

ENGINEERING SPECIFICATIONS

Concrete Deck Motor Truck Scale

1 GENERAL PROVISIONS

- 1.1 Furnish and install one concrete deck motor truck scale and associated electronic controls.
- 1.2 The scale shall have a clear and unobstructed weighing surface of not less than 70 feet long and 11 feet wide.
- 1.3 The scale shall have a profile of 14-1/2" inches, which is measured from the top of the scale to the top of the foundation slab or pier at the load cell bearing points.
- 1.4 The scale shall be fully electronic in design and shall not incorporate any mechanical weighing elements, check rods, or check stays.
- 1.5 The scale shall be designed to perform as a single weighing platform and shall be of flat-top design. Side rail support beams are not acceptable.
- 1.6 The scale shall have a gross weighing capacity of 100 tons.
- 1.7 The scale shall have a Concentrated Load Capacity (CLC) of 100,000 pounds.
- 1.8 The scale shall be designed to accept vehicles that generate up to 80,000 pounds per tandem axle.
- 1.9 The scale shall be designed to accept an average daily traffic volume of up to 250 vehicles per day for 20 years at the designed usage, assuming that 100% of the vehicles are fully loaded with the equivalent of 80,000 lbs. on their dual tandem axle.
- 1.10 In order for the bid to be considered, Supplier must provide written confirmation of empirical testing data to validate the design of the weighbridge through actual life-cycle testing. During the testing process the weighbridge must see a minimum of 1 million cycles, with at least 80,000 lbs. of test load, applied on the 8 contact points of a standard truck's dual tandem axle tires. This documentation must be provided with the proposal submittal. Failure to provide this information will result in the bid being considered non-responsive.
- 1.11 The scale shall be calibrated to a minimum of 120,000 pounds by 20-pound increments and not to exceed 200,000 pounds. System configurations with increments greater than 20-pound increments will not be accepted; therefore scales with gross capacities in excess of 200,000 pounds will not be acceptable in order for the scale to meet NTEP Legal For Trade regulatory requirements.
- 1.12 The scale weighing related electronics shall be comprised solely of load cells, load cell cables and digital weight display. No other devices shall be permitted between the load cell and the digital weight display. Junction boxes, summing boards, gathering boards and gathering boxes, Totalizers, external analog to digital converter boxes and sectional controller boxes will not be accepted because of their significant and inherent maintenance issues.

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- 1.13 The load cells and load cell mounting hardware shall be constructed of stainless steel. The cables shall be stainless steel sheathed. Load cells which are not stainless steel and hermetically sealed shall not be acceptable because of their inability to prevent moisture from entering the load cell and causing a premature failure.
- 1.14 The scale shall meet the requirements set forth by the current edition of the National Institute of Standards and Technology Handbook 44 (NIST H-44). The scale manufacturer shall provide a Certificate of Conformance (NTEP Certification) to these standards upon request.
- 1.15 The design and manufacture of the scale weighbridge, load cells, and digital instrument shall be of one manufacturer to maximize compatibility and availability of components and to insure maximum benefit from the system's lightning protection capability. Also, the manufacturer shall have a quality system that has been registered to the standards of ISO 9001.
- 1.16 The manufacturer or bidder shall provide with the bid proposal a listing of the total cost (labor, parts, travel time and mileage) for two service technicians to travel to the scale site with a heavy duty test truck, stay on site for four (4) hours to troubleshoot and replace one load cell in the scale and the main printed circuit board in the weight display. This listing shall be provided for service in the following three timeframes: 6 months after installation, 36 months after installation, and 58 months after installation. Listings of the same costs at these three time periods must also be provided assuming the failure is the result of a lightning strike. The cost of recalibration must be included in each service cost summary. Failure to provide the information required in 1.16 will cause your bid submittal to be considered non-responsive and disqualified from consideration.
- 1.17 The scale shall be a Mettler-Toledo, Inc. Model VTC221 or equivalent.

