

Truck Mounted Falling Weight Deflectometer Test System Specification

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Truck Mounted Falling Weight Deflectometer Test System Specification

006505

SPECIFICATIONS

1-48-DX-D-AC

M-57-GS-X-AA

**I. GENERAL SPECIFICATIONS:**

**A. INTENT STATEMENT:**

NOTE: Pennsylvania Department of General Services, PCID No. 1075, "*General Requirements for Bidding PENNDOT Vehicles/Equipment*", most current version effective at the time and date of bid opening, is included as a part of this specification. PCID No. 1075 may be reviewed and downloaded from the Department of General Services website, <http://www.dgs.state.pa.us>. Delivery as required per Department of General Service PCID NO. 1075 Section "G". All units must be delivered within **180** days after receipt of the purchase order by the successful bidder.

The purpose of this specification is to describe a vehicle (truck) which will include a mounted Falling-Weight-Deflectometer (FWD) system to be used for roadway testing operations, the test equipment is commonly referred to as a Truck Mounted Deflectometer (TMD). The systems must be new and fully operational at the time of purchase. Bidders must meet all requirements indicated in this specification

The entire system shall be designed to provide the capabilities to acquire test data efficiently, safely and accurately.

It is understood that the components specified are minimum and if the manufacturer's Engineering Department recommends or deems necessary a more robust component, other than specified, be installed to meet the vehicles intent statement and to not void the warranty, it shall be the bidders/vendors responsibility.

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I. GENERAL SPECIFICATIONS (Continued)

B. VEHICLE (TRUCK) COMPONENTS:

The pavement loading device shall be a pickup Truck Mounted Falling Weight Deflectometer (TMD). The unit shall be of durable construction and be stable when driven at highway speeds on normal roads. For safety, the TMD design will be such that it will not require any auxiliary support for stabilization during testing. The vehicle provided shall meet the following specifications. When possible, items specified shall be installed at the factory by the automotive manufacturer.

1. Description: A two wheel drive, SRW (single rear wheel), crew cab, 1 U.S. ton pickup truck (must be the most recent or current model year available).
2. Style: - XLT Trim.
3. Engine: - 6.2L Flex Fuel V8 engine.
4. Wheelbase: - Wheelbase dimension shall be between 176 inches.
5. Transmission: TorqShift® Heavy-Duty 6-speed SelectShift™ Automatic.
6. Alternator: - Single, Extra-Heavy-Duty, 240-amp.
7. Pickup Box Delete (SRW).
8. Heavy Service Suspension Package for Pickup Box Delete.
9. 11,400 GVWR Package (F-350 SRW).
10. Floor mats- All weather.
11. Remote Start System.
12. AM/FM radio, with hands free function for mobile device. Ref. Bluetooth.
13. Seats - Front, Power 8-Way Lumbar Support, Driver Seat.
14. Cab Steps - Platform black molded-in-color.
15. Rear View Camera - Center High Mounted Stop Light (CHMSL) Camera.
16. Reverse Sensing System.
17. Upfitter Switches.
18. Mirrors - PowerScope® Trailer Tow, Power Heated Glass/Power Telescoping/Power Fold-away/LED Spot Lights.
19. Exterior Color: White.
20. Fuel Capacity. Fuel tank size: 48 GAL— 176" Wheelbase.

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I. GENERAL SPECIFICATIONS (Continued)

B. VEHICLE (TRUCK) COMPONENTS: (Continued)

If some options are not available from the manufacturer, at the time of purchase, PennDOT will determine allowable modifications to the options, by consent.

Additional Vehicle After Market Component Add Ons:

21. Keys: 4 complete sets of keys/fobs for all locks and the ignition system.
22. The vehicle shall be equipped with a service body designed for a CA (cab to axle) dimension of 60 inches. Acceptable models are:
  - Knapheide 700, or KSS Series
  - Reading Classic II
23. Garmin - Drive 60LM 6" GPS Model: 010-01533-0C: Device shall be mounted by suction cup on center of windshield with easy accessibility to driver.
24. Engine hour meter that operates only when the engine is running.
25. Voltage meter showing battery voltage when vehicle is running.
26. Fire extinguisher, with mount, rechargeable, 5LB. 3A:40BC.
27. Emergency triangle warning kit as per EQN-66A. Placement to be approved prior to build.
28. 10 person, first aid kit approx. 5 inch high x 8 inch wide x 3 inch deep with mountable cabinet.
29. **Whelen Light Kit Part # PADOTSY5, Kit contains the following lighting.**
  - 1 - R10PADOT Light Bar to be mounted to the driver's side of the bulkhead, above cab roof line. In no case shall the light bar be mounted on the roof of the vehicle.
  - 2- LINZ6A lights to be grill mounted per EQN – 115.
  - 2 - M6AD Amber warning lights.
  - 2 - M6BTDD Stop, Tail, Turn lights.
  - 2 - M6BUD Back-up lights.
  - 2 - 11-486152-000 Vertical black flange housing assembly. Above warning, STT, and back up lights shall be mounted within housing per EQN - 120M.
  - 2 - LINZ6AD Amber warning lights, grommet mounted, mounted 1 to each side of bed per EQN - 120M. All amber warning lights are to be wired in conjunction, controlled by a single illuminated rocker switch mounted within easy reach of the driver.
  - 2 - LINZ6 Grommet Kits.
  - 8 - W441D Harness side mating Deutsch connectors.The above lights are supplied with male and female Deutsch connectors that shall be utilized to connect the vendor supplied harness to each light source.
  - 1 - PFP1PA Tripod pedestal work light with coiled cord, remote mount (holder bracket) and plug to be supplied in the cab. A work Light receptacle shall be wired and mounted in the rear of the truck and one receptacle on the left front side of the body. Work light receptacles shall have a constant 12 volt power supply, circuit to be properly protected and have a chassis ground.

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I. GENERAL SPECIFICATIONS (Continued)

B. VEHICLE (TRUCK) COMPONENTS: (Continued)

29. Each compartment shall have the Vista Compartment lighting System (Tel: 219-264-0711). The 3/8" LED rope lighting sections shall be mounted on the inside of each compartment door and shall occupy space on the left, top, and right of each compartment. Rope sections shall extend full length of compartment on left and right sides. All compartments lighting shall be controlled by a single illuminated rocker switch mounted within easy reach of the driver.  
Body builder to supply remaining marker and ICC lighting, they shall be protected against damage and shall also be shock mounted.  
Connections shall be water tight. All Body lighting shall be LED.  
The Warning lights / Light bar shall have a lighted, permanently labeled toggle switch located in the dash.  
Body wiring shall be Grote, Trucklite, or Prior Approved Equal.  
License plate lighting shall specifically be a Truck light 36 series PN# 36140C LED lamp with light bracket PN#36710.  
There shall be no splices outside of a sealed box or fixture.  
There shall be a seven-way trailer (Pin Type) receptacle mounted on rear. Per EQN - 80A.  
A color-coded electrical wiring chart and schematic shall accompany each body.  
No wiring shall be left exposed or hung where it could be damaged by the elements or debris.

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I. GENERAL SPECIFICATIONS: (Continued)

C. TRUCK MOUNTED DEFLECTOMETER TEST SYSTEM SPECIFICATION:

1. SPECIFIC REQUIREMENTS:

The Truck Mounted Deflectometer (TMD) Test System (hereafter called the System) shall be a new, currently advertised production model that meets all of the following conditions:

- a. This model or line of equipment shall specifically have at least five years or more prior assembly, operational, and maintenance experience in the United States.
- b. A reference list, with complete names, addresses, and telephone numbers of at least five (5) different active owner/agencies in the United States who purchased directly from the manufacturer and who own the same Model of the manufacturer's equipment, including their relevant representative(s) in the United States, shall be provided by the manufacturer to ascertain quality assurance, assure non-prototype integrity of equipment model, and to confirm the capacity of the manufacturer to deliver and support the equipment exactly to these specifications.
- c. The System shall meet or exceed the specifications set forth by ASTM D4694-96 "Standard Test Method for Deflections with a Falling Weight Type Impulse Load Device".
- d. The manufacturer of the System shall have a full parts inventory and established service network, including a well-established record of equipment support in the U.S., verifiable through the above reference list.
- e. Additionally, the manufacturer will have a complete parts list, including current prices, which will be available upon request.
- f. The manufacturer will be able to provide a 60 month or longer trouble-shooting history for all customers in the United States.
- g. The System shall include all standard equipment advertised whether or not specifically called for herein, including the manufacturer's standard warranty.
- h. The System shall consist of an electromechanical pavement loading device (No Substitutes), that does not use hydraulics, plus an appropriately matched electronic package for data acquisition of the applied load and deflections, including a hardware/software package for automatic recording and preliminary data processing in the field.

