

METTLER TOLEDO



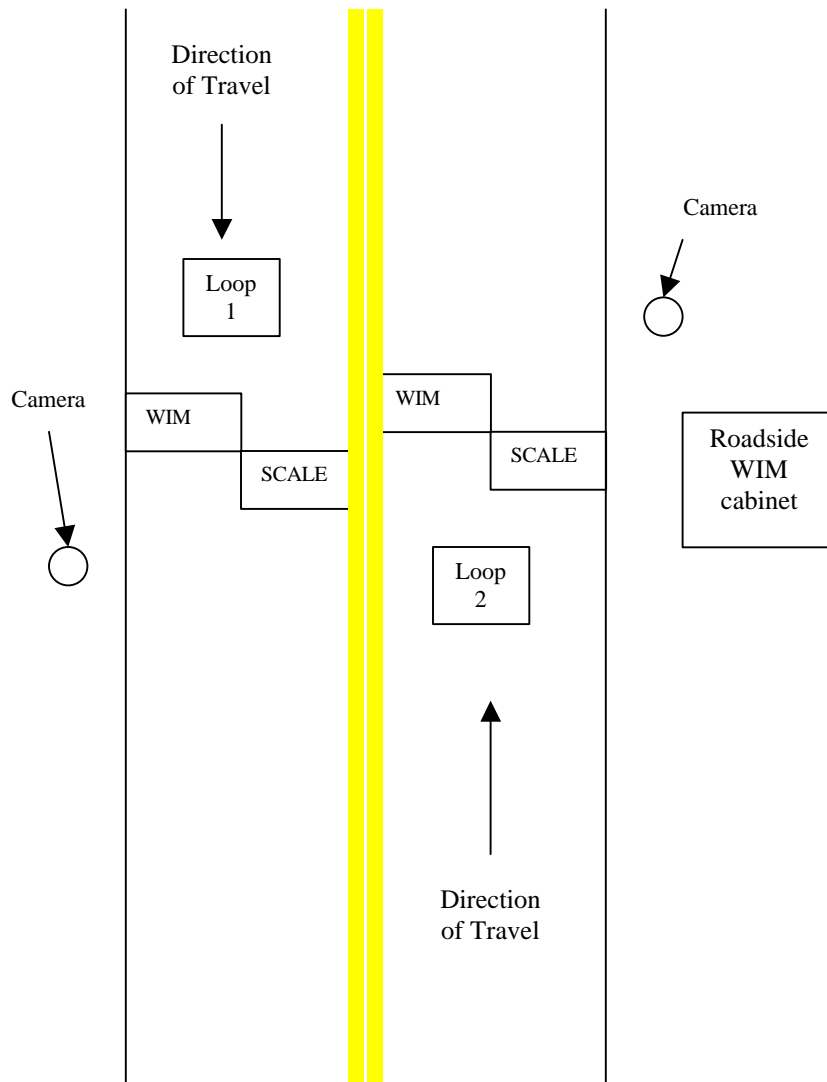
VIRTUAL BY-PASS WEIGH-IN-MOTION SPECIFICATIONS

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METTLER TOLEDO VIRTUAL BY-PASS WIM



Virtual By-Pass WIM Sequencing

1. Vehicle crosses L1 or L2 to initiate WIM system.
2. Vehicle crosses WIM scales and weight limits (thresholds) are checked. There are thresholds for the following: gross, single axle, tandem axle, inner bridge, federal bridge formula, speed, and length.
3. If the vehicle does not exceed threshold the weight or vehicle record is stored per Federal Highway requirements. If the threshold is exceeded the vehicle record is stored as above and the camera takes a picture. The weights for that vehicle are superimposed in the digital picture.
4. Depending on this system configuration, this digital picture is either stored for later retrieval, transmitted via wireless to laptop in patrol car, or transmitted to local weigh station.
5. If the system is configured with two camera's (one northbound, one southbound) the digital picture is an overview of the tractor. If a second camera per direction is add the digital picture is an overview of the tractor plus detail (close up) of the tractor door.

		KEY	
Basic		Optional	
L1	Scale Loop	Not Shown: Wireless communication	
WIM	WIM Scale Platforms	Not Shown: Laptop in patrol car	
L2	Scale Loop	Not Shown: Third or fourth camera (close up of tractor door)	

WIM SYSTEM ACCURACY

There are many variables that will effect the "real world" WIM system accuracy.

