INTERNATIONAL ROAD DYNAMICS INC.

LTPP WIM DATA COLLECTION SYSTEMS

INSTALLATION AND CALIBRATION FOR INDIANA SPS-6 LTPP ID 180600

July 31, 2008
CLIN 3004C TASK ORDER # 19

CONTRACT NO. DTFH61-05-D-00001

U.S. Department of Transportation
Federal Highway Administration

LONG TERM Pavement PERFORMANCE

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

This report details the installation and calibration of the Indiana SPS-6 Weigh-in-Motion (WIM) site located on US31 mile post 216.9. US31 is a four lane divided highway with two north bound and south bound lanes. The WIM site is instrumented with IRD's iSINC (Intelligent Sensor Interface Network Controller) WIM Electronics, Kistler Quartz Sensors and inductive loops.

The LTPP lane is in the north bound driving lane and is instrumented with two inductive loops and 8 Kistler Quartz sensors. The south bound drive lane is instrumented with two inductive loops and 8 Kistler Quartz sensors. The north bound and south pass lanes are instrumented with two inductive loops and 4 Kistler Quartz sensors

This Kistler sensor configuration used in the LTPP lane is referred to as a double threshold. There are two sensors arrays which span the entire width of the roadway. Each array weighs each side of the vehicle separately and twice (four measurements per axle).

The WIM system uses a landline modem for remote communication and data downloading. The WIM system power is provided by 120 volt A.C. service. The WIM Controller cabinet is located on the shoulder approximately 62 ft. east of the north bound shoulder.

The WIM equipment installation began on June 23, 2008 and was completed on July 1, 2008. The site was calibrated on July 16 & 17 2008.

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

Debbie Walker (COTR)
FHWA LTPP
ph: 202-493-3068
e: deborah.walker@fhwa.dot.gov

Mark Gardner (RSC)
Fugro
ph: 512-977-1800

Victor Gallivan (Division Representative)
FHWA
ph: 317-226-7493

State Highway Agency (SHA)
Kirk Mangold INDOT ph: 317-233-3690
Donn Klepinger ph: 317-591-5264
Scott MacArthur INDOT ph: 317-233-1166
Tommy Nantung INDOT ph: 765-463-1521 ext.248

Bruce Myers
International Road Dynamics (Phase 2 Contractor)
ph: 717-264-2077
c: 717-860-1817
e: bruce.myers@irdinc.com

3.0 SHEET 16 – SITE CALIBRATION SUMMARY

SITE CALIBRATION INFORMATION

1. DATE OF CALIBRATION (MONTH/DAY/YEAR): **July 16, 2008**

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 **-0.8 %** STANDARD DEVIATION **1.4%**
   SINGLE AXLE MEAN DIFFERENCE **.1%** STANDARD DEVIATION **2.2 %**
   DOUBLE AXLES MEAN DIFFERENCE **-1.3%** STANDARD DEVIATION **3.9%**

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

9. DEFINE THE SPEED RANGES USED (MPH): **48 - 55, 56 – 60, 61 – 68**

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&5 100**%**
    FHWA CLASS 8 100**%**
    FHWA CLASS 9 100**%**
    FHWA CLASS 12 **%**
    "UNCLASSIFIED" VEHICLES: **%**

15. PICTURES: _____

16. NOTES:
    _____

PERSON LEADING CALIBRATION EFFORT: **Tim Weber**
CONTACT INFORMATION: **563-940-4068**

3.1.1 iSINC SITE CALIBRATION FACTORS & SITE PARAMETERS AS OF 7-16-2008

Calibration Menu

Select Lane		1					
Select Axle Sensor		1					
Threshold		16					
WIM Calib Factors >		Select Speed Bin	1	2	3	4	5
		Max Speed (kph)	80	88	96	105	112
		Calib Factor	3260	3260	3260	3260	3260
Select Lane		1					
Select Axle Sensor		2					
Threshold		16					
WIM Calib Factors >		Select Speed Bin	1	2	3	4	5
		Max Speed (kph)	80	88	96	105	112
		Calib Factor	3142	3142	3142	3142	3142
Select Lane		1					
Select Axle Sensor		3					
Threshold		16					
WIM Calib Factors >		Select Speed Bin	1	2	3	4	5
		Max Speed (kph)	80	88	96	105	112
		Calib Factor	3260	3260	3260	3260	3260
Select Lane		1					
Select Axle Sensor		4					
Threshold		16					
WIM Calib Factors >		Select Speed Bin	1	2	3	4	5
		Max Speed (kph)	80	88	96	105	112
		Calib Factor	3142	3142	3142	3142	3142