2 SCALE FOUNDATION REQUIREMENTS

- 2.1 The foundation shall meet all local requirements and the minimum specifications as stated in this section.
- 2.2 The minimum soil bearing required shall be 2,500 pounds per square foot (psf) for a variable footer, 1,500 psf for a beam slab, and 2,000 psf for a pit foundation. The buyer shall be responsible for determining whether or not the soil conditions are adequate.
- 2.3 The foundation shall extend the full length and width of the scale platform.
- 2.4 The foundation shall provide a minimum of 3 inches of clearance to the weighbridge along the length of the scale.
- 2.5 The foundation shall be constructed to provide positive drainage away from its center.

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- 2.6 The foundation must be higher than the surrounding grade to promote drainage away from the scale.
- 2.7 The foundation shall be poured and constructed of concrete with a minimum strength of 3,000 psi at a 28-day cure with 5 to 7% air entrainment.
- 2.8 The foundation shall be reinforced in all load-bearing areas.
- 2.9 The foundation shall be designed to include an approach on each end of the scale in accordance with local regulations and the guidelines of NIST HB-44.

3 WEIGHBRIDGE SPECIFICATIONS

- 3.1 The scale weighbridge shall be constructed of three prefabricated scale modules each with a nominal surface dimension of 11' wide by 23'-4" long.
- 3.2 The prefabricated scale modules shall be so designed to enable field pouring of the concrete without additional field forming. No field added steel reinforcing bar shall be required for installation. Field reinforcement shall be accomplished through the use of polypropylene fibers such as Fiber-Lok or equivalent.
- 3.3 The scale weighbridge shall be capable of weighing trucks that have dual-tandem axle weights (4 feet minimum between dual axles and at least 10 feet from next axle) of up to 80,000 pounds, and shall have a Concentrated Load Capacity (CLC) of 100,000 pounds.
- 3.4 The scale deck shall be poured and constructed of concrete with a minimum strength of 4,000 psi at a 28-day cure with 5 to 7% air entrainment.
- 3.5 The concrete deck shall be supported by an integral steel structure of sufficient design and construction to meet the loading and life expectancy as specified in Section 1 of this specification.
- 3.6 All welding shall be completed in accordance with the American Welding Society (AWS) D1.1 Structural Welding Code.
- 3.7 All welding shall be performed by welding operators who have been certified to the AWS D1.1 Structural Welding Code.
- 3.8 The weighbridge shall be designed to allow access to load cell cables, base plates, and all foundation anchor bolts from the top of the scale platform.
- 3.9 The weighbridge and load cell mounting assemblies shall be designed to allow installation or replacement of a load cell with only one additional inch of clearance or less required between the top of the foundation and the bottom of the weighbridge on pit-less installations.
- 3.10 There shall be no bolted connections between the load cell and weighbridge assemblies.

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- 3.11 The load cell assembly shall be designed so that when you are at the scale weighbridge with a lifting jack, the load cell can be replaced in less than 5 minutes.
- 3.12 There shall be no field welding or field fabrication required for the installation of the scale.

4 SURFACE PREPARATION AND FINISH

- 4.1 The weighbridge shall be shot blasted to a minimum SSPC-SP6 specification prior to painting.
- 4.2 All exterior surfaces of the scale shall have a two component, high build epoxy finish, impregnated with aluminum flake for increased corrosion resistance and UV protection, providing total Dry Film Thickness of 5-7 mils; International/Akzo Nobel Intergard 7562 or equivalent.
- 4.3 The finish shall be force cured in order to reduce risk of contamination and ensure durability of the surface.

