INTERNATIONAL ROAD DYNAMICS INC.

LTPP WIM DATA COLLECTION SYSTEMS

INSTALLATION AND CALIBRATION FOR CALIFORNIA SPS-2 LTPP ID 060200

FEBRUARY 4, 2008
CLIN 2004A TASK ORDER # 15

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 California LTPP SPS-2 Weigh-in-Motion (WIM) site located on SR-99 at mile post 32.5. The WIM site is instrumented with IRD's Intelligent Sensor Interface Network Controller (iSINC) WIM Electronics and the IRD/PAT 1.75 Meter Bending Plate sensor.

The LTPP lane is in the north bound driving lane and is equipped with two inductive loops and two bending plates. The sensor configuration is loop - bending plate - bending plate -loop. The bending plates are spaced 10 feet apart and are placed in the left and right wheel path. The inductive loops are placed before and after the leading and trailing bending plates. The WIM Controller cabinet is located on the shoulder of the north bound drive lane.

For remote communication the WIM system uses a Raven CDMA modem manufactured by Sierra Wireless. The modem was provided by CALTRANS. Initially CALTRANS provided a CDMA modem manufactured by Data Remote Inc. Attempts to configure this modem to operate with IRD's WIM electronics were unsuccessful.

Power is provided by two 80 watt Solar Panels charging one 12 volt 100amp hour battery. The Solar Power System was furnished and installed by CALTRANS.

The WIM equipment installation began on November 27, 2007 and was completed on November 30, 2007. Power and phone service was established at the WIM site in mid January. The site was calibrated on January 30, 2008 using two loaded 5 axle semis.

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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email: deborah.walker@fhwa.dot.gov

Kevin Senn (RSC)
Nichols Consulting Engineers
ph: (775) 827-4400

Jason Dietz (Division Representative)
FHWA
ph: (916) 498-5886

State of California (CALTRANS)
Linda Savinelli (916) 761-4335
Stan Norikane (916) 761-5651
Joe Avis Ph: (916) 654-5975

Bruce Myers
International Road Dynamics (Phase 2 Contractor)
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3.0 SHEET 16 – SITE CALIBRATION SUMMARY

SITE CALIBRATION INFORMATION

1. DATE OF CALIBRATION (MONTH/DAY/YEAR): **January 30, 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 **.2 %** STANDARD DEVIATION **.9%**
   SINGLE AXLE MEAN DIFFERENCE **- .6%** STANDARD DEVIATION **1.7%**
   DOUBLE AXLES MEAN DIFFERENCE **.3%** STANDARD DEVIATION **1.6%**

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

9. DEFINE THE SPEED RANGES USED (MPH): **45 - 53, 54 – 58, 59 – 62, 63 - 66**

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: **Richard Maynard**
CONTACT INFORMATION: **(916) 712-6444**

3.1.1 iSINC SITE CALIBRATION FACTORS & SITE PARAMETERS AS OF 01-30-2008

Calibration Parameters

Select Lane		1					
Select Axle Sensor		1					
Threshold		40					
WIM Calib Factors >		Select Speed Bin	1	2	3	4	5
		Max Speed (kph)	80	88	96	105	112
		Calib Factor	3395	3395	3420	3360	3360
Select Lane		1					
Select Axle Sensor		2					
Threshold		40					
WIM Calib Factors >		Select Speed Bin	1	2	3	4	5
		Max Speed (kph)	80	88	96	105	112
		Calib Factor	3395	3395	3420	3360	3360

Site Parameters

Lane Name			1
Lane State			ENABLED
Upstream Loop >		Loop State	ENABLED
		Module UID	9
		Channel Num	0
		Polarity Active	LOW
		Width (cm)	300
Downstream Loop >		Loop State	ENABLED
		Module UID	9
		Channel Num	1
		Polarity Active	LOW
		Width (cm)	300
		Distance(cm)	667
Axle Sensors >		Select Axle	1
		Axle State	ENABLED
		Module UID	5
		Channel Num	0
		Polarity Active	HIGH
		Type	PAT BP
		Distance(cm)	270
		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	PAT BP
		Distance(cm)	570
		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
	Axle Sensor Width(cm)		50
	Axl Sep(cm)		272
Axle Snsor Debounce >	Type	PAT BP	
	On (ticks)	25	
	Off (ticks)	10	
DIOM Debounce	Loop On (ticks)	40	
	Loop Off (ticks)	40	
	Ovrhgt on (ticks)	40	
	Ovrhgt off (ticks)	0	
	Axle On (ticks)	40	
	Axle Off (ticks)	40	

4.0 WIM SITE INVENTORY

1. ROUTE SR-99 MILEPOST:32.5 LTPP DIRECTION: **N** S E W

2. SITE DESCRIPTION
   GRADE: <1%
   ☐ Sag vertical
   Nearest SPS section upstream of the site: 060203
   Distance from sensor to nearest upstream SPS Section:

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 – 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

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: 35 ft
    Type: 336
    Access controlled by: ☐ LTPP / ☒ State / ☐ Joint
    Primary contact: Stan Norikane (916) 654-5651
    Alternate contact: Linda Savinelli

11. POWER:
    Power type: ☐ Overhead / ☐ Underground / ☒ Solar
    Distance from cabinet to drop: 10 ft
    Service provider: N/A.