Site Parameters Menu

Lane Name			1 NB DR
Lane State			ENABLED
Upstream Loop >		Loop State	ENABLED
		Module UID	9
		Channel Num	0
		Polarity Active	LOW
		Width (cm)	200
Downstream Loop >		Loop State	ENABLED
		Module UID	9
		Channel Num	1
		Polarity Active	LOW
		Width (cm)	200
		Distance(cm)	670
Axle Sensors >		Select Axle	1
		Axle State	ENABLED
		Module UID	5
		Channel Num	0
		Polarity Active	HIGH
		Type	KISTLER_DUAL
		Poition	Left
		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
		Poition	Right
		Distance(cm)	274
		Temp State	ENABLED
		Temp Module UID	5
		Temp Channel Num	0
Axle Sensors >		Select Axle	3
		Axle State	ENABLED
		Module UID	5
		Channel Num	2
		Polarity Active	HIGH
		Type	KISTLER_DUAL
		Poition	Left
		Distance(cm)	579
		Temp State	ENABLED
		Temp Module UID	5
		Temp Channel Num	0
Axle Sensors >		Select Axle	4
		Axle State	ENABLED
		Module UID	5
		Channel Num	3
		Polarity Active	HIGH
		Type	KISTLER_DUAL
		Poition	Right
		Distance(cm)	579
		Temp State	ENABLED
		Temp Module UID	5
		Temp Channel Num	0
Processing >	MaxTimeout(ms)		3000
	Dynamic Comp(%)		100
	Sig Wt Diff(%)		40
	Min Axle Wt(kg)		1360
	Veh Rec Mode		Split
	Axl Sep(cm)		305

4.0 WIM SITE INVENTORY

1. ROUTE US31 MILEPOST: 216.9 LTPP DIRECTION: **N** S E W

2. SITE DESCRIPTION
   GRADE: <1%
   ☐ Sag vertical
   Nearest SPS section downstream of the site: 180607
   Distance from sensor to nearest downstream SPS Section: 3,380 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: 62 ft
    Distance from sensors: 72 ft
    Type: 336
    Access controlled by: ☐ LTPP / ☒ State / ☐ Joint
    Primary contact: Donn Klepinger (317) 591-5264

11. POWER:
    Power type: ☐ Overhead / ☒ Underground / ☐ Solar
    Distance from cabinet to drop: 25 ft
    Service provider: N/A.

12. TELEPHONE:
    Telephone type: ☐ Overhead / ☒ Underground / ☐ Cell
    Distance from cabinet to drop: 25 ft.
    Phone # : (574) 892-5912

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

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

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

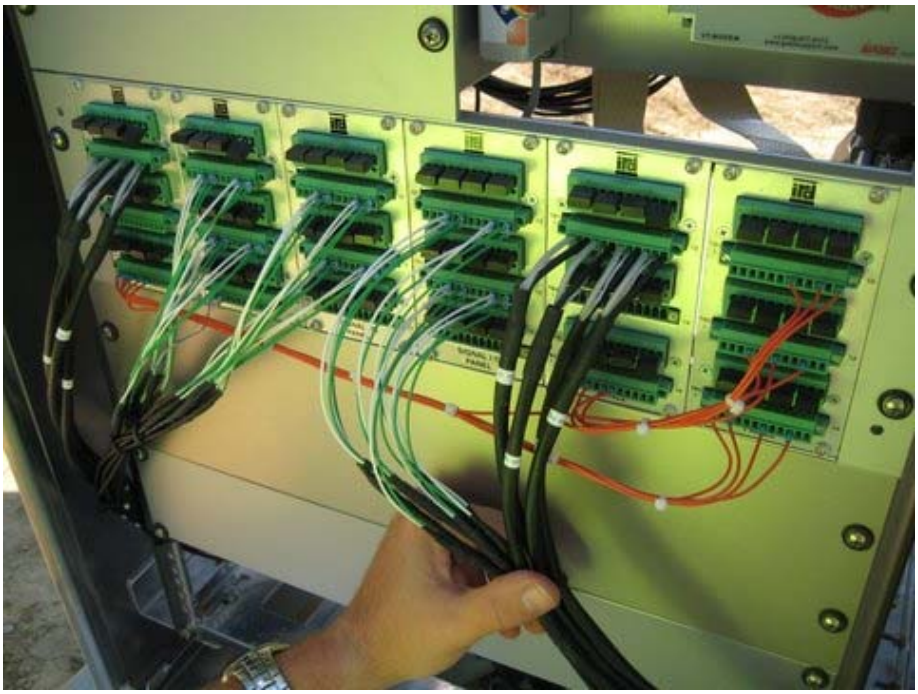
16. NOTES:

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

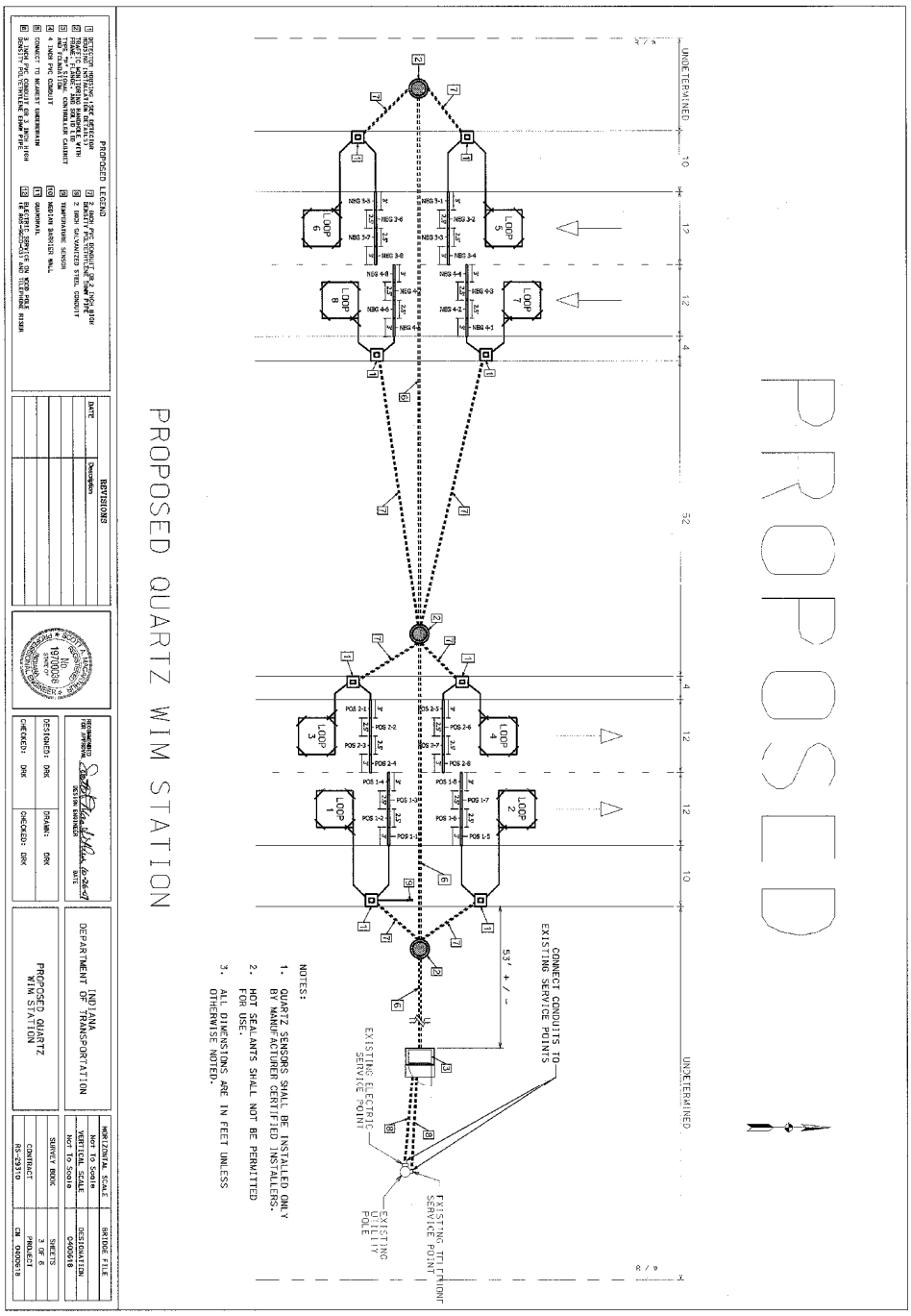
4.1.1 SITE MAP

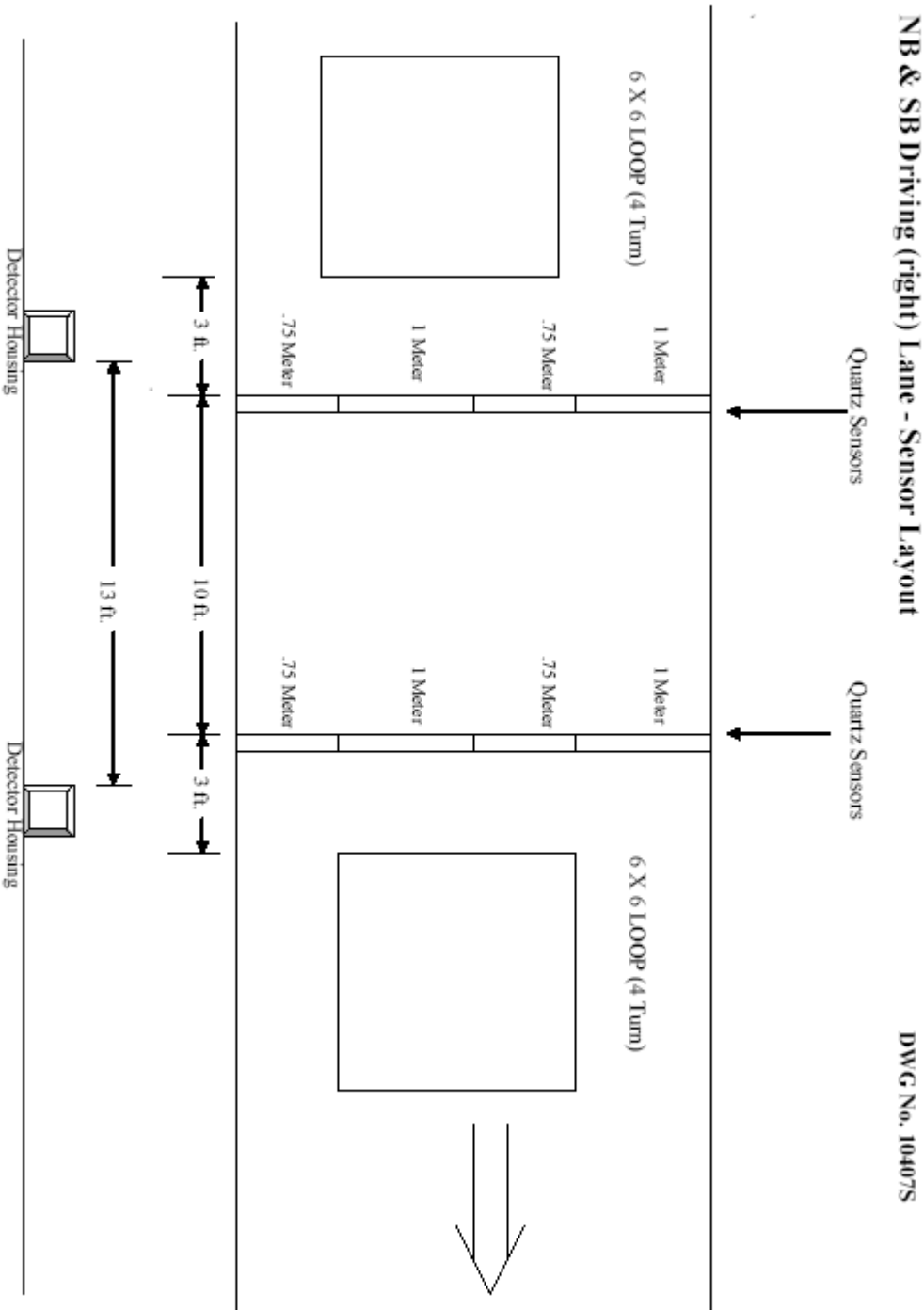
US31 North Bound Mile Post 216.9

4.1.2 PICTURES, WIM SITE

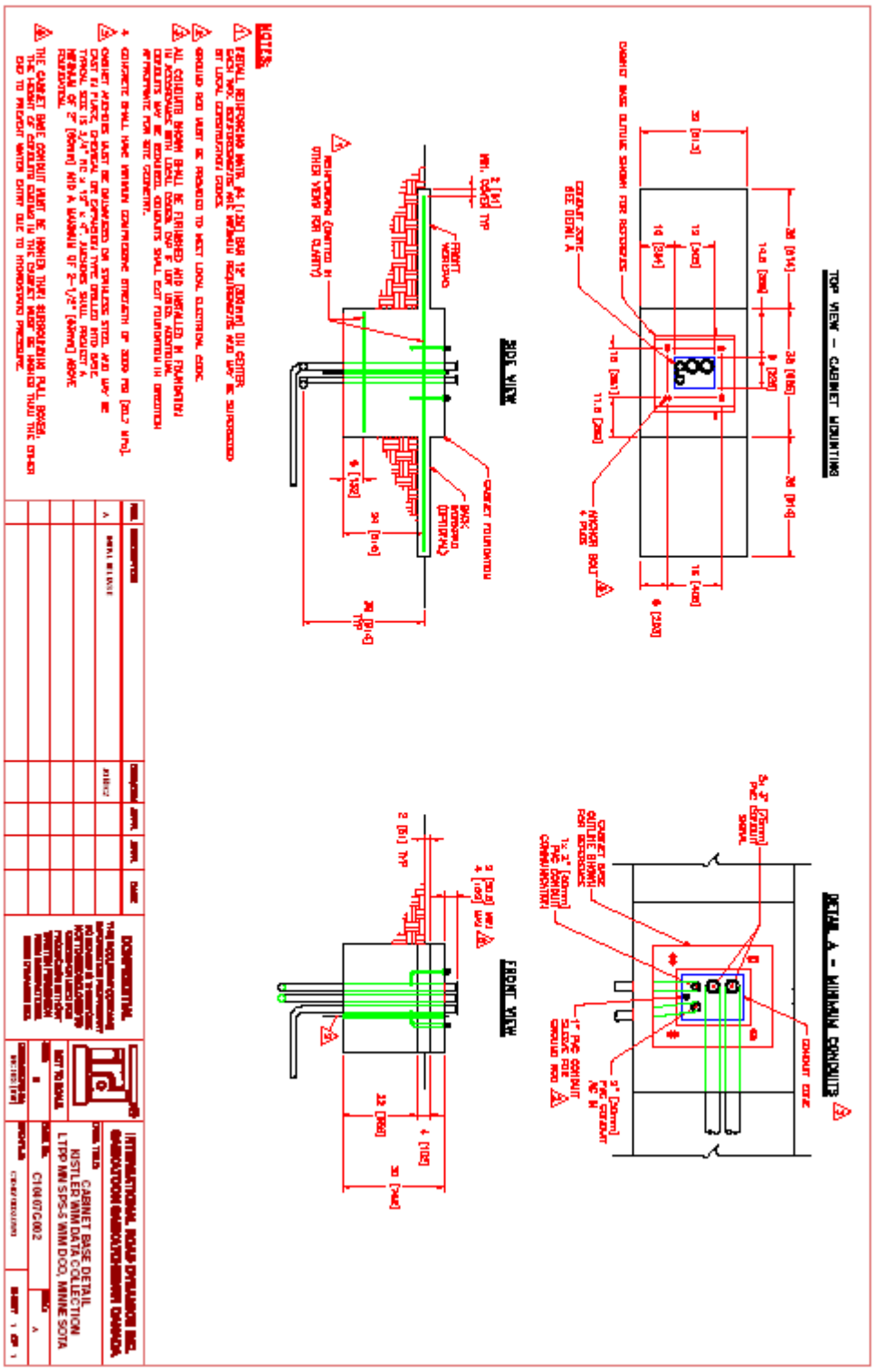


4.1.3 SITE DRAWING & LAYOUT




NB & SB Driving (right) Lane - Sensor Layout
DWG No. 10407S
Quartz Sensors
Quartz Sensors
6 X 6 LOOP (4 Turn)
6 X 6 LOOP (4 Turn)
1 Meter
.75 Meter
1 Meter
.75 Meter
1 Meter
.75 Meter
1 Meter
.75 Meter
3 ft.
10 ft.
3 ft.
13 ft.
Detector Housing
Detector Housing

