

APPENDIX A – WEIGH IN MOTION SYSTEM (WIM) SPECIFICATIONS

FOR

CONTRACT NO. T200811301

US 301, MARYLAND STATE LINE TO LEVELS ROAD

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## **PART 1 – DESCRIPTION**

### **1.1 SUMMARY**

A Truck Weigh Station with Inspection Facility is located on US 301 (Middletown Warwick Road) in New Castle County near the Delaware/Maryland State Line. The existing SYSTEM consists of a weigh in motion (WIM) Scale subsystem on mainline US 301 located in Maryland for data collection and vehicle sorting, and a Static Scale subsystem with operations building and inspection lot located in Delaware which is used for weight enforcement and detailed truck inspection. The existing SYSTEM contains variable message signs, loop detectors, static guide signals, and over-height detection. The existing SYSTEM and all components have been integrated into a seamless SYSTEM for operation by the Delaware State Police (DSP) and the Delaware Department of Transportation (DeIDOT).

Modifications are required to the existing SYSTEM to be compatible with the proposed mainline US 301 roadway improvements and proposed weigh station ramp modifications. The objective is to maintain a fully operational SYSTEM which accurately and automatically pre-selects vehicles while in motion, for enforcement weighing for as much of the proposed duration of Contract T200811301 as possible or as noted in the contract documents. Upon completion of all SYSTEM modifications, the SYSTEM shall perform as was intended prior to the start of work or as specified in the contract documents.

The existing WIM SYSTEM is proprietary in nature and was installed by Mettler Toledo, Inc. under DeIDOT Contract No. 23-500-38. The existing SYSTEM is covered under a maintenance and warranty program administered by Mettler Toledo, Inc. As a result of the proprietary nature of this system and maintenance and warranty programs, all modifications to the existing system must be performed by Mettler Toledo, Inc. or their agents.

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## 1.2 REFERENCES

All work performed under Item 763619 – Weigh in Motion System (WIM) shall adhere to the following applicable standards:

- A. National Institute of Standards and Technology (NIST) Handbook 44
- B. National Fire Protection Association (NFPA)
  - 1. 70 - National Electric Code (NEC)
- C. National Electrical Manufacturers Association (NEMA)
- D. American Welding Society (AWS)
  - 1. D1.5 - Bridge Welding Code
- E. American Society of Testing and Materials (ASTM)
  - 1. E1318 - 02 - Standard Specification for Highway Weigh-in-Motion (WIM) Systems with User Requirements and Test Methods
  - 2. A36 – Structural Steel
  - 3. A53 – Black and Hot-Dipped, Zinc Coated, Welded and Seamless

## 1.3 EXISTING SYSTEM DESCRIPTION

The existing SYSTEM weighs all northbound US 301 vehicles at the WIM scale located approximately one-half mile south of the Delaware/Maryland stateline and signals truck drivers to either enter or bypass the weigh station and inspection facility located just north of Strawberry Lane in Delaware. The existing SYSTEM is compatible with existing Commercial Vehicle Information Systems and Networks (CVISN) equipment also located along northbound US 301 between the WIM scale and weigh station. The vehicle data obtained from CVISN is included in the mainline vehicle sorting process to increase the efficiency of system.

The existing SYSTEM automatically performs the following functions:

- A. Sorts and directs potential violators to enter the weigh station for legal static weighing and/or inspection
- B. Violations are determined based on the following criteria:
  - 1. Weight
    - a) Axle
    - b) Gross
    - c) Tandem

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2. Exceeding posted speed limit
3. Misalignment passing over WIM scale
4. Over dimension
  - a) Overall length (75')
5. Imbalance
  - a) Side to side
  - b) Axle to axle within a tandem axle group
6. Specialized vehicles based on classification
7. Over height

C. Compliant vehicles may still be directed to the Weigh Station and Inspection Facility through random selection.

The existing SYSTEM detects potential violators which bypass the weigh station. The errant vehicle is identified on US 301 by a traffic monitoring sensor located just after the deceleration lane. The Operator is alerted by an alarm when the errant vehicle passes the entrance to the deceleration ramp. The WIM data is displayed on the monitor when the truck bypasses the weigh station building.

