INTERNATIONAL ROAD DYNAMICS INC.

LTPP WIM DATA COLLECTION SYSTEMS

INSTALLATION AND CALIBRATION FOR VIRGINIA SPS-1 LTPP ID 510100

January 11, 2007

CLIN 2004A TASK ORDER # 16

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 Virginia SPS-1 Weigh-in-Motion (WIM) site located on US29 at mile post 12.8. The WIM site is instrumented with IRD's iSINC (Intelligent Sensor Interface Network Controller) WIM Electronic and the IRD/PAT 1.75 Meter Bending Plate. The two south bound lanes are instrumented for WIM data collection consisting of two inductive loops and two bending plates. The right lane closest to the shoulder is the LTPP lane. The WIM system will use a landline phone for communication and 120V A.C. to power the equipment. The utilities service drop for both power and phone are located next to the WIM cabinet.

The WIM equipment installation began on October 30, 2006 and was completed on November 4, 2006. The WIM system was commissioned and calibrated on December 19 and 20 2006 respectively.

A vehicle classification test or Sheet 20 was not completed during the calibration. Intermittent axle separation and loop errors, mostly occurring on 2 axle vehicles prevented the system from classifying these vehicles properly. It was later determined 2 menu settings were reversed. This problem was corrected on January 4, 2007. Subsequent data analysis proved these errors no longer exist. The 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

- FHWA – LTPP Contracting Officer's Technical Representative (COTR)
  - Debbie Walker –
  - ph: (202) 493-3068
  - deborah.walker@fhwa.dot.gov

- Virginia DOT
  - Tom Schinkel (804) 786-7006
  - Richard Bush (804) 786-7006
  - Hamlin Williams (804) 786-0134

- FHWA Division Office, Division Representative
  - Lorenzo Casanova
  - ph: (804) 775-3362

- International Road Dynamics, Phase 2 Contractor, Project Manager
  - Bruce Myers -
  - ph: (717) 264-2077
  - bruce.myers@irdinc.com

- Thompson Trucking Inc. (Calibration Trucks)
  - ph: (434) 799-2742

3.0 SHEET 16 – SITE CALIBRATION SUMMARY

SITE CALIBRATION INFORMATION

1. DATE OF CALIBRATION (MONTH/DAY/YEAR): **Dec 20, 2006**

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 **-0.0%** STANDARD DEVIATION **1.9%**
   SINGLE AXLE MEAN DIFFERENCE -**5.3%** STANDARD DEVIATION **3.5%**
   DOUBLE AXLES MEAN DIFFERENCE **1.0%** STANDARD DEVIATION **2.8%**

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

9. DEFINE THE SPEED RANGES USED (MPH): **40 - 50, 50 - 60, 60 - 70**

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 **%**
    FHWA CLASS 3 **%**
    FHWA CLASS 4&5 **%**
    FHWA CLASS 8 **%**
    FHWA CLASS 9 **%**
    FHWA CLASS 12 **%**
    "UNCLASSIFIED" VEHICLES: **%**

15. PICTURES: _____

16. NOTES:
    _____

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

3.1.1 INITIAL AND FINAL SITE CALIBRATION FACTORS VIRGINIA SPS-1, US29, MP 12.8

Time of Change : 12-20-2006 8:00am

Site Parameters

Lane **1**

Upstream Loop
- Loop State **Enabled**
- Module ID **9**
- Channel ID **0**
- Polarity **Active Low**
- Width (cm) **285**

Downstream Loop
- Loop State **Enabled**
- Module ID **9**
- Channel ID **1**
- Polarity **Active Low**
- Width (cm) **285**
- Distance (cm) **670**

Axle Sensors

Axle **1**
- Axle State **Enabled**
- Module ID **5**
- Channel ID **0**
- Polarity Active **High**
- Type **Bending Plate**
- Distance (cm) **270**
- Temp Module UID **1**
- Temp Channel Num **0**

Axle **2**
- Axle State **Enabled**
- Module ID **5**
- Channel ID **1**
- Polarity **Active High**
- Type **Bending Plate**
- Distance (cm) **640**
- Temp Module UID **1**
- Temp Channel Num **0**

Processing
- Axle Sensor Width **50**
- Axle Sep **370**

Calibration

Lane **1**

Axle Sensor **1**
- Threshold **60**
- WIM Calib Factors
  - Speed Bin **1**
  - Max Speed **72 kph (45 mph)**
  - Calibration Factor **3700**
  - Speed Bin **2**
  - Max Speed **88 kph (55 mph)**
  - Calibration Factor **3700**
  - Speed Bin **3**
  - Max Speed **105 kph (65 mph)**
  - Calibration Factor **3700**
  - Speed Bin **4**
  - Max Speed **121 kph (75 mph)**
  - Calibration Factor **3700**
  - Speed Bin **5**
  - Max Speed **137 kph (85 mph)**
  - Calibration Factor **3700**

Axle Sensor **2**
- Threshold **60**
- WIM Calib Factors
  - Speed Bin **1**
  - Max Speed **72 kph (45 mph)**
  - Calibration Factor **3700**
  - Speed Bin **2**
  - Max Speed **88 kph (55 mph)**
  - Calibration Factor **3700**
  - Speed Bin **3**
  - Max Speed **105 kph (65 mph)**
  - Calibration Factor **3700**
  - Speed Bin **4**
  - Max Speed **121 kph (75 mph)**
  - Calibration Factor **3700**
  - Speed Bin **5**
  - Max Speed **137 kph (85 mph)**
  - Calibration Factor **3700**