5 LOAD CELL SPECIFICATIONS

- 5.1 Each load cell shall have a minimum capacity of 50 metric tons (110,000 pounds) with 300% ultimate overload rating.
- 5.2 All Load cells shall be certified by NTEP and meet the specifications as set forth by NIST HB-44 for Class III L devices. The manufacturer shall provide a Certificate of Conformance to these standards upon request.
- 5.3 All load cells shall be certified to meet the specifications set forth by the International Organization of Legal Metrology (OIML) in document R60 for C3 load cells, which requires 60% tighter accuracy tolerances than NIST HB-44 for Class III L devices. The manufacturer shall provide a Certificate of Conformance to these standards upon request.
- 5.4 Load cells shall be digital with an integral microprocessor and analog-to-digital conversion function located within the load cell housing.
- 5.5 Load cells shall output only converted digital information without load correction for load position to the scale instrument. Analog output of signals from the load cell is not acceptable due to susceptibility of signal interference.
- 5.6 The load cell assembly shall be constructed so as to perform as a rocker pin and shall have no positive fixed mechanical connectors, such as bolts or links that are required in mounting the load cell to the weighbridge or foundation base plates.
- 5.7 The load cell shall not require check rods, flexures or chain links for stabilization, as each of these items are sources of ongoing maintenance requirements.

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- 5.8 The load cell shall not require a junction box to communicate between the load cell and scale instrument. No other devices shall be permitted between the load cell and the digital weight display. Junction boxes, summing boards, gathering boards and gathering boxes, Totalizers, external analog to digital converter boxes and sectional controller boxes will not be accepted because of their significant and inherent maintenance issues.
- 5.9 The load cell shall be of stainless steel construction and hermetically sealed with a minimum NEMA 6P / IP68 (submersible) and IP69K rating.
- 5.10 The load cell shall contain integral Transient Voltage Surge Suppressors (TVSS) for all input and communication lines. Each TVSS shall contain self-resetting thermal breakers to protect the load cell components from voltage and current surges.
- 5.11 The load cell shall come equipped with a neoprene rubber boot to keep debris from contaminating the lower bearing surface.
- 5.12 The load cell shall have a positive-lock quick connector integral to its housing for connecting and disconnecting the load cell interface cable at the load cell. The connector shall be of glass-to-metal, pin-type construction to maintain a hermetic seal.
- 5.13 System shall be so designed as to permit a load cell cable to be replaced without either splicing the load cell cable or replacing the load cell, either of which will contribute to eventual system failure and unnecessary service costs System shall be so designed as to permit the replacing the load cell cable without requiring that the scale must be recalibrated, further reducing service and maintenance costs.
- 5.14 The load cell shall have the following specifications:
 - 5.14.1 V_{min} : 5.0 pounds maximum
 - 5.14.2 Hysteresis: $\pm 0.025\%$ of full scale
 - 5.14.3 Non-Linearity: $\pm 0.015\%$ of full scale
 - 5.14.4 Creep (30 minutes): $\pm 0.017\%$ of applied load
 - 5.14.5 Temperature range: $-10^{\circ}\text{C} + 40^{\circ}\text{C}$
- 5.15 The load cell interface cable shall be stainless steel sheathed for environmental and rodent protection. Neoprene covered load cell cable shall not be permitted.
 - 5.15.1 Load cell cables which are hard wired directly to the load cell are not acceptable due to the failure rates associated with moisture wicking into the load cell from aged cables or damaged cables, and due to the unnecessary expense associated with replacing entire load cells when only a cable has been damaged.
- 5.16 The load cell shall have a minimum 5-year warranty against defects in materials and workmanship and failure resulting from lightning or surge voltages. The

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warranty shall cover all costs associated with replacement parts, travel, mileage, on-site labor and recalibration after repair, the full cost of which shall be supported solely by the manufacturer and not in part by any other 3rd party.

- 5.17 Load cells shall be Mettler-Toledo, Inc. POWERCELL[®] PDX[®] load cell or equivalent.

