INTERNATIONAL ROAD DYNAMICS INC.

LTPP WIM DATA COLLECTION SYSTEMS

INSTALLATION AND CALIBRATION FOR ARIZONA SPS-2 LTPP ID 040200

APRIL 24, 2007

CLIN 2004A TASK ORDER # 9

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 Arizona SPS-2 Weigh-in-Motion (WIM) site located on I-10 at mile post 108.5. The WIM site is instrumented with IRD's iSINC (Intelligent Sensor Interface Network Controller) WIM Electronics and the IRD/PAT 1.75 Meter Bending Plate. The east bound driving lane is instrumented for WIM data collection consisting of two inductive loops and two bending plates. The WIM system uses a GPRS Cellular Modem for communication and a solar power system to power the equipment.

The WIM equipment installation began on August 14, 2006 and was completed on August 16, 2006. Calibration was started on November 28, 2006 however the weight readings from the test trucks were too erratic so the calibration was canceled.

The problem was later identified as noisy signals from the Bending Plates. The Bending Plate was not supported across the entire length (frames were bent), causing it to vibrate on vehicle passage. Some bending is normal during shipping to the site. These irregularities can usually be eliminated during the shimming process.

On March 27 both Bending Plate Frames were replaced. The Bending Plate signals were checked and found to be in excellent condition.

On April 17, 2007 the site was calibrated. 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

- Arizona DOT
  - Estomih (Tom) Kombe (602) 712-3135

- FHWA Division Office, Division Representative
  - Alan Hansen
  - ph: (602) 379-3645 ext. 108

- LTPP Regional Support Contractor (RCS)
  - Jason Puccinelli
  - ph: (775) 329-4955

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

- Otto Logistics LLC (Calibration Trucks)
  - ph: (480) 641-3500

3.0 SHEET 16 – SITE CALIBRATION SUMMARY

SITE CALIBRATION INFORMATION

1. DATE OF CALIBRATION (MONTH/DAY/YEAR): **November 30, 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 **30**

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 **- 0.5%** STANDARD DEVIATION **2.5%**
   SINGLE AXLE MEAN DIFFERENCE **-10.6%** STANDARD DEVIATION **3.3%**
   DOUBLE AXLES MEAN DIFFERENCE **1.2%** STANDARD DEVIATION **4.2%**

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

9. DEFINE THE SPEED RANGES USED (MPH): **45 - 55, 55 - 65, 65- 75**

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: **Greg Felsing**
CONTACT INFORMATION: **623-256-9900**

3.1.1 FINAL SITE CALIBRATION FACTORS ARIZONA SPS-2 I-10, MILE POST 108.5

Time of Change : 4/17/2007 12:30pm

Site Parameters

- Axle Sensor Debounce
  - Type PAT Bending Plate
    - On (ticks) **32**
    - Off (ticks **10**
- 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) **830**
  - Axle Sensors
    - Axle **1**
    - Axle State **Enabled**
    - Module ID **5**
    - Channel ID **0**
    - Polarity Active **High**
    - Type **Bending Plate**
    - Distance (cm**) 341**
    - 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) **775**
    - Temp Module UID **1**
    - Temp Channel Num **0**
  - Processing
    - Axle Sensor Width **50**
    - Axle Sep **381**

Calibration

- Lane **1**
  - Axle Sensor **1**
  - Threshold **40**
  - WIM Calib Factors
    - Speed Bin **1**
    - Max Speed **88 kph (55 mph)**
    - Calibration Factor **3390**
    - Speed Bin **2**
    - Max Speed **96 kph (60 mph)**
    - Calibration Factor **3375**
    - Speed Bin **3**
    - Max Speed **105 kph (65 mph)**
    - Calibration Factor **3417**
    - Speed Bin **4**
    - Max Speed **112 kph (70 mph)**
    - Calibration Factor **3460**
    - Speed Bin **5**
    - Max Speed **120 kph (75 mph)**
    - Calibration Factor **3499**
  - Axle Sensor **2**
  - Threshold **40**
  - WIM Calib Factors
    - Speed Bin **1**
    - Max Speed **88 kph (55 mph)**
    - Calibration Factor **3390**
    - Speed Bin **2**
    - Max Speed **96 kph (60 mph)**
    - Calibration Factor **3375**
    - Speed Bin **3**
    - Max Speed **105 kph (65 mph)**
    - Calibration Factor **3417**
    - Speed Bin **4**
    - Max Speed **112 kph (70 mph)**
    - Calibration Factor **3460**
    - Speed Bin **5**
    - Max Speed **120 kph (75 mph)**
    - Calibration Factor **3499**

4.0 WIM SITE INVENTORY

1. ROUTE I-10 MILEPOST:108.5 LTPP DIRECTION: N S **E** W

2. SITE DESCRIPTION
   GRADE: 1%
   ☐ Sag vertical
   Nearest SPS section upstream of the site: 040267
   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: 12 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: 40 ft
    Distance from sensors: 45 ft
    Type: 336
    Access controlled by: ☐ LTPP / ☒ State / ☐ Joint
    Primary contact: Tom Kombe (602) 712-3135
    Alternate contact:

11. POWER:
    Power type: ☐ Overhead / ☐ Underground / ☒ Solar
    Distance from cabinet to drop: 3 ft
    Service provider: 2 X 80 Watt Solar Panels, 2 X 64 Amp Hr. Batteries

12. TELEPHONE:
    Telephone type: ☐ Overhead / ☐ Underground / ☒ Cell
    Distance from cabinet to drop: N/At
    Service provider: AT&T

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

14. TEST TRUCK CYCLE:
    Turnaround time: 12 minutes
    Turnaround distance: 10 miles

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

16. NOTES:

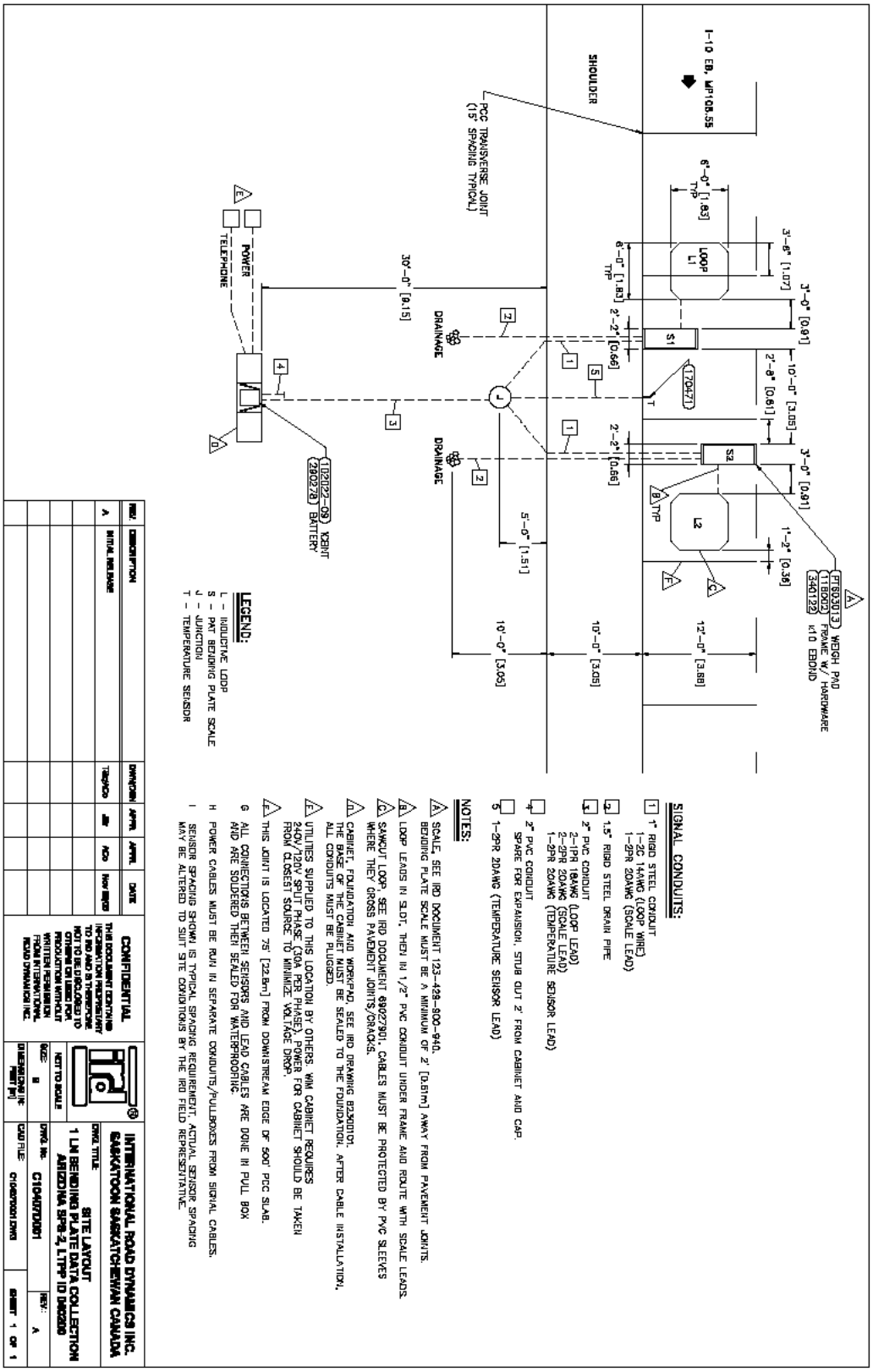
COMPLETED BY: **Bruce Myers**
CONTACT INFORMATION: **717-264-2077**