4.0 WIM SITE INVENTORY

1. ROUTE US29 MILEPOST:12.8 LTPP DIRECTION: N **S** E W

2. SITE DESCRIPTION
   GRADE: 1%
   ☐ Sag vertical
   Nearest SPS section upstream of the site: 510100
   Distance from sensor to nearest upstream SPS Section: 200 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: 13 inch concrete

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

6. SENSOR SEQUENCE: Loop - Bending Plate - Bending Plate - 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
   Clearance under plates: 2.25 inches
   Clearance/access to flush fines from under system: Unbolt retaining rails and lift bending plate

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

    Distance from edge of travel lane to cabinet: 25 ft
    Distance from sensors: 75 ft
    Type: 336
    Access controlled by: ☐ LTPP / ☒ State / ☐ Joint
    Primary contact: Richard Bush (804) 786-7006
    Alternate contact:

11. POWER:
    Power type: ☐ Overhead / ☒ Underground / ☐ Solar
    Distance from cabinet to drop: 3 ft
    Service provider: A.C.

12. TELEPHONE:
    Telephone type: ☐ Overhead / ☒ Underground / ☐ Cell
    Distance from cabinet to drop: 2 ft
    Service provider: _____

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

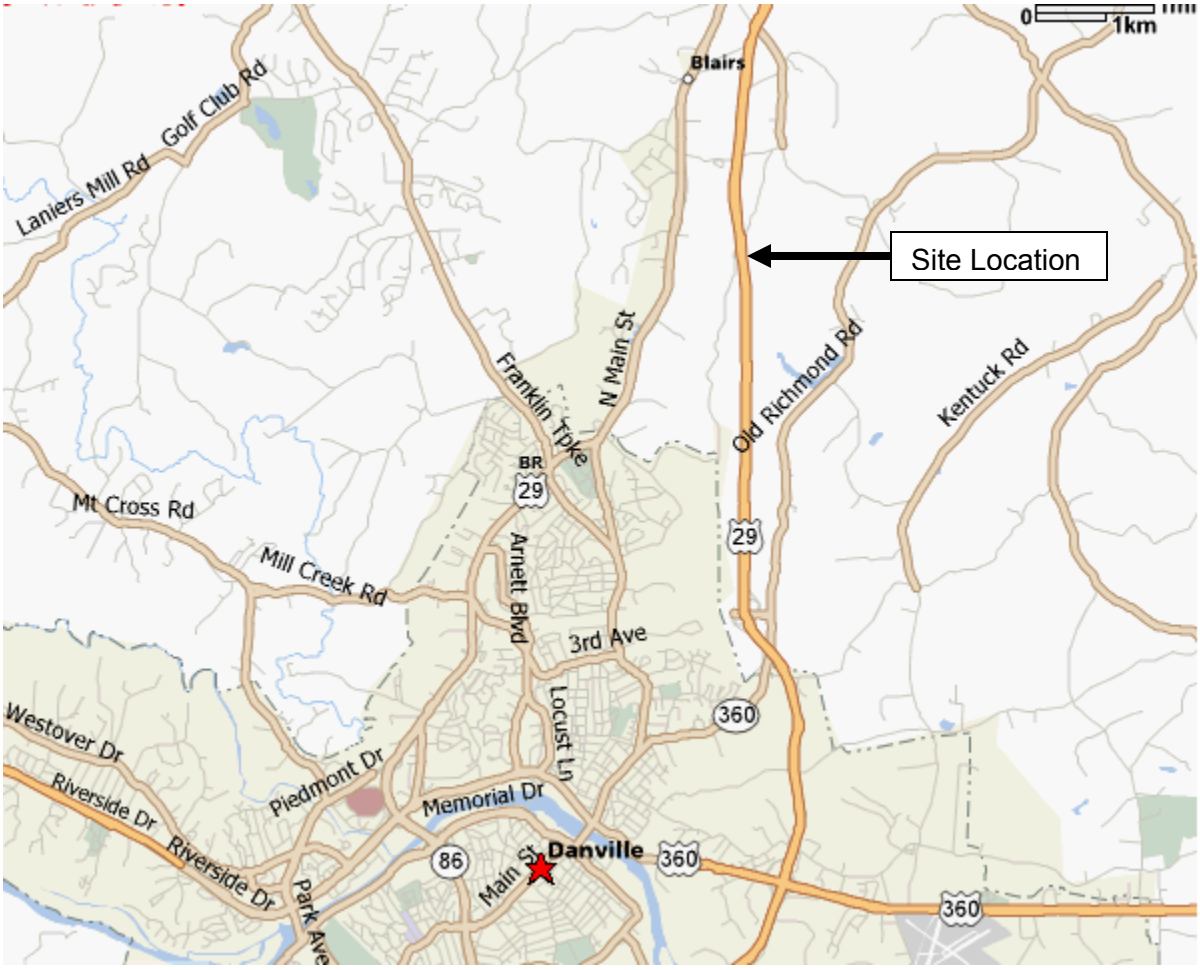
14. TEST TRUCK CYCLE:
    Turnaround time: 14 minutes
    Turnaround distance: 10 miles