6 SCALE INSTRUMENT SPECIFICATIONS

- 6.1 The scale instrument shall be designed for use in vehicle scale weighing applications. It shall be capable of performing basic weighing operations including but not limited to:
- 6.1.1 Inbound/outbound two-weighment operations.
 - 6.1.2 Single weighment operations where vehicle tare weights are known either through preset tares which are stored in the scale instrument memory or manually entered tare values which are entered through the keyboard.
 - 6.1.3 Transient vehicle weighing operations where the transaction is to be completed but the record will not be added to memory accumulators or totals.
- 6.2 The instrument shall, as a minimum, utilize a 128 x 64 dot vacuum florescent display with graphic capability to present the transactional information along with weight to the operator. During normal weighing operations the display will incorporate the following elements:
- 6.2.1 Weight (21mm high characters)
 - 6.2.2 Time and Date
 - 6.2.3 Center of Zero
 - 6.2.4 Mode of Operation (Gross or Net)
 - 6.2.5 Weighing Unit (lb or kg)
- 6.3 The scale instrument shall have the following keyboard operations:
- 6.3.1 0-9 Numeric Keys
 - 6.3.2 . (Decimal Point)
 - 6.3.3 Clear
 - 6.3.4 Tare
 - 6.3.5 Zero
 - 6.3.6 Print
 - 6.3.7 Four Application-Specific Assignable Soft Keys with icons for easy operator use to identify TempID and VehID, etc.

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- 6.3.8 Five Scale-Function Soft Keys
- 6.3.9 Screen Navigation Keys for Up, Down, Left, and Right Commands
- 6.3.10 Enter
- 6.4 The operator shall be capable of entering alphanumeric characters through the terminal without the need for an external keyboard. However, the scale instrument shall, as an accessory, be capable of being interfaced to a standard USB-style computer keyboard without modifications to the scale instrument hardware or software for the purpose of entering alphanumeric information, as well as emulation of application and scale instrument soft-key functionality, if required.
- 6.5 The scale instrument shall have the following operational parameters:
 - 6.5.1 Capable of communicating with up to 6 pairs of digital load cell assemblies.
 - 6.5.2 Ability to digitally average the weight information sent from the load cells and updating the instrument's weight display 15 times per second.
 - 6.5.3 Capable of being programmed for sign-corrected net weighing so that all net weights are positive.
 - 6.5.4 Have a transaction counter to automatically assign sequence numbers to transactions.
 - 6.5.5 Have automatic zero capture on power-up selectable to capture zero at 2% or 10% of the full-scale capacity.
 - 6.5.6 Have adjustable digital filtering.
 - 6.5.7 Have adjustable automatic zero maintenance selectable for ± 0.5 , ± 1 , or ± 3 displayed increments.
 - 6.5.8 Have push-button zero selectable for $\pm 2\%$ or $\pm 20\%$ of full-scale capacity.
 - 6.5.9 Tare, Zero, and Print functions shall be inhibited while the weight display is changing. Motion detection shall be selectable for ± 0.5 , ± 1.0 , ± 2.0 , or ± 3.0 increments.
 - 6.5.10 Only receives digital information from the load cell assemblies. There shall be no analog-to-digital conversion function in the scale instrument.
 - 6.5.11 Capable of providing load correction for load position.
- 6.6 The scale instrument shall have the following service characteristics:
 - 6.6.1 Set-up and navigation through all phases of set-up, calibration, and testing shall be intuitive through a decision-tree format.

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- 6.6.2 Capable of performing calibration, span, zero, and shift adjustment through software calculations that require no in-scale adjustment.
- 6.6.3 Entry of information shall be accomplished through the instrument's keyboard only.
- 6.6.4 Capable of assigning each load cell with its own unique identification number and displaying the weight reading of each individual load cell through the instrument without disconnecting any of the load cells from the system.
- 6.6.5 Ability to display digital raw counts for the attached digital load cells with their values being updated on a real-time basis. The scale instrument shall also be capable of displaying the raw count values of multiple digital load cells on the graphical display.
- 6.6.6 Ability to identify and to immediately display an error condition associated with an individual load cell in the event of a failure or out-of-tolerance condition. The displayed message shall identify the failed load cell and the cause of the failure to avoid an invalid weightment on the scale.
- 6.6.7 Ability to monitor and display health of load cell network and to compare the current network status to the values captured during calibration. This is a requirement to reduce downtime and provide information to the user so that the user can proactively use the information to determine the most convenient time to address maintenance issues, while avoiding downtime at the most inopportune time.
- 6.6.8 Load cell health information shall include individual load cell temperature, supply voltage at load cell, signal voltages, maximum loading. These data are vital in reducing downtime and troubleshooting time and cost.
- 6.6.9 Ability to monitor the gas concentration sensors in each load cell and identify which load cell may be breached or physically damaged so that unscheduled downtime can be eliminated.
- 6.6.10 Ability to access system status data through an Ethernet connection using a web server residing on the instrument for remote diagnostics
- 6.6.11 Ability to access system memory through an Ethernet connection using a shared data server. This allows tighter integration with customer operations.
- 6.7 The scale instrument shall be NTEP certified and meet or exceed the specifications set forth by NIST HB-44 for Class II, III, and III-L Devices. The manufacturer upon request shall provide a Certificate of Conformance to these standards.
- 6.8 The scale instrument shall be housed in a metal enclosure that is suitable for desk or wall mounting.