- Pavement Smoothness (maintenance) of Approach / Exit Slabs
- Truck Variable (Truck Type, Drivers, condition of Vehicle)

Pavement Smoothness

In order to meet ASTM type III specification the paved approach of the WIM Scale (150ft.) and after the scale (100ft.) needs to meet ASTM pavement specifications and be Portland concrete, and not vary more than 1/8 inch in 20 feet. Pavement smoothness is the user responsibility.

In order to meet ASTM type 1 specification the paved approach of the WIM scale (25ft.) and after the scale (6ft.) needs to meet ASTM pavement specifications and be Portland concrete, and not vary more than 1/8 inch in 20 feet. Pavement smoothness is the user responsibility.

Truck Variables

A WIM System is evaluated only with vehicles with loads over 80% of their rated gross vehicle capacity to assure suspensions are engaged. Truck variables such as type, driver skill, and condition cannot be controlled.

Accuracy

Accuracy performance is to meet the following criteria for loaded vehicles. Type III specifications, which are as follows:

	<u>Accuracy</u>	<u>Conformance</u>
Gross Weight	± 5%	95%
Single Axle Load	± 15%	95%
Tandem Load	± 10%	95%
Axle Spacing	> of ± .5ft. or 5%	95%

Accuracy performance is to meet the following criteria for loaded vehicles. Type I specifications, which are as follows:

	<u>Accuracy</u>	<u>Conformance</u>
Gross Weight	± 10%	95%
Single Axle Load	± 20%	95%
Tandem Load	± 15%	95%
Axle Spacing	> of ± .5ft. or 5%	95%

WIM Testing Procedure

The following method shall be used to verify the WIM system accuracy:

ACCEPTABLE PERFORMANCE TEST

- A. This section shall apply to all work performed under this contract. Time is of the essence in this contract and the Contractor shall provide the completed system installed and ready for Acceptance Performance Test (APT) after the project completion date. The Contractor shall provide a minimum of **2** weeks advanced notice as to when the APT period will start.
- B. The in-motion calibration tests of the entire WIM system shall be performed by the Contractor after installation is completed and prior to beginning the APT period. The Contractor shall provide the Engineer one weeks notice of the in-motion calibration tests. Calibration weights will be provided by the Contractor.
- C. The APT period shall begin ***two weeks after the completion of the project and calibration of the in motion scales.*** This two week time period will be used as a burn-in and training period, which the system will be functional. The Engineer will assist in this process if requested by the Contractor.
- D. The Contractor shall submit a detailed test plan to the Department for approval, no later than 90 days after notice to proceed. During the APT period, the entire **SYSTEM** shall be fully operational under normal traffic conditioning and operate trouble free for 24 hours each day for 7 days of each week for 40 consecutive days. The Engineer will check the calibrated performance by obtaining actual truck weight samples. The test for WIM accuracy must be conducted and met Bi-weekly during the APT period. The test shall be conducted by comparing actual static weights to WIM weights of class nine vehicles. The Contractor shall provide a WIM scale system specialist to assist in the operation for a period of at least 2 weeks. This specialist shall be made available at additional times during the APT period at the discretion of the Engineer. If problems of any kind are encountered during the APT, at the discretion of the Department, the 40 day APT will start over until 40 continuous days of trouble free operation are experienced. ***This re-start can only occur twice.***

- E. During the two week burn-in period, the Contractor shall train a minimum of 10 Department staff (to be designated by the Department) in the operation of the **SYSTEM** for a period of 1 week.
- F. The Acceptance Performance Test shall demonstrate to the satisfaction of the Department that the weigh-in-motion enforcement system has been constructed and consistently meet the performance requirements of the plans and of these Technical Special Provisions. The APT will be the basis for acceptance or rejection of the **SYSTEM** as a result of demonstrated performance.

The Department will suspend Contract time during the first scheduled Acceptance Performance Test (APT). Contract time will resume if the **SYSTEM** fails during the first, allotted APT time period. When the APT resumes, the entire time period is required as detailed in this section and the Department will suspend the Contract time. The Department will withhold final acceptance of the project until after the successful completion and acceptance of the APT.