The existing SYSTEM automatically determines static scale violations by the following:

1. Axle
2. Axle group
3. Gross

The existing SYSTEM allows the following operator control:

A. Accumulation of axles on multi axle (more than two axles in an axle group) vehicles (up to 19 axles).

1. When a multi axle (more than two axles in an axle group) truck approaches the Static scale, the system sets off an alarm alerting the operator that a manual weighing process is needed. The first axle is positioned on the scale and the weight is stored. This weight is shown as axle one and the Operator directs the truck to pull forward until the next axle is positioned on the scale. If the previous axle is still on the scale the controller will determine the difference and show this amount as axle two. This process continues until the entire truck is weighed. The software recognizes whether the previously weighed axle is still on scale or has exited; in either case the software determines individual axle weights for these multi axle vehicles.

B. Ability to manually override the SYSTEM and direct individual trucks into the

weigh station either by programmed weight, programmed axle spacing, or randomly.

C. Manual control of the mainline and static scale variable message signs (VMS).

The complete existing SYSTEM includes the following package components and accessories.

A. WIM Subsystem

1. Weigh bridges and frames
2. Load cells
3. Field unit
4. Logic controller
5. WIM computer
6. WIM software
7. Printer

B. Static Scale Subsystem

1. Static scale
2. Load cells
3. Instrument (digital display)
4. Static scale computer
5. Static scale software
6. Printer
7. Static scale pit
8. Approach slabs
9. Sump pumps
10. Pit lighting and receptacles
11. Surge voltage protection

C. Mainline Variable Message Signs

1. VMS Board
2. VMS Cabinet
3. Traffic Monitoring Device
4. Inductive Loops

D. Static Scale Variable Message Sign

E. Inductive tracking loops

The existing WIM Subsystem determines whether the truck is a potential violator or compliant vehicle and directs the vehicle to enter or bypass the weigh station and includes a function that automatically resets the tracking sequence. The WIM Subsystem measures and records the following data:

A. Weight

1. Gross
2. Individual axle
3. Individual wheel
4. Tandems
  - a) Tri-Axle
  - b) Bridge
    1. Front
    2. Rear

B. Axle imbalance percent difference side to side

C. Axle imbalance percent difference axle to axle within tandem axle group

D. Speed

E. Axle spacing

F. Off WIM scales

G. Classification of vehicle

H. Violation

I. Over-height vehicles

The existing Static Scale Subsystem determines the following:

A. Static weights for:

1. Steer Axle
2. Drive Axle(s)
3. Trailer Axle(s)
4. Gross

B. Location of axle on platform to within 2" of the actual location

C. Automatically determines if vehicles are in compliance with Delaware's weight limits

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- D. Automatically determines if axles are properly position on static scale, if not alert operator by visual and audio alarms
- E. Determines if vehicle is violator and if so, alert operator by visual and audio alarms, and if not a violator auto-release
- F. Automatically sequences and weighs the non-multi axle (more than two axles in an axle group) vehicles across static scale
- G. Record and store static scale and WIM shift counts
- H. Auto-calibrates the WIM scales

The existing mainline Variable Message Signs provide the following information in conjunction with WIM scale data:

- A. Direct potential violators to the weigh station
- B. Direct compliant vehicles to bypass weigh station
- C. Only illuminate for commercial vehicles
- D. Display weigh station closed when not open

The existing Static Scale Variable Message Sign provides the following information to vehicle operators subject to static scale weighing:

- A. Stop
- B. Exit
- C. Pull forward
- D. Back up
- E. Park

The existing inductive tracking loops located along mainline US 301 (northbound), the deceleration ramp to weigh station, and the weigh station inspection lot track vehicle location between the WIM scale and the static scale. This inductive loop tracking system performs the following operations:

- A. Vehicle class, weight, and speed are determined when a vehicle crosses the WIM scale. This data is tracked using inductive loops through a series of queues. The queues are assigned as follows:
  - 1. Queue 0 - The area between the WIM scale and the first VMS
  - 2. Queue 1 – The area between the first and second VMS
  - 3. Queue 2 – The area between second and third VMS
  - 4. Queue 3 – The area between the third VMS and the ramp where trucks either enter the weigh station or continue on U.S. 301.