4.1.1 SITE MAP

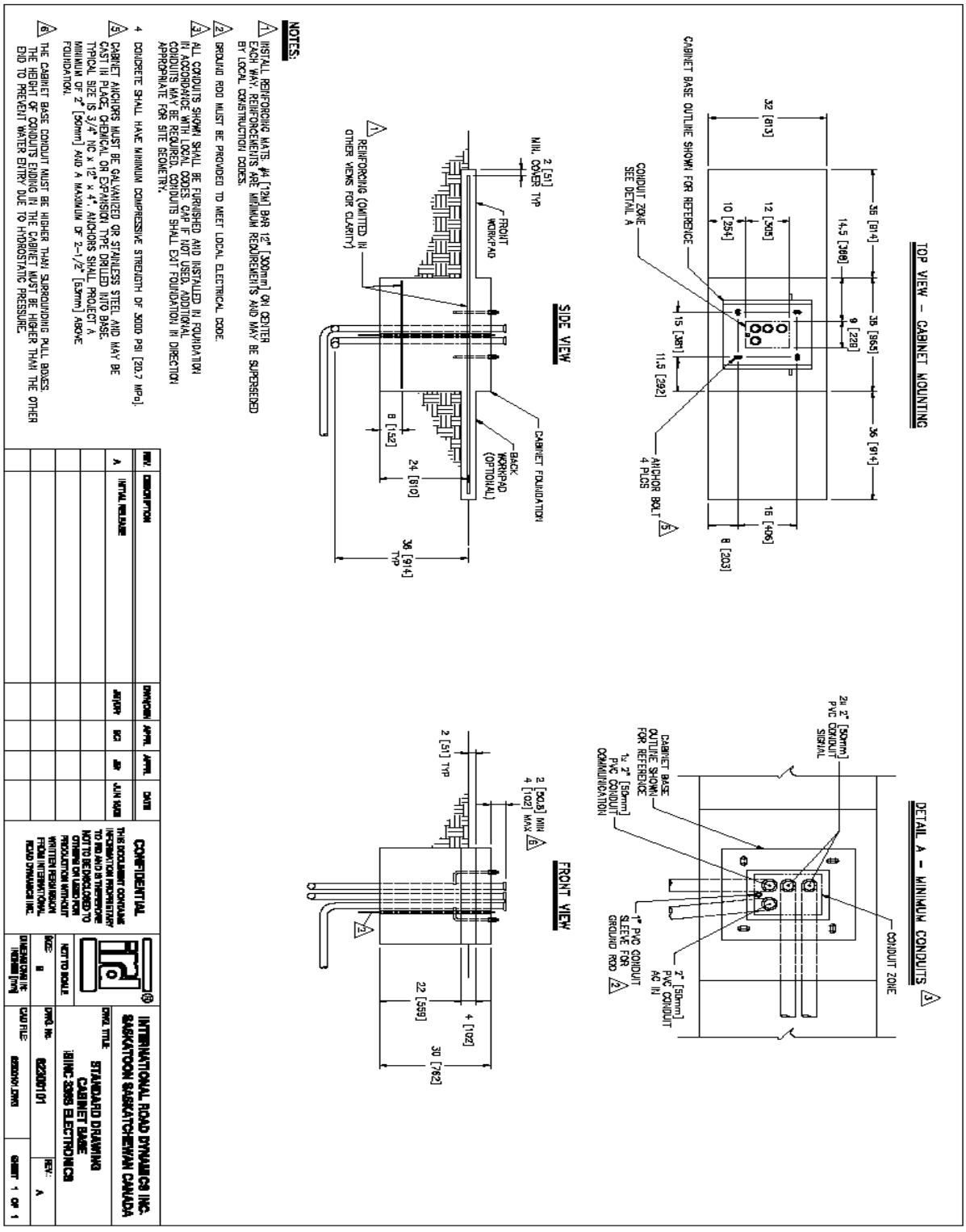

Bullhead City
Kingman
Flagstaff
Lake Havasu City
Prescott
Colorado River Indian Reservation
Fort Apache Indian Reservation
Glendale
I-10 E
Phoenix
Mesa
Tempe
Site Location
San Carlos Indian Reservation
Gila River Indian Reservation
Yuma Proving Ground
Brawley
El Centro
Yuma
Barry M Goldwater Air Force Range
Tucson
Papago Indian Reservation
Vail

4.1.2 PICTURES, WIM SITE

4.1.3 SITE LAYOUT



4.1.4 WIM CABINET CONCRETE PEDESTAL



NOTES:

1. INSTALL REINFORCING MATL #4 [13M] BAR 12" [300mm] ON CENTER EACH WAY. REINFORCEMENTS ARE MINIMUM REQUIREMENTS AND MAY BE SUPERSEDED BY LOCAL CONSTRUCTION CODES.
2. GROUND ROD MUST BE PROVIDED TO MEET LOCAL ELECTRICAL CODE.
3. ALL CONDUITS SHOWN SHALL BE FURNISHED AND INSTALLED IN FOUNDATION IN ACCORDANCE WITH LOCAL CODES. CAP IF NOT USED. ADDITIONAL CONDUITS MAY BE REQUIRED. CONDUITS SHALL EXIT FOUNDATION IN DIRECTION APPROPRIATE FOR SITE GEOMETRY.
4. CONCRETE SHALL HAVE MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI [20.7 MPa].
5. CABINET ANCHORS MUST BE GALVANIZED OR STAINLESS STEEL AND MAY BE CAST IN PLACE, CHEMICAL OR EXPANSION TYPE DRILLED INTO BASE. TYPICAL SIZE IS 3/4" NC x 12" x 4", ANCHORS SHALL PROJECT A MINIMUM OF 2" [50mm] AND A MAXIMUM OF 2-1/2" [63mm] ABOVE FOUNDATION.
6. THE CABINET BASE CONDUIT MUST BE HIGHER THAN SURROUNDING PULL BOXES THE HEIGHT OF CONDUITS ENDING IN THE CABINET MUST BE HIGHER THAN THE OTHER END TO PREVENT WATER ENTRY DUE TO HYDROSTATIC PRESSURE.