At the end of the Acceptance Performance Test period, if the **SYSTEM** performance requirements as described in the plans and these Technical Special Provisions has not been successfully demonstrated to the satisfaction of the Department, the Department shall reserve the right to continue testing or reject the entire **SYSTEM** for a maximum of two, additional Acceptance Performance Tests (APT's). If the **SYSTEM** does not pass the first, scheduled APT or such additional APT as the Department may authorize under this provision, the Department will reject the **SYSTEM** and the Contractor shall replace the **SYSTEM** with one that meets the Department's requirements at no additional cost to the Department.

Vehicle Suitability

1. Gross static weight must be a minimum of 80% of GVC (gross vehicle capacity) or 64,000-lb.
2. Liquid tankers, livestock, and car haulers are excluded.
3. Vehicles traveling less than 5 mph or more than 70 mph will be excluded.

GENERAL PROVISIONS WEIGH IN MOTION

- 1.0 The intent of the following provisions is to ensure the WIM system is manufactured to documented quality standards. This is important because the system is subject to highway traffic. Also, these provisions ensure the system will meet documented accuracy requirements for maximum performance, and be supported by local service technicians to minimize down time.
 - 1.1. The scale manufacturer shall have local service.
 - 1.2. The design and manufacture of the WIM scales, load cells, and associated controls shall be of one manufacture to maximize compatibility. This manufacturer shall have a quality system that has been registered to the standards of ISO9001.
 - 1.3. All Welding performed during fabrication of WIM scale platforms and frames must be performed by welders with current AWS D1.1 certification.
 - 1.4. The manufacturer shall provide with the bid proposal a listing of major spare parts and corresponding prices.
 - 1.5. The system shall be a METTLER TOLEDO type or approved equal.
 - 1.6. The system shall meet ASTM type III or type I functional performance requirements, assuming the pavement before and after WIM scales meets ASTM E1318-02 sections 6.1.2, 6.1.3, 6.1.5 and 6.16 requirements

WIM Scales Foundation Requirements

- 2.0 The intent of this section is to ensure the scales maintain elevation and will not settle over time. Changes in elevation or settling of the scales cause inaccuracy in weighing.
 - 2.1 The WIM scales shall have a foundation to support and maintain the scale's elevation.
 - 2.2 The foundation shall meet local requirements and the minimum specifications stated in the section.
 - 2.3 The minimum soil bearing required shall be 1,500 pounds per square foot. The contractor shall be responsible for determining whether or not the soil conditions are adequate.
 - 2.4 The foundation shall be 164-in. wide, 95-in. long, and 10 in. thick.
 - 2.5 The foundation shall be poured and constructed of Portland concrete with a minimum strength of 3,500 PSI.
 - 2.6 The foundation shall be reinforced per manufactures guidelines.
 - 2.7 The foundation shall be constructed to provide adequate drainage.

WIM Scales

- 3.0 The intent of this section is to ensure the WIM scales accurately weigh and measure vehicles at highway speeds, and are field repairable. The following described WIM scales accurately weigh the left and right wheels independently and determine speed, axle spacing, and off scale conditions without the use of other maintenance intensive sensors (axle sensors). These scales are field repairable, because of this and the elimination of axle sensors, maintenance and repairs are accomplished with minimal lane closure time.
- 3.1 The WIM scale consists of two platforms that weigh the left and right wheels independently. The weighing surface of the platforms will measure 6 ft. wide and 30 in. long in the direction of travel, so that together the two platforms will cover a 12-ft. wide lane.
 - 3.2 Each WIM scale platform shall be supported by four (4) bolts on shear beam load cells for quick replacement.
 - 3.3 Each WIM scale platform shall be mounted in separate frames no more than 12 in. deep.
 - 3.4 The platforms are to be installed flush with the road surface and must be able to withstand heavy truck traffic and normal road maintenance devices such as sweepers and snow plows.
 - 3.5 The WIM scales shall be installed in a staggered configuration so that the scales can determine speed and axle spacing without the use of other in road devices.
 - 3.6 The WIM scales staggered configuration and system software shall determine off scale situations without the use of other in road devices.
 - 3.7 The WIM scales shall be capable of weighing a 50,000-pound single axle, and have a minimum of 150% overload capacity.
 - 3.8 Each WIM scale shall have a static weighing accuracy of 1% or better as demonstrated by applying certified test weights in three places on each platform (The center and each side). Furthermore, the linearity of the indicated weight must not deviate by more than 1% from the actual weight as test weights are added or removed over the full range of the scales rated weighing capacity.
 - 3.9 Each WIM scale platform shall be designed to handle speeds up to 90 miles per hour.
 - 3.10 The WIM scales shall be field repairable on site.
 - 3.11 Repair or replacement of any load cell shall be accomplished with no more than a 1-hour lane closure. The WIM scales shall not require calibration after replacing a load cell.