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I. GENERAL SPECIFICATIONS: (Continued)

C. TRUCK MOUNTED DEFLECTOMETER TEST SYSTEM SPECIFICATION: (Continued)

2. PAVEMENT LOADING/DEFLECTION MEASUREMENT SYSTEM:

- a. All metal parts on the pavement loading device, including exposed electric, shall be corrosion resistant by either being plated to provide galvanic protection, protected by rubber coating, be made of stainless steel, high impact PVC, or painted with quality primer and then quality urethane enamel and or powder coating.
- b. The unit shall be capable of testing by electronically lowering and raising the loading plate, falling weight, deflection sensor bar subassembly to the pavement surface from automated controls located within the vehicle. The automated controls, after lowering the loading plate, shall be capable of running any selected test sequence and any number of drops of the falling weight from any succession or combination of four pre-selected heights automatically before raising the loading plate.
- c. A single-mass falling weight/buffer subassembly system shall be furnished which directly transfers the full energy of the single falling mass to the loading plate through the proper configuration of buffers to achieve a loading time of 25 - 30 msec, for any falling height. This loading system shall be electromechanically operated and designed so that at least four (4) different configurations of mass may be employed. All four mass configurations shall produce a transient load pulse approximately half-sine wave formed and 25 to 30 msec in duration, with a minimum rise time of 10 to 15 msec for any falling height (for all loads).
- d. The loading system shall be capable of applying impact loads (of 25 - 30 msec duration) at any peak load magnitude in the range of 1,000 lbf to 27,000 lbf (4 KN to 120 KN).
- e. The drop weights shall be constructed so that the falling weight/buffer subassembly may be quickly and conveniently changed between falling masses of 50 kg, 150 kg, 250 kg, and 350 kg. Storage of weights when not in use shall be integrated into the utility bed and within close proximity to the falling mass, to minimize handling. Each of these falling weight/buffer combinations shall be constructed so as to be capable of releasing the weight from a variable height, pre adjustable in the Field Program to any drop height between 50mm and 400mm, such that peak load ranges for the four specified masses are producible as follows:

Drop Weight Mass		(Peak) Loading Range @ 25 to 30 msec time of loading	
50	kg (110 lbs)	4	KN - 12 KN (1000 - 2600 lbf)
150	kg (330 lbs)	12	KN - 45 KN (2600 - 10000 lbf)
250	kg (550 lbs)	24	KN - 85 KN (5300 - 19000 lbf)
350	kg (770 lbs)	36	KN - 120 KN (8000 - 27000 lbf)

- f. The System shall be capable of carrying out a typical complete test sequence, consisting of the automated sequence initiation from within the vehicle which activates the lowering of the loading plate/falling weight/deflection sensor bar subassembly to the surface being tested, running (e.g.) three (3) test loads of 18,000 lbf each (using the 350 kg weight package), and raising the subassembly to the transport position again, all within a period of 15 seconds or less.
- g. The loading subassembly and the falling weight shall be operated by an entirely electromechanical system using **no hydraulics (No Substitute).**

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I. GENERAL SPECIFICATIONS: (Continued)

C. TRUCK MOUNTED DEFLECTOMETER TEST SYSTEM SPECIFICATION: (Continued)

2. PAVEMENT LOADING/DEFLECTION MEASUREMENT SYSTEM: (Continued)

- h. The pavement loading device shall be equipped with tools for raising the loading plate/falling weight/seismic sensor bar subassembly in an emergency, e.g., if the electromechanical system fails.
- i. Two different sizes of loading plates shall be provided, one segmented plate that is 300 mm in diameter and one solid plate that is 450 mm in diameter. A non-segmented 300 mm diameter plate assembly shall be optionally available at additional cost from the manufacturer.
- j. The System shall include a load cell which is capable of accurately measuring the force that is applied perpendicular to the loading plate through a separate channel of the electronic system. To insure that the impact force is applied perpendicular to the loading plate, a swivel shall be used between the loading plate and hit bracket. The resolution of the load cell shall be 1 KPa or better (36 lbf with the 450 mm plate). The force may be expressed in terms of pressure, as a function of loading plate size.
- k. The System shall provide a minimum of seven (7), optionally up to fifteen (15) deflection sensing transducers (hereafter called "deflectors"), providing seven (7), optionally up to fifteen (15) separate and electronically discrete deflection measurements per test. The System Electronics shall always provide fifteen (15) separate deflection measuring channels, making an upgrade to more than seven (7) discrete deflection measurements per test possible by only adding more deflectors.

