INTERNATIONAL ROAD DYNAMICS INC.

# LTPP WIM DATA COLLECTION SYSTEMS

# INSTALLATION AND CALIBRATION FOR DELAWARE SPS-1 LTPP ID 100100

**JULY 23, 2007**

**CLIN 2004C TASK ORDER # 14**

**CONTRACT NO. DTFH61-05-D-00001**

U.S. Department of Transportation
Federal Highway Administration

LONG TERM Pavement PERFORMANCE

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# 1.0 EXECUTIVE SUMMARY

This report details the installation and calibration of the Delaware SPS-1 Weigh-in-Motion (WIM) site located on US113, 450 ft. N. of W. Robbins Road. The WIM site is instrumented with IRD's iSINC (Intelligent Sensor Interface Network Controller) WIM Electronics and Kistler Quartz Sensors. The LTPP lane is in the south bound driving lane it's instrumented with two inductive loops and 4 Kistler Quartz sensors. The WIM system uses a landline modem for communication and power is provided by 120 Volt A.C. service. The WIM Controller cabinet is located on the shoulder west of the south bound lanes.

The WIM equipment installation began on July 10, 2007 and was completed on July 11, 2007. On Saturday July 14 at 5:08 am the WIM system was hit by a major surge (lightning). It blew out the modem and CPU board on the iSINC. On July 18 these parts were replaced and the WIM system was re-commissioned. On July 19, 2007 the system was calibrated using two class 9 vehicles.

The calibration results demonstrate the WIM system meets the LTPP performance requirements for weight and axle spacing as detailed in the *Data Collection Guide for SPS WIM Sites*.

# 2.0 POINT OF CONTACTS

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# 3.0 SHEET 16 – SITE CALIBRATION SUMMARY

SITE CALIBRATION INFORMATION

1. DATE OF CALIBRATION (MONTH/DAY/YEAR): **July 19, 2007**

2. TYPE OF EQUIPMENT CALIBRATED:
   - ☒ WIM
   - ☐ CLASSIFIER
   - ☐ BOTH

3. REASON FOR CALIBRATION
   - ☐ REGULARLY SCHEDULED SITE VISIT
   - ☐ RESEARCH
   - ☐ EQUIPMENT REPLACEMENT
   - ☐ TRAINING
   - ☐ DATA TRIGGERED SYSTEM REVISION
   - ☒ NEW EQUIPMENT INSTALLATION
   - ☐ OTHER (SPECIFY) _____

4. SENSORS INSTALLED IN LTPP LANE AT THIS SITE (CHECK ALL THAT APPLY):
   - ☐ BARE ROUND PIEZO CERAMIC
   - ☐ BARE FLAT PIEZO
   - ☐ BENDING PLATES
   - ☐ CHANNELIZED ROUND PIEZO
   - ☐ LOAD CELLS
   - ☒ QUARTZ PIEZO
   - ☐ CHANNELIZED FLAT PIEZO
   - ☒ INDUCTANCE LOOPS
   - ☐ CAPACITANCE PADS
   - ☐ OTHER (SPECIFY) _____

5. EQUIPMENT MANUFACTURER: **International Road Dynamics Inc.**

WIM SYSTEM CALIBRATION SPECIFICS

6. CALIBRATION TECHNIQUE USED:
   - ☐ TRAFFIC STREAM:
     - NUMBER OF TRUCKS _____
     - ☐ STATIC SCALE
   - ☒ TEST TRUCKS:
     - NUMBER OF TEST TRUCKS **2**
     - PASSES PER TRUCK **21**

| TRUCK# | TYPE | SUSPENSION |
|---|---|---|
| 1 | **9** | **1 & 2** |
| 2 | **9** | **1 & 2** |
| 3 | **X** | **X** |
| 4 | **X** | **X** |
| 5 | **X** | **X** |

TYPE PER FHWA 13 BIN SYSTEM
SUSPENSION TYPES:
1 – AIR
2 – LEAF SPRING
3 – OTHER

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   GVW MEAN DIFFERENCE **1 %** STANDARD DEVIATION **2.9%**
   SINGLE AXLE MEAN DIFFERENCE -**1.2%** STANDARD DEVIATION **3.1%**
   DOUBLE AXLES MEAN DIFFERENCE **1.6%** STANDARD DEVIATION **4.5%**

8. NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED: **3**

9. DEFINE THE SPEED RANGES USED (MPH): **30 - 45, 45 – 55, 55 - 65**

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) **See following sheets**

11. IS AUTO-CALIBRATION USED AT THIS SITE? ☐
    IF USED, LIST AND DEFINE AUTO-CALIBRATION VALUE _____

CLASSIFIER TEST SPECIFICS

12. METHOD FOR COLLECTING INDEPENDENT VOLUME MEASUREMENT BY VEHICLE CLASS:
    ☐ VIDEO
    ☒ MANUAL
    ☐ PARALLEL CLASSIFIERS

13. METHOD TO DETERMINE LENGTH OF COUNT:
    TIME
    NUMBER OF VEHICLES
    NUMBER OF TRUCKS

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
    FHWA CLASS 2 100**%**
    FHWA CLASS 3 100**%**
    FHWA CLASS 4&5 90**%**
    FHWA CLASS 8 100**%**
    FHWA CLASS 9 100**%**
    FHWA CLASS 12 **%**
    "UNCLASSIFIED" VEHICLES: **%**

15. PICTURES: _____

16. NOTES:
    _____

PERSON LEADING CALIBRATION EFFORT: **Bruce Myers**
CONTACT INFORMATION: **717-264-2077**

### 3.1.1 iSINC SITE CALIBRATION FACTORS & SITE PARAMETERS

Delaware LTPP Current As of Date: July 19, 2007

**Calibration Parameters >**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Select Lane | | 1 | | | | | |
| Select Axle Sensor | | 1 | | | | | |
| Threshold | | 16 | | | | | |
| WIM Calib Factors > | | Select Speed Bin | 1 | 2 | 3 | 4 | 5 |
| | | Max Speed (kph) | 65 | 72 | 80 | 88 | 105 |
| | | Calib Factor | 3253 | 3253 | 3388 | 3421 | 3455 |
| Select Lane | | 1 | | | | | |
| Select Axle Sensor | | 2 | | | | | |
| Threshold | | 16 | | | | | |
| WIM Calib Factors > | | Select Speed Bin | 1 | 2 | 3 | 4 | 5 |
| | | Max Speed (kph) | 65 | 72 | 80 | 88 | 105 |
| | | Calib Factor | 3388 | 3388 | 3529 | 3564 | 3599 |