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

16. NOTES:
    _____

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

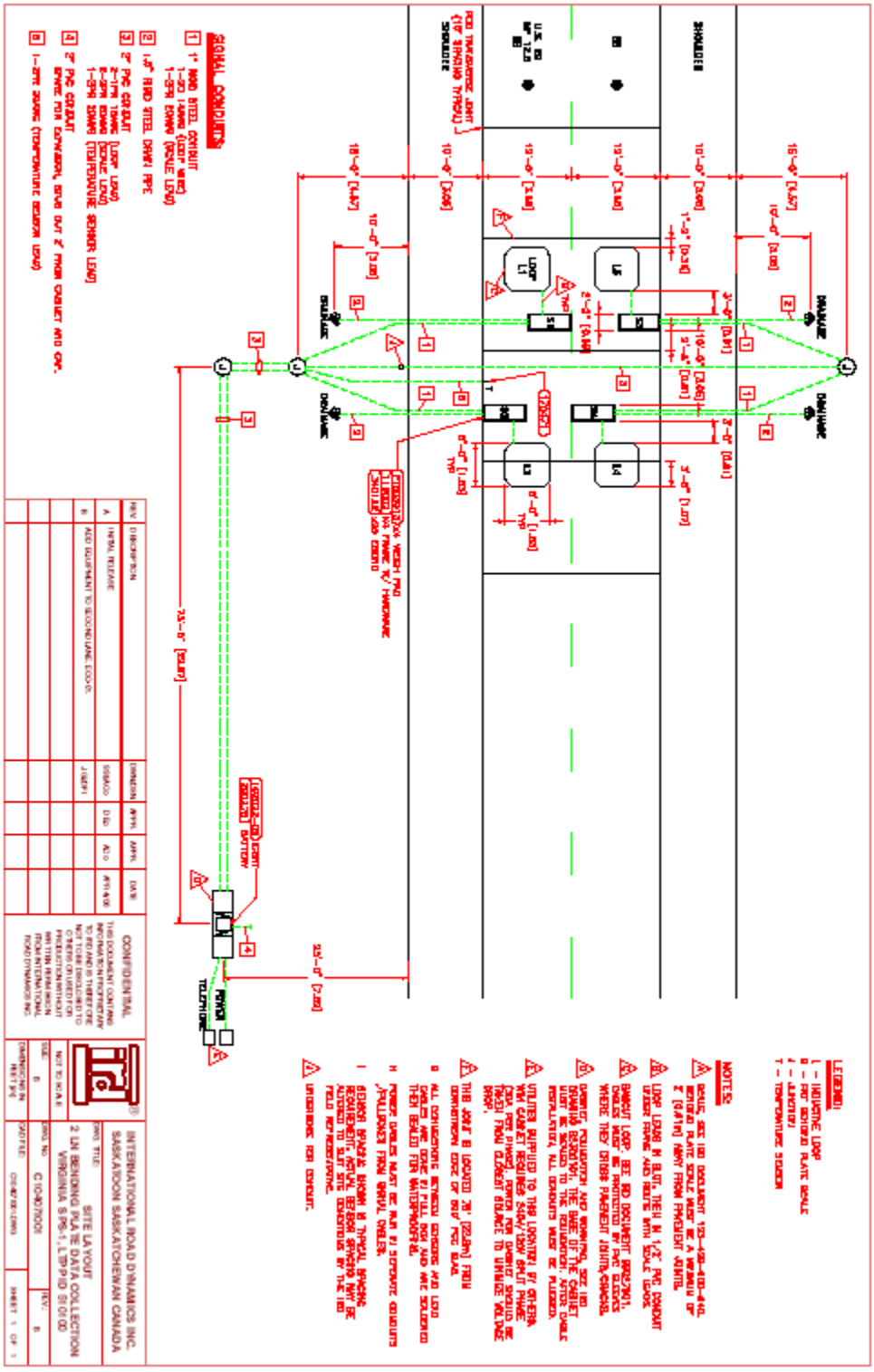
4.1.1 SITE MAP


0
1km
Blairs
Golf Club Rd
Laniers Mill Rd
Site Location
N Main St
Franklin Tpke
Old Richmond Rd
Kentuck Rd
BR
29
Mt Cross Rd
Mill Creek Rd
Arnett Blvd
3rd Ave
29
360
Locust Ln
Westover Dr
Riverside Dr
Piedmont Dr
Memorial Dr
Riverside Dr
86
Main St
Danville
360
360
Park Ave

