station	Crossing	Length (Ft)	
395+91.0 - 80.5' R	395+91.0 - 24.0' R	I-29 SB	56	
396+27.6 - 85.0' R	396+27.6 - 23.0' R	I-29 SB	62	
	118			

Trenching shall include all sand bedding, backfilling, refurbishing, compacting and removal of all excavated materials as required. Boring, if necessary shall be done in accordance with SDDOT's standard specification. All costs associated with boring and trenching shall be incidental to the contract unit price per foot of "2" Rigid Conduit, Schedule 80".

The Contractor shall leave pull ropes for cables in all spare conduits.

All cost to furnish and install conduit and all conduit fittings shall be incidental to the contract unit price per linear foot for "1" Rigid Conduit, Schedule 40", "2" Rigid Conduit, Schedule 40", "3" Rigid Conduit, Schedule 40", "2" Rigid Conduit, Schedule 80", and "3" Rigid Conduit, Schedule 80". All costs to bore under existing roadways shall be incidental to the contract unit price per linear foot for "2" Rigid Conduit, Schedule 80" and "3" Rigid Conduit, Schedule 80".

### 6.7. PULLBOXES/JUNCTION BOXES

Contractor shall furnish and install all pullboxes/junction boxes as necessary for cabling. Pullboxes/Junction boxes shall be Type 2 for all fiber optic wiring and be spaced no further than 200' apart. Type 3 Junction boxes shall be used for all electrical wiring and be spaced no further than 500' apart. Junction boxes shall be placed at all 90° bends.

Cabling and splices shall be high quality and waterproof. The pull boxes shall be strategically located such that they are high on the inslope near the shoulder's edge and easily accessible. If cable splices are necessary, they shall be located in the pull boxes and meet SDDOT specifications.

All cost to furnish and install pullboxes/junction boxes shall be incidental to the contract unit price of "Type 2 Electrical Junction Box" and "Type 3 Electrical Junction Box". See standard plate 635.65.

### 6.8. ELECTRICAL SERVICE

Contractor shall furnish and install all materials to provide working electrical service as shown on plan sheets. All cost to furnish and install all materials needed to provide working electrical services shall be incidental to the contract bid items for Electrical Junction Box, Rigid Conduit, and Copper Wire.

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### 7. SYSTEM ACCEPTANCE

The testing procedures to demonstrate compliance with the contract requirements must be carried out jointly by the Contractor, IRD, and SDDOT personnel at the site.

Acceptance of the system shall consist of two parts. The first part follows installation, calibration, and testing and is termed 'Installation Acceptance'. The second part follows a successful 30-day performance period and is termed 'Final Acceptance'.

#### 7.1. INSTALLATION ACCEPTANCE

The Contractor shall test the system, as specified in Subsections A, B, C and D to SDDOT's satisfaction.

#### A. WEIGHT TESTING

The accuracy of the system is dependent on the pavement's smoothness and must be within  $\pm 6\%$  95% of the time for gross weights, within  $\pm 10\%$  95% of the time for groups of axles, and within  $\pm 15\%$  95% of the time for individual axles. This accuracy shall be determined by comparing the WIM readings with the static weight of a 5-axle tractor-semitrailer with gross weight between 75,000 and 80,000 pounds. The tandem axles on the tractor and trailer shall not be spaced more than 55" apart. This vehicle shall use air-ride suspension and carry a non-shifting load. The static weight shall be recorded at a certified static scale and the driver shall produce the weigh ticket to the Project Engineer.

The test with this vehicle shall consist of a minimum of 10 runs over the scales in each lane within the normal range of highway speeds at the site, made after the last calibration of the system and after the last hardware and software changes, if any are needed.

The Contractor shall secure and pay for any and all test trucks used in testing the system. The Contractor shall be responsible for any traffic control that may be needed during the testing of the system. All costs related to the testing of the system shall be included in the contract unit price for the "Weigh-In-Motion System".

### **B. AXLE SPACING TESTING**

The test for axle spacing accuracy shall be conducted concurrently with Axle Weight Testing, using the 5-axle tractor-semitrailer test truck. The spacing between axles recorded by the WIM equipment shall be within  $\pm 6$  inches of spacings measured manually by tape measure for axle spacings less than or equal to 10 feet and within  $\pm 5\%$  for axle spacings greater than 10 feet, 95% of the time.