**Site Parameters >**

| | | | |
|---|---|---|---|
| Lane Name | | | 4 |
| Lane State | | | ENABLED |
| Upstream Loop > | | Loop State | ENABLED |
| | | Module UID | 9 |
| | | Channel Num | 0 |
| | | Polarity Active | LOW |
| | | Width (cm) | 250 |
| Downstream Loop > | | Loop State | ENABLED |
| | | Module UID | 9 |
| | | Channel Num | 1 |
| | | Polarity Active | LOW |
| | | Width (cm) | 250 |
| | | Distance(cm) | 670 |
| Axle Sensors > | | Select Axle | 1 |
| | | Axle State | ENABLED |
| | | Module UID | 5 |
| | | Channel Num | 0 |
| | | Polarity Active | HIGH |
| | | Type | KISTLER_DUAL |
| | | Distance(cm) | 274 |
| | | Temp State | ENABLED |
| | | Temp Module UID | 5 |
| | | Temp Channel Num | 0 |
| Axle Sensors > | | Select Axle | 2 |
| | | Axle State | ENABLED |
| | | Module UID | 5 |
| | | Channel Num | 1 |
| | | Polarity Active | HIGH |
| | | Type | KISTLER_DUAL |
| | | Distance(cm) | 579 |
| | | Temp State | ENABLED |
| | | Temp Module UID | 5 |
| | | Temp Channel Num | 0 |
| Processing > | MaxTimeout(ms) | | 3000 |
| | Dynamic Comp(%) | | 103 |
| | Sig Wt Diff(%) | | 40 |
| | Min Axle Wt(kg) | | 1360 |
| | Veh Rec Mode | | Split |
| | Axl Sep(cm) | | 305 |
| Axle Snsor Debounce > | Type | KISTLER_DUAL | |
| | On (ticks) | 8 | |
| | Off (ticks) | 40 | |

# 4.0 WIM SITE INVENTORY

1. ROUTE US113 MILEPOST: 450 ft. N. of W. Robbins Road LTPP DIRECTION: N **S** E W

2. SITE DESCRIPTION
   GRADE: <1%
   ☐ Sag vertical
   Nearest SPS section upstream of the site: 100104
   Distance from sensor to nearest upstream SPS Section: 900 ft.

3. LANE CONFIGURATION
   Number of lanes in LTPP direction: 2 lanes
   Lane width: 12 ft.
   ☐ Median painted
   ☐ Median physical barrier
   ☒ Median grass
   ☐ Median none
   ☐ Shoulder curb and gutter
   ☒ Shoulder paved AC
   ☐ Shoulder paved PCC
   ☐ Shoulder unpaved
   Shoulder width: 10 ft.

4. PAVEMENT TYPE: PCC

5. CONDITION: (Surface distresses by type / severity within WIM section)
   Good

6. SENSOR SEQUENCE: Loop - Kistler - Kistler - Loop

7. PAVEMENT REPLACEMENT AND/OR GRINDING:
   Straightedge check: Performed _____ Result: ☒ Pass / ☐ Marginal / ☐ Unsatisfactory
   Short wave check: Performed _____ Result: ☒ Pass / ☐ Marginal / ☐ Unsatisfactory
   Long wave check: Performed _____ Result: ☒ Pass / ☐ Marginal / ☐ Unsatisfactory

8. ANY EFFECTS FROM RAMPS OR LANE TRANSITIONS:
   ☐ Intersection/driveway within 300m upstream, distance: _____
   ☐ Intersection/driveway within 300m downstream, distance: _____
   ☐ LTPP lane used for passing by vehicles traveling in south bound lane

9. DRAINAGE:
   ☐ Open to ground
   ☐ Pipe to culvert or ditch
   ☒ None
   ☐ French drain

10. CABINET LOCATION:
    - ☒ Same side of road as LTPP lane
    - ☐ Median
    - ☐ Behind guard rail

    Distance from edge of travel lane to cabinet: 40 ft
    Distance from sensors: 98 ft
    Type: 336
    Access controlled by: ☐ LTPP / ☒ State / ☐ Joint
    Primary contact: Tyrone Crittendon
    Alternate contact:

11. POWER:
    Power type: ☐ Overhead / ☐ Underground / ☐ Solar
    Distance from cabinet to drop: 5 ft
    Service provider: N/A.

12. TELEPHONE:
    Telephone type: ☐ Overhead / ☒ Underground / ☒ Cell
    Distance from cabinet to drop: 20 ft
    Phone # : (302) 854-6710

13. SYSTEM:
    Software: iSINC
    Version:
    Connection: ☒ RS232 / ☐ Parallel port / ☐ USB / ☐ Other

14. TEST TRUCK CYCLE:
    Turnaround time: 14 minutes
    Turnaround distance: 14 miles

15. PICTURES: See following pages, Site Map, WIM Site, Site layout drawings

16. NOTES:

COMPLETED BY: **Bruce Myers**
CONTACT INFORMATION: **717-264-2077**

### 4.1.1 SITE MAP


Staytonville
Kent
Sussex
13
36
16
16
Greenwood
Owens
Oakley
Ellendale
30
1
5
16
113
Site Location
404
Bridgeville
Redden
Harbeson
Gravel Hill
Coverdale Crossroads
9
Cannon
18
Georgetown
Old Furnace
30
Seaford
Concord
Stockley
Piney Grove
0
2mi
2km