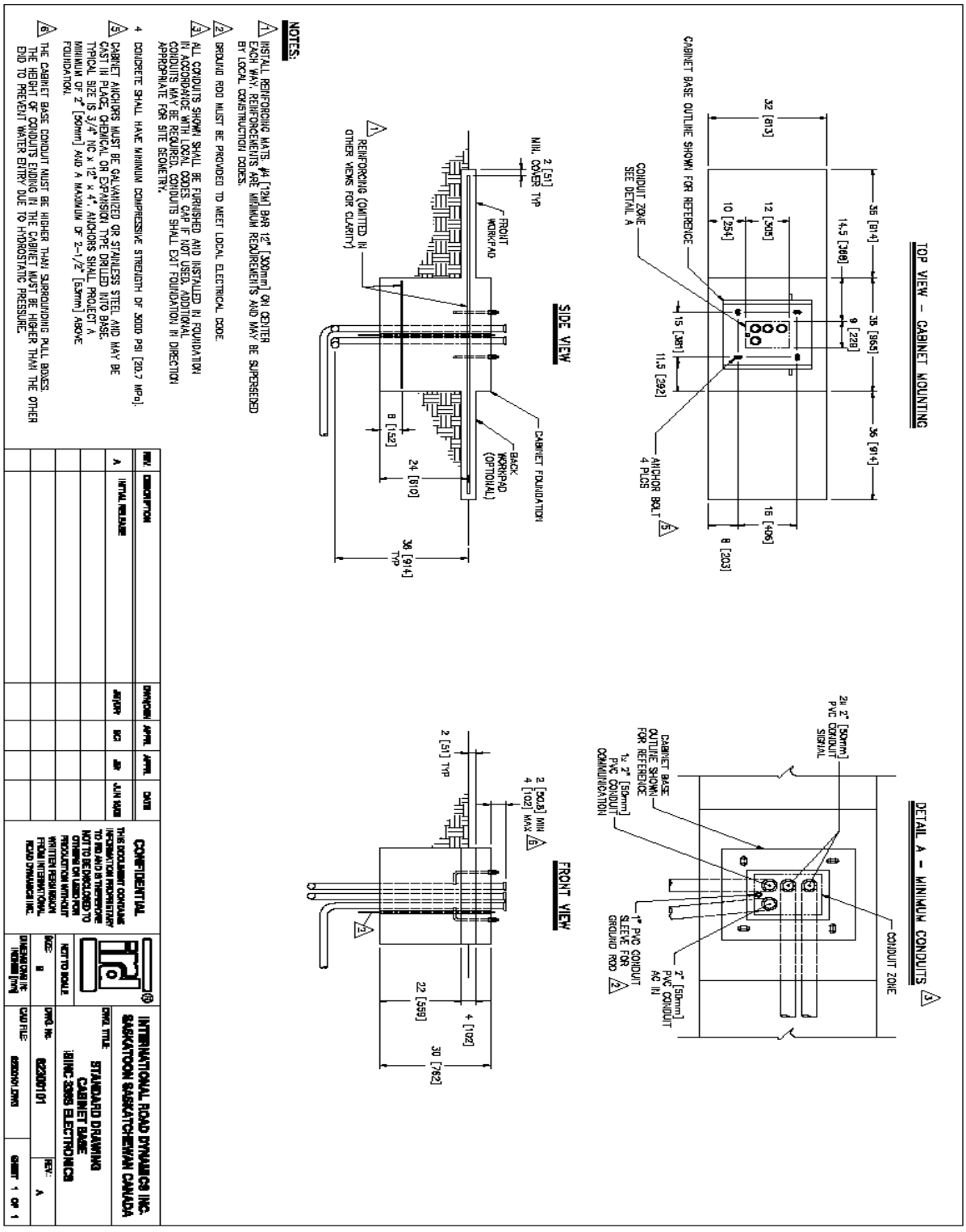
4.1.2 PICTURES, WIM SITE

4.1.3 PICTURES, INSTALLATION

4.1.4 SITE LAYOUT



4.1.5 WIM CABINET CONCRETE PEDESTAL



4.1.6 ELECTRICAL READINGS

International Road Dynamics Inc.

Site Service Sheet

Clear

Bending Plate **System Type: iSINC**

Date: 12/19/2006 **State: VA** **Location: US29 Mile Post 12.8**
Job #: 10407I **Site #:** **Directions:**

Loops	**Lane - 1**		**Lane - 2**		**Lane -**		**Lane -**	
	Lead	**Trail**	**Lead**	**Trail**	**Lead**	**Trail**	**Lead**	**Trail**
Resistance	0.8Ω	0.8Ω	1Ω	1Ω				
Leakage	inf.	inf.	inf.	inf.				
Inductance								
Frequency	N/A	N/A	N/A	N/A				

Weighpads	**Lane - 1**		**Lane - 2**		**Lane -**		**Lane -**	
	Lead	**Trail**	**Lead**	**Trail**	**Lead**	**Trail**	**Lead**	**Trail**
Supply	979Ω	979Ω	979Ω	979Ω				
Signal	846Ω	846Ω	846Ω	846Ω				
Shield	inf.	inf.	inf.	inf.				
Zero Pt	0.2 mV	0.1 mV	0.2 mV	0.2 mV				
Serial #	7259	7254	7253	7257				

Piezos	**Lane -**		**Lane -**		**Lane -**		**Lane -**	
Amplitude								
Capacitance								
Resistance								

System

A/C Service	120 VAC
Power Supply	13.5
Solar Panel	N/A
Back-Up	13.5 VDC
System Input	N/A
Modem Power	13.4 VDC
Phone off hook	9 VDC
Phone on hook	48 VDC

Temp Sensor

Red to Blk	8 MΩ
Red to Wht	6.07MΩ
Wht to Blk	40KΩ

Technician: **Bruce Myers** **Date:** **12/19/2006**

5.0 WIM CALIBRATION

5.1.1 TEST TRUCK #1 INFORMATION

DATE OF CALIBRATION: **December 20, 2006**

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		10920		D
B		25740		D (B&C combined)
C				
D		25000		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)
	61660		61660

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

9. TRACTOR MANUFACTURER:
   Make: International
   Model: 9900

10. TRAILER LOAD DESCRIPTION: Rock

11. TRAILER TARE WEIGHT (lb): _____

12. AXLE SPACINGS

Axle	Spacing (feet & inches)
A-B	15'
B-C	4.4'
C-D	19.5’
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	Leaf spring – two leaves
B	11R24	air
C	11R24	air
D	11R24	air
E	11R24	air

5.1.2 PICTURES, TEST TRUCK 1


CONTINENTAL
HSR

5.1.3 TEST TRUCK #2 INFORMATION

DATE OF CALIBRATION: **December 20, 2006**

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		10320		D
B		30680		D (B&C combined)
C				
D		35640		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)
	76640		