The deflection sensors (hereafter called "deflectors") shall be inertial transducers, such that the peak magnitudes of deflection are obtained from an inertial reference system through signal integration. For maximum calibration accuracy and stability, all signal processing shall be performed digitally, i.e. no analog electronic circuits may be used for integration or filtering. The direct, buffered output from the deflectors shall be digitized by an Analog-to-Digital converting circuitry with 16-bit resolution or better. With 7 (or optionally more) active deflectors, each of these shall be sampled no less than 20 times per millisecond irrespective of the number of active channels.

One (1) of the deflectors shall measure the deflection of the pavement surface through the center of the loading plate, while at least six (6) remaining active deflectors shall be capable of being positioned along the raise/lower bar, up to a distance of 1.82 m (6 ft) from the center of the loading plate.

All deflector holders shall be spring loaded, insuring good contact between the deflectors and the surface being tested. The deflectors shall be easily removable from their holders for exchange and for calibration verification purposes, and shall be robust, reasonably trouble-free, and capable of withstanding typical field conditions.

All deflectors/deflector holders shall be easily movable along the length of the raise/lower bar and extension bars to allow for any user defined distance from the load plate and spacing to be used.

- l. The electronic measuring and processing of the applied load and corresponding deflections shall be capable of recording the peak values to a typical relative accuracy of 1% of reading + or - 1 digit and an absolute accuracy of 2% of reading + or - 2 digits (with the load expressed in terms of pressure in kilonewtons per square meter [kPa] and the deflections in microns [ $m \times 10^{-6}$ ], all simultaneously.



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I. GENERAL SPECIFICATIONS: (Continued)

C. TRUCK MOUNTED DEFLECTOMETER TEST SYSTEM SPECIFICATION: (Continued)

2. PAVEMENT LOADING/DEFLECTION MEASUREMENT SYSTEM: (Continued)

- l. Deflection reading resolution shall be one (1) micron (1 micron =  $10^{-6}$  meter = 0.04 mil = 0.00004 inches) or better (0.1 micron resolution shall be user selectable). All measured load and deflection data shall be displayed for comparison purposes (e.g., repeatability), and no "averaging" or semi-frequent data anomalies shall occur.
- m. Equipment accuracy shall remain stable over time, and verification shall not be required on a frequent basis (regardless of types of test sites, changes in deflector distances, etc.). User equipment "calibration" of any kind shall not be required to meet the guaranteed precision and bias specifications (see paragraph j.). Ongoing user verification of original guaranteed deflection specifications shall be provided in the form of a relative/dynamic field calibration verification procedure in which a minimum of seven (7) of the deflectors are placed into a mechanical columnar device to obtain comparative relative calibration verification of the deflectors at any distance from the load up to a distance of at least 1.82 meters (6 feet) to insure that all deflectors give the same data output within specification tolerances, at large as well as small deflection levels, and both close to and far from the loading plate, under the FWD loading conditions.
- n. Additionally, the equipment shall meet the load and deflection accuracy "precision and bias" requirements as defined by the FWD absolute dynamic reference calibration and dynamic relative calibration procedures of the American Association of State Highway and Transportation Officials (AASHTO) Standard Practice R 32-11 Calibrating the load Cell and Deflection Sensors for a Falling Weight Deflectometer, (formerly the Strategic Highway Research Program (SHRP)/Federal Highway Administration (FHWA) Long Term Pavement Performance (LTPP) program. These FWD calibration procedures are outlined in ASTM D4694-96 and detailed in AASHTO R32-11. The System shall be capable of successfully performing these procedures upon delivery if taken to a current certified compatible AASHTO R 32 FWD calibration site. No additional manufacturer's calibration procedure or other significant deviation from the AASHTO Calibration Protocol, for either reference or relative calibration, will be necessary/required to demonstrate compliance to the accuracy or accuracy stability of this procedure. In addition, the manufacturer shall provide a data format and program field operation that allows seamless data analysis and operation to meet/conform to all aspects of the AASHTO FWD Calibration procedure/protocol, including the WinFWDCal program (FWD reference/relative calibration shareware) and including the recording of whole history load/deflection measurement data as required.
- o. The manufacturer shall provide, at time of System offer/proposal, verifiable AASHTO R 32 calibration results that show the measurement accuracy meets or exceeds the guaranteed load/deflection precision and bias standards (see paragraph j.) for each measurement and that this guaranteed accuracy is stable from one calibration to the next and over at least a three year period for equipment of similar make and model. The manufacturer shall guarantee that this accuracy stability shall remain as specified regardless of the pavement materials upon which testing is carried out (e.g., will not require electrical deflector gain or other physical modification "recalibration" from one pavement type to another - i.e., the equipment will not be "site dependent"), nor will it be influenced by changes in the deflector distances from the center of the load (i.e., "distance dependent") within the specifications shown.