#### C. VEHICLE CLASSIFICATION TESTING

The system must properly classify a minimum of 90% of all vehicles and 95% of all 5-axle tractor-semitrailers The test which SDDOT may conduct at the site shall be to visually classify vehicles to verify proper classification.

### D. VEHICLE SPEED TESTING

The speed recorded by the system may be checked by SDDOT to verify that 95% of the vehicle speeds collected are within  $\pm 2$  mph of their actual speed determined by a properly calibrated speed detector.

#### 7.2. Upon FINAL ACCEPTANCE

INSTALLATION ACCEPTANCE and after verbal notification by IRD to the SDDOT Project Engineer the system shall undergo a 30-day performance period constituting 30 consecutive days in which no remedial action or interpretation is required by the Contractor, IRD, or SDDOT personnel to view or obtain data and tables that are being accumulated.

Upon completion of 30 consecutive days of successful operation, beginning with the start of the most recent 30-day test period, the system will be considered accepted. SDDOT reserves the option to check the performance of the system at any time during the life of this contract following testing procedures outlined in Section 7.1. Major malfunctions will be taken into consideration of acceptance or rejection of the system.

#### 8. MEASUREMENT AND PAYMENT

#### 8.1. METHOD OF MEASUREMENT

Measurement for the WIM will not be made. The quantity shown in the plans will be the quantity used for payment.

#### 8.2. BASIS OF PAYMENT

Payment to the Contractor for the WIM System portion of the contract shall be as follows:

A. The first partial payment will be 70% of the contract lump sum unit price for "Weigh-In-Motion System". The first partial payment will be made upon Installation Acceptance as defined in Section 7.1.

B. The final payment will be 30% of the contract lump sum unit price for "Weigh-In-Motion System". Final payment will be made upon Final Acceptance as defined in Section 7.2.

Payment will be full compensation for labor, equipment, tools, materials, and all other items of work required to furnish, install, and test the WIM System.

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		1"	2"	3"		2"	3"		2/C					2/C					Type 2	Type 3					
Locat	tion to Location	Ft	Ft	Ft		Ft	Ft		Ft					Ft					Each	Each					
SISSET	ON WEIGH SCALE																								
Pullbox - P	Pullbox - R		200																1						
w	/IM Location																								
WIM Cabinet	Pullbox - R		10	20																					
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Pullbox - R	Loop 1	23																			<u> </u>				
Pullbox - R	O/H Pole		10																						
Pullbox - R	WIM Scale SB					29															<u> </u>				
Pullbox - R	Plezo 1	23																							
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Pullbox - W	Pullbox - X						56												1						
Pullbox - X	Pullbox - Y			33															1						
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Pullbox - Y	Piezo 3	24																							
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Pullbox - Y	Pullbox - Z			58															1		<u> </u>		_		
Pullbox - Z	Loop 8	10																			<u> </u>				
Pullbox - Z	Loop 6	9																				_	_		
Pullbox - Z	WIM Scale NB	-				11															<u> </u>				
Pullbox - Z	Loop 5	9																					_		
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STATE OF	PROJECT	SHEET	TOTAL
SOUTH DAKOTA	IM 0299(74)235	G9	G24



		220.777	OUTET	TOTAL							
	STATE OF	PROJECT	NO.	SHEETS							
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		T IN PLACE	WINDROFESS/ON	4.							
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<u>Q</u>	P		8161								
		E E E E E E E E E E E E E E E E E E E	JOSH LARSON	R							
			4-18-14 HDAKOTP	unn.							
		1	1. 152	HII!							
		C	102Millauro	N.							
R											
	JAJA										
		I-29 MAINLINE WI	<b>N SORTER</b>								
NOT TO SCALE	SISS	SETON POE, SOUTH	I DAKOTA [	оот							
SIZE:	DWG. No.		REV.:								
			- I								
FEET	GAD FILE:	MSDMLS04 DWG	SHEET	OF							