4.1.4 WIM CABINET CONCRETE PEDESTAL



4.1.5 ELECTRICAL READINGS

IRD

Site Service Sheet

Clear

System Type: iSINC/Kistler Quartz

Date: 7/16/2008 **State:** IN **Location:** US31 Mile Post 216.9
Job #: 10407S **Site #:** **Directions:** Approx. 1 Mile South of Argos

		Lead	Trail	Lead	Trail	Lead	Trail	Lead	Trail
Loops	**Lane**	**1 NB**	**1 NB**	**2 NB**	**2 NB**	**3 NB**	**3 NB**	**4 NB**	**4 NB**
	Resistance	.8 ohm	.8 ohm	.8 ohm	.8 ohm	1 ohm	1 ohm	1.2 ohm	1.2 ohm
	Leakage	inf	inf	inf	inf	inf	inf	inf	inf
	Inductance uH								
	Frequency								
Kistler	**Lane - 1**	**CH 0**	**CH 0**	**CH 1**	**CH 1**	**CH 2**	**CH 2**	**CH 3**	**CH 3**
	Amplitude	OK	OK	OK	OK	OK	OK	OK	OK
	Capacitance	5.2nf	4.5nf	6.0nf	4.3nf	5.3nf	4.4nf	5.0nf	4.5nf
	Resistance	inf	inf	inf	inf	inf	inf	inf	inf
	Serial #	1677439	1672590	1663604	1671148	1672630	1666816	1677445	1671125
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	O.K.
Power Supply	13.4 Vdc
DC Supply	13.4 Vdc
Back-Up	13.4 Vdc
System Input	
Modem Power	
Phone off	10 Vdc
Phone on	52 Vdc

Software

System: iSINC

Site Full Operating Capacity **Pass**

Technician: Tim Weber **Date:** 7/21/2008

5.0 WIM CALIBRATION

5.1.1 TEST TRUCK #1 INFORMATION

DATE OF CALIBRATION: **July 16, 2008**

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		10700		D
B		29000		D (B&C combined)
C				
D		38000		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)
	78500		78500

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

9. TRACTOR MANUFACTURER:
   Make: Kenworth
   Model:

10. TRAILER LOAD DESCRIPTION: Steel

11. TRAILER TARE WEIGHT (lb): _____

12. AXLE SPACINGS

Axle	Spacing (feet & inches)
A-B	18.6'
B-C	4.3'
C-D	30.5’
D-E	10.1’

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 – three leaves
B	11R24.5	air
C	11R24.5	air
D	11R22.5	air
E	11R22.5	airl

5.1.2 PICTURES, TEST TRUCK 1


WENDT
1-800-272-4345

5.1.3 TEST TRUCK #2 INFORMATION

DATE OF CALIBRATION: **July 16, 2008**

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		10900		D
B		22900		D (B&C combined)
C				
D		29700		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)
	63500		63500

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

9. TRACTOR MANUFACTURER:
   Make: Kenworth
   Model:

10. TRAILER LOAD DESCRIPTION: Two Forklifts

11. TRAILER TARE WEIGHT (lb): _____

12. AXLE SPACINGS

Axle	Spacing (feet & inches)
A-B	19.5'
B-C	4.3'
C-D	31.3'
D-E	10.1'

KINGPIN OFFSET FROM AXLE B (ft, + towards rear): +2 ft

SUSPENSSION:

Axle	17. Tire Size	18. Suspension description (leaf, air, # of leaves, taper or flat leaf, etc.)
A	11R24.5	Leaf spring – three leaves
B	11R24.5	air
C	11R24.5	air
D	11R22.5	air
E	11R22.5	air

5.1.4 PICTURES, TEST TRUCK 2


HYSTER


WENDT
1-800-272-6346

6.0 TEST TRUCK CALIBRATION RECORDS

6.1.1 VALIDATION RUNS

International Road Dynamics Inc.

FHWA VERIFICATION 2008b

Static Test Vehicle Measurements

ID				GVW	F/A	T1	T2	1>2	2>3	3>4	4>5
1				78.5	10.7	29.0	38.8	18.6	4.3	30.5	10.1
2				63.5	10.9	22.9	29.7	19.5	4.3	31.3	10.1