### 4.1.2 PICTURES, WIM SITE

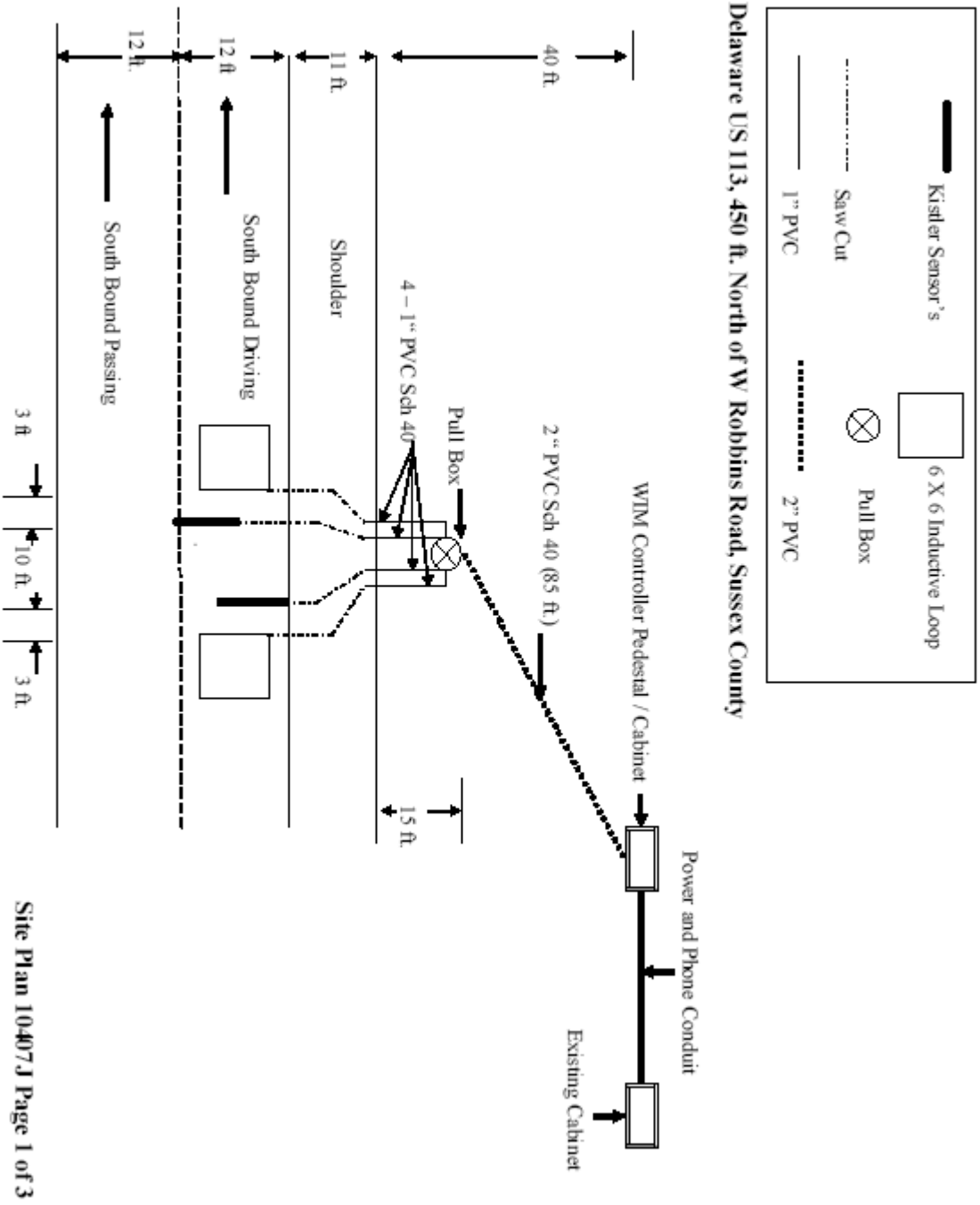

### 4.1.3 PICTURES, INSTALLATION

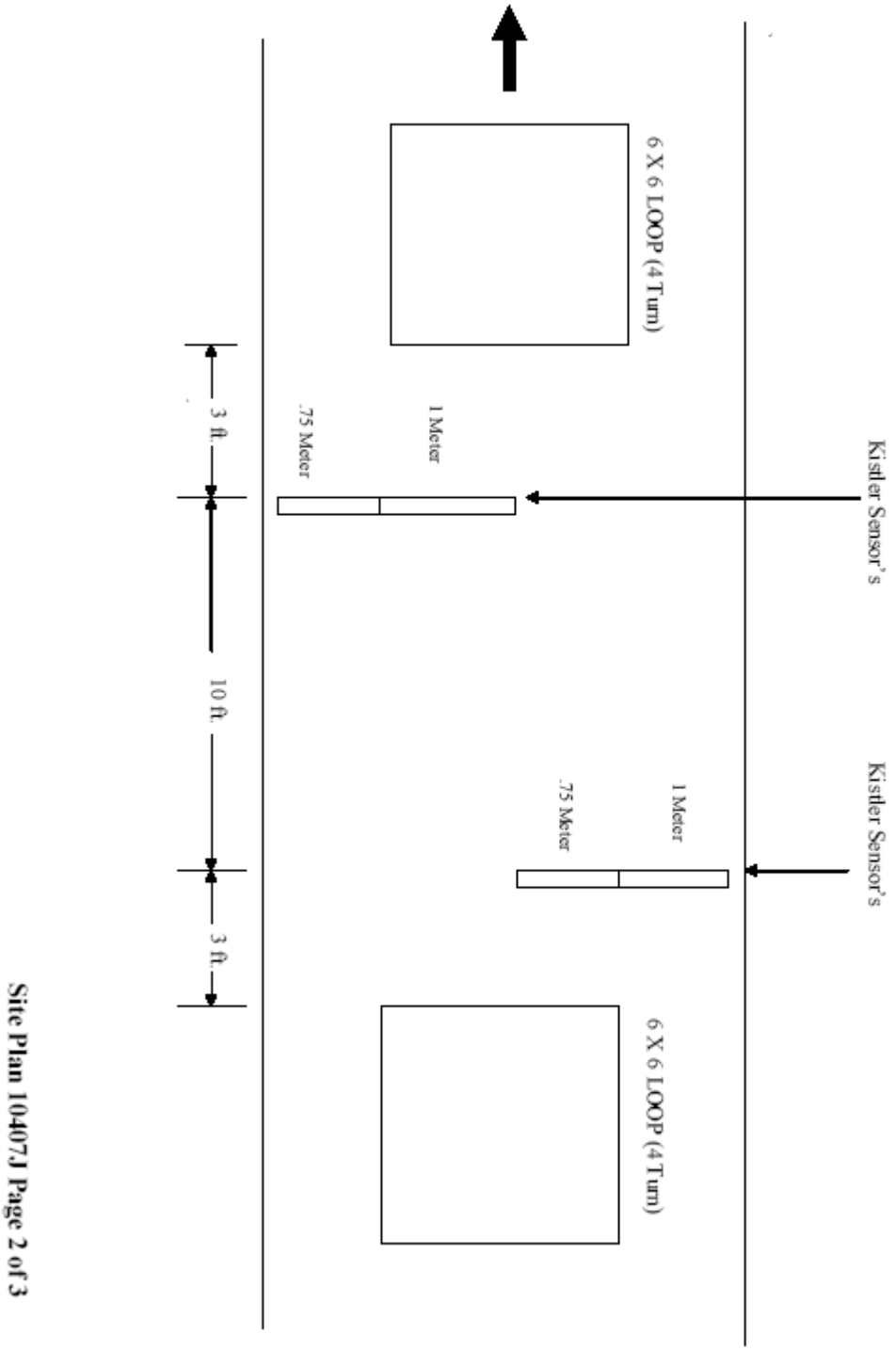


2007/07/11


2007/07/11

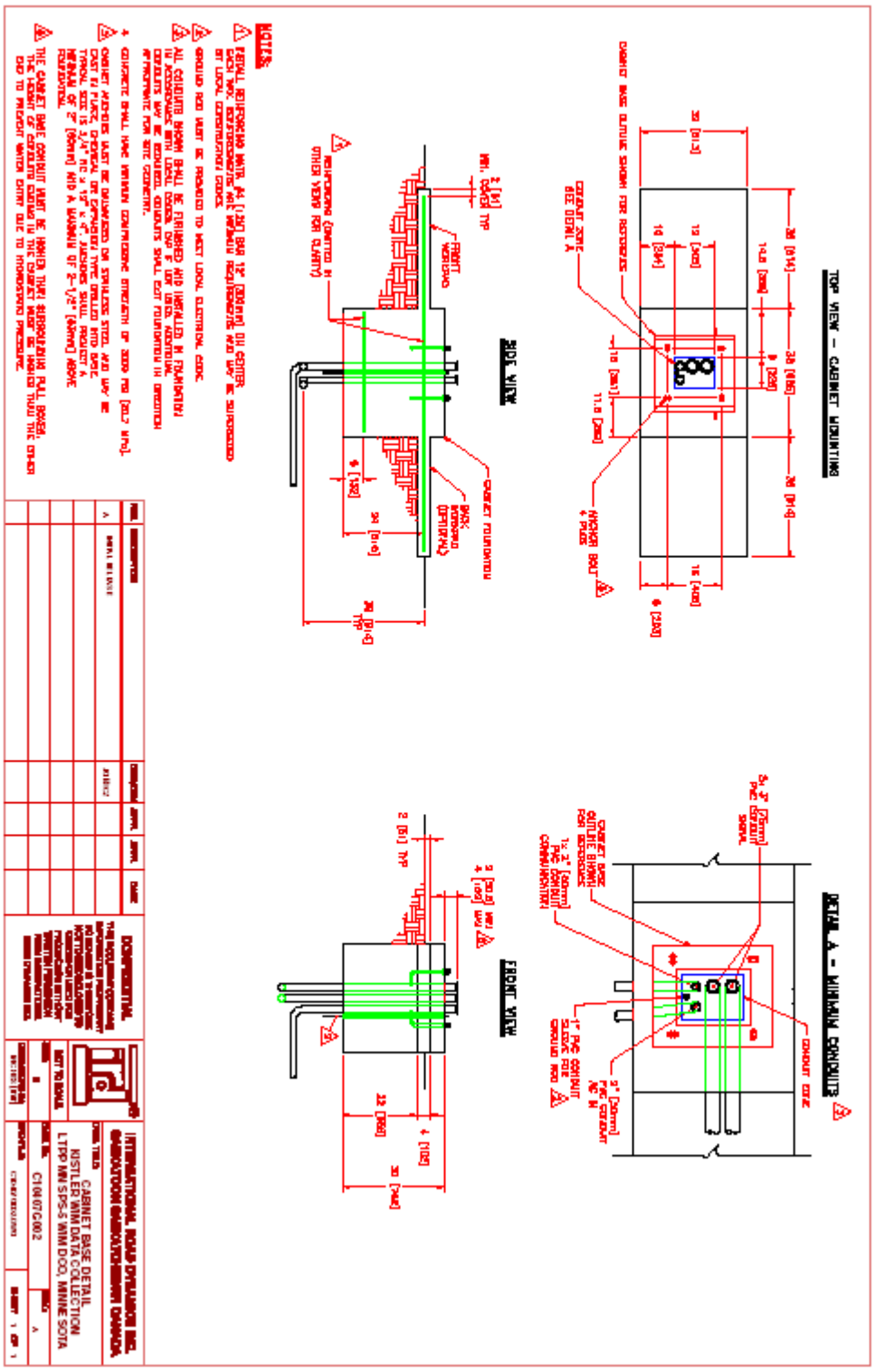
### 4.1.4 STE LAYOUT






Site Plan 10407J Page 2 of 3

### 4.1.5 WIM CABINET CONCRETE PEDESTAL



### 4.1.6 ELECTRICAL READINGS

**IRD**

**Site Service Sheet**

Clear

System Type: iSINC / Kistler Quartz

Date: 7/11/2007 State: DE Location: US 113 South Bound
Job #: 10407J Site #: Directions: 450 ft. North of W. Robbins Road

| | | Lead | Trail | Lead | Trail | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Loops | Lane | 1 | 1 | | | | | | |
| Resistance | | 1.9 Ω | 2 Ω | | | | | | |
| Leakage | | inf | inf | | | | | | |
| Inductance uH | | 196.0 | 267.0 | | | | | | |
| Frequency | | High | High | | | | | | |
| Kistler | Lane - 1 | Lead | Lead | Trail | Trail | | | | |
| Amplitude | | OK | OK | OK | OK | | | | |
| Capacitance | | 8.3 nF | 6.8 nF | 7.7 nF | 6.8 nF | | | | |
| Resistance | | inf. | inf. | inf. | inf. | | | | |
| Serial # | | 1581608 | 1602689 | 1581116 | 1597943 | | | | |
| Kistler | Lane - 2 | | | | | | | | |
| Amplitude | | | | | | | | | |
| Capacitance | | | | | | | | | |
| Resistance | | | | | | | | | |