### SIGNAL CONDUITS: (All conduit supplied by Contractor) 1 1" CONDUIT 1-2C 14AWG (LOOP WIRE) 2 2" CONDUIT 2-3PR 20AWG (SLC LEAD) 4-2C 18AWG (OFF-SCALE LEAD) 3 1" CONDUIT 1-RG58 COAXIAL CABLE (PIEZO LEAD) 4 2" CONDUIT 1-3PR 20AWG (SLC LEAD) 2-2C 18AWG (OFF-SCALE LEAD) 5 3" CONDUIT 4-2C 18AWG (LOOP LEADS) 2-3PR 20AWG (SLC LEAD) 4-2C 18AWG (OFF-SCALE LEAD) 6 2" CONDUIT 1-2C 18AWG (OVERHEIGHT SIGNAL) 7 2" CONDUIT 1-8 STRAND FIBER OPTIC CABLE (AVI) 1-CAT5 NETWORK CABLE (CAMERA) 8 3" CONDUIT 4-2C 18AWG (LOOP LEADS) 4-RG58 COAXIAL CABLE (PIEZO LEAD) 9 3" CONDUIT

2-RG58 COAXIAL CABLE (PIEZO LEAD)

10	2"	CONDUIT 1–8 STRAND FIBER OPTIC CABLE (EXISTING FIBER OPTIC CABLE REMOVED FOR RESET)
11	2"	CONDUIT 2–8 STRAND FIBER OPTIC CABLE
12	2"	CONDUIT 2–8 STRAND FIBER OPTIC CABLE 1–CAT5 NETWORK CABLE
13	2"	CONDUIT 4–8 STRAND FIBER OPTIC CABLE
14	3"	CONDUIT 4–2C 18AWG (LOOP LEADS) 3–RG58 COAXIAL CABLE (PIEZO LEAD) 2–3PR 20AWG (SLC LEAD) 4–2C 18AWG (OFF–SCALE LEAD)
15	2"	CONDUIT 4–3PR 20AWG (SLC LEAD) 8–2C 18AWG (OFF–SCALE LEAD)
16	3"	CONDUIT 6–2C 18AWG (LOOP LEADS) 2–RG58 COAXIAL CABLE (PIEZO LEAD) 2–3PR 20AWG (SLC LEAD) 4–2C 18AWG (OFF–SCALE LEAD)
17	2"	CONDUIT 2–2C 18AWG (LOOP LEADS) 2–RG58 COAXIAL CABLE (PIEZO LEAD)
18	3"	CONDUIT 8–RG58 COAXIAL CABLE (PIEZO LEAD)
19	1"	CONDUIT

8-2C 18AWG (LOOP LEADS)

REV.	DESCRIPTION	DWN/DSN	APPR.	APPR.	DATE	CONFIDENTIAL	R	INTERNATIONAL ROAD DYNAMICS INC.		
										SASKATOON SASKATCHEWAN CANADA
						TO IRD AND IS THEREFORE				DWG. TITLE: SITE LAYOUT
						OTHERS OR USED FOR PRODUCTION WITHOUT	NOT TO SCALE	I-29 MAINLINE WIM SORTER SISSETON POE, SOUTH DAKOTA DOT		
						WRITTEN PERMISSION FROM INTERNATIONAL	SIZE: B	DWG. No. MSDMLS04 REV.: -		
						ROAD DTNAMICS INC.	DIMENSIONS IN: FEET	CAD FILE: MSDMLS04.DWG SHEET OF		

STATE OF	PROJECT	SHEET	TOTAL
SOUTH DAKOTA	IM 0299(74)235	G12	G24

### POWER CONDUITS: (All items supplied by Contractor)

(EXISTING WIRE REMOVED FOR RESET)

POLES: (All items removed, reset and supplied by Contractor)

W1 REMOVE AND RESET OVERHEIGHT POLE ON EXISTING FOOTING (ADVANCED WIM LOCATION)

W2 REMOVE AND RESET OVERHEIGHT POLE ON EXISTING FOOTING (ADVANCED WIM LOCATION)

W3 REMOVE AND RESET ADVANCED AVI/CAMERA POLE ON EXISTING FOOTING (ADVANCED WIM LOCATION)





NCUDC	STATE OF	PROJECT	SHEET	TOTAL
			NO.	SHEETS
neene	DAKOTA	IM 0299(74)235	G13	G24



### NOTES: (THIS SHEET ONLY)

- A CABINET WITH WIM ELECTRONICS.
- B CABINET BASE.
- PULL BOX/JUNCTION BOX.
- D DRILL THROUGH SHOULDER FOR CONDUIT.
- F FOR SLC SCALE DETAILS, SEE DRAWING SHEET G19.
- OVERHEIGHT SEE SHEET G16 FOR INSTALLATION DETAILS.
- MAINLINE WIM POWER 120V 30A SERVICE. TYPICAL OPERATING CURRENT 10A. EXTERNAL LOAD CENTER REQUIRED.
- $/\mathrm{J}$  avi/camera pole see sheet G15 for installation details.
- K UNDER BORE.