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- 6.9 The scale instrument shall have flexible storage capability with a minimum of 256 Mbytes of flexible memory in which to store pertinent vehicle, transactional, and commodity information. The scale instrument shall be capable of storing the weight information automatically or enabling the operator to assign a memory location to the weight manually. The scale instrument will run SQL or equivalent database application to enable possible integration into higher level databases.
- 6.10 The scale instrument shall have subtotal and total weight accumulators.
- 6.11 The operator shall be able to enter up to 12 digits of alphanumeric ID through the instrument keyboard.
- 6.12 The scale instrument shall have gross/net weight switching.
- 6.13 The scale instrument shall be capable of being programmed and calibrated in pounds or kilograms.
- 6.14 The scale instrument shall have the following data communications capabilities:
 - 6.14.1 One com port RS232
 - 6.14.2 One com port RS232, RS422, or RS485
 - 6.14.3 One TCP/IP 10 Base-T Ethernet
 - 6.14.4 One Web server
 - 6.14.5 One Shared Data server
- 6.15 The scale instrument shall output the following information:
 - 6.15.1 Gross, Tare, and Net Weight
 - 6.15.2 ID
 - 6.15.3 Transaction Counter
 - 6.15.4 Time and Date
 - 6.15.5 Variable Application-Specific Information
 - 6.15.6 Standard Reports Generated by the Scale Instrument
- 6.16 The scale instrument shall be UL/cUL listed.
- 6.17 Scale instrument shall have the ability to connect with external PC software to allow configuration, data backup and restore, security unlock capabilities, FTP access to log files so as to significantly reduce service cost and downtime during any repair and maintenance of the scale.
- 6.18 The scale instrument shall be a Mettler-Toledo, Inc. Model IND560 or equivalent.

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7 JUNCTION BOXES AND CABLES

- 7.1 Junction boxes shall not be permitted in the scale, attached to the exterior of the scale, or remotely mounted from the scale. Sectional controllers with encapsulated PCBs shall not be permitted due to the failure rates associated with PCBs that have wired connections made within enclosures which are not hermetically sealed.
- 7.2 Load cell cables and scale instrument cables shall be stainless steel sheathed for environmental and rodent protection.
- 7.3 In order to minimize maintenance issues, only a single cable shall be used to transmit data or weight signals between the weighbridge and the digital weight display.

8 LIGHTNING PROTECTION SPECIFICATIONS

- 8.1 A comprehensive lightning protection system shall be provided with the scale.
- 8.2 The system shall not require complicated wiring or devices to provide this protection.
- 8.3 Major scale components including load cells and scale instrument shall be included in the lightning protection system.
- 8.4 Grounding of all scale components including load cells, scale instrument, and accessories shall be to one common point. Systems with multiple ground points are not acceptable.
- 8.5 An AC line surge protector shall conveniently plug into a common electrical outlet and have a receptacle.
- 8.6 Each AC line surge protector required shall have one isolated, grounding, hospital-grade duplex receptacle, and an internal 15-amp circuit breaker.
- 8.7 Verification of the lightning protection system's performance shall be available in writing from a third-party verification laboratory upon request. Proposals submitted without confirming the availability of 3rd party confirmation that the load cells, cables and instrument as a system have been able to withstand the equivalent of a lightning strike with 38,000 amperes will be rejected.
- 8.8 The lightning protection system shall be a Mettler-Toledo, Inc. StrikeShield™ Lightning Protection System or equivalent.