12. TELEPHONE:
    Telephone type: ☐ Overhead / ☐ Underground / ☒ Cell (CDMA)
    Distance from cabinet to drop: N/A
    Phone # : californiasps2wim.earlink.com

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

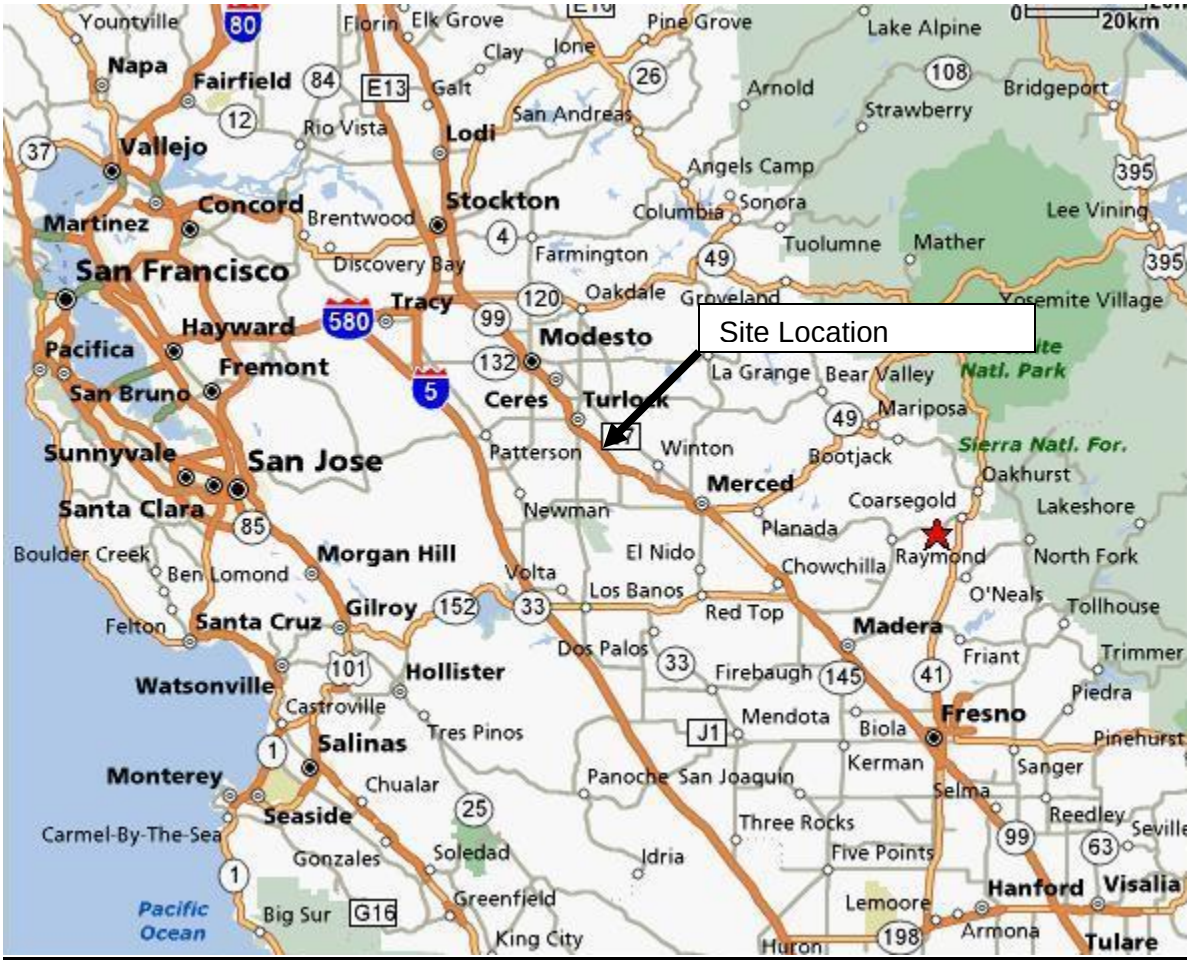
14. TEST TRUCK CYCLE:
    Turnaround time: 8 minutes
    Turnaround distance: 5 miles