REV.	DESCRIPTION	DRAWN/DATE	APPR'L	APPR'L	DATE
A	INITIAL RELEASE	ARTURY	BCI	AM	JUN 14/05

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DIMENSIONS IN: MM [INCHES] [mm]
SIZE: B
SCALE: NOT TO SCALE

INTERNATIONAL ROAD DYNAMICS INC.
SASKATOON SASKATCHEWAN CANADA

DWG. TITLE: STANDARD DRAWING
CABINET BASE
IRINC 3305 ELECTRONICS

DWG. No: 6230101 REV: A
CAD FILE: 6230101.DWG
SHEET 1 OF 1

4.1.5 ELECTRICAL READINGS

International Road Dynamics Inc.

Site Service Sheet

Clear

Bending Plate **System Type:** iSINC

Date: 11/28/2006 **State:** AZ **Location:** I-10 Mile Post 108.5
Job #: 10407D **Site #:** **Directions:** Approx. 20 Miles West of Phoenix

Loops	Lane - 1		Lane -		Lane -		Lane -	
	Lead	Trail	Lead	Trail	Lead	Trail	Lead	Trail
Resistance	.8 Ω	.8 Ω						
Leakage	inf.	inf.						
Inductance								
Frequency	N/A	N/A						

Weighpads	Lane - 1		Lane -		Lane -		Lane -	
	Lead	Trail	Lead	Trail	Lead	Trail	Lead	Trail
Supply	980Ω	980Ω						
Signal	847Ω	847Ω						
Shield	inf.	inf.						
Zero Pt	0.1 mV	0.1 mV						
Serial #								

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

System	
A/C Service	
Power Supply	13.4
Solar Panel	18 VDC
Back-Up	
System Input	N/A
Modem Power	13.4 VDC
Phone off hook	
Phone on hook	

Temp Sensor	
Red to Blk	8.3 MΩ
Red to Wht	6MΩ
Wht to Blk	40KΩ

Technician: Bruce Myers **Date:** 11/28/2006

5.0 WIM CALIBRATION

5.1.1 TEST TRUCK #1 INFORMATION

DATE OF CALIBRATION: **April 17, 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		10000		D
B		34900		D (B&C combined)
C				
D		32600		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)
	77500		77500

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

9. TRACTOR MANUFACTURER:
   Make: Peterbilt
   Model:

10. TRAILER LOAD DESCRIPTION: Trash

11. TRAILER TARE WEIGHT (lb): _____

12. AXLE SPACINGS

Axle	Spacing (feet & inches)
A-B	13.1'
B-C	4.5'
C-D	34.6’
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

5.1.2 PICTURES, TEST TRUCK 1

5.1.3 TEST TRUCK #2 INFORMATION

DATE OF CALIBRATION: **April 17, 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		9900		D
B		25600		D (B&C combined)
C				
D		28200		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)
	63600		63600

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

9. TRACTOR MANUFACTURER:
   Make: Peterbilt
   Model:

10. TRAILER LOAD DESCRIPTION: Trash

11. TRAILER TARE WEIGHT (lb): _____

12. AXLE SPACINGS

Axle	Spacing (feet & inches)
A-B	14.6’
B-C	4.5’
C-D	34.7’
D-E	4.2’

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 – APRIL 17, 2007

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				77.5	10.0	34.9	32.6	13.1	4.5	34.6	4.3
2				63.6	9.9	25.6	28.2	14.6	4.5	34.7	4.2