- B. Additional queues are used once the vehicle has entered the weigh station to track to the vehicle between the static scale and inspection lot.
- C. Determine maximum vehicle queuing at the static scale approach and subsequently direct additional vehicles to bypass the Weigh Station and Inspection Facility until proper storage is available.
- D. Determine potential violators which bypass Weigh Station
- E. Reset variable message signs

#### **1.4 SUBMITTALS**

The Contractor shall furnish documentation that demonstrates to the satisfaction of the Engineer that all proposed equipment to modify the existing SYSTEM is fully compatible and interoperable with the existing SYSTEM. The Contractor must clearly identify that all proposed equipment and software updates are currently being used elsewhere in the United States under conditions similar to those proposed as part of this contract.

The Contractor shall submit the following documents for all proposed modifications to the existing SYSTEM:

1. Equipment drawings
2. Circuit diagrams
3. Field wiring diagrams
4. Instruction manuals
5. Bill of Materials
6. Spare parts list
7. Manufacturer's product data

The contractor shall provide training materials in accordance with Section 3.2 of this specification.

#### **1.5 WARRANTY**

The SYSTEM manufacturer shall warrant new equipment in writing against defective material, lightning, and workmanship.

The SYSTEM manufacturer shall warrant the SYSTEM to perform as required by these Special Provisions, giving proper and continuous service under all conditions required and specified.

The SYSTEM manufacturer's warranty shall be for a period of five years for new equipment, but not less than the manufacturer's standard warranty for the products from

the date of final acceptance of the project and at which time the following shall transfer to DeIDOT:

1. SYSTEM manufacturer's routine maintenance schedule
2. Contractor shall furnish the written manufacturer's warranty to the Engineer at the time that the equipment performance supporting data is submitted
3. The warranties shall state that they are subject to transfer to the Department

The SYSTEM manufacturer's written warranty must be accepted and approved by the Engineer 30 calendar days prior to the anticipated installation of the warranty's subject.

The Contractor shall provide a Maintenance Bond for the operation of all mechanical and electrical components modified and/or installed as a part of this contract which will be in effect for two years after final acceptance. The bond term will be for 2 years and will renew annually. The Maintenance Bond shall satisfy the provisions of Delaware Statutes and the bonding company is required to have an A.M. Best Rating of "A" or better. Write and issue the Maintenance Bond for the amount of the total sum bid for pay Item 763619.

The Contractor shall provide a new Maintenance Bond for the balance of the two year period from a bonding company with an "A" or better rating if the previous bonding company drops below the "A" rating during the two year Maintenance Bond period. In such event, Contractor shall pay all costs of the premium for the new Maintenance Bond.

## **PART 2 – SYSTEM MODIFICATIONS**

### **2.1 GENERAL REQUIREMENTS**

Proposed modifications to the existing SYSTEM will include the following:

1. Relocation of power and communication conduits and cables
2. Coordination with existing CVISN component relocations
3. Relocation of VMS #3 and cable termination for relocated VMS
4. Calibration of over-height detector and scales
5. Installation of Traffic Monitoring Sensors and associated equipment
6. Software updates, calibration, training, and testing

The equipment approved by the Engineer shall be provided and installed according to the plans and Special Provisions. Should the equipment proposed by the Contractor become unavailable, the Engineer may approve in writing alternate equipment proposed by the Contractor due to the unavailability of the originally specified equipment.