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I. GENERAL SPECIFICATIONS: (Continued)

C. TRUCK MOUNTED DEFLECTOMETER TEST SYSTEM SPECIFICATION: (Continued)

2. PAVEMENT LOADING/DEFLECTION MEASUREMENT SYSTEM: (Continued)

- p. Due to guaranteed equipment measurement stability, manufacturer and/or AASHTO calibration reference verification procedures shall need to be carried out only on an infrequent basis (e.g., annually or greater [typical], semi-annually or once per month maximum for research use), and shall not retard or interfere with normal testing operations. No additional calibration and/or calibration verification procedures of any kind shall be necessary between the infrequent recommended calibrations in order to assure System meets the guaranteed load/deflection measurement precision and bias (see paragraph (l).) on an ongoing basis.
- q. The capability of generating and storing a digitized record of the load vs. time and deflection(s) vs. time history of each test sequence shall be provided in the software package offered with the System, and plotting of this data will be user selectable at the time of testing. Irrespective of the number of channels (1 load plus 9 or more deflectors), the sample rate shall be 20 kHz per channel, and each and every sample shall have the same resolution as the peak value.
- r. The FWD test system shall include a host vehicle with twin 160 amp (min.) alternators or a heavy duty high output single alternator. The dedicated alternators/alternator shall be capable of providing total power to both the electronic recording equipment and the electromechanical loading device.

There shall also be an electrical connection outlet on the exterior passenger side of the vehicle that will be wired to allow the entire FWD test system to be powered from a standard 110VAC outlet, without having to run the host vehicle. The outlet will have a weatherized door or cover when not in use and be able to be used with a standard heavy duty extension cord.

- s. Additional items must also be included in the total system cost:

**A Spare Parts Kit** — including one spare deflector.

**FWD Tool Kit** — essential tools for periodic maintenance of the FWD.

**Video System** — compact hardware designed for operator assistance in PCC joint testing and equipment operation monitoring. The video system shall be available with a night vision digital video camera, designed and mounted for shock resistance, and interfaced to a separate video monitor mounted in an area convenient for the operator.

**Whelen Light** package installed, REFERENCE Section I. B. 29

**Photo-Logging System** — The TMD shall include a rear mounted and a forward viewing Photo-Logging System. The photo-logging system shall allow the user to capture color images of the pavement surface for each TMD test point and/or at user defined fixed intervals for the forward viewing images. The first camera shall display color images of the pavement surface near the load plate and TMD deflectors. The second camera shall provide forward viewing color images (Right-of-way). Each rear and forward viewing image shall be stored sequentially and referenced by the TMD distance measurement instrument (DMI).

**Project Viewing Software** — the software shall allow for viewing the photo-logging images synchronized with the FWD data that is sequenced with a pavement analysis program.

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I. GENERAL SPECIFICATIONS: (Continued)

D. COMPUTER/SOFTWARE DATA RECORDING SYSTEM:

1. The System shall include a laptop or notebook computer with all software and hardware necessary to conduct full control of the testing operations from the computer keyboard. The following minimum specifications will apply:

- **Windows 10 operating system (If compatible with FWD Software)**
- **15.6" screen or larger**
- **16GB RAM**
- **7th Gen Intel® Core™ i7-7500U mobile processor**
- **512GB solid state drive (SSD)**
- **Built-in stereo speakers**
- **Bluetooth interface syncs with compatible devices**
- **(3) USB 3.0 ports**
- **Next-generation wireless connectivity**
- **Backlit keyboard**