¢	PROTE APPRO	PROTECT IN PLACE PROTECT IN PLACE APPROX STATION		-90 FESSION 4 EGNO 8161 INSON 18-14 HDAVG 1 HDAVG 1 HD	THANEER THANK
R R R R R	INTERNA SASKATO	TIONAL ROAD I		AMICS AN CA	INC. NADA
	DWG. TITLE: I-2 SISSET(	SITE LAYOU 9 MAINLINE WIM ON POE, SOUTH	JT I SO DAI	RTER KOTA I	рот
SIZE: B	DWG. No.	ISDMLS04		REV.:	-
DIMENSIONS IN: FEET	CAD FILE:	SDMLS04.DWG		HEET	OF





	REV.	DESCRIPTION	DWN/DSN	APPR.	APPR.	DATE	CONFIDENTIAL	
							THIS DOCUMENT CONTAINS INFORMATION PROPRIETARY	ΙĨ
SEE SECTION F							TO IRD AND IS THEREFORE NOT TO BE DISCLOSED TO	
							PRODUCTION WITHOUT	NC
							FROM INTERNATIONAL	SIZE:
							KUAD DI NAMICS INC.	DIME



### GENERAL INSTALLATION INST



- 2. INSTALL CONCRETE ANCHOR BOLTS,
- 4. PLACE 6" OF 1" NOMINAL CRUSHED
- 6. INSTALL DRAIN PIPES AND CONDUITS. MUST ALLOW FREE FLOW AWAY FROM THE HIGH WATER LEVEL OF THE DITC THE OUTLET MUST BE MAINTAINED AT
- 7. USE JACK SCREWS TO POSITION FRAM
- 8. INSTALL GROUND CLAMPS AND GROUN
- 9. LOCATE THE EDGE OF THE SCALE FR STRING LINE FROM THE ROADWAY AC
- 10. FINAL SET OF THE SCALE USING A M SPANNING ACROSS ADJACENT SCALE ARE PARALLEL AND THERE IS NO TWI
- 12. POUR AND VIBRATE CONCRETE AROUN
- 13. SLOPE AND FINISH PIT SURFACE AND
- 14. CONCRETE MUST MEET THE FOLLOWIN 1500PSI - INSTALL PLATFORM IN FRA





GROUND ROD 4 PLCS

(ONLY ONE SHOWN

<u>SECT</u>



	STATE OF	PROJECT		SHEET NO.	TOTAL SHEETS				
RUCTIONS:	DAKOTA	IM 0299(74)235		G17	G24				
RS, O-RINGS, GF BOW, ALL NECES T PADS, CONDU	ROUND RO SSARY CO IT CONNEC	D CONNECTORS, 2–10' NCRETE ANCHOR BOLTS, CTING HOSE AND CLAMPS	LEN JA( S,	GTHS CK					
JACK SCREWS AI F 40" AND COMI	ND J-BAR PACT PIT	S ONTO SCALE FRAMES. BOTTOM.							
ROCK AND VIBR	ATE COMP	PACT.							
SEAL ALL CONI I THE OUTLET O CH OR MANHOLE. ALL TIMES.	NECTIONS. F DRAIN F THE FLC	DRAINAGE AT EDGE OF PIPE. THE OUTLET MUST W ALONG THE DRAIN AN	ROA BE D A	ADWAY WELL / WAY FF	ABOVE ROM				
WE PROPERLY - HURIZUNTALLY AND VERTICALLY. ND RODS. AME FLUSH WITH THE SURROUNDING ROAD SURFACE USING A POSS THE CODNERS OF THE SOALE FRAME									
ROSS THE CORNERS OF THE SCALE FRAME. IACHINISTS LEVEL MOUNTED ON AN ADJUSTABLE SUPPORT, BEARING PADS TO ENSURE THAT ALL FRAME EDGES IST IN THE SCALE FRAME.									
ND FRAME. CONCRETE SHOULD HAVE MAX. SLUMP OF 3". ) SCALE FRAME FLOOR FOR PROPER DRAINAGE TO DRAINPIPE INLET. NG SPECIFICATIONS: AME									
58.0"		o"							
38.0" 10.0" STRING LINE MACHINISTS LEVEL ACROSS EACH PAIR OF BEARING PADS ADJUSTABLE MACHINISTS LEVEL SUPPORT GROUND ROD CONNECTOR WELDED NUT FOR J-BARS 44 PLCS 2.000x2.000x0.250 ANGLE IRON ANCHOR 00 750 L-BAR 44 PLCS									
•	<u> _#</u> # 	— 12' GROUND ROD 4 F	PLCS	6					
1 <u>ION A-A</u>		The second	ED PP	REGNO 8161 JOSH LARSON 4-18-14 Crith Dando	THE MANEER				
	INTE SASP	RNATIONAL ROAD D	YN	AMICS AN CA	S INC. NADA				
DWG. TITLE: I-29 MAINLINE WIM SORTER SISSETON POE, SOUTH DAKOTA DOT									
SIZE: B	DWG. No	MSDMLS04		REV.:	-				
FEET		MSDMLS04.DWG	S	HEET	OF				