| Serial # | | | | | | | | | |
| Piezo | Lane - 3 | | | | | | | | |
| Amplitude | | | | | | | | | |
| Capacitance | | | | | | | | | |
| Resistance | | | | | | | | | |
| Serial # | | | | | | | | | |
| Kistler | Lane - 4 | | | | | | | | |
| Amplitude | | | | | | | | | |
| Capacitance | | | | | | | | | |
| Resistance | | | | | | | | | |
| Serial # | | | | | | | | | |

| System | |
|---|---|
| A/C Service | 120.0 |
| Power Supply | |
| Solar Panel | |
| Back-Up | |
| System Input | |
| Modem Power | |
| Phone off | 10 VDC |
| Phone on | 52 VDC |

| Temp Sensor | |
|---|---|
| Red to Blk | 7 MΩ |
| Red to Wht | 6.07MΩ |
| Wht to Blk | 40KΩ |

| Software | |
|---|---|
| System | iSINC |

Site Full Operating Capacity Pass √
Fail

Technician: Steven Schroader Date: 7/11/2007

# 5.0 WIM CALIBRATION

## 5.1.1 TEST TRUCK #1 INFORMATION

DATE OF CALIBRATION: **July 19, 2007**

1. TEST TRUCK NUMBER: 1 2. FHWA CLASS: 9 3. Number of axles: 5

| Axle | Empty Truck Axle Weights (lb) | 4. Pre-Test Loaded Axle Weights (lb) | 5. Post-Test Loaded Axle Weights (lb) | 6. Measured Directly or Calculated |
|---|---|---|---|---|
| A | | 11500 | | D |
| B | | 23800 | | D (B&C combined) |
| C | | | | |
| D | | 29220 | | D (D&E combined) |
| E | | | | |