All conduit and junction wells shall be installed as shown on the plans under separate pay items. Fiber optic communication cable and electric cables shall be relocated, installed, or replaced as necessary to provide a functioning SYSTEM under Item 763619. The field units shall communicate to the weigh station over a 24-strand backbone multimode fiber optic cable, appropriate for underground conduit applications. All new or relocated fiber optic cable shall be provided, installed, terminated and tested by the Contractor. The contractor shall provide all necessary equipment including fiber optic cable, splice enclosures, termination panels and patch cords required to complete the SYSTEM communications circuit modifications. Material, installation, and testing procedures shall be in accordance with Delaware Department of Technology and Information (DTI) standard specifications.

Modifications to existing CVISN equipment are necessary under this project. These modifications include antenna adjustments on existing mast arms, and the relocation of the northern most pole and mast arm (compliance pole). Relocation of the compliance pole is covered under Item 746951 – Relocating Pole and Mast Arm. All CVISN antenna adjustments are to be performed by DeIDOT's CVISN representative. The Contractor and SYSTEM manufacturer shall coordinate all SYSTEM modifications with the CVISN equipment modifications to ensure the truck weight enforcement SYSTEM is fully compatible with the CVISN electronic screening system prior to the acceptance testing period.

All existing electronic components are connected to and are protected by a grounding system, electric power surge protection, and an enhanced point discharge lightning protection system. Upon installation or modification of SYSTEM components, each component must be immediately connected to the protection systems so as to reduce the chances of lightning damage during construction. Any lightning damage to components or conductors which occurs prior to connection to the protection systems is the responsibility of the Contractor. The Contractor shall replace within one week any damaged components and conductors at their own expense.

## **2.2 MAINLINE VARIABLE MESSAGE SIGNS (VMS)**

The existing SYSTEM includes three Mainline Variable Message Signs (VMS). The northern most sign (VMS #3) must be relocated as shown on the plans. Relocation includes removal and storage of the existing sign, design and installation of new sign post foundations and supports, and installation of VMS. All conduit and junction wells shall be installed as shown on the plans under separate pay items. Communication and power cables are to be relocated or replaced as necessary under Item 763619. Upon completion of all SYSTEM modifications each of the existing mainline VMS must operate as intended prior to modifications and shall adhere to the following:

1. The mainline VMS shall be programmable to display the following messages:

- a. ENTER WEIGH STATION
  - b. BYPASS WEIGH STATION
  - c. WEIGH STATION CLOSED
2. The mainline VMS shall have a visibility of 0.25 miles (1,320 feet) at all times under normal atmospheric conditions.
  3. The mainline VMS message can be changed by both the WIM computer and the Operator manual override.

The Contractor is responsible for the design and construction of the new sign supports and foundations for the relocated VMS sign in accordance with the AASHTO Roadside Design Guide, Latest Edition, as well as applicable DeIDOT standards. Sign supports shall be a breakaway type. The design shall be signed and sealed by a Professional Engineer registered in the State of Delaware. Shop drawings shall be submitted in accordance with Subsection 105.04 of the Standard Specifications.

### **2.3 SYSTEM CALIBRATION**

Upon completion of all SYSTEM modifications the SYSTEM components shall be properly calibrated prior to performance testing. Calibration shall include but is not limited to the WIM scale, static scale, and over height detectors.

### **2.4 TRAFFIC MONITORING SENSORS**

Traffic monitoring sensors shall be provided to track vehicles and maintain sequence of queues between the WIM scale and weigh station and are to be located by the SYSTEM manufacturer to ensure operability with the existing SYSTEM. Traffic monitoring sensors are to be radar based with the capability to monitor multiple lanes of traffic.

### **2.5 SOFTWARE UPDATES**

The SYSTEM manufacturer shall provide all software updates necessary to deliver a fully functional SYSTEM after all modifications are complete. The SYSTEM software must be capable of monitoring multiple lanes of traffic.

## **PART 3 – CALIBRATION, TRAINING, AND ACCEPTANCE TESTING**

### **3.1 SYSTEM CALIBRATION**

A two (2) week calibration period will be allotted to ready the system for acceptance testing. The Contractor shall provide a minimum four (4) week notice to the Engineer prior to the start of the calibration period. Upon completion of all proposed SYSTEM modifications and CVISN modifications the SYSTEM manufacturer shall perform in-motion calibration tests of WIM subsystem. The SYSTEM manufacturer shall provide

all calibration weights.