	STATE OF	PROJECT	SHEET NO.	SHEETS
	DAKOTA	IM 0299(74)235	G18	G24
SHOWN ARE MINIM CONSTRUCTION 8"Ø x 16" EPOXI 5" O.C. SECURE I EXACTLY 90' TO LLY AND HORIZON DURE. 2'	IUM REQU CODES. Y COATED DOWEL INT LONGITUD ITALLY.	IN 0299(74)235 IREMENTS DOWELS TO HOLE INAL INAL INAL	G18	G24
			<u>, , , , , , , , , , , , , , , , , , , </u>	Ì,
<u> </u>			N. N	28/
DRAIN DETA	<u>IL</u>	PRECAST CO HEADWALL F 41'+/- F	DNCRETE FOR DRAIN ROM CENTEF	RLINE
0" APPLY JO SCALE PI ROAD SURFACE #4 BAR ( 	DINT SEAL IT — ROAI CONTINUOU E 2. FOR REBAI	ANT ALONG D INTERFACE. JS AROUND FRAME R MAT		
1.5 DIA. / #4 BAR @ TOP & R(	ABS DRAIN ■ 8" O.C. DTTOM	, LINE E.W.		
			BIGI JOSH LARSON 4-18-14 BINDAO	A A A A A A A A A A A A A A A A A A A
		RNATIONAL ROAD		S INC. ANADA
NOT TO SCALE	DWG. TIT	LE: SITE LAYO I-29 MAINLINE WII SETON POE, SOUTH	UT M SORTER I DAKOTA	рот
SIZE: B	DWG. No.	MSDMLS04	REV.:	-
DIMENSIONS IN: FEET	CAD FILE	: MSDMLS04.DWG	SHEET	OF



### SECTION B-B - PIEZO SENSOR DETAIL



SECTION C-C (SHEETS G13 & G14) -PREFORMED LOOP IN JOINTED CONCRETE PAVEMEN



REV.	DESCRIPTION	DWN/DSN	APPR.	APPR.	DATE	CONFIDENTIAL
						THIS DOCUMENT CONTAINS
						TO IRD AND IS THEREFORE NOT TO BE DISCLOSED TO
						OTHERS OR USED FOR PRODUCTION WITHOUT
						WRITTEN PERMISSION FROM INTERNATIONAL
						ROAD DINAMICS INC.

	STATE OF	PROJECT	SHEET	TOTAL		
TAILS	SOUTH DAKOTA	IM 0299(74)235	G19	G24		
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1" LEA	AD CONDU	JIT				
L CUININECTIONS	BEIWEEN	N SENSURS AND LEAD	V			
IN SOLDERED /	ND SEAL	IN THE JUNCTION BU	NG			
LN JOLDLILD F	NIND JLAL	LU FOR WATLIFROUT	110.			
I DETAIL						
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	NEW PAVI	EMENT				
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		DNS 16 AWC				
- PREFORMED LO	UP (5 IU	KNS, ID AWG.)	NUN POFESSIO	111		
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		1878 1876	0161	AGIN		
		REG	JOSH	ER		
			LARSON 4-18-14	шп,		
		in the second	TH DAKOTA	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII		
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		7				
		RNATIONAL ROAD	YNAMIC			
	SASK	ATOON SASKATCH	EWAN CA	NADA		
		I-29 MAINLINE WIM	SORTER			
NOT TO SCALE	SISS	SETON POE, SOUTH	DAKOTA	DOT		
SIZE:	DWG. No.		REV.:			
В		MSDMLS04		-		
DIMENSIONS IN:	CAD FILE	MSDMLS04.DWG	SHEET	OF		