7. CALCULATIONS:

| Empty Truck Gross Weight (lb) | Pre-Test Loaded Gross Weight (lb) | Post-Test Loaded Gross Weight (lb) | Pre to Post Difference (lb) |
|---|---|---|---|
| | 64520 | | 64520 |

8. TRACTOR CAB STYLE: ☐ Cab over engine / ☒ Conventional ☐ With sleeper

9. TRACTOR MANUFACTURER:
   Make: International
   Model:

10. TRAILER LOAD DESCRIPTION: Concrete Barriers

11. TRAILER TARE WEIGHT (lb): _____

12. AXLE SPACINGS

| Axle | Spacing (feet & inches) |
|---|---|
| A-B | 17.7' |
| B-C | 4.2' |
| C-D | 35.9’ |
| D-E | 4.1’ |

KINGPIN OFFSET FROM AXLE B (ft, + towards rear): +1.5 ft

SUSPENSSION:

| Axle | 17. Tire Size | 18. Suspension description (leaf, air, # of leaves, taper or flat leaf, etc.) |
|---|---|---|
| A | 11R24.5 | Leaf spring – two leaves |
| B | 11R24.5 | air |
| C | 11R24.5 | air |
| D | 11R24.5 | air |
| E | 11R24.5 | air |

### 5.1.2 PICTURES, TEST TRUCK 1



07.19.2007


Battle Creek
Truck Service
877-965-9051
07.19.2007

### 5.1.3 TEST TRUCK #2 INFORMATION

DATE OF CALIBRATION: **July 19, 2007**

1. TEST TRUCK NUMBER: 2 2. FHWA CLASS: 9 3. Number of axles: 5

| Axle | Empty Truck Axle Weights (lb) | 4. Pre-Test Loaded Axle Weights (lb) | 5. Post-Test Loaded Axle Weights (lb) | 6. Measured Directly or Calculated |
|---|---|---|---|---|
| A | | 11700 | | D |
| B | | 26560 | | D (B&C combined) |
| C | | | | |
| D | | 38500 | | D (D&E combined) |
| E | | | | |

7. CALCULATIONS:

| Empty Truck Gross Weight (lb) | Pre-Test Loaded Gross Weight (lb) | Post-Test Loaded Gross Weight (lb) | Pre to Post Difference (lb) |
|---|---|---|---|
| | 76760 | | 76760 |

8. TRACTOR CAB STYLE: ☐ Cab over engine / ☒ Conventional ☒ With sleeper

9. TRACTOR MANUFACTURER:
   Make: International
   Model:

10. TRAILER LOAD DESCRIPTION: Concrete Barriers

11. TRAILER TARE WEIGHT (lb): _____

12. AXLE SPACINGS

| Axle | Spacing (feet & inches) |
|---|---|
| A-B | 17.8’ |
| B-C | 4.6’ |
| C-D | 30.3’ |
| D-E | 10’ |

KINGPIN OFFSET FROM AXLE B (ft, + towards rear): +1.5 ft

SUSPENSSION:

| Axle | 17. Tire Size | 18. Suspension description (leaf, air, # of leaves, taper or flat leaf, etc.) |
|---|---|---|
| A | 11R24.5 | Leaf spring – two leaves |
| B | 11R24.5 | air |
| C | 11R24.5 | air |
| D | 11R24.5 | air |
| E | 11R24.5 | air |

### 5.1.4 PICTURES, TEST TRUCK 2



07.19.2007


MICHELIN
OLEDO
07.19.2007

# 6.0 TEST TRUCK CALIBRATION RECORDS

## 6.1.1 VALIDATION RUNS

International Road Dynamics Inc.

FHWA VERIFICATION

**Static Test Vehicle Measurements**

| ID | | | | GVW | F/A | T1 | T2 | 1>2 | 2>3 | 3>4 | 4>5 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | 64.5 | 11.5 | 23.8 | 29.2 | 17.7 | 4.2 | 35.9 | 4.1 |
| 2 | | | | 76.8 | 11.7 | 26.6 | 38.5 | 17.8 | 4.6 | 30.3 | 10.0 |