9 PRINTER SPECIFICATIONS – DOCUMENT PRINTER

- 9.1 The printer shall be housed in a suitable enclosure for desktop mounting.

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- 9.2 The printer shall interface with the scale instrument using a singular cable with quick connectors on each end and shall not require any modifications to the instrument or printer.
- 9.3 The printer shall have a serial interface capable of communicating with the instrument using an RS232C interface with selectable transmission rates from 300 to 9,600 baud. Transmission must be on demand.
- 9.4 The printer shall have a nine-pin dot matrix print head with a minimum rated life of 200 million characters.
- 9.5 The printer shall be capable of printing at a minimum speed of 300 characters per second.
- 9.6 The printer shall have an easily replaceable ink ribbon cartridge that shall be rated for a minimum life of 3 million characters.
- 9.7 The printer shall be capable of accepting single or up to six-part forms.
- 9.8 An adjustable paper guide shall be provided.
- 9.9 The printer shall provide both friction-feed and tractor-feed paper advance.
- 9.10 The printer shall have a minimum buffer memory capable of storing at least 28,000 characters.
- 9.11 The printer shall be capable of printing all information sent from the scale instrument, including:
 - 9.11.1 Gross, Tare, and Net Weights
 - 9.11.2 Time and Date
 - 9.11.3 Transaction Counter Number
 - 9.11.4 12-Digit Alphanumeric ID
 - 9.11.5 Standard Reports Generated by the Scale Instrument
- 9.12 All materials, components, and electrical design shall comply with UL and CSA standards and requirements.
- 9.13 The printer shall be an Okidata Microline 320 Turbo or equivalent.

10 PRINTER SPECIFICATIONS – TICKET PRINTER

- 10.1 The printer shall be housed in a suitable enclosure for desktop mounting.
- 10.2 The printer shall interface with the scale instrument using a singular cable with quick connectors on each end and shall not require any modifications to the instrument or printer.

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- 10.3 The printer shall have a serial interface capable of communicating with the instrument using an RS232C interface with selectable transmission rates from 300 to 9,600 baud. Transmission must be on demand.
- 10.4 The printer shall have a nine-pin dot matrix print head with a minimum rated life of 70 million characters.
- 10.5 The printer shall be capable of printing 3.1 lines per second.
- 10.6 The printer shall have an easily replaceable ink ribbon cartridge that shall be rated for a minimum life of 1.2 million characters.
- 10.7 The printer shall be capable of accepting forms up to 0.25 mm thick, original plus 2.
- 10.8 The printer shall provide friction-feed paper advance.
- 10.9 The printer shall have a minimum buffer memory capable of storing at least 2000 bytes.
- 10.10 The printer shall be capable of printing all information sent from the scale instrument, including:
 - 10.10.1 Gross, Tare, and Net Weights
 - 10.10.2 Time and Date
 - 10.10.3 Transaction Counter Number
 - 10.10.4 12-Digit Alphanumeric ID
- 10.11 All materials, components, and electrical design shall comply with UL and CSA standards and requirements.

The printer shall be a Mettler-Toledo, Inc. APR 310 or equal.

11 WARRANTY REQUIREMENTS

- 11.1 The scale manufacturer shall warrant the scale assembly including all load cells, weighbridge structure, scale instrument and associated cables from failures due to a defect in manufacturing, workmanship, lightning, or surge voltages.
- 11.2 The warranty will warrant the product for a period of 5 years from date of installation or 62 months from date of shipment to the Buyer, whichever occurs first. Bidder shall promptly correct any such defect appearing within the warranty period.
- 11.3 The warranty shall support 100% coverage of repair parts, labor, travel time, and mileage from the closest service location, or at the manufacturer's sole discretion, replacement of the product under warranty. The full cost of warranty as specified herein shall be supported solely by the manufacturer and not in part by any other 3rd party or service provider.