Published Date: 1st Qtr. 2010	S D D O T	S
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	STATE OF	PROJECT		SHEET	TOTAL SHEETS		
	DAKOTA	IM 0299(74)	235	G21	G24		
names				753			
g Diameter	1/-	2" Rigid grounding	g condui	† e			
	grounded are shown on the						
		neid wiring didgr	uni.				
	With	Bushings					
		<ul> <li>A service of the structure state of the State Public State</li> </ul>					
(For Signal Pole Footbace)							
		teor Signal Pole F	ootings)				
Diamotor	- 10	chor Rod (Typ)					
and r	ZU * XOW	** For Pol	r Signal le Footin	as			
				30			
	o do la Vola da da	When dir	sed a bu	ial is			
	` _	or bell e	and shall	be			
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		in de					
		<u>bu</u>					
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ns. Circular	ties ma	y be used in lieu	J of the				
he No. 4 t	ies shall	except for the be spaced 6 incl	top two nes apar	+			
spaced 3	inches ap	bart. The ties sh the cape.	nall be				
at each e	end.						
fications f	or footi	ng materials.					
inches to	6 inches	s above footing	for fixe	d			
the slip p	plane or	tracture plane	tor				
uring all pho	ases of	construction unt	til poles	are			
to formation		- 12 June					
not fit, co	steel cag intact th	ne Office of Bri	dge Desi	gn			
ment will be	e made f	or the redesign	ed footi	ng.			
shown on	footing	detail shall be inc	cidental ·	to			
e concrete	has att	ained design str	ength				
the breeks							
feet in all	direction	is. The Contracto	or may t	e			
some break	away po	le locations.	Septembe	er 6, 201	3		
			PLATE	WMBER			
POLI	E FOOTING		635	.55			
			Sheet	l of I	1		
					-		



, asilonoa Bata, 13t 201, 2017	7			
Published Date: 1st Otr. 2014	5440	5		ELE
The electrical junction	DOX	es s	shall be	UL
Specification for Under all the electrical juncti	on t	ove	Enclos s shall	ure be
The electrical junction	box	es s	shall co	
** The cover of the junc size letters and shall t wires for a traffic sid	be r gnal	ther	ssed. W h the l	
of friction value of 0.	.5 as	s de	termine	ed b
The cover shall have a	lift	ing	eye.	
The cover shall be gash and washers.	kete	ed w	ith a m	ninin
GENERAL NOTES:		2		
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3	3 1	)pen with	Bottor Gasket	n 17
2	2 0	)pen with	Bottor Gasket	n 13
	0	)pen with	Bottor Gasket	
TYI	PE	DESC	RIPTION	
	E	LEC	TRICA	<u>L</u> .

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_		STATE	OF		PROJECT		SHEET	TOTAL
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_								
	IL INICA							
	JUNCI	IMENSIO	NS					
	Α	В	С					
1	11"-15"	18"-21"	18" (M	lin.)				
1	3"- 8 <b>"</b>	23 <b>"-</b> 28"	18" (M	lin.)				
1	17 <b>"</b> -22"	24"-30"	18" (M	lin.)				
1	28"-33"	36"-48 <b>"</b>	24" (N	lin.)				
7.0								
ir	nimum of	f two s	stainl	ess st	teel bolts			
		n wet	and a	try co	efficient			
C	by AST	M F 60	9.	, y co				
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o e	go shall logo sh	be "Sig all be "	nal" <b>.</b> 'Lighti	When ing".	the junct	ion box		
nı	oly with	the Ar	merico	n Nat	tional Star	ndards		
communications Engineers (SCTE) 77 2007 ure Integrity. The loading requirement for be Tier 8 of ANSI/SCTE 77 2007.								
UL listed.								
_						June	26, 201	2
ELECTRICAL JUNCTION BOXES								
TYPE 1 THROUGH TYPE 4 Sheet 2 of 2						-		
_								-







STATE OF		PROJECT	SHEET	TOTAL SHEETS
DAKOTA	IM	0299(74)235	G24	G24
			-	