**Dynamic Test Vehicle Measurements**

| ID | V# | Speed | Temp | GVW | F/A | T1 | T2 | 1>2 | 2>3 | 3>4 | 4>5 | am |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4276 | 33 | 99 | 66.5 | 10.9 | 26.0 | 29.6 | 17.4 | 4.2 | *35.3* | 4.0 | 9:22am |
| 2 | 4277 | 36 | 99 | 76.9 | 11.3 | 26.9 | 38.7 | 17.5 | 4.5 | 30.0 | 9.9 | 9:22am |
| 1 | 4362 | 47 | 101 | 61.6 | 10.9 | 24.1 | 26.6 | 17.8 | 4.2 | 35.9 | 4.1 | 9:38am |
| 2 | 4363 | 47 | 101 | 79.1 | 11.5 | 27.6 | 40.0 | 17.8 | 4.6 | 30.5 | 10.0 | 9:38am |
| 1 | 4470 | 59 | 104 | 61.5 | 10.8 | 22.8 | 27.9 | 17.7 | 4.4 | 36.0 | 4.1 | 9:52am |
| 2 | 4471 | 58 | 104 | 75.4 | 11.4 | 25.4 | 38.7 | 17.7 | 4.6 | 30.3 | 10.0 | 9:52am |
| 1 | 4545 | 37 | 104 | 66.6 | 10.8 | 26.2 | 29.7 | 17.7 | 4.3 | 35.9 | 4.1 | 10:06am |
| 2 | 4546 | 37 | 104 | 77.5 | 11.7 | 26.9 | 39.0 | 17.8 | 4.6 | 30.4 | 10.0 | 10:06am |
| 1 | 4633 | 46 | 106 | 67.5 | 10.7 | 26.3 | 30.5 | 17.7 | 4.2 | 35.9 | 4.1 | 10:21am |
| 2 | 4634 | 45 | 106 | 77.2 | 11.6 | 27.1 | 38.5 | 17.7 | 4.6 | 30.3 | 9.9 | 10:21am |
| 1 | 4709 | 57 | 106 | 64.7 | 11.2 | 23.5 | 30.0 | 17.8 | 4.2 | 36.0 | 4.1 | 10:34am |
| 2 | 4710 | 57 | 106 | 77.0 | 11.5 | 27.1 | 38.3 | 17.7 | 4.6 | 30.3 | 10.0 | 10:34am |
| 1 | 5025 | 37 | 116 | 65.9 | 11.4 | 26.0 | 28.5 | 17.8 | 4.2 | 35.9 | 4.1 | 11:22am |
| 2 | 5026 | 39 | 116 | 77.7 | 12.2 | 26.9 | 38.7 | 17.8 | 4.6 | 30.4 | 10.0 | 11:22am |
| 1 | 5130 | 46 | 117 | 62.5 | 11.4 | 23.7 | 27.3 | 17.7 | 4.2 | 36.0 | 4.1 | 11:35am |
| 2 | 5131 | 45 | 117 | 80.2 | 12.2 | 27.5 | 40.5 | 17.8 | 4.6 | 30.4 | 10.0 | 11:35am |
| 1 | 5219 | 58 | 119 | 61.9 | 11.0 | 24.0 | 26.9 | 17.7 | 4.3 | 35.9 | 4.1 | 11:49am |
| 2 | 5220 | 58 | 119 | 77.9 | 11.7 | 27.8 | 38.4 | 17.8 | 4.6 | 30.5 | 10.0 | 11:49am |
| 1 | 5309 | 37 | 117 | 67.8 | 11.2 | 26.2 | 30.4 | 17.6 | 4.2 | 35.8 | 4.1 | 12:03am |
| 2 | 5310 | 36 | 117 | 80.0 | 12.2 | 28.2 | 41.1 | 17.7 | 4.6 | 30.3 | 10.0 | 12:03am |
| 1 | 5404 | 42 | 120 | 67.4 | 11.4 | 26.7 | 29.3 | 17.7 | 4.3 | 35.9 | 4.1 | 12:17pm |
| 2 | 5405 | 43 | 120 | 79.5 | 12.1 | 28.0 | 39.5 | 17.7 | 4.6 | 30.4 | 10.0 | 12:17pm |
| 1 | 5499 | 53 | 121 | 63.0 | 11.1 | 24.4 | 27.5 | 17.7 | 4.3 | 35.7 | 4.1 | 12:31pm |
| 2 | 5500 | 52 | 121 | 78.0 | 11.6 | 26.6 | 39.7 | 17.7 | 4.6 | 30.3 | 9.9 | 12:31pm |
| 1 | 5600 | 63 | 122 | 66.2 | 11.4 | 24.2 | 30.6 | 17.8 | 4.2 | 36.0 | 4.1 | 12:45pm |
| 2 | 5601 | 63 | 122 | 78.0 | 11.9 | 25.7 | 40.3 | 17.8 | 4.6 | 30.4 | 10.0 | 12:45pm |
| 1 | 5691 | 42 | 125 | 62.6 | 11.0 | 23.8 | 27.7 | 17.8 | 4.3 | 36.1 | 4.1 | 13:00 pm |
| 2 | 5692 | 39 | 125 | 78.3 | 12.0 | 27.6 | 38.8 | 17.8 | 4.6 | 30.4 | 10.0 | 13:00 pm |
| 1 | 5798 | 52 | 126 | 62.1 | 11.2 | 23.4 | 27.6 | 17.7 | 4.2 | 35.8 | 4.1 | 13:15 pm |
| 2 | 5799 | 52 | 126 | 79.8 | 12.0 | 27.3 | 40.5 | 17.7 | 4.6 | 30.4 | 10.0 | 13:15 pm |
| 1 | 5900 | 62 | 126 | 64.5 | 11.1 | 24.3 | 29.0 | 17.7 | 4.2 | 35.8 | 4.1 | 13:30 pm |
| 2 | 5901 | 62 | 126 | 77.3 | 11.9 | 26.3 | 39.1 | 17.7 | 4.6 | 30.4 | 10.0 | 13:30 pm |
| 1 | 6301 | 53 | 128 | 62.7 | 10.9 | 24.5 | 27.4 | 17.8 | 4.2 | 35.8 | 4.1 | 14:28 pm |
| 2 | 6302 | 52 | 128 | 79.9 | 11.9 | 27.5 | 40.6 | 17.7 | 4.6 | 30.4 | 10.0 | 14:28 pm |
| 1 | 6418 | 53 | 129 | 65.1 | 11.2 | 24.0 | 29.9 | 17.7 | 4.2 | 35.8 | 4.1 | 14:43 pm |
| 2 | 6419 | 52 | 129 | 79.9 | 11.9 | 27.3 | 40.7 | 17.7 | 4.6 | 30.4 | 10.0 | 14:43 pm |
| 1 | 6507 | 62 | 129 | 63.7 | 11.3 | 25.6 | 26.8 | 17.8 | 4.3 | 35.9 | 4.1 | 14:57pm |
| 2 | 6508 | 64 | 129 | 80.5 | 11.9 | 28.0 | 40.6 | 17.8 | 4.6 | 30.5 | 10.0 | 14:57pm |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

| | |
|---|---|
| Date: | 2007/07/19 |
| Technician: | Bruce Myers |
| Location: | LTPP Delaware |