WIM Scale Platforms and Frames Surface Preparation and Finish

4.0 The intent of this section is to ensure that metal surfaces are prepared properly before painting. The steel preparation and paint procedure can minimize maintenance and provide protection against corrosion.

4.1 Surface Preparation

- 4.1.1 Before abrasive blasting, clean per SSPC-SP1
- 4.1.2 The weldment shall be abrasive blasted with a nine-wheel horizontal wheelabrator descaler per SSPC A SP-10 (near white blast)
- 4.1.3 Travel rate to be 10 ft./min +/- 1 ft./min
- 4.1.4 Abrasive material to be steel grit / shot combination
- 4.1.5 Blat profile to be 1.5 to 2.5 Mils.

4.2 Coating Specification

- 4.2.1 Direct to metal Carboline 890 (Cycloalaphaticamine Epoxy)
- 4.2.2 Color,, State Gray # 1753
- 4.2.3 75% +/- 2% solids by volume minimum
- 4.2.4 Must be suitable for salt solution immersion
- 4.2.5 Temperature resistance to be 200 degrees F continuos
- 4.2.6 Must meet VDC level of 2.0 Lbs/Gal maximum as applied
- 4.2.7 Shall be lead and chromate free
- 4.2.8 Can not contain any substance defined as carcinogenic by the U.S. EPA

4.3 Coating Application Procedure

- 4.3.1 Perform spray applied stripe coat on all edges and other irregular surfaces
- 4.3.2 Spray apply specified coating with 50% overlap for first coat
- 4.3.3 Spray apply second coat with 50% overlap at right angles to first coat
- 4.3.4 Interval between coats to be as specified by coating manufacturer for ambient conditions present
- 4.3.5 Wet millage to be verified and documented at 10 - 12 Mils minimum.

4.4 Curing

- 4.4.1 Each coat to be force cured at 220 degrees F for a minimum of 15 minutes.
- 4.4.2 Coating must cure to 6 - 8 Mils DFT minimum.

WIM Scale Loadcell Specifications

5.0 The intent of this section ensures the WIM load cell is designed to handle the repetitive cycles and extreme weather conditions. The load cells shall be manufactured to tight tolerances to ensure repeatability, accuracy, and serviceability of the WIM scale. Because each load cell is bolted to the platform, and manufactured to the following specifications the load cells are interchangeable to the point that re-calibration is not required. This makes replacement quick, simple, and less costly.

5.1 Each load cell shall have a minimum capacity of 16,000 pounds

5.2 Each load cell shall be of shear beam design with strain gauges

5.3 Each load cell shall be of stainless steel construction

5.4 Each load cell shall be hermetically sealed

5.5 Each load cell shall have temperature compensation inherent in the load cell design

5.6 The load cell specifications

5.6.1 Overload 150% FS (full scale) safe, 300% FS ultimate

5.6.2 Repeatability +/- 0.01% FS

5.6.3 Non-Linearity +/- 0.07% FS

5.6.4 Hysteresis +/- 0.15% FS

5.6.5 Creep 20 sec. - 1 hour(*) +/-0.05% FS

5.6.6 Safe side load +/-100%FS

5.6.7 Span Temp. Coeff 100ppm/deg C

5.6.8 Zero Temp. Coeff 300ppm/deg C

(*) Loading and unloading time not to exceed 60 sec. Each

5.7 The manufacturing tolerance of the load cells must allow them to be interchangeable to the point that no calibration is required after replacing a load cell.

5.8 Each load cell shall have an integral cable with a stainless steel outer shield. This cable shall be of sufficient length to reach the WIM controller without intermediate connections. No junction boxes shall be placed in the WIM scale pit or below grade.

Virtual By-Pass Controller

6.0 The intent of this section is to ensure the WIM controller is designed and constructed according to the specifications below.