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

16. NOTES:

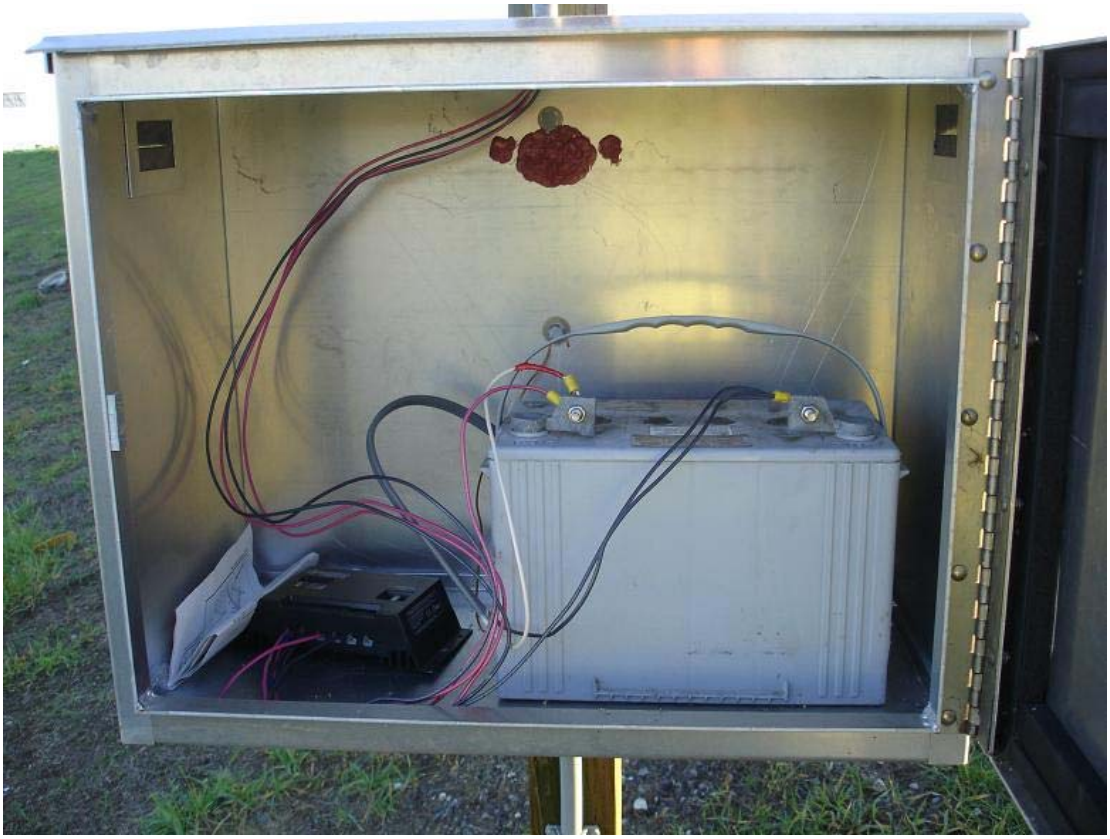
COMPLETED BY: **Bruce Myers**
CONTACT INFORMATION: (**717) 264-2077**