Dynamic Test Vehicle Measurements

ID	V#	Speed	Temp	GVW	F/A	T1	T2	1>2	2>3	3>4	4>5
1	47122	50	85	76.3	8.9	33.8	32.5	13.1	4.4	34.6	4.1
2	47123	49	85	63.8	8.5	27.2	28.1	14.8	4.4	34.8	4.1
1	47245	50	85	78.0	9.2	35.9	32.9	13.0	4.4	34.5	4.1
2	47246	49	86	63.6	8.8	26.6	28.3	14.9	4.4	34.9	4.1
1	47364	50	86	78.9	9.1	35.8	34.2	12.9	4.3	34.3	4.1
2	47365	50	87	63.3	8.5	26.0	28.7	14.8	4.4	34.7	4.1
1	47479	54	87	75.4	8.4	34.7	32.3	13.0	4.4	34.4	4.1
2	47480	54	88	62.6	8.5	26.5	27.5	14.8	4.3	34.5	4.1
1	47593	56	89	76.3	8.9	36.0	31.4	13.0	4.4	34.7	4.2
2	47594	55	89	64.5	8.6	26.8	29.2	14.7	4.4	34.8	4.0
1	47699	62	89	77.4	9.3	35.5	32.6	13.2	4.4	34.8	4.2
2	47700	60	89	62.6	8.7	26.9	27.0	14.9	4.4	34.7	4.1
1	47830	61	90	77.0	8.6	35.9	32.6	13.0	4.4	34.5	4.1
2	47831	60	90	63.0	8.1	26.8	28.1	14.8	4.4	35.0	4.1
1	47944	60	93	74.4	8.8	36.1	29.5	13.1	4.3	34.5	4.3
2	47945	59	93	63.2	8.4	26.6	28.3	14.8	4.4	34.6	4.2
1	46645	71	95	79.5	9.6	36.3	33.5	13.1	4.5	34.5	4.1
2	48062	64	95	61.8	8.7	27.5	25.6	14.9	4.4	35.1	4.2
1	48179	65	97	78.0	9.4	36.7	31.9	13.2	4.4	34.5	4.1
2	48180	66	97	64.3	9.0	27.6	27.7	14.9	4.5	35.2	4.2
1	48278	65	99	71.5	8.9	31.9	30.7	13.0	4.5	34.6	4.1
2	48279	65	99	62.3	8.7	25.7	27.8	14.8	4.4	34.6	4.1
1	48394	72	99	77.5	8.9	33.7	34.9	13.0	4.4	34.6	4.2
2	48395	70	99	64.3	9.1	26.1	29.0	14.9	4.4	34.9	4.1
2	90	69	101	65.9	9.1	26.4	30.4	14.8	4.5	34.8	4.1
1	210	50	101	76.0	8.8	35.3	31.8	12.9	4.3	34.3	4.2
2	211	51	101	63.3	8.6	26.2	28.5	14.8	4.4	34.9	4.1
1	334	52	102	75.9	8.6	35.3	32.1	13.1	4.4	34.9	4.2
2	335	50	102	64.9	9.2	26.9	28.8	14.8	4.4	34.9	4.1
1	457	60	105	75.8	9.0	35.5	31.4	13.0	4.4	34.6	4.1
2	458	60	105	64.5	8.8	26.9	28.9	14.9	4.4	35.0	4.2
1	46534	72	100	79.1	9.5	37.0	32.7	13.1	4.4	34.9	4.1
2	46535	70	100	65.9	9.4	27.4	29.1	14.9	4.4	35.1	4.1
1	48490	72	101	72.9	9.0	35.8	28.2	13.1	4.4	34.7	4.1
2	48491	70	101	65.0	8.9	27.0	29.2	14.9	4.4	35.1	4.1

Date:	April 17,2007
Technician:	Greg Felsing
Location:	I-10 EB Mp 108.5 Arizona

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	47122	50	85	-1.6%	11.0%	-3.2%	-0.3%	1.6%	11.0%	3.2%	-0.3%
2	47123	49	85	0.3%	13.8%	6.4%	-0.3%	0.3%	13.8%	6.4%	-0.3%
1	47245	50	85	0.6%	-8.0%	2.8%	0.9%	0.6%	-8.0%	2.8%	0.9%
2	47246	49	86	0.0%	10.8%	4.1%	0.4%	0.0%	10.8%	4.1%	0.4%
1	47364	50	86	1.8%	-9.0%	2.5%	4.9%	1.8%	-9.0%	2.5%	4.9%
2	47365	50	87	-0.5%	13.8%	1.7%	1.8%	0.5%	13.8%	1.7%	1.8%
1	47479	54	87	-2.8%	16.0%	-0.6%	-0.9%	2.8%	16.0%	0.6%	-0.9%
2	47480	54	88	-1.6%	13.8%	3.7%	-2.4%	1.6%	13.8%	3.7%	-2.4%
1	47593	56	89	-1.6%	11.0%	3.1%	-3.7%	1.6%	11.0%	3.1%	-3.7%
2	47594	55	89	1.4%	12.8%	4.9%	3.6%	1.4%	12.8%	4.9%	3.6%
1	47699	62	89	-0.2%	-7.0%	1.7%	0.0%	0.2%	-7.0%	1.7%	0.0%
2	47700	60	89	-1.6%	11.8%	5.2%	-4.2%	1.6%	11.8%	5.2%	-4.2%
1	47830	61	90	-0.7%	14.0%	2.8%	0.0%	0.7%	14.0%	2.8%	0.0%
2	47831	60	90	-0.9%	17.8%	4.9%	-0.3%	0.9%	17.8%	4.9%	-0.3%
1	47944	60	93	-4.0%	12.0%	3.4%	-9.5%	4.0%	12.0%	3.4%	-9.5%
2	47945	59	93	-0.6%	14.8%	4.1%	0.4%	0.6%	14.8%	4.1%	0.4%
1	46645	71	95	2.5%	-4.0%	4.0%	2.8%	2.5%	-4.0%	4.0%	2.8%
2	48062	64	95	-2.8%	11.8%	7.6%	-9.2%	2.8%	11.8%	7.6%	-9.2%
1	48179	65	97	0.6%	-6.0%	5.1%	-2.1%	0.6%	-6.0%	5.1%	-2.1%
2	48180	66	97	1.1%	-8.7%	8.0%	-1.7%	1.1%	-8.7%	8.0%	-1.7%
1	48278	65	99	-7.8%	11.0%	-8.6%	-5.8%	7.8%	11.0%	8.6%	-5.8%
2	48279	65	99	-2.0%	11.8%	0.5%	-1.3%	2.0%	11.8%	0.5%	-1.3%
1	48394	72	99	-0.1%	11.0%	-3.5%	7.1%	0.1%	11.0%	3.5%	7.1%
2	48395	70	99	1.1%	-7.7%	2.1%	2.9%	1.1%	-7.7%	2.1%	2.9%
2	90	69	101	3.6%	-7.7%	3.3%	7.9%	3.6%	-7.7%	3.3%	7.9%
1	210	50	101	-2.0%	12.0%	1.1%	-2.5%	2.0%	12.0%	1.1%	-2.5%
2	211	51	101	-0.5%	12.8%	2.5%	1.1%	0.5%	12.8%	2.5%	1.1%
1	334	52	102	-2.1%	4.0%	1.1%	-1.5%	2.1%	14.0%	1.1%	-1.5%
2	335	50	102	2.0%	-6.7%	5.2%	2.2%	2.0%	-6.7%	5.2%	2.2%
1	457	60	105	-2.2%	10.0%	1.7%	-3.7%	2.2%	10.0%	1.7%	-3.7%
2	458	60	105	1.4%	10.8%	5.2%	2.6%	1.4%	10.8%	5.2%	2.6%
1	46534	72	100	2.0%	-5.0%	6.0%	0.3%	2.0%	-5.0%	6.0%	0.3%
2	46535	70	100	3.6%	-4.7%	7.2%	3.3%	3.6%	-4.7%	7.2%	3.3%
1	48490	72	101	-6.0%	10.0%	2.5%	13.5%	6.0%	10.0%	2.5%	13.5%
2	48491	70	101	2.2%	-9.7%	5.6%	3.6%	2.2%	-9.7%	5.6%	3.6%