6.1 Shall be constructed in a standard outdoor traffic control cabinet

6.2 Shall be capable of supporting an interface for AVI equipment

6.3 Shall receive cables from the WeighBridges, loops, cameras, and transmit or store data as specified.

6.4 Shall run Windows 2000 or XP operating system.

6.5 Dial up modem shall be used to access the following functions:

- Specify which pictures should be logged or transmitted
- Set over weight thresholds
- Download pictures with WIM superimposed data

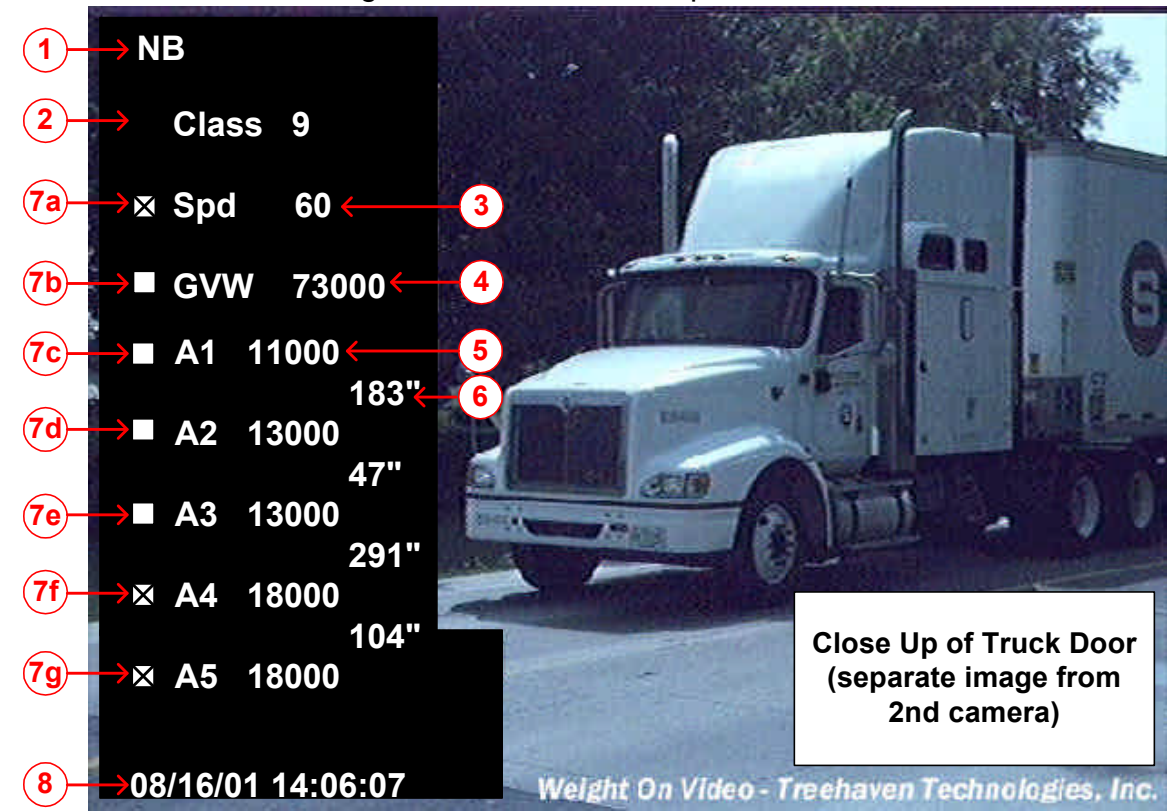
- Download Federal Highway WIM data (card format)
 - Provide routine system/file maintenance such as deleting old pictures once they are uploaded.
- 6.6 System shall log data for all vehicles
- 6.7 System shall log annotated pictures for the user-defined classifications
- 6.8 System shall log annotated pictures for the following user-defined violations
- Check for GVW violations on selected classes and annotate captured picture accordingly
 - Check for Tandem violations on selected classes and annotate captured picture accordingly
 - Check for Axle violations on selected classes and annotate captured picture accordingly
 - Check for Bridge violations on selected classes and annotate captured picture accordingly
 - Check for Speed violations on selected classes and annotate captured picture accordingly
- 6.9 A daily report shall be generated that provides a time stamp list of all vehicles, indicating their violation(s) and the file name(s) of the corresponding picture with overlaid text. The time stamp shall be used as a primary key for accessing details of the WIM record.
- 6.10 For testing purposes, it shall be possible to log pictures (with WIM data overlaid) of all vehicles.
- 6.11 A suitable concrete pad, shall be installed which will be large enough to support the Controller and provide standing area for maintenance personnel
- 6.12 Shall include a module for terminating all in-road items (scales, loops, camera(s), etc.) and provide necessary communications.
- 6.13 Shall include power supply, convenience outlet with light, and surge protection for both lightning and electric.
- 6.14 This controller or other equipment in this system shall not require UPS for adequate operation