Additional Hardware and Software:

- **External Storage: 2 Corsair Survivor external 64GB USB 3 flash drives**
- **Microsoft Office Professional current version**
- **Epson WorkForce WF-M1030 Monochrome Inkjet Printer C11CC82201**
- **(1) 1TB Portable External Hard Drive - USB 3.0**

2. The system will record data from field testing, keyed-in site identification information, time, pavement condition, wheel path, sensor spacing, loading plate size, etc., and also completely monitor all electrical sensors, motor temperature, shot bolts status sensors, voltages, and instrument ranges throughout the System. The computer/software system shall automatically warn the equipment operator of error conditions in both data output and equipment operations. It shall also display the troubleshooting procedures for any error conditions displayed or determined. Selectable test checking of data output, including check of decreasing deflections at each drop, excessive deflection (e.g., exceeding deflector electrical range), exceeding user input percentage of variation of load/deflections per sequence of drops, will be supplied.

The standard System Software shall be capable of handling all deflection channels and one load channel simultaneously, and it shall utilize a minimum sampling rate of 20 kHz per channel (see Section (q) above). The sampling window length (i.e. the sampling period) shall be user controllable between 40 msec. and 400 msec.

The standard System Software shall be capable of storing the load whole history and whole histories for all deflection channels simultaneously in time windows ranging from 40 msec. to 400 msec. All whole history data from the load and all deflections shall be stored in a single data file with no post-processed file conversion needed.

The standard System Software shall be capable of performing "load sensing" or "deflection sensing", that is, based on previous drops, the drop height shall be automatically adjusted to obtain a desired load (or deflection) level (including any drop height between the 4 standard drop heights).

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I. GENERAL SPECIFICATIONS: (Continued)

D. COMPUTER/SOFTWARE DATA RECORDING SYSTEM: (Continued)

The System Software shall be designed to operate as a native program in the Windows® 10 environment on the system computer. The System Software shall be GUI (Graphical User Interface) based and allow flexible layout and resizable windows. The GUI shall provide for display of normal operator/equipment interface functions such as setup, test location, file storage and data display as well as distance display (large and resizable), Geographic Position Data (GPS or DGPS), thermometer displays, time history plot, surface modulus plot and video camera (photo-logging) display on the actual testing screen. Both voice and text feedback for error and warning messages shall be present in the software. Language support capability shall be provided. The System Software shall allow data storage in backwards-compatible ASCII file formats as well as advanced formats to include PDDX, and MDB (Microsoft Data Base) formats. The FWD data shall always be stored in the MDB format with the additional formats selectable by the user. No file conversion into the MDB format will be required.

The System Software shall track and log any changes to the primary program and equipment parameters. In addition the operator shall be able to retrieve roadway network information from the field Software, by accessing database information using the System Software.

The System Software shall be able to run in a Simulator Mode (with or without having the pavement loading device, etc., connected), being able to simulate all System functions, making it usable for detailed operation training/demonstration on the System microcomputer or on any other compatible PC, e.g., in the office.

The native MDB file format of the software shall be compatible and directly accessible automatically to a mechanistic analysis program with no manual entry or file conversion required. This program, using the TMD file load and deflection data plus user supplied layer thicknesses and traffic data, shall be able to estimate the non-linear response of the subgrade, calculate the E-moduli of up to four (4) pavement layers (both flexible and rigid), determine joint transfer, as well as assess seasonal variation in the E-moduli, predict future failure, and recommend overlay thickness if needed, based on user-defined material damage relationships and climatic variations, as well as additional calculations useful in the mechanistic analysis of pavements, for each point tested, using the deflection basin data as recorded in the TMD file format. Analysis programs shall be fully documented. Capability of plotting surface and layer moduli shall be presented in real time for viewing.

3. The software provided for checking and editing of field data shall be fully compatible with the chosen computer. Also, prior to dropping of the weight, the load/deflection signals are checked so that signal noise and/or signal drift does not exceed a preadjustable (preset) level within the measuring or sampling period. Also, deflection data shall be monitored so that peak deflection data shall not fail to decrease with increasing distance from the load without warning.
4. A trigger device shall be furnished which activates the sensing equipment immediately prior to initial impact of the falling mass in order to insure proper registration of the actual quantities of load and deflection, to the accuracy specified in (Section j). If any error is present or forthcoming in these values during testing, such an error shall be detectable from the display.
5. The operator shall have the option of displaying the peak load magnitude for either load plate as both force and pressure in either Metric units or English units as follows: kilonewtons and kilonewtons per meter squared (kN/m<sup>2</sup>) which is kiloPascal (kPa), or pounds (lbf) and pounds per inch squared (psi), and deflection in either millionths of a meter (microns) or thousandths of an inch (mils). All load and deflection data will always be magnetically stored in kN/m<sup>2</sup> and microns, and optionally in lbf, psi and mils as well.