System accuracy will be monitored by the Engineer from the electronic database created and stored on the static scale computer. This database shall be created by continuous electronic recording of vehicles from the vehicle stream, which are loaded to within 75% (60,000 lbs.) of the legal allowable limit. The report for WIM accuracy must be printed from the static scale computer by the Engineer. WIM accuracy on all vehicles loaded above 60,000 pounds and traveling between the speeds of 5 to 85 miles per hour shall meet or exceed ASTM 1318.02 Standards as follows:

1. Axle weights + 15% (95% of trucks)
2. Tandem weights + 10% (95% of trucks)
3. Gross weights + 6% (95% of trucks)
4. Wheel load + 20% (95% of trucks)
5. Axle spacing + 6 inches or 5% (68% of axles), whichever is greater

The actual stable static weights and WIM weights shall be stored in the common database to determine WIM scale accuracy compliance, as opposed to the method described in ASTM E 1318-02.

Upon completion of the two-week calibration period, the SYSTEM manufacturer shall train Operators as specified in Section 3.2.

### **3.2 TRAINING**

The SYSTEM manufacturer shall provide training to weigh station operators upon completion of the calibration period. The SYSTEM manufacturer shall provide six copies of written training materials for reference and two days (8 hour sessions) of training, as needed. Training materials shall also be provided in electronic portable document format (.pdf). Training topics will include a refresher and system overview, as well as comprehensive training on the operation of the SYSTEM. The training materials are to include a narrative description of the interaction of all SYSTEM components. All training materials shall be submitted to the engineer for review 30 days prior to the anticipated training dates. The SYSTEM manufacturer shall provide names, telephone numbers, and email addresses of technical contacts for operator reference.

### **3.3 ACCEPTANCE PERFORMANCE TEST (APT)**

The APT shall demonstrate to the satisfaction of the Engineer that the weigh-in-motion/static enforcement system modifications are complete and the SYSTEM consistently meets the performance requirements of the plans and of these Special Provisions. The Contractor shall provide the Engineer a minimum 2 week advanced notice prior to the start of the APT period.

During the APT period, the SYSTEM shall be fully operational under normal traffic conditions and operate trouble free (defined as any error that will not reset by means of rebooting PC) for 24 hours each day for 7 days of each week for 30 consecutive days.

The SYSTEM manufacturer must leave the site prior to the start of the APT and may only return if a problem is encountered or accompanied by the Engineer. The SYSTEM manufacturer shall not be allowed remote computer connection with the SYSTEM. If problems of any kind are encountered during the APT, the SYSTEM manufacturer will be informed and the problem(s) shall be simultaneously witnessed by the Engineer and Contractor. If a problem is confirmed by all, a strike will be assessed and the problem shall be corrected. After confirmation from SYSTEM manufacturer that problems are solved and at the discretion of the Engineer, the APT will start over until 30 continuous days of trouble free operation are experienced. This re-start, or strike, can only occur three times. After the third strike DeIDOT reserves the right to continue testing or reject the SYSTEM and execute the Maintenance bond.

Should equipment installed with the original SYSTEM fail during the APT the test will be stopped and DeIDOT will request a repair quote from the SYSTEM manufacturer. The APT will resume only after repairs are complete and accepted.

**PART 4 – METHOD OF MEASUREMENT**

Payment for this item will be made on a lump sum basis wherein no measurement will be made.

**PART 5 – BASIS OF PAYMENT**

Partial Payments will be made under the basis of the following cost schedule expressed as a percentage of the contract lump sum price for Item 763619 – Weigh in Motion System (WIM).

- |  |     |
|--|-----|
| 1. Completion of all proposed SYSTEM modifications           | 60% |
| 2. Completion of SYSTEM calibration and training             | 20% |
| 3. Completion of the APT to the satisfaction of the Engineer | 20% |

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