6.1.3 OVERALL PERFORMANCE

International Road Dynamics Inc.

FHWA VERIFICATION

Specifications					
Confidence	95%	Speed range low	45	to	55
	(1.96)	Speed range medium	55	to	65
Gross vehicle weight	10%	Speed range high	65	to	76
Tandem group weight	15%	Temperature range low	80	to	90
Single axle weight	20%	Temperature range medium	90	to	100
Axle spacings	0.5	Temperature range high	100	to	110

Overall					
Characteristic	Error	StdDev	Specification	Calculated	Pass/Fail
Gross vehicle weight	-0.5%	2.5%	10%	5.3%	pass
Tandem group weight	1.2%	4.2%	15%	9.5%	pass
Single axle weight	-10.6%	3.3%	20%	17.0%	pass
Axle spacings	0.0	0.2	0.5	0.3	pass

Speed range 45 to 55 (13 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	-0.4%	1.6%	10%	3.6%
Tandem group weight	1.5%	2.5%	15%	6.6%
Single axle weight	-11.9%	2.7%	20%	6.7%
Axle spacings	-0.1	0.2	0.5	0.4

Speed range 55 to 65 (13 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	-1.7%	2.3%	10%	6.4%
Tandem group weight	0.0%	4.7%	15%	9.4%
Single axle weight	-11.5%	3.1%	20%	17.7%
Axle spacings	0.0	0.2	0.5	0.3

Speed range 65 to 76 (9 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	1.1%	2.9%	10%	7.1%
Tandem group weight	2.7%	5.1%	15%	12.8%
Single axle weight	-7.6%	2.5%	20%	12.8%
Axle spacings	0.0	0.2	0.5	0.4

Temperature range 80 to 90 (14 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	-0.5%	1.3%	10%	3.1%
Tandem group weight	1.4%	2.8%	15%	7.1%
Single axle weight	-12.2%	3.0%	20%	18.3%

Temperature range 90 to 100 (12 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	-0.5%	3.2%	10%	7.0%
Tandem group weight	0.9%	5.3%	15%	11.5%
Single axle weight	-9.0%	3.5%	20%	16.2%

Temperature range 100 to 110 (9 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	-0.4%	3.0%	10%	6.5%
Tandem group weight	1.4%	4.7%	15%	10.9%
Single axle weight	-10.4%	2.3%	20%	15.1%