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D. COMPUTER/SOFTWARE DATA RECORDING SYSTEM: (Continued)

6. **Other hardware that must be included with system:**

**Automated Distance Measuring Instrument (DMI)** — measurements taken by this DMI shall be displayed the system computer display and integrated into the FWD computer operations program which shall store the station number, along with the other FWD data (deflections, load, temperatures, time, etc.). The DMI features shall include bi-directional (up/down) counting, six digit display, count hold, display hold, and multiple measurement unit selection.

**Automated Air Temperature Probe** — directly feeding ambient (air) temperature data into the Field Program. The probe may be used for manually taking the asphalt temperature.

**Automated, non-contact Infra-Red Temperature Transmitter** — will monitor and store the pavement SURFACE temperature ONLY.

**Automated Transport Locks** — the loading subassembly shall be equipped with electrically operated, Automated Transport Locks, which will lock automatically the subassembly after each raising of the loading plate.

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**II. DRAWINGS:**

EQN-66A	dated	Rev.	07-20-09	1 sheet	Triangle storage box & bracket
EQN-80A	dated	Rev.	08-02-16	1 sheet	WIRING DIAGRAM-7WAY ROUND PIN FEMALE CONNECTOR
EQN-115	dated	Rev.	07-03-12	1 sheet	CREW CAB GRILLE LIGHT FIXTURES
EQN-120M	dated	Rev.	09-28-11	1 SHEET	CREW CAB BODY LIGHTING

The above referenced drawings shall become part of these specifications.

These drawings reflect the intent of the Department and any discrepancies shall be resolved at the line setting ticket meeting between the vendor and the Equipment Chief, or the pre-production inspection of the truck.

DRAWINGS APPEAR AT THE END OF THE SPECIFICATIONS

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**III. MANUALS:**

- 1 Operator's
- 1 Parts
- 1 Service
- 1 Engine
- 1 Transmission (Automatic or Manual)
- 1 Body and Sub-frame (Parts and Service)
- 1 Complete set of manuals for any additional items/equipment added to a piece of equipment.

The manuals listed shall be official O.E.M. publications supplemented with technical manuals for all components as published by sub-vendors/manufacturers

The successful vendor shall furnish all applicable manuals per unit.

Parts Manual presented must be a relative to "all" items utilized to build these units, with appropriate part numbers.

Delivery of these manuals shall be completed within a maximum of 90 days after the model is accepted.

Manuals may be supplied on CD Disc in lieu of paper manuals.

Two (2) complete sets of combined User/Troubleshooting/Maintenance Manuals shall be provided by the manufacturer which include a complete set of parts diagrams, parts list, and detailed schematic diagrams for both the electrical and hydraulic systems, except the chosen microcomputer and any proprietary Printed Circuit Boards, for all equipment so that the purchaser will be able to operate and maintain the System properly. Some data collection software editions may be documented primarily by on-line HELP functions.

All proprietary Printed Circuit Boards shall be available on short notice from the manufacturer as replacement parts, and they shall be readily interchangeable.

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**IV. TRAINING:**

**Mechanic:**

The successful vendor shall include services of qualified factory trained technicians for not more than \_\_\_X\_\_\_ training sessions of not more than \_\_\_X\_\_\_ hours at \_\_\_X\_\_\_ PENNDOT locations to train personnel for in-depth preventive maintenance, overhaul, and review of the proper usage of parts and service manuals, as well as component/system adjustments that need to be monitored at specified service intervals.

**Operator:**

The successful vendor shall include services of qualified factory trained technicians for not more than \_\_\_5\_\_\_ training sessions of not more than \_\_\_6\_\_\_ hours at \_\_\_1\_\_\_ PENNDOT location to train personnel in the proper operation, safety and servicing of the equipment.

The successful vendor shall submit a training plan to the Equipment Division for approval within 45 days after receipt of the Purchase Order. The training plan shall consist of course outline and class schedule.