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

9. TRACTOR MANUFACTURER:
   Make: International
   Model: 9900

10. TRAILER LOAD DESCRIPTION: Rock

11. TRAILER TARE WEIGHT (lb): _____

12. AXLE SPACINGS

Axle	Spacing (feet & inches)
A-B	15’
B-C	4.3’
C-D	28’
D-E	4.3’

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	Leaf spring – two leaves
B	11R24	air
C	11R24	air
D	11R24	air
E	11R24	air

5.1.4 PICTURES, TEST TRUCK 2

6.0 TEST TRUCK CALIBRATION RECORDS - DECEMBER 20, 2006

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				61.7	10.9	25.7	25.0	15.0	4.4	19.5	4.1
2				76.6	10.3	30.7	35.6	15.0	4.3	28.0	4.3

Dynamic Test Vehicle Measurements

ID	V#	Speed	Temp	GVW	F/A	T1	T2	1>2	2>3	3>4	4>5
1	396	48	48	61.7	10.7	26.1	24.9	15.0	4.3	19.5	4.1
2	397	43	48	77.7	9.9	32.0	35.8	14.9	4.3	28.1	4.3
1	460	56	49	62.2	9.7	27.0	25.5	15.0	4.3	19.5	4.1
2	461	52	49	74.1	9.0	30.3	34.8	14.9	4.3	27.9	4.3
1	586	47	53	61.9	10.5	26.2	25.2	15.0	4.3	19.6	4.1
2	587	43	53	78.1	10.5	31.8	35.8	14.9	4.3	27.9	4.3
1	654	55	54	63.0	9.9	27.2	25.9	15.0	4.3	19.6	4.1
2	656	54	54	72.2	9.4	29.6	33.3	14.9	4.3	28.0	4.3
1	711	65	54	60.2	10.1	26.3	23.9	15.0	4.3	19.6	4.1
2	712	61	54	78.3	10.0	32.1	36.2	14.9	4.3	27.9	4.3
1	791	47	53	62.2	10.4	26.1	25.4	15.0	4.3	19.6	4.1
2	792	43	53	77.3	9.5	31.8	36.0	14.9	4.3	28.0	4.3
1	866	57	54	62.6	9.5	26.9	26.1	15.0	4.3	19.6	4.1
2	867	48	54	78.6	9.6	32.0	37.0	14.9	4.3	28.0	4.3
1	932	60	55	63.8	11.3	26.6	25.9	15.1	4.4	19.6	4.1
2	933	62	55	77.0	9.5	31.7	35.7	14.9	4.4	28.1	4.3
1	1295	63	55	59.7	10.7	24.9	24.2	15.1	4.3	19.6	4.1
2	1297	59	55	76.1	9.7	31.6	34.8	14.9	4.3	27.9	4.3
1	1388	65	55	61.9	10.5	25.7	25.7	15.0	4.3	19.5	4.0
2	1390	62	55	77.3	9.7	31.6	36.0	14.8	4.3	27.9	4.3
1	1468	65	54	61.7	10.4	26.9	24.4	15.0	4.3	19.6	4.1
2	1469	61	54	76.6	10.2	31.1	35.3	14.9	4.3	27.9	4.3
1	1549	62	51	62.9	10.5	27.4	24.9	14.9	4.3	19.5	4.3
2	1550	62	51	76.0	9.4	31.5	35.1	14.9	4.3	28.1	4.3
1	1698	67	51	60.8	10.4	25.9	24.4	15.0	4.4	19.6	4.1
2	1699	62	51	76.7	10.2	31.5	35.1	14.9	4.3	27.9	4.3
2	1778	59	51	77.8	9.8	32.4	35.7	14.9	4.3	27.9	4.3
1	1850	66	48	61.8	10.4	26.1	25.3	15.0	4.3	19.8	4.0
2	1851	62	48	76.5	9.6	31.2	35.6	14.9	4.3	28.0	4.2
1	1965	65	46	61.9	10.4	26.5	24.9	15.0	4.3	19.8	4.1
1	2053	65	44	61.6	10.4	26.3	24.9	15.0	4.3	19.6	4.0
2	2054	64	44	74.5	9.5	30.4	34.6	14.9	4.3	28.1	4.3
1	2114	67	45	60.8	10.3	26.4	24.0	15.0	4.4	19.9	4.2
2	2115	63	45	77.0	9.5	30.9	36.5	14.9	4.3	28.1	4.3
2	2212	62	47	75.6	9.8	31.0	34.7	14.9	4.3	28.0	4.3
1	2281	64	46	60.3	10.2	26.5	23.6	15.0	4.3	19.6	4.1
2	2282	61	46	76.4	9.9	31.4	35.1	14.9	4.3	27.9	4.3