4.1.1 SITE MAP

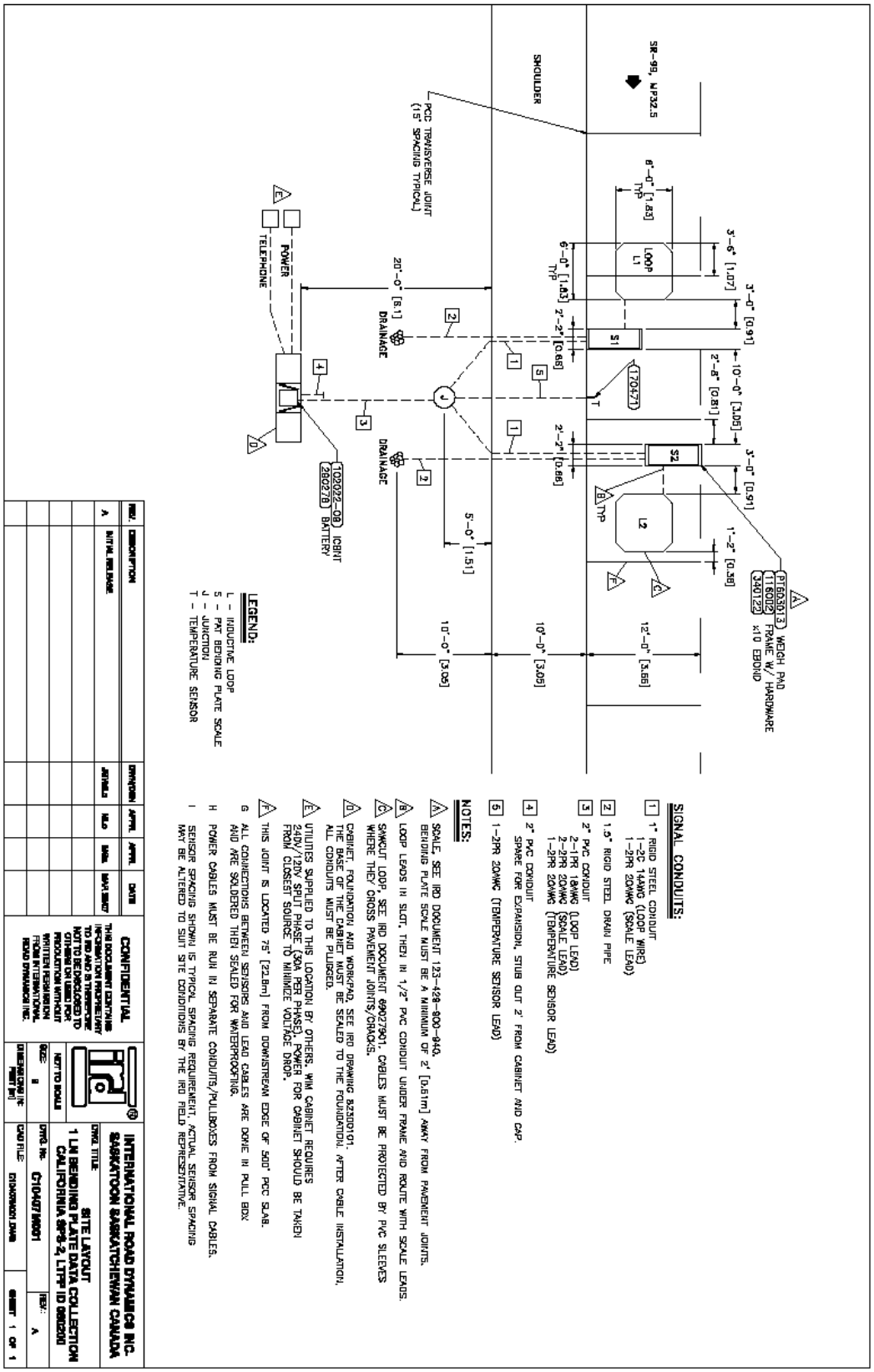


SR-99 Mile Post 32.5

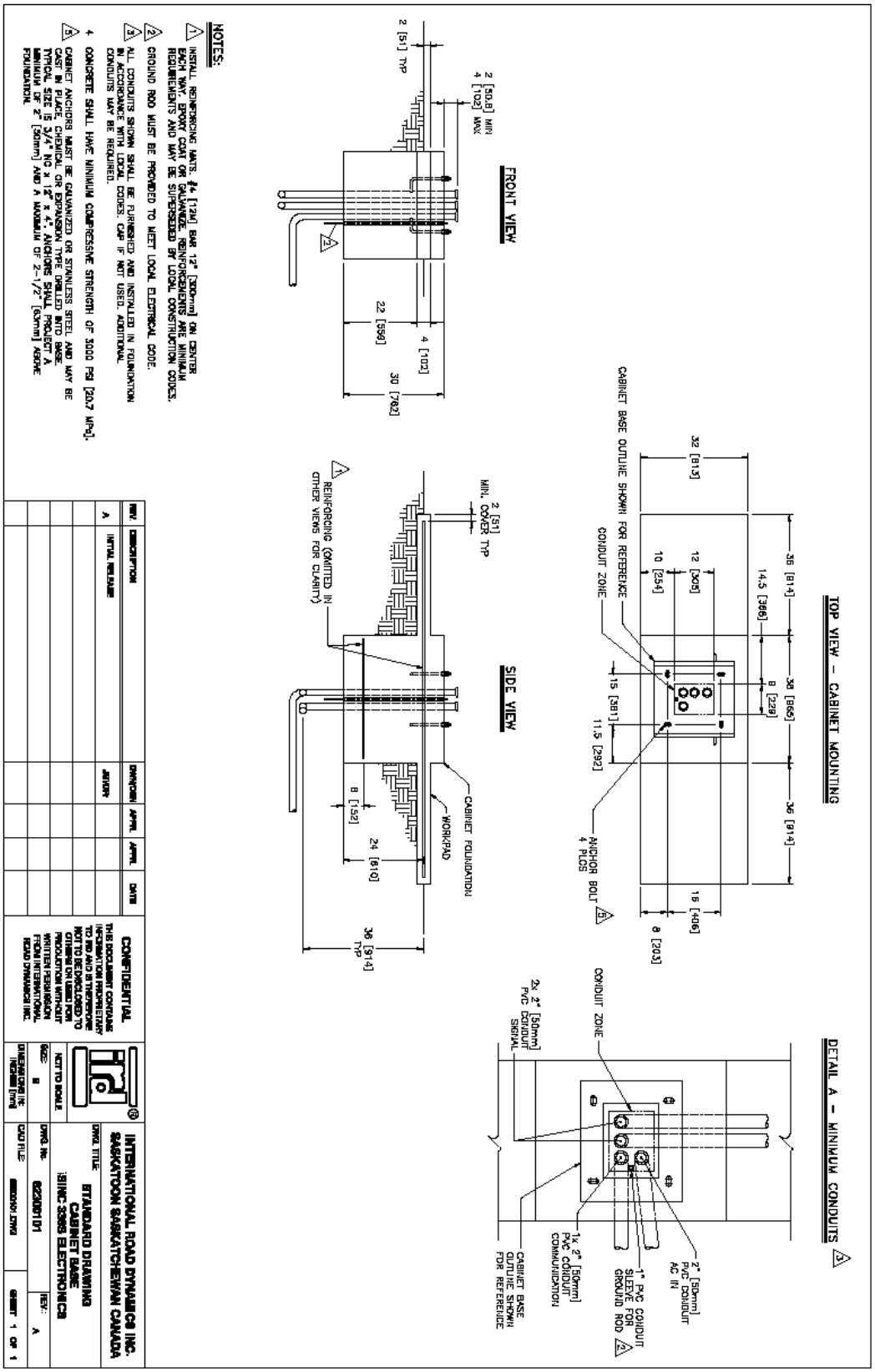
4.1.2 PICTURES, WIM SITE



4.1.3 SITE DRAWING & LAYOUT



4.1.4 WIM CABINET CONCRETE PEDESTAL



4.1.5 ELECTRICAL READINGS

International Road Dynamics Inc.