Dynamic Test Vehicle Measurements

ID	V#	Speed	Temp	GVW	F/A	T1	T2	1>2	2>3	3>4	4>5
1	38126	54	84	77.2	10.5	29.0	37.6	18.7	4.4	30.6	10.1
1	38211	60	84	79.7	10.8	30.2	38.7	18.6	4.4	30.6	10.1
1	38416	65	84	80.1	10.8	30.2	39.0	18.7	4.4	30.5	10.2
1	38495	54	84	77.9	10.6	30.2	37.1	18.7	4.4	30.6	10.1
1	38564	62	84	79.8	10.7	30.5	38.7	18.8	4.4	30.7	10.2
1	39645	65	84	80.7	10.8	31.0	38.9	18.8	4.4	30.6	10.2
1	38721	55	84	78.0	10.7	29.9	37.4	18.8	4.4	30.6	10.1
1	38797	60	84	80.3	10.8	30.7	38.8	18.7	4.4	30.6	10.1
1	38897	65	86	80.2	10.6	31.5	38.1	18.7	4.4	30.8	10.2
1	38980	54	86	79.1	11.1	30.7	37.3	18.8	4.4	30.8	10.1
1	39051	59	86	79.0	11.3	29.5	38.3	18.8	4.4	30.6	10.2
1	39309	55	88	78.2	10.6	30.2	37.3	18.8	4.4	30.6	10.1
1	39380	60	88	79.7	10.6	30.9	38.3	18.7	4.4	30.6	10.1
1	39457	55	90	78.8	10.3	30.2	38.4	18.8	4.4	30.6	10.1
1	39513	60	90	80.4	10.7	30.6	38.9	18.8	4.4	30.6	10.1
1	39587	65	91	81.0	10.3	31.4	39.4	18.8	4.4	30.7	10.2
1	39645	59	91	78.3	10.5	30.5	37.3	18.7	4.4	30.6	10.1
1	39749	60	91	80.9	10.5	30.7	39.7	18.7	4.4	30.7	10.2
1	39871	60	93	80.5	10.6	30.8	39.1	18.8	4.4	30.7	10.1
1	39945	52	93	77.9	11.0	29.7	37.1	18.8	4.4	30.7	10.1
1	40426	49	93	78.7	10.9	30.2	37.5	18.8	4.4	30.7	10.2
2	38150	57	84	63.1	11.4	23.1	28.6	19.8	4.3	31.6	10.2
2	38217	64	84	64.8	11.0	23.8	30.1	19.7	4.3	31.4	10.2
2	38420	65	84	65.1	11.1	24.5	29.5	19.7	4.3	31.5	10.1
2	38496	56	84	62.9	11.3	23.1	28.5	19.6	4.3	31.5	10.2
2	38565	62	84	64.9	11.0	23.9	29.9	19.7	4.3	31.6	10.2
2	38723	55	84	62.1	10.9	23.1	28.1	19.8	4.3	31.5	10.2
2	38800	63	84	64.3	10.7	23.4	30.2	19.7	4.3	31.5	10.2
2	38906	64	86	64.5	11.1	22.6	30.8	19.7	4.3	31.6	10.2
2	38995	56	86	63.3	10.9	24.3	28.2	19.8	4.3	31.6	10.2
2	39052	62	86	64.1	10.8	23.5	29.8	19.7	4.3	31.5	10.2
2	39312	57	88	64.7	10.5	24.8	29.3	19.6	4.3	31.5	10.2
2	39475	67	90	63.0	10.7	23.3	29.1	19.6	4.3	31.5	10.2
2	39531	57	90	62.9	10.7	24.4	27.8	19.7	4.3	31.6	10.2
2	39593	63	91	65.4	11.2	24.3	29.9	19.8	4.3	31.6	10.2
2	39661	57	91	63.5	11.1	24.0	28.4	19.8	4.4	31.6	10.2
2	39750	62	91	64.2	10.8	23.3	30.2	19.7	4.3	31.6	10.2
2	39808	56	91	63.5	11.2	23.9	28.3	19.7	4.3	31.6	10.2
2	39878	63	93	63.4	10.7	22.8	29.9	19.6	4.3	31.6	10.2
2	39956	55	93	63.6	10.9	23.9	28.7	19.7	4.3	31.5	10.2
2	40434	57	93	63.9	11.0	24.1	28.8	19.7	4.3	31.6	10.2
2	40704	52	95	63.1	10.5	24.8	27.8	19.8	4.4	31.6	10.1