All training must be completed within 60 days after the dates established in the approved training plan unless an extension is mutually agreed to in writing by the Chief of the Equipment Division.

All training shall be coordinated with the District Equipment Managers, with the exception of Asphalt related training, which must be coordinated with the Statewide Training Coordinator (717) 787-4836, Fax (717) 783-4438.



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**V. WARRANTY:**

Per PCID No. 1075. And the additional specific warranty items stated below.

This warranty is in effect as follows, starting from date of acceptance by the Department. Warranty shall not be voided due to Department operation as explained in the Intent Statement. It is understood that the components specified are minimum and if the manufacturer's Engineering Department recommends or deems necessary a more robust component, other than specified, be installed to meet the vehicles intent statement and to not void the warranty, it shall be the bidders/vendors responsibility.

Warranty & Documentation

1. With the exception of the recording/playback microcomputer instrument specified in Section (I-D), the System shall be expressly warranted to be free from defects in materials and workmanship for a period of one (1) year from the date of acceptance of delivery by the purchaser. This express warranty shall be limited to the prompt repair and replacement of parts and the necessary labor and services required to repair the System, with the exception of the recording/playback microcomputer instrument specified in Section (I-D). In the event large or heavy components of the System, with the exception of the recording/playback microcomputer instrument described in Section (I-D), prove to be defective during the period covered by this express warranty, the producers may, at their option, make the necessary repairs at one of its places of business or at the place where the System is located.

This express warranty shall be extended to purchaser at no additional cost, except that (a) the purchaser shall be liable for all shipping costs and expenses incurred in delivering any small parts of the System to the manufacturer, and (b) in the event the manufacturer chooses to replace or repair any defective large or heavy components of the System at one of its places of business during the period covered by this express warranty, the manufacturer shall defray all shipping costs and expenses incurred in delivering both the defective components to the manufacturer and the repaired or replaced components back to purchaser. The recording/playback computer instrument specified in Section (I-D) shall not be covered by this express warranty and shall be covered by the standard warranty provided by the manufacturer of the computer.

This express warranty, in addition to its general repair and replacement remedy, provides an option to return the equipment for the purchase price if it generally fails to meet the deflection specifications listed in Items (l) and (m) (above). The return option is applicable only if within 12 months of delivery, the equipment, under normal, intended use and with recommended maintenance, fails in a significant way to perform according to the deflection specifications in Items (l) and (m). To exercise the return option, the purchaser must clearly demonstrate to the producer a general performance deficiency with respect to the deflection measurement accuracy as defined by Items (l) and (m) of these equipment specifications.

2. The express warranty set forth in Section (V) is the exclusive and only warranty extended by the manufacturer to the original purchaser only. The manufacturer makes no warranty of merchantability with respect to the system purchased and makes no warranty that the system purchased is fit for any particular purpose. There are no warranties which extend beyond the description on the face hereof.
3. The express warranty set forth in Section (V) shall not apply to any defects in the System caused by the negligence or misuse by purchaser or its agents, employees, or representatives in the operation of the System.

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**V. WARRANTY: (Continued)**

4. Two (2) complete sets of combined User/Troubleshooting/Maintenance Manuals shall be provided by the manufacturer which include a complete set of parts diagrams, parts list, and detailed schematic diagrams for both the electrical systems, except the chosen computer and any proprietary Printed Circuit Boards, for all equipment so that the purchaser will be able to operate and maintain the System properly. Some data collection software editions may be documented primarily by on-line HELP functions.
5. All proprietary Printed Circuit Boards shall be available on short notice from the manufacturer as replacement parts, and they shall be readily interchangeable.
6. In the event of a breach or repudiation by the manufacturer of the contract for the sale of the System, the purchaser shall not be entitled to recover any incidental or consequential damages as defined in the California Commercial Code.
7. The System described in the foregoing Sections shall conform in all respects to the Specifications and Stipulations brought forth therein.

**BODY WARRANTY:**

Constructability and durability of body shall be guaranteed for five (5) years, parts and labor. A decal shall be affixed to the driver's door, on the inside, stating the company's name, address and phone number.

**BODY ELECTRICAL/LIGHTING:**

Wiring harness shall be 5 years 100% parts. First year shall include 100% labor.  
All LED lights shall be 5 years 100% parts.