Date:	2006/12/20
Technician:	Bruce Myers
Location:	Danville, VA US29 Lane 1

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	396	48	48	0.0%	-1.8%	1.6%	-0.4%	0.0	-0.1	0.0	0.0
2	397	43	48	1.4%	-3.9%	4.2%	0.6%	-0.1	0.0	0.1	0.0
1	460	56	49	0.8%	11.0%	5.1%	2.0%	0.0	-0.1	0.0	0.0
2	461	52	49	-3.3%	12.6%	1.3%	-2.2%	-0.1	0.0	-0.1	0.0
1	586	47	53	0.3%	-3.7%	1.9%	0.8%	0.0	-0.1	0.1	0.0
2	587	43	53	2.0%	1.9%	3.6%	0.6%	-0.1	0.0	-0.1	0.0
1	654	55	54	2.1%	-9.2%	5.8%	3.6%	0.0	-0.1	0.1	0.0
2	656	54	54	-5.7%	-8.7%	3.6%	-6.5%	-0.1	0.0	0.0	0.0
1	711	65	54	-2.4%	-7.3%	2.3%	-4.4%	0.0	-0.1	0.1	0.0
2	712	61	54	2.2%	-2.9%	4.6%	1.7%	-0.1	0.0	-0.1	0.0
1	791	47	53	0.8%	-4.6%	1.6%	1.6%	0.0	-0.1	0.1	0.0
2	792	43	53	0.9%	-7.8%	3.6%	1.1%	-0.1	0.0	0.0	0.0
1	866	57	54	1.5%	12.8%	4.7%	4.4%	0.0	-0.1	0.1	0.0
2	867	48	54	2.6%	-6.8%	4.2%	3.9%	-0.1	0.0	0.0	0.0
1	932	60	55	3.4%	3.7%	3.5%	3.6%	0.1	0.0	0.1	0.0
2	933	62	55	0.5%	-7.8%	3.3%	0.3%	-0.1	0.1	0.1	0.0
1	1295	63	55	-3.2%	-1.8%	3.1%	-3.2%	0.1	-0.1	0.1	0.0
2	1297	59	55	-0.7%	-5.8%	2.9%	-2.2%	-0.1	0.0	-0.1	0.0
1	1388	65	55	0.3%	-3.7%	0.0%	2.8%	0.0	-0.1	0.0	-0.1
2	1390	62	55	0.9%	-5.8%	2.9%	1.1%	-0.2	0.0	-0.1	0.0
1	1468	65	54	0.0%	-4.6%	4.7%	-2.4%	0.0	-0.1	0.1	0.0
2	1469	61	54	0.0%	-1.0%	1.3%	-0.8%	-0.1	0.0	-0.1	0.0
1	1549	62	51	1.9%	-3.7%	6.6%	-0.4%	-0.1	-0.1	0.0	0.2
2	1550	62	51	-0.8%	-8.7%	2.6%	-1.4%	-0.1	0.0	0.1	0.0
1	1698	67	51	-1.5%	-4.6%	0.8%	-2.4%	0.0	0.0	0.1	0.0
2	1699	62	51	0.1%	-1.0%	2.6%	-1.4%	-0.1	0.0	-0.1	0.0
2	1778	59	51	1.6%	-4.9%	5.5%	0.3%	-0.1	0.0	-0.1	0.0
1	1850	66	48	0.2%	-4.6%	1.6%	1.2%	0.0	-0.1	0.3	-0.1
2	1851	62	48	-0.1%	-6.8%	1.6%	0.0%	-0.1	0.0	0.0	-0.1
1	1965	65	46	0.3%	-4.6%	3.1%	-0.4%	0.0	-0.1	0.3	0.0
1	2053	65	44	-0.2%	-4.6%	2.3%	-0.4%	0.0	-0.1	0.1	-0.1
2	2054	64	44	-2.7%	-7.8%	1.0%	-2.8%	-0.1	0.0	0.1	0.0
1	2114	67	45	-1.5%	-5.5%	2.7%	-4.0%	0.0	0.0	0.4	0.1
2	2115	63	45	0.5%	-7.8%	0.7%	2.5%	-0.1	0.0	0.1	0.0
2	2212	62	47	-1.3%	-4.9%	1.0%	-2.5%	-0.1	0.0	0.0	0.0
1	2281	64	46	-2.3%	-6.4%	3.1%	-5.6%	0.0	-0.1	0.1	0.0
2	2282	61	46	-0.3%	-3.9%	2.3%	-1.4%	-0.1	0.0	-0.1	0.0

6.1.3 OVERALL PERFORMANCE

International Road Dynamics Inc.

FHWA VERIFICATION

Specifications						
Confidence	95%	Speed range low	40	to	52
	(1.96)	Speed range medium	52	to	62
Gross vehicle weight	10%	Speed range high	62	to	72
Tandem group weight	15%	Temperature range low	43	to	48
Single axle weight	20%	Temperature range medium	48	to	53
Axle spacings	0.5	Temperature range high	53	to	60

Overall					
Characteristic	Error	StdDev	Specification	Calculated	Pass/Fail
Gross vehicle weight	0.0%	1.9%	10%	3.7%	pass
Tandem group weight	1.0%	2.8%	15%	6.5%	pass
Single axle weight	-5.3%	3.5%	20%	12.1%	pass
Axle spacings	0.0	0.1	0.5	0.2	pass

Speed range 40 to 52 (8 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	0.6%	1.8%	10%	4.2%
Tandem group weight	1.6%	2.0%	15%	5.5%
Single axle weight	-4.9%	4.3%	20%	5.6%
Axle spacings	0.0	0.1	0.5	0.1

Speed range 52 to 62 (17 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	0.4%	2.0%	10%	4.4%
Tandem group weight	1.6%	2.9%	15%	7.4%
Single axle weight	-5.6%	4.1%	20%	13.8%
Axle spacings	0.0	0.1	0.5	0.2

Speed range 62 to 72 (12 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	-1.0%	1.4%	10%	3.8%
Tandem group weight	-0.1%	2.8%	15%	5.7%
Single axle weight	-5.3%	1.8%	20%	8.9%
Axle spacings	0.0	0.1	0.5	0.2

Temperature range 43 to 48 (12 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	-0.5%	1.2%	10%	2.9%
Tandem group weight	0.4%	2.4%	15%	5.2%
Single axle weight	-5.2%	1.7%	20%	8.7%

Temperature range 48 to 53 (11 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	0.3%	1.6%	10%	3.5%
Tandem group weight	1.4%	2.5%	15%	6.3%
Single axle weight	-5.5%	4.3%	20%	14.1%