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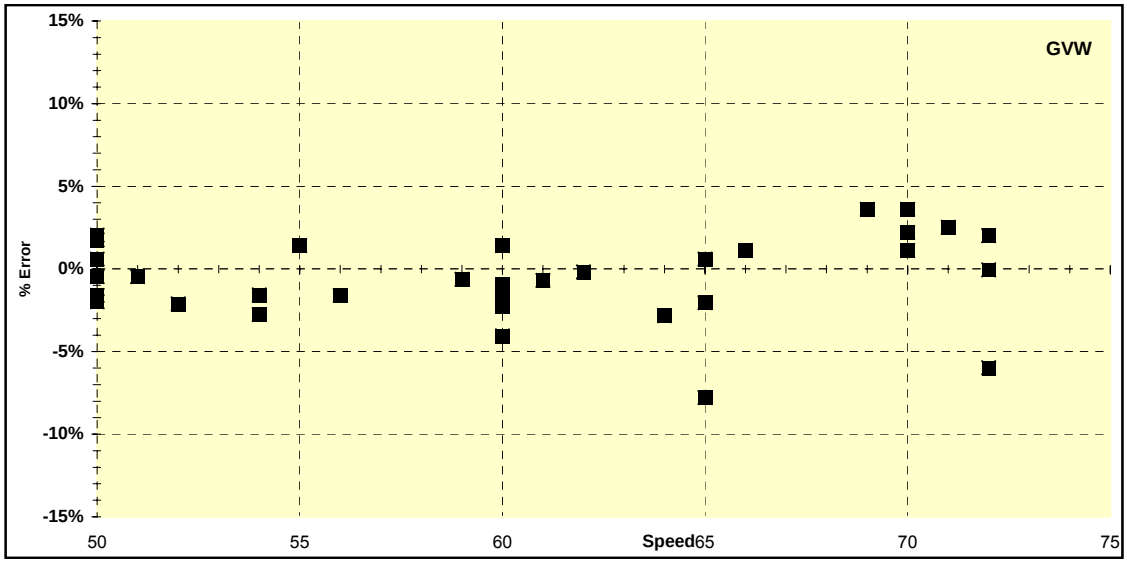
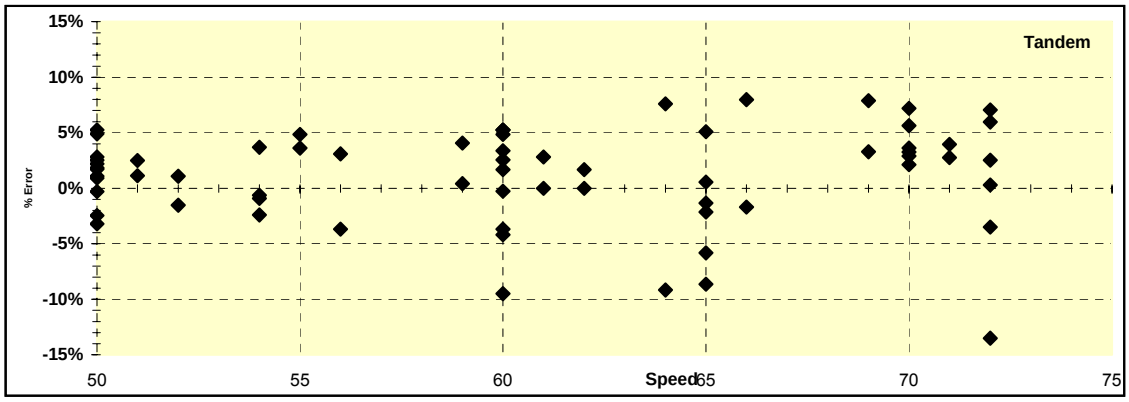
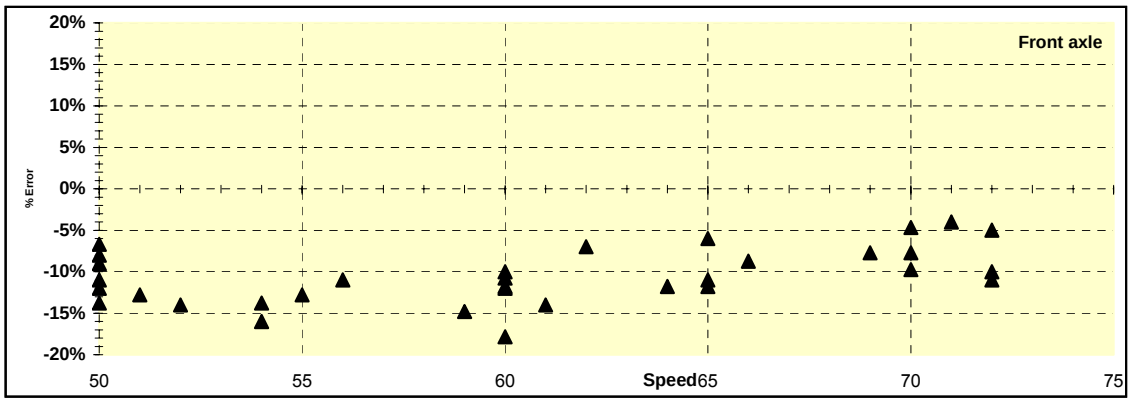
6.1.4 WEIGHT GRAPHS

International Road Dynamics Inc.