### 6.1.2 TEST TRUCKS ERROR CALCULATIONS

| Truck | V# | Speed | Temp | GVW | F/A | T1 | T2 | 1>2 | 2>3 | 3>4 | 4>5 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4276 | 33 | 99 | 3.1% | -5.2% | 9.2% | 1.4% | -0.3 | 0.0 | -0.6 | -0.1 |
| 2 | 4277 | 36 | 99 | 0.1% | -3.4% | 1.1% | 0.5% | -0.3 | -0.1 | -0.3 | -0.1 |
| 1 | 4362 | 47 | 101 | -4.5% | -5.2% | 1.3% | -8.9% | 0.1 | 0.0 | 0.0 | 0.0 |
| 2 | 4363 | 47 | 101 | 3.0% | -1.7% | 3.8% | 3.9% | 0.0 | 0.0 | 0.2 | 0.0 |
| 1 | 4470 | 59 | 104 | -4.7% | -6.1% | -4.2% | -4.5% | 0.0 | 0.2 | 0.1 | 0.0 |
| 2 | 4471 | 58 | 104 | -1.8% | -2.6% | -4.5% | 0.5% | -0.1 | 0.0 | 0.0 | 0.0 |
| 1 | 4545 | 37 | 104 | 3.3% | -6.1% | 10.1% | 1.7% | 0.0 | 0.1 | 0.0 | 0.0 |
| 2 | 4546 | 37 | 104 | 0.9% | 0.0% | 1.1% | 1.3% | 0.0 | 0.0 | 0.1 | 0.0 |
| 1 | 4633 | 46 | 106 | 4.7% | -7.0% | 10.5% | 4.5% | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 4634 | 45 | 106 | 0.5% | -0.9% | 1.9% | 0.0% | -0.1 | 0.0 | 0.0 | -0.1 |
| 1 | 4709 | 57 | 106 | 0.3% | -2.6% | -1.3% | 2.7% | 0.1 | 0.0 | 0.1 | 0.0 |
| 2 | 4710 | 57 | 106 | 0.3% | -1.7% | 1.9% | -0.5% | -0.1 | 0.0 | 0.0 | 0.0 |
| 1 | 5025 | 37 | 116 | 2.2% | -0.9% | 9.2% | -2.4% | 0.1 | 0.0 | 0.0 | 0.0 |
| 2 | 5026 | 39 | 116 | 1.2% | 4.3% | 1.1% | 0.5% | 0.0 | 0.0 | 0.1 | 0.0 |
| 1 | 5130 | 46 | 117 | -3.1% | -0.9% | -0.4% | -6.5% | 0.0 | 0.0 | 0.1 | 0.0 |
| 2 | 5131 | 45 | 117 | 4.4% | 4.3% | 3.4% | 5.2% | 0.0 | 0.0 | 0.1 | 0.0 |
| 1 | 5219 | 58 | 119 | -4.0% | -4.3% | 0.8% | -7.9% | 0.0 | 0.1 | 0.0 | 0.0 |
| 2 | 5220 | 58 | 119 | 1.4% | 0.0% | 4.5% | -0.3% | 0.0 | 0.0 | 0.2 | 0.0 |
| 1 | 5309 | 37 | 117 | 5.1% | -2.6% | 10.1% | 4.1% | -0.1 | 0.0 | -0.1 | 0.0 |
| 2 | 5310 | 36 | 117 | 4.2% | 4.3% | 6.0% | 6.8% | -0.1 | 0.0 | 0.0 | 0.0 |
| 1 | 5404 | 42 | 120 | 4.5% | -0.9% | 12.2% | 0.3% | 0.0 | 0.1 | 0.0 | 0.0 |
| 2 | 5405 | 43 | 120 | 3.5% | 3.4% | 5.3% | 2.6% | -0.1 | 0.0 | 0.1 | 0.0 |
| 1 | 5499 | 53 | 121 | -2.3% | -3.5% | 2.5% | -5.8% | 0.0 | 0.1 | -0.2 | 0.0 |
| 2 | 5500 | 52 | 121 | 1.6% | -0.9% | 0.0% | 3.1% | -0.1 | 0.0 | 0.0 | -0.1 |
| 1 | 5600 | 63 | 122 | 2.6% | -0.9% | 1.7% | 4.8% | 0.1 | 0.0 | 0.1 | 0.0 |
| 2 | 5601 | 63 | 122 | 1.6% | 1.7% | -3.4% | 4.7% | 0.0 | 0.0 | 0.1 | 0.0 |
| 1 | 5691 | 42 | 125 | -2.9% | -4.3% | 0.0% | -5.1% | 0.1 | 0.1 | 0.2 | 0.0 |
| 2 | 5692 | 39 | 125 | 2.0% | 2.6% | 3.8% | 0.8% | 0.0 | 0.0 | 0.1 | 0.0 |
| 1 | 5798 | 52 | 126 | -3.7% | -2.6% | -1.7% | -5.5% | 0.0 | 0.0 | -0.1 | 0.0 |
| 2 | 5799 | 52 | 126 | 3.9% | 2.6% | 2.6% | 5.2% | -0.1 | 0.0 | 0.1 | 0.0 |
| 1 | 5900 | 62 | 126 | 0.0% | -3.5% | 2.1% | -0.7% | 0.0 | 0.0 | -0.1 | 0.0 |
| 2 | 5901 | 62 | 126 | 0.7% | 1.7% | -1.1% | 1.6% | -0.1 | 0.0 | 0.1 | 0.0 |
| 1 | 6301 | 53 | 128 | -2.8% | -5.2% | 2.9% | -6.2% | 0.1 | 0.0 | -0.1 | 0.0 |
| 2 | 6302 | 52 | 128 | 4.0% | 1.7% | 3.4% | 5.5% | -0.1 | 0.0 | 0.1 | 0.0 |
| 1 | 6418 | 53 | 129 | 0.9% | -2.6% | 0.8% | 2.4% | 0.0 | 0.0 | -0.1 | 0.0 |
| 2 | 6419 | 52 | 129 | 4.0% | 1.7% | 2.6% | 5.7% | -0.1 | 0.0 | 0.1 | 0.0 |
| 1 | 6507 | 62 | 129 | -1.2% | -1.7% | 7.6% | -8.2% | 0.1 | 0.1 | 0.0 | 0.0 |
| 2 | 6508 | 64 | 129 | 4.8% | 1.7% | 5.3% | 5.5% | 0.0 | 0.0 | 0.2 | 0.0 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

### 6.1.3 OVERALL PERFORMANCE

International Road Dynamics Inc.

FHWA VERIFICATION

| Specifications | | | | | | |
|---|---|---|---|---|---|---|
| Confidence | 95% | Speed range low | 30 | to | 45 |
| | (1.96) | Speed range medium | 45 | to | 55 |
| Gross vehicle weight | 10% | Speed range high | 55 | to | 65 |
| Tandem group weight | 15% | Temperature range low | 95 | to | 105 |
| Single axle weight | 20% | Temperature range medium | 105 | to | 115 |
| Axle spacings | 0.5 | Temperature range high | 115 | to | 125 |

| Overall | | | | | |
|---|---|---|---|---|---|
| Characteristic | Error | StdDev | Specification | Calculated | Pass/Fail |
| Gross vehicle weight | 1.0% | 2.9% | 10% | 6.7% | pass |
| Tandem group weight | 1.6% | 4.5% | 15% | 10.4% | pass |
| Single axle weight | -1.2% | 3.1% | 20% | 7.4% | pass |
| Axle spacings | 0.0 | 0.1 | 0.5 | 0.2 | pass |

| Speed range 30 to 45 (14 runs) | | | | |
|---|---|---|---|---|
| Characteristic | Error | StdDev | Specification | Calculated |
| Gross vehicle weight | 2.3% | 2.2% | 10% | 6.7% |
| Tandem group weight | 3.3% | 4.1% | 15% | 11.4% |
| Single axle weight | -0.4% | 3.7% | 20% | 11.6% |
| Axle spacings | 0.0 | 0.1 | 0.5 | 0.3 |

| Speed range 45 to 55 (12 runs) | | | | |
|---|---|---|---|---|
| Characteristic | Error | StdDev | Specification | Calculated |
| Gross vehicle weight | 0.5% | 3.5% | 10% | 7.6% |
| Tandem group weight | 1.1% | 4.7% | 15% | 10.4% |
| Single axle weight | -2.0% | 3.0% | 20% | 8.0% |
| Axle spacings | 0.0 | 0.1 | 0.5 | 0.1 |

| Speed range 55 to 65 (12 runs) | | | | |
|---|---|---|---|---|
| Characteristic | Error | StdDev | Specification | Calculated |
| Gross vehicle weight | 0.0% | 2.7% | 10% | 5.4% |
| Tandem group weight | 0.3% | 4.2% | 15% | 8.6% |
| Single axle weight | -1.5% | 2.5% | 20% | 6.6% |
| Axle spacings | 0.0 | 0.1 | 0.5 | 0.2 |

| Temperature range 95 to 105 (8 runs) | | | | |
|---|---|---|---|---|
| Characteristic | Error | StdDev | Specification | Calculated |
| Gross vehicle weight | -0.1% | 3.3% | 10% | 6.7% |
| Tandem group weight | 0.9% | 4.8% | 15% | 10.5% |
| Single axle weight | -3.8% | 2.2% | 20% | 8.3% |