Temperature range 53 to 60 (14 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	0.1%	2.5%	10%	5.2%
Tandem group weight	1.3%	3.3%	15%	8.0%
Single axle weight	-5.3%	4.1%	20%	13.6%

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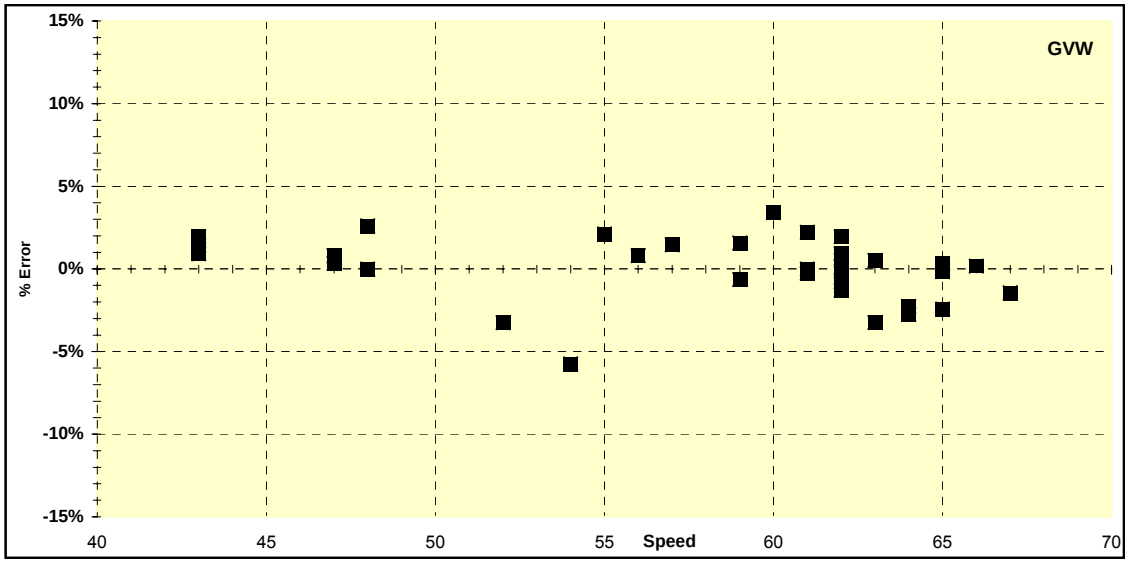
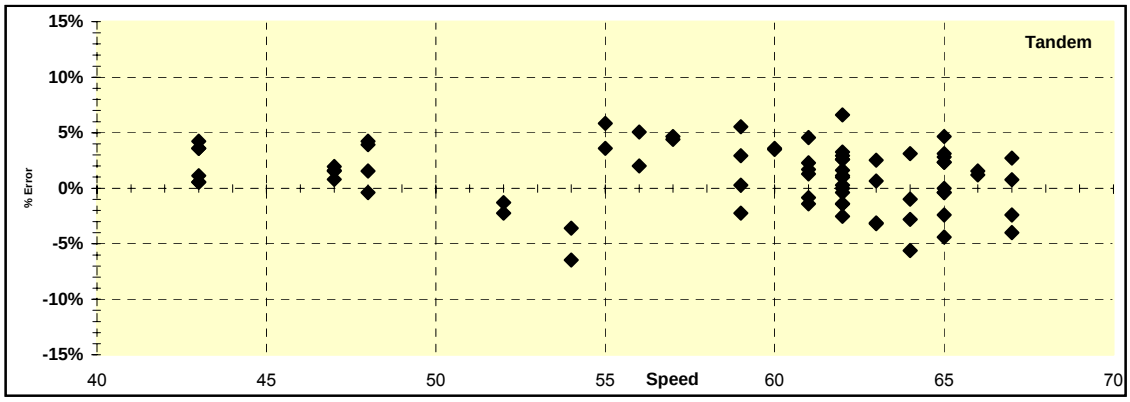
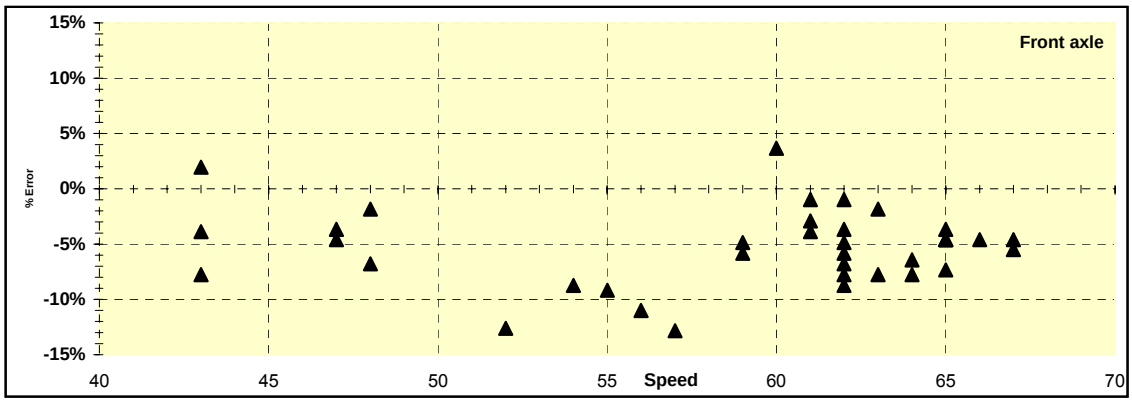
6.1.4 WEIGHT GRAPHS

International Road Dynamics Inc.