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	38126	54	84	-1.7%	-1.9%	0.0%	-3.1%	0.1	0.1	0.1	0.0
1	38211	60	84	1.5%	0.9%	4.1%	-0.3%	0.0	0.1	0.1	0.0
1	38416	65	84	2.0%	0.9%	4.1%	0.5%	0.1	0.1	0.0	0.1
1	38495	54	84	-0.8%	-0.9%	4.1%	-4.4%	0.1	0.1	0.1	0.0
1	38564	62	84	1.7%	0.0%	5.2%	-0.3%	0.2	0.1	0.2	0.1
1	39645	65	84	2.8%	0.9%	6.9%	0.3%	0.2	0.1	0.1	0.1
1	38721	55	84	-0.6%	0.0%	3.1%	-3.6%	0.2	0.1	0.1	0.0
1	38797	60	84	2.3%	0.9%	5.9%	0.0%	0.1	0.1	0.1	0.0
1	38897	65	86	2.2%	-0.9%	8.6%	-1.8%	0.1	0.1	0.3	0.1
1	38980	54	86	0.8%	3.7%	5.9%	-3.9%	0.2	0.1	0.3	0.0
1	39051	59	86	0.6%	5.6%	1.7%	-1.3%	0.2	0.1	0.1	0.1
1	39309	55	88	-0.4%	-0.9%	4.1%	-3.9%	0.2	0.1	0.1	0.0
1	39380	60	88	1.5%	-0.9%	6.6%	-1.3%	0.1	0.1	0.1	0.0
1	39457	55	90	0.4%	-3.7%	4.1%	-1.0%	0.2	0.1	0.1	0.0
1	39513	60	90	2.4%	0.0%	5.5%	0.3%	0.2	0.1	0.1	0.0
1	39587	65	91	3.2%	-3.7%	8.3%	1.5%	0.2	0.1	0.2	0.1
1	39645	59	91	-0.3%	-1.9%	5.2%	-3.9%	0.1	0.1	0.1	0.0
1	39749	60	91	3.1%	-1.9%	5.9%	2.3%	0.1	0.1	0.2	0.1
1	39871	60	93	2.5%	-0.9%	6.2%	0.8%	0.2	0.1	0.2	0.0
1	39945	52	93	-0.8%	2.8%	2.4%	-4.4%	0.2	0.1	0.2	0.0
1	40426	49	93	0.3%	1.9%	4.1%	-3.4%	0.2	0.1	0.2	0.1
2	38150	57	84	-0.6%	4.6%	0.9%	-3.7%	0.3	0.0	0.3	0.1
2	38217	64	84	2.0%	0.9%	3.9%	1.3%	0.2	0.0	0.1	0.1
2	38420	65	84	2.5%	1.8%	7.0%	-0.7%	0.2	0.0	0.2	0.0
2	38496	56	84	-0.9%	3.7%	0.9%	-4.0%	0.1	0.0	0.2	0.1
2	38565	62	84	2.2%	0.9%	4.4%	0.7%	0.2	0.0	0.3	0.1
2	38723	55	84	-2.2%	0.0%	0.9%	-5.4%	0.3	0.0	0.2	0.1
2	38800	63	84	1.3%	-1.8%	2.2%	1.7%	0.2	0.0	0.2	0.1
2	38906	64	86	1.6%	1.8%	-1.3%	3.7%	0.2	0.0	0.3	0.1
2	38995	56	86	-0.3%	0.0%	6.1%	-5.1%	0.3	0.0	0.3	0.1
2	39052	62	86	0.9%	-0.9%	2.6%	0.3%	0.2	0.0	0.2	0.1
2	39312	57	88	1.9%	-3.7%	8.3%	-1.3%	0.1	0.0	0.2	0.1
2	39475	67	90	-0.8%	-1.8%	1.7%	-2.0%	0.1	0.0	0.2	0.1
2	39531	57	90	-0.9%	-1.8%	6.6%	-6.4%	0.2	0.0	0.3	0.1
2	39593	63	91	3.0%	2.8%	6.1%	0.7%	0.3	0.0	0.3	0.1
2	39661	57	91	0.0%	1.8%	4.8%	-4.4%	0.3	0.1	0.3	0.1
2	39750	62	91	1.1%	-0.9%	1.7%	1.7%	0.2	0.0	0.3	0.1
2	39808	56	91	0.0%	2.8%	4.4%	-4.7%	0.2	0.0	0.3	0.1
2	39878	63	93	-0.2%	-1.8%	-0.4%	0.7%	0.1	0.0	0.3	0.1
2	39956	55	93	0.2%	0.0%	4.4%	-3.4%	0.2	0.0	0.2	0.1

6.1.3 OVERALL PERFORMANCE

International Road Dynamics Inc.
FHWA VERIFICATION 2008b

Specifications					
Confidence	95%	Speed range low	45	to	55
	(1.96)	Speed range medium	55	to	60
Gross vehicle weight	10%	Speed range high	60	to	70
Tandem group weight	15%	Temperature range low	60	to	85
Single axle weight	20%	Temperature range medium	85	to	90
Axle spacings	0.5	Temperature range high	90	to	95

Overall					
Characteristic	Error	StdDev	Specification	Calculated	Pass/Fail
Gross vehicle weight	0.8%	1.4%	10%	3.6%	pass
Tandem group weight	1.3%	3.9%	15%	9.0%	pass
Single axle weight	0.1%	2.2%	20%	4.5%	pass
Axle spacings	0.1	0.1	0.5	0.3	pass

Speed range 45 to 55 (11 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	-0.5%	0.9%	10%	2.3%
Tandem group weight	-0.1%	4.3%	15%	8.6%
Single axle weight	-0.2%	2.4%	20%	8.8%
Axle spacings	0.1	0.1	0.5	0.3

Speed range 55 to 60 (16 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	0.8%	1.3%	10%	3.6%
Tandem group weight	1.3%	4.3%	15%	9.8%
Single axle weight	0.6%	2.6%	20%	5.8%
Axle spacings	0.1	0.1	0.5	0.3

Speed range 60 to 70 (15 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	1.7%	1.1%	10%	3.9%
Tandem group weight	2.3%	2.9%	15%	8.1%
Single axle weight	-0.1%	1.8%	20%	3.7%
Axle spacings	0.1	0.1	0.5	0.3