FHWA VERIFICATION







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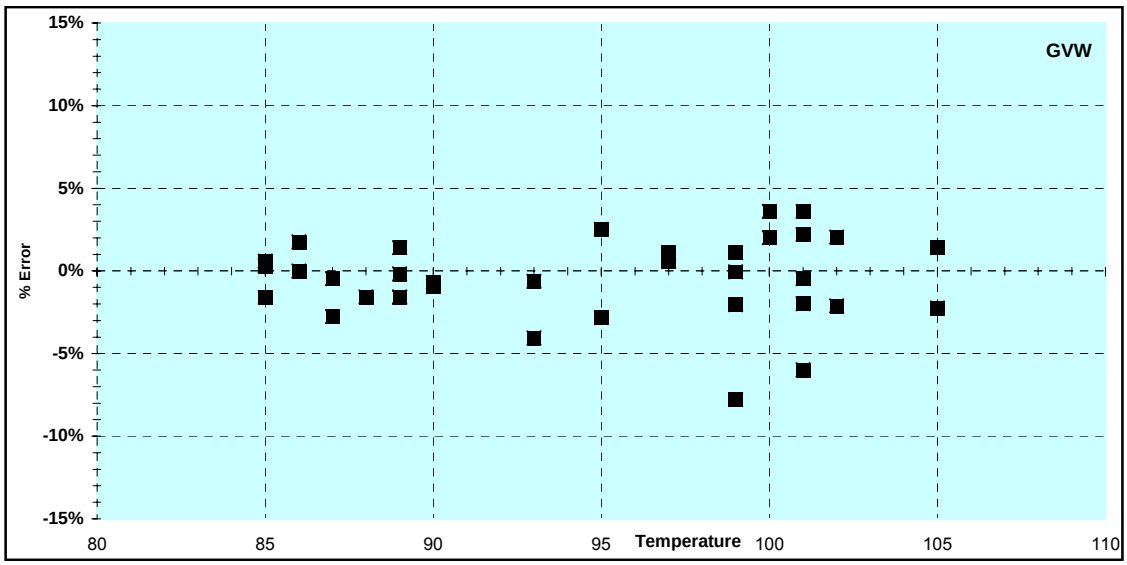
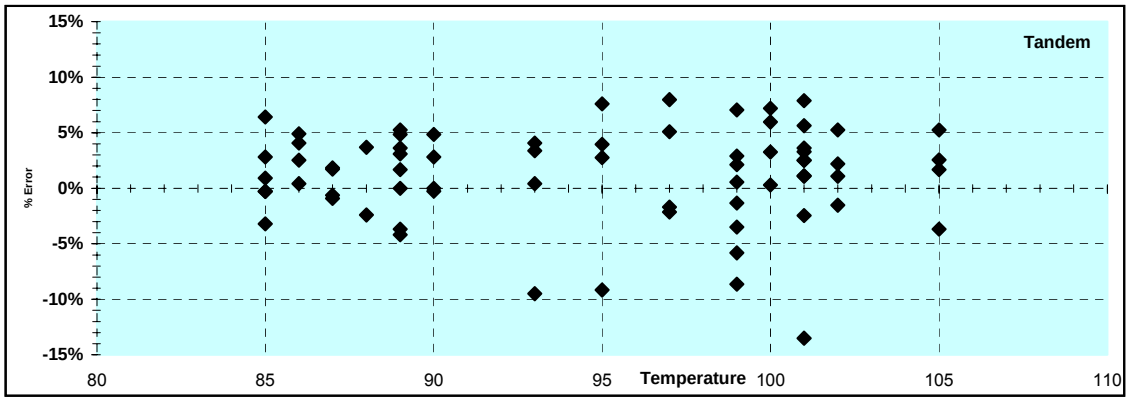
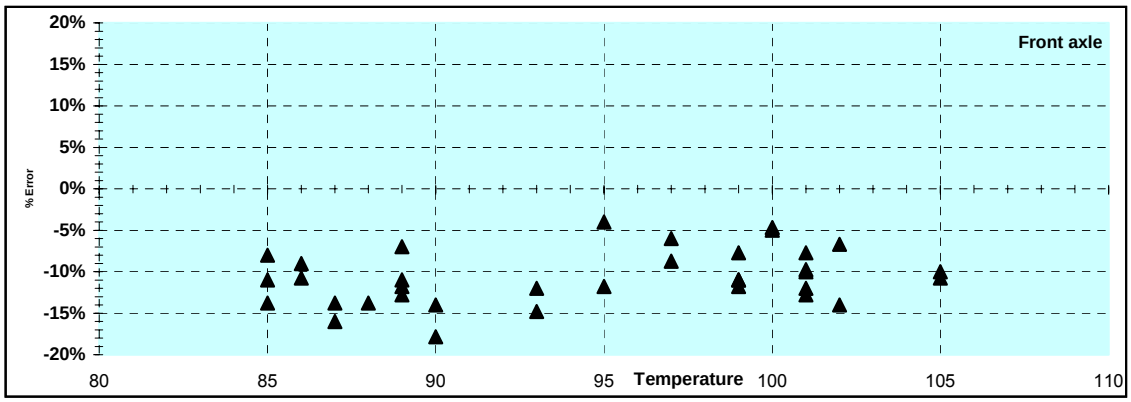
6.1.5 TEMPERATURE INFLUENCE GRAPHS

International Road Dynamics Inc.

FHWA VERIFICATION







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