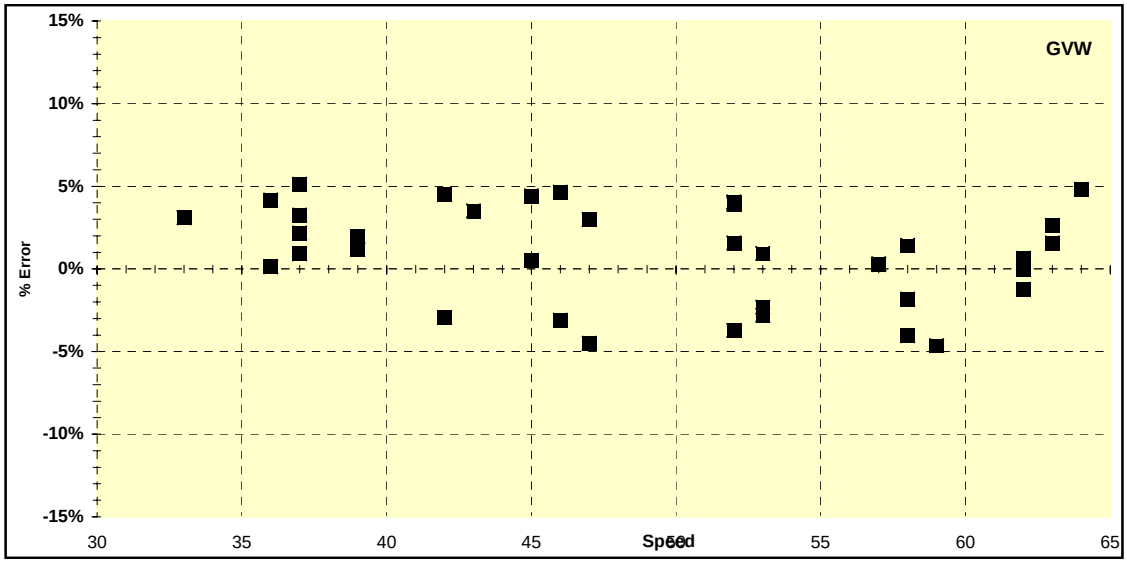
| Temperature range 105 to 115 (4 runs) | | | | |
|---|---|---|---|---|
| Characteristic | Error | StdDev | Specification | Calculated |
| Gross vehicle weight | 1.4% | 2.1% | 10% | 5.8% |
| Tandem group weight | 2.5% | 3.7% | 15% | 9.9% |
| Single axle weight | -3.0% | 2.7% | 20% | 8.5% |

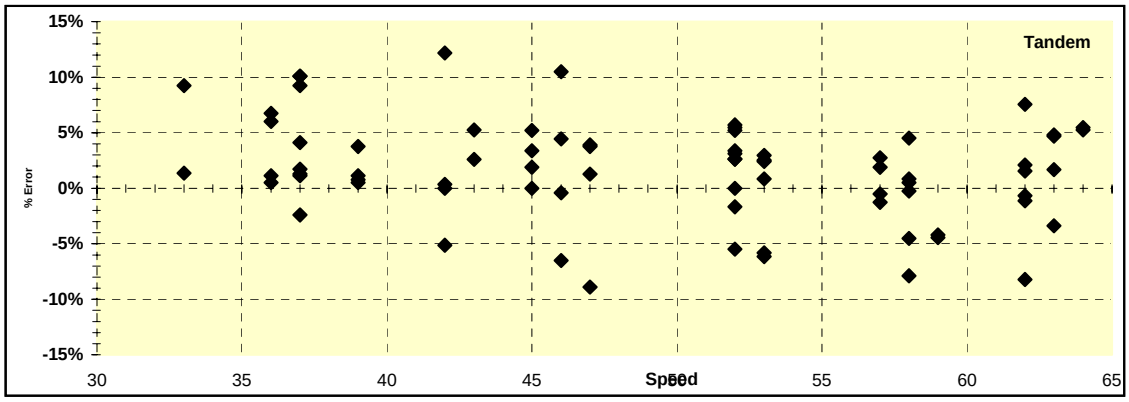
| Temperature range 115 to 125 (16 runs) | | | | |
|---|---|---|---|---|
| Characteristic | Error | StdDev | Specification | Calculated |
| Gross vehicle weight | 1.4% | 2.9% | 10% | 7.3% |
| Tandem group weight | 1.9% | 4.7% | 15% | 11.3% |
| Single axle weight | 0.1% | 3.0% | 20% | 6.2% |

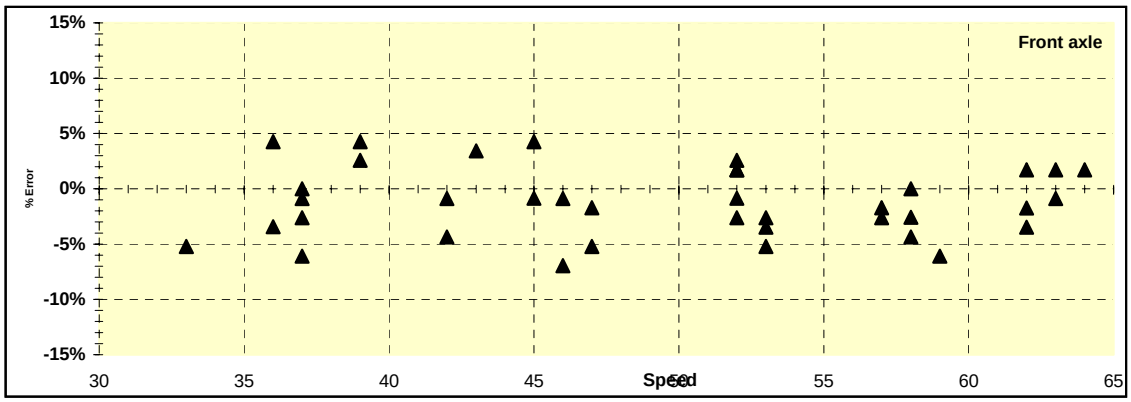
### 6.1.4 WEIGHT GRAPHS

International Road Dynamics Inc.

FHWA VERIFICATION



### 6.1.5 TEMPERATURE INFLUENCE GRAPHS

International Road Dynamics Inc.