Site Service Sheet

Clear

System Type: iSINC/PAT BP

Date: 1/30/2008 **State:** California **Location:** SR-99 NB MP 32.5
Job #: SO#10407M **Site #:** **LTPP ID:** 60200

	Lane - 1		Lane -		Lane -		Lane -	
Loops	**Lead**	**Trail**						
Resistance	1.0	1.0						
Leakage	inf.	inf.						
Inductance	155mH	150mH						
Frequency	N/A	N/A						

	Lane - 1		Lane -		Lane -		Lane -	
Weighpads	**Lead**	**Trail**						
Supply	971	972						
Signal	844	845						
Shield	inf.	inf.						
Zero Pt	0.0mV	0.1mV						
Serial #								

Piezos								
Amplitude								
Capacitance								
Resistance								

System

A/C Service	N/A
Power Supply	N/A
Solar Panel	14.0vdc
Back-Up	14.0vdc
System Input	11.33vdc
Modem Power	13.87vdc
Phone off hook	N/A
Phone on hook	N/A

Technician: Richard Maynard **Date:** 1/30/2008

5.0 WIM CALIBRATION

5.1.1 TEST TRUCK #1 INFORMATION

DATE OF CALIBRATION: **January 30, 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		11740		D
B		27080		D (B&C combined)
C				
D		23980		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)
	62800		62800

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

9. TRACTOR MANUFACTURER:
   Make: Kenworth
   Model:

10. TRAILER LOAD DESCRIPTION: Lumber

11. TRAILER TARE WEIGHT (lb): _____

12. AXLE SPACINGS

Axle	Spacing (feet & inches)
A-B	18.4'
B-C	4.3'
C-D	32’
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	11R24.5	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


California
Cascade
Industries
33

5.1.3 TEST TRUCK #2 INFORMATION

DATE OF CALIBRATION: **January 30, 2008**

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		11980		D
B		30580		D (B&C combined)
C				
D		36020		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)
	78580		78580

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

9. TRACTOR MANUFACTURER:
   Make: Kenworth
   Model:

10. TRAILER LOAD DESCRIPTION: Lumber

11. TRAILER TARE WEIGHT (lb): _____

12. AXLE SPACINGS

Axle	Spacing (feet & inches)
A-B	18.4’
B-C	4.3’
C-D	26.8’
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 – 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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California
Cascade
Industries
SACTO, CA
ICC MC-295462
US DOT 399789

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				62.8	11.7	27.1	24.0	18.4	4.3	32.0	4.3
2				78.6	12.0	30.6	36.0	18.4	4.3	26.8	10.1