Logged Pictures

- 7.1 The information required on the picture stored in the database or transmitted is shown in Figure 1. The actual layout of the information on the screen may be changed subject to State approval. Descriptions for each field are listed below.
1. Traveling direction of vehicle – NB, SB, EB, WB
 2. Vehicle Class
 3. Vehicle speed in miles per hour
 4. Gross vehicle weight in pounds
 5. Axle weight in pounds
 6. Axle spacing in inches

- 7a. Check box for speed violation (threshold set by user)
- 7b. Check box for GVW violation (threshold set by user)
- 7c. Check box for axle violation on Axle 1 (threshold set by user)
- 7d. Check box for axle violation on Axle 2 (threshold set by user)
- 7e. Check box for axle violation on Axle 3 (threshold set by user)
- 7f. Check box for axle violation on Axle 4 (threshold set by user)
- 7g. Check box for axle violation on Axle 5 (threshold set by user)
- 8. Date (MM/DD/YY) and Time (HH:MM:SS) (this information shall be obtained from the actual WIM system so that records will be synchronized)

Figure 1. Picture of Compliant Truck



Violations will be indicated on the image in the following manner:

- Speed violations will be denoted with an 'X' in box 7a.
- GVW violations will be denoted with an 'X' in box 7b.
- Single axle violations will be denoted with an 'X' in the corresponding box(es) 7c, 7d, 7e, 7f, 7g.
- Tandem axle violations will be denoted with an 'X' in the corresponding box(es) 7d & 7e, 7f & 7g.
- Bridge violations will be denoted with an 'X' in boxes 7d, 7e, 7f, 7g.

Lightning Protection

8.0 A comprehensive lightning protection system shall be provided with the system and covered by warranty

8.1 The system including WIM load cells, WIM controller, and camera(s) shall be covered by the lightning protection system.

Minimum Camera Specifications

9.0 The following minimum specifications shall be met for the camera(s):

Imager	2/3" progressive scanning interline transfer CCD (Prima RGB color filter)
Pixel	768 (H) x 484 (V)
Cell Size	11.6µm (H) x 13.6 µm (V) progressive scan
Scanning	Progressive, 525 lines 30 Hz or 60 Hz 2:1 interface
Sync	Internal/external auto switch HD/VD, 1.0 Vp-p, Impedance 4.7 KOhms VD=interlace 60 Hz/non-interlace 30 Hz HD=15.734 kHz +/- 5%
Data Clock Output	14.31818 MHz
TV Resolution	470(H) x 484(V) (analog), 760 x 484 (digital sampling)
S/N Ratio	50dB
Min. Illumination	10.0 lux, f=1.4 (no shutter). Sensitivity: 10µV/e-
Video Output	1.0 Vp-p RGB and NTSC video, @ 75 Ohm and 8-bit x 3 TTL output
AGC	OFF
Gamma	0.45 or 1.0 (0.45 std.)
Lens Mount	C-mount
Power Req.	12 V DC 600mA
Operating Temp.	-10 C to 50 C
Vibration & Shock	Vibration 7G, Shock 70G
Size (W x H x L)	51 mm x 46 mm x 162 mm (2"x 1.81"x 6.38")

Weight	225 grams (4.3 oz)
Power Cable	12P-02
Power Supply	K25-12V, PD-12, or PD-12P (with 12 pin connector)
Auto iris Connector	None
Functional Options	Y/C Output

9.2 Camera(s) shall be mounted in an environmental enclosure with heater and blower.

Virtual By-Pass System Warranty

10.0 The manufacturer shall warrant the system including all load cells, WIM controller, camera(s) for a period of two years from the date of acceptance from failures due to a defect in manufacturing, workmanship, lightning, or surge voltages.

10.1 The written warranty must be acceptable and approved by the user prior to the execution of the construction contract.

10.2 The manufacturer shall bear the charges and expenses associated with replacement parts, equipment, (excluding remote laptops) and any associated freight or handling expenses incurred in the repair or replacement of the system due to failed or damaged items under warranty.

10.3 This warranty excludes damage caused by flooding, accidents, vandalism or natural disasters. The manufacturer shall commence to provide such warranty service within 24 hours of notice that warranty work is required.