FHWA VERIFICATION







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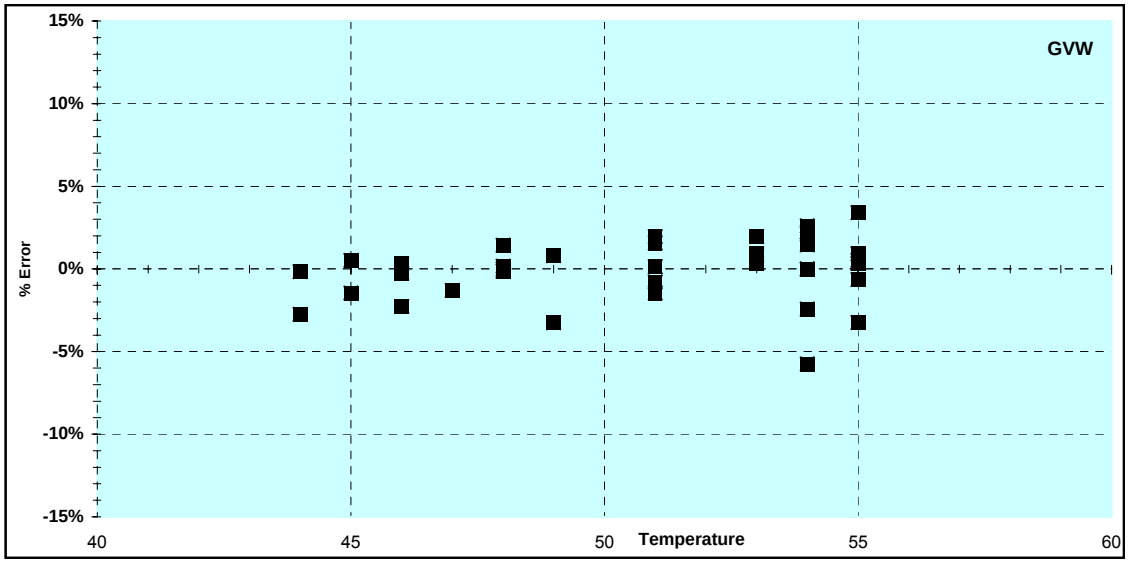
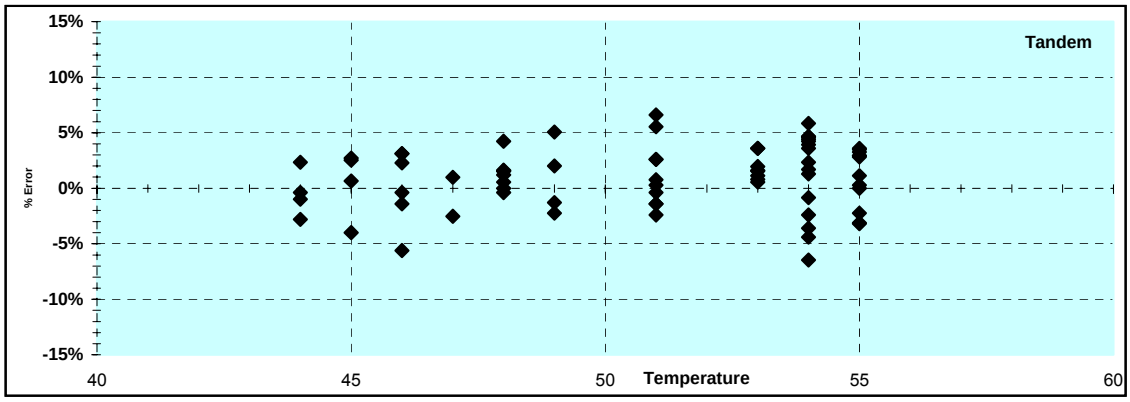
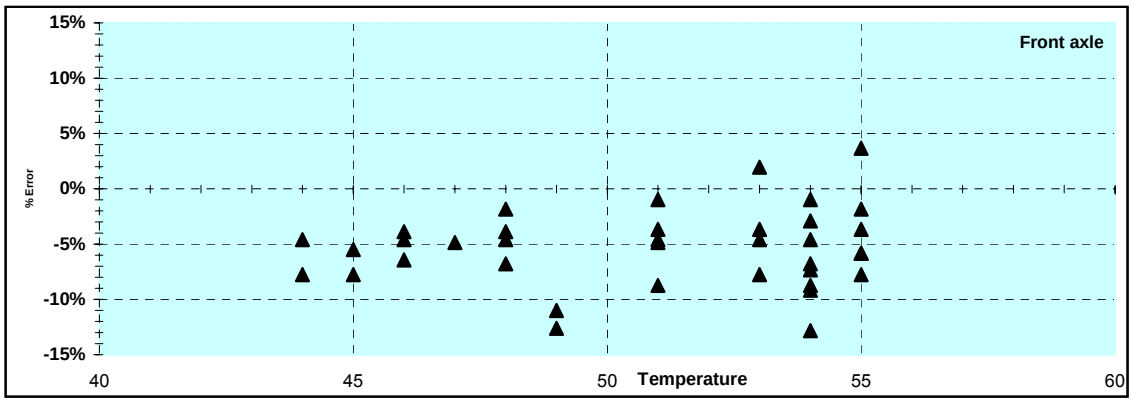
6.1.5 TEMPERATURE INFLUENCE GRAPHS

International Road Dynamics Inc.

FHWA VERIFICATION







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