b

Dynamic Test Vehicle Measurements

ID	V#	Speed	Temp	GVW	F/A	T1	T2	1>2	2>3	3>4	4>5
1	61938	65	52	63.5	11.6	27.4	24.5	18.4	4.2	32.1	4.3
2	62029	64	52	77.9	11.9	29.8	36.0	18.4	4.3	26.8	10.1
2	62113	64	52	79.3	12.0	30.6	36.6	18.4	4.3	26.8	10.1
1	62141	63	52	62.6	11.7	26.9	24.0	18.4	4.2	32.0	4.3
2	62234	64	52	78.7	12.2	29.9	36.6	18.4	4.3	26.9	10.0
1	62256	65	52	63.2	11.8	27.3	24.1	18.4	4.2	32.1	4.3
2	62345	64	52	78.9	11.9	31.1	35.8	18.4	4.3	26.8	10.1
1	62383	59	52	63.2	11.7	27.1	24.4	18.4	4.2	31.8	4.2
1	62488	59	54	62.8	12.0	26.9	23.9	18.3	4.2	31.9	4.2
2	62547	59	54	78.1	11.8	30.6	35.6	18.4	4.3	26.8	10.0
1	62596	59	54	63.3	11.9	26.9	24.6	18.4	4.2	32.0	4.3
2	62654	60	54	78.1	11.9	30.3	35.9	18.4	4.3	26.8	10.1
1	62700	54	54	63.4	11.6	27.1	24.7	18.4	4.2	32.0	4.3
2	62761	55	54	78.4	11.7	31.2	35.2	18.4	4.3	26.8	10.0
1	62824	55	54	62.9	11.6	27.2	24.2	18.4	4.2	32.1	4.3
2	62883	55	54	78.0	11.9	30.4	35.6	18.3	4.3	26.8	10.0
1	62937	50	54	63.0	11.5	27.6	23.9	18.5	4.2	32.2	4.3
2	62988	54	54	77.9	11.9	30.0	35.9	18.4	4.3	26.7	10.0
1	63070	54	55	63.0	11.5	27.0	24.5	18.4	4.2	32.0	4.3
2	63104	49	55	79.8	12.1	31.0	36.6	18.3	4.3	26.7	10.0
1	63185	50	55	62.5	11.6	26.9	24.1	18.4	4.2	32.0	4.3
2	63217	50	55	79.5	11.7	30.1	37.7	18.3	4.3	26.9	10.0
1	63290	50	55	63.0	12.0	27.2	23.8	18.4	4.2	32.0	4.3
2	63323	50	55	79.9	11.6	30.5	37.6	18.3	4.3	26.7	10.0
1	63392	62	55	63.4	11.9	27.1	24.5	18.4	4.2	32.1	4.3
2	63437	64	55	78.1	11.9	30.5	35.6	18.3	4.3	26.7	10.0
1	63490	65	55	63.3	11.7	27.2	24.5	18.5	4.2	32.2	4.3
2	63549	64	55	78.5	11.9	30.9	35.6	18.3	4.3	26.7	10.0
1	63600	64	55	63.3	11.6	26.9	24.8	18.4	4.2	32.1	4.3
2	63654	59	55	77.2	11.5	30.2	35.6	18.3	4.3	26.8	10.0
1	63685	59	55	64.0	12.0	27.2	24.9	18.4	4.2	32.0	4.3
2	63751	59	55	79.0	11.9	30.7	36.5	18.3	4.3	26.7	10.0
1	63796	54	55	64.2	11.8	27.7	24.7	18.4	4.2	32.0	4.3
2	63893	55	55	78.2	11.7	30.5	36.1	18.4	4.3	26.9	10.0
1	63915	54	55	61.8	11.2	26.5	24.1	18.4	4.2	32.1	4.3
2	64010	55	55	77.9	12.1	30.7	35.1	18.3	4.2	26.7	10.0
1	64024	50	55	62.9	11.6	27.2	24.1	18.4	4.2	32.1	4.3
2	64122	50	55	78.6	11.6	31.3	35.7	18.3	4.2	26.8	10.0
1	64140	49	55	62.9	11.8	26.7	24.4	18.4	4.2	32.0	4.3
2	64234	50	55	77.9	11.7	30.0	36.2	18.3	4.3	26.6	10.0

Date:	2008/01/30
Technician:	Richard Maynard - IRD
Location:	Delhi LTPP - Hwy 99 NB

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	61938	65	52	1.1%	-0.9%	1.1%	2.1%	0.0	-0.1	0.1	0.0
2	62029	64	52	-0.9%	-0.8%	-2.6%	0.0%	0.0	0.0	0.0	0.0
2	62113	64	52	0.9%	0.0%	0.0%	1.7%	0.0	0.0	0.0	0.0
1	62141	63	52	-0.3%	0.0%	-0.7%	0.0%	0.0	-0.1	0.0	0.0
2	62234	64	52	0.1%	1.7%	-2.3%	1.7%	0.0	0.0	0.1	-0.1
1	62256	65	52	0.6%	0.9%	0.7%	0.4%	0.0	-0.1	0.1	0.0
2	62345	64	52	0.4%	-0.8%	1.6%	-0.6%	0.0	0.0	0.0	0.0
1	62383	59	52	0.6%	0.0%	0.0%	1.7%	0.0	-0.1	-0.2	-0.1
1	62488	59	54	0.0%	2.6%	-0.7%	-0.4%	-0.1	-0.1	-0.1	-0.1
2	62547	59	54	-0.6%	-1.7%	0.0%	-1.1%	0.0	0.0	0.0	-0.1
1	62596	59	54	0.8%	1.7%	-0.7%	2.5%	0.0	-0.1	0.0	0.0
2	62654	60	54	-0.6%	-0.8%	-1.0%	-0.3%	0.0	0.0	0.0	0.0
1	62700	54	54	1.0%	-0.9%	0.0%	2.9%	0.0	-0.1	0.0	0.0
2	62761	55	54	-0.3%	-2.5%	2.0%	-2.2%	0.0	0.0	0.0	-0.1
1	62824	55	54	0.2%	-0.9%	0.4%	0.8%	0.0	-0.1	0.1	0.0
2	62883	55	54	-0.8%	-0.8%	-0.7%	-1.1%	-0.1	0.0	0.0	-0.1
1	62937	50	54	0.3%	-1.7%	1.8%	-0.4%	0.1	-0.1	0.2	0.0
2	62988	54	54	-0.9%	-0.8%	-2.0%	-0.3%	0.0	0.0	-0.1	-0.1
1	63070	54	55	0.3%	-1.7%	-0.4%	2.1%	0.0	-0.1	0.0	0.0
2	63104	49	55	1.5%	0.8%	1.3%	1.7%	-0.1	0.0	-0.1	-0.1
1	63185	50	55	-0.5%	-0.9%	-0.7%	0.4%	0.0	-0.1	0.0	0.0
2	63217	50	55	1.1%	-2.5%	-1.6%	4.7%	-0.1	0.0	0.1	-0.1
1	63290	50	55	0.3%	2.6%	0.4%	-0.8%	0.0	-0.1	0.0	0.0
2	63323	50	55	1.7%	-3.3%	-0.3%	4.4%	-0.1	0.0	-0.1	-0.1
1	63392	62	55	1.0%	1.7%	0.0%	2.1%	0.0	-0.1	0.1	0.0
2	63437	64	55	-0.6%	-0.8%	-0.3%	-1.1%	-0.1	0.0	-0.1	-0.1
1	63490	65	55	0.8%	0.0%	0.4%	2.1%	0.1	-0.1	0.2	0.0
2	63549	64	55	-0.1%	-0.8%	1.0%	-1.1%	-0.1	0.0	-0.1	-0.1
1	63600	64	55	0.8%	-0.9%	-0.7%	3.3%	0.0	-0.1	0.1	0.0
2	63654	59	55	-1.8%	-4.2%	-1.3%	-1.1%	-0.1	0.0	0.0	-0.1
1	63685	59	55	1.9%	2.6%	0.4%	3.7%	0.0	-0.1	0.0	0.0
2	63751	59	55	0.5%	-0.8%	0.3%	1.4%	-0.1	0.0	-0.1	-0.1
1	63796	54	55	2.2%	0.9%	2.2%	2.9%	0.0	-0.1	0.0	0.0
2	63893	55	55	-0.5%	-2.5%	-0.3%	0.3%	0.0	0.0	0.1	-0.1
1	63915	54	55	-1.6%	-4.3%	-2.2%	0.4%	0.0	-0.1	0.1	0.0
2	64010	55	55	-0.9%	0.8%	0.3%	-2.5%	-0.1	-0.1	-0.1	-0.1
1	64024	50	55	0.2%	-0.9%	0.4%	0.4%	0.0	-0.1	0.1	0.0
2	64122	50	55	0.0%	-3.3%	2.3%	-0.8%	-0.1	-0.1	0.0	-0.1
1	64140	49	55	0.2%	0.9%	-1.5%	1.7%	0.0	-0.1	0.0	0.0
2	64234	50	55	-0.9%	-2.5%	-2.0%	0.6%	-0.1	0.0	-0.2	-0.1