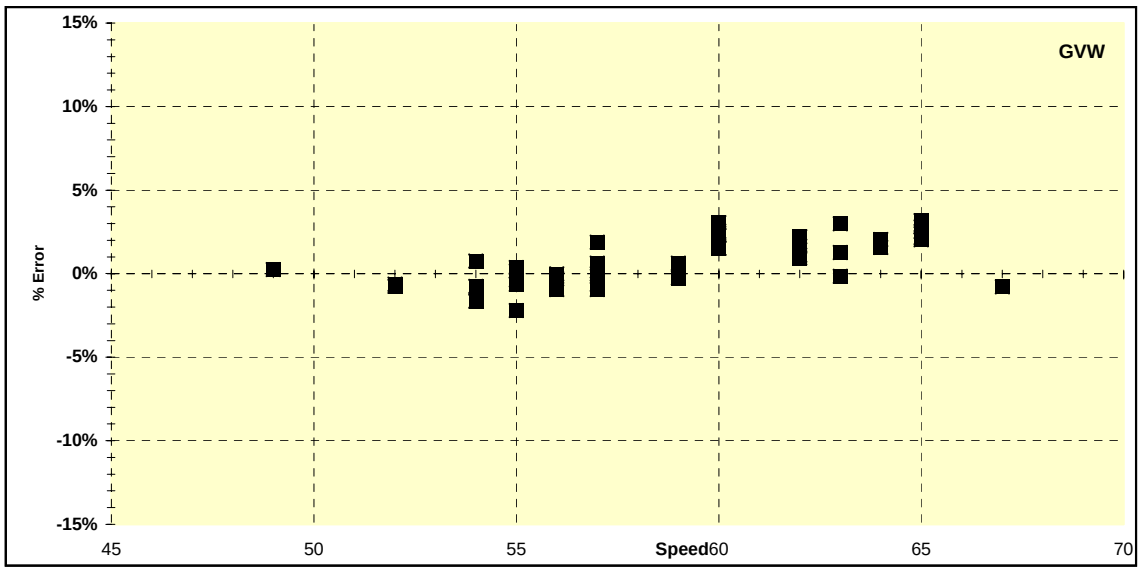
Temperature range 60 to 85 (15 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	0.8%	1.7%	10%	4.2%
Tandem group weight	1.1%	3.4%	15%	7.8%
Single axle weight	0.7%	1.7%	20%	4.3%

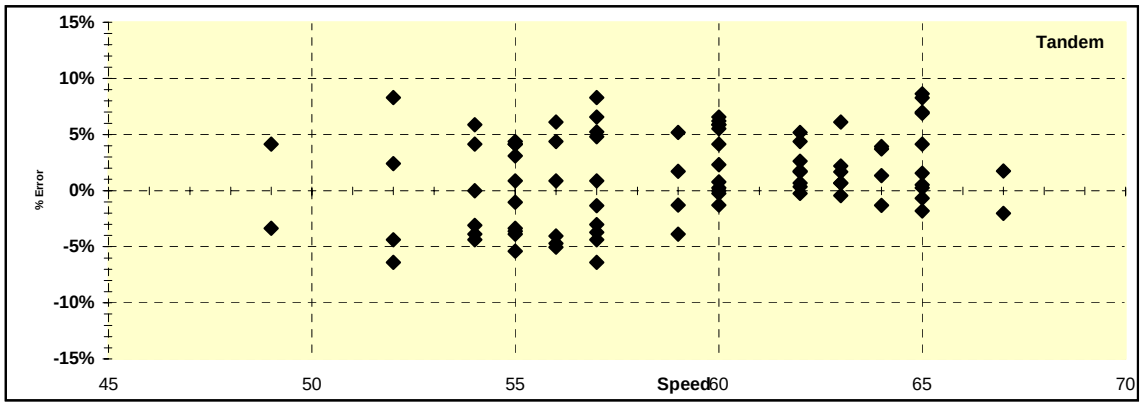
Temperature range 85 to 90 (13 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	0.8%	1.1%	10%	3.0%
Tandem group weight	1.4%	4.2%	15%	9.9%
Single axle weight	-0.3%	2.7%	20%	5.7%

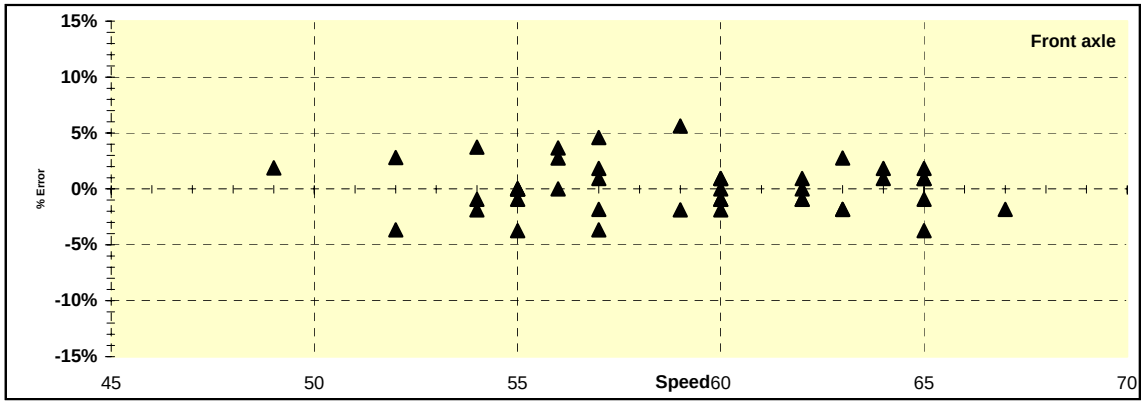
Temperature range 90 to 95 (14 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	0.9%	1.4%	10%	3.8%
Tandem group weight	1.5%	4.3%	15%	10.1%
Single axle weight	-0.1%	2.3%	20%	4.8%

6.1.4 WEIGHT GRAPHS

International Road Dynamics Inc.
FHWA VERIFICATION 2008b







6.1.5 TEMPERATURE INFLUENCE GRAPHS

International Road Dynamics Inc.