6.1.3 OVERALL PERFORMANCE

International Road Dynamics Inc.

FHWA VERIFICATION

Specifications						
Confidence	95%	Speed range low	45	to	53
	(1.96)	Speed range medium	53	to	59
Gross vehicle weight	10%	Speed range high	59	to	70
Tandem group weight	15%	Temperature range low	50	to	52
Single axle weight	20%	Temperature range medium	52	to	54
Axle spacings	0.5	Temperature range high	54	to	56

Overall					
Characteristic	Error	StdDev	Specification	Calculated	Pass/Fail
Gross vehicle weight	0.2%	0.9%	10%	2.0%	pass
Tandem group weight	0.3%	1.6%	15%	3.4%	pass
Single axle weight	-0.6%	1.7%	20%	4.0%	pass
Axle spacings	0.0	0.1	0.5	0.2	pass

Speed range 45 to 53 (10 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	0.4%	0.8%	10%	2.1%
Tandem group weight	0.6%	1.8%	15%	4.2%
Single axle weight	-1.1%	2.0%	20%	4.3%
Axle spacings	0.0	0.1	0.5	0.2

Speed range 53 to 59 (17 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	0.0%	1.1%	10%	2.2%
Tandem group weight	0.2%	1.6%	15%	3.4%
Single axle weight	-0.7%	2.0%	20%	4.8%
Axle spacings	0.0	0.1	0.5	0.2

Speed range 59 to 70 (12 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	0.3%	0.7%	10%	1.7%
Tandem group weight	0.3%	1.5%	15%	3.2%
Single axle weight	-0.1%	1.0%	20%	2.2%
Axle spacings	0.0	0.1	0.5	0.1

Temperature range 50 to 52 (8 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	0.3%	0.7%	10%	1.7%
Tandem group weight	0.3%	1.4%	15%	3.1%
Single axle weight	0.0%	0.9%	20%	1.8%

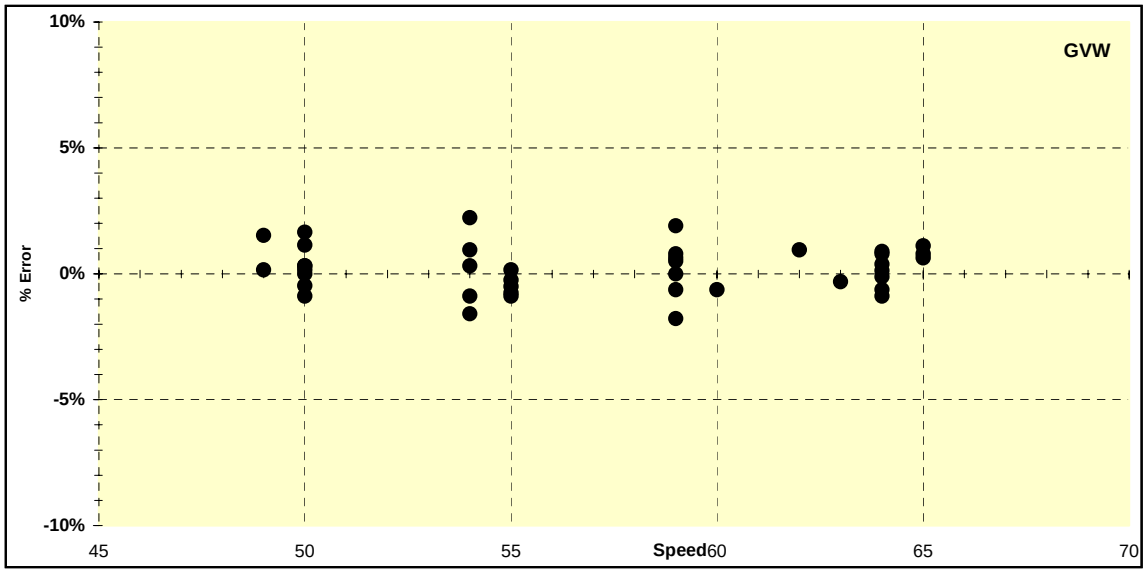
Temperature range 52 to 54 (10 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	-0.1%	0.7%	10%	1.4%
Tandem group weight	0.0%	1.4%	15%	2.8%
Single axle weight	-0.6%	1.5%	20%	3.7%

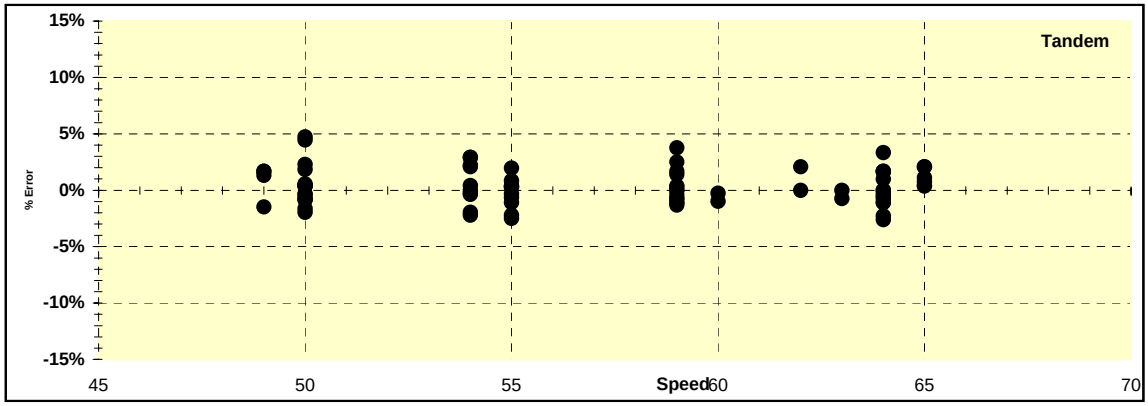
Temperature range 54 to 56 (22 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	0.3%	1.1%	10%	2.4%
Tandem group weight	0.5%	1.7%	15%	4.0%
Single axle weight	-0.9%	2.0%	20%	5.0%

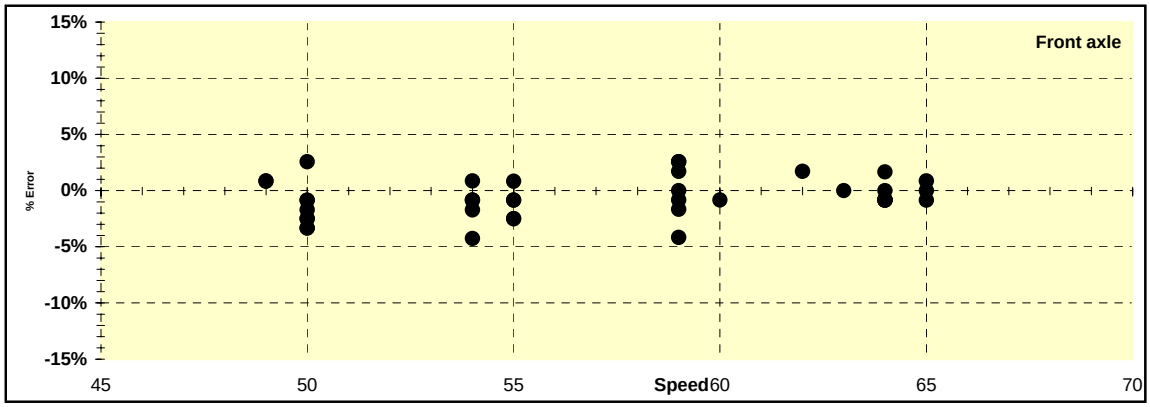
6.1.4 WEIGHT GRAPHS

International Road Dynamics Inc.

FHWA VERIFICATION







6.1.5 TEMPERATURE INFLUENCE GRAPHS

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