INTERNATIONAL ROAD DYNAMICS INC.

LTPP WIM DATA COLLECTION SYSTEMS

INSTALLATION AND CALIBRATION FOR PENNSYVANIA SPS-6 LTPP ID 420600

June 6, 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 Pennsylvania SPS-6 Weigh-in-Motion (WIM) site located on I-80 WB at mile post 158.2. The WIM site is instrumented with IRD's iSINC (Intelligent Sensor Interface Network Controller) WIM Electronic and Kistler Quartz Sensor's. The west bound driving lane is instrumented for WIM data collection consisting of two inductive loops and 8 Kistler Quartz sensors. The west bound passing lane is instrumented for classification data collection consisting of two inductive loops and one 12 ft. MSI BL class II sensor. The 12 ft. sensor was used in hopes improving capture of motorcycles. The WIM system uses a CDMA modem for communication. Power is provided by two 80 watt Solar Panels charging two 12 volt, 64 amp hr. batteries. The WIM Controller cabinet is located in the median.

The WIM equipment installation began on April 30, 2007 and was completed on May 2, 2007. The WIM system was commissioned and calibrated on May 21 and May 22, 2007 respectively.

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 (202) 493-3068
  - deborah.walker@fhwa.dot.gov

- Pennsylvania DOT
  - Joni Sharp (717) 787-0186
  - Leslie McCoy (717) 783-9972
  - Todd Rottet (717) 787-4574

- FHWA Division Office, Division Representative
  - Zahur Siddiqui (717) 221-3410

- Stantec - LTPP Regional Support Contractor (RSC)
  - Basel Abukhater (716) 632-0804

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

3.0 SHEET 16 – SITE CALIBRATION SUMMARY

SITE CALIBRATION INFORMATION

1. DATE OF CALIBRATION (MONTH/DAY/YEAR): **May 22, 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	**1.5%**	STANDARD DEVIATION **2.6%**
SINGLE AXLE MEAN DIFFERENCE	-**0.8%**	STANDARD DEVIATION **3.8%**
DOUBLE AXLES MEAN DIFFERENCE	**1.8%**	STANDARD DEVIATION **3.6%**

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

9. DEFINE THE SPEED RANGES USED (MPH): **45 - 52, 52 - 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 iSINC FINAL SITE CALIBRATION FACTORS PENNSYLVANIA

Calibration >							
Select Lane		4					
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	3071	3040	3024	3024	3040

Select Lane		4					
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	3245	3213	3196	3196	3213

Select Lane		4					
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	3071	3040	3024	3024	3040

Select Lane		4					
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	3245	3213	3196	3196	3213

3.1.2 iSINC SET-UP SITE PARAMETERS

Lane Name			4
Lane State			ENABLED
Upstream Loop >		Loop State	ENABLED
		Module UID	9
		Channel Num	2
		Polarity Active	LOW
		Width (cm)	250
Downstream Loop >		Loop State	ENABLED
		Module UID	9
		Channel Num	3
		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)	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
		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
		Distance(cm)	579
		Temp State	ENABLED
		Temp Module UID	5
		Temp Channel Num	0

DIOM Debounce Times >	Loop On (ticks)	40	
	Loop Off (ticks)	40	
	OvrHgt On (ticks)	40	
	OvrHght Off (ticks)	0	
	Axle On (ticks)	40	
	Axle Off (ticks)	40	
Axle Snsor Debounce >	Type	KISTLER_DUAL	PIEZO
	On (ticks)	8	8
	Off (ticks)	40	40

3.1.3 iSINC SET-UP PROCESSING

Processing >	MaxTimeout(ms)		3000
	Dynamic Comp(%)		100
	Sig Wt Diff(%)		40
	Min Axle Wt(kg)		1360
	Veh Rec Mode		Split
	Axl Sep(cm)		246

4.0 WIM SITE INVENTORY

1. ROUTE I-80 MILEPOST:158.2 LTPP DIRECTION: N S E **W**

2. SITE DESCRIPTION
   GRADE: 1%
   ☐ Sag vertical
   Nearest SPS section upstream of the site: 420600
   Distance from sensor to nearest upstream SPS Section: 7 Miles

3. LANE CONFIGURATION
   Number of lanes in LTPP direction: 2 lanes
   Lane width: 12 ft.

☐ Median painted	☐ Shoulder curb and gutter
☐ Median physical barrier	☐ Shoulder paved AC
☒ Median grass	☒ Shoulder paved PCC
☐ Median none	☐ Shoulder unpaved

   Shoulder width: 10 ft.

4. PAVEMENT TYPE: 24 inch AC(19 inch base, 3 inch binder, 2 inch wearing). ***Base*** = Superpave PG-64-22 10 to < 30 million ESals 37.5 mm. ***Binder*** = Superpave PG-76-22 >/= 30 million ESals 19mm. ***Wearing*** = Superpave PG-76-22 >/= 30 million ESals 12.5 mm SRL-E

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

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: 70 ft
    Distance from sensors: 105 ft
    Type: 336
    Access controlled by: ☐ LTPP / ☒ State / ☐ Joint
    Primary contact: Joni Sharp (717) 787-0186
    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: 2 ft
    Service provider: Verizon CDMA

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

14. TEST TRUCK CYCLE:
    Turnaround time: 10 minutes
    Turnaround distance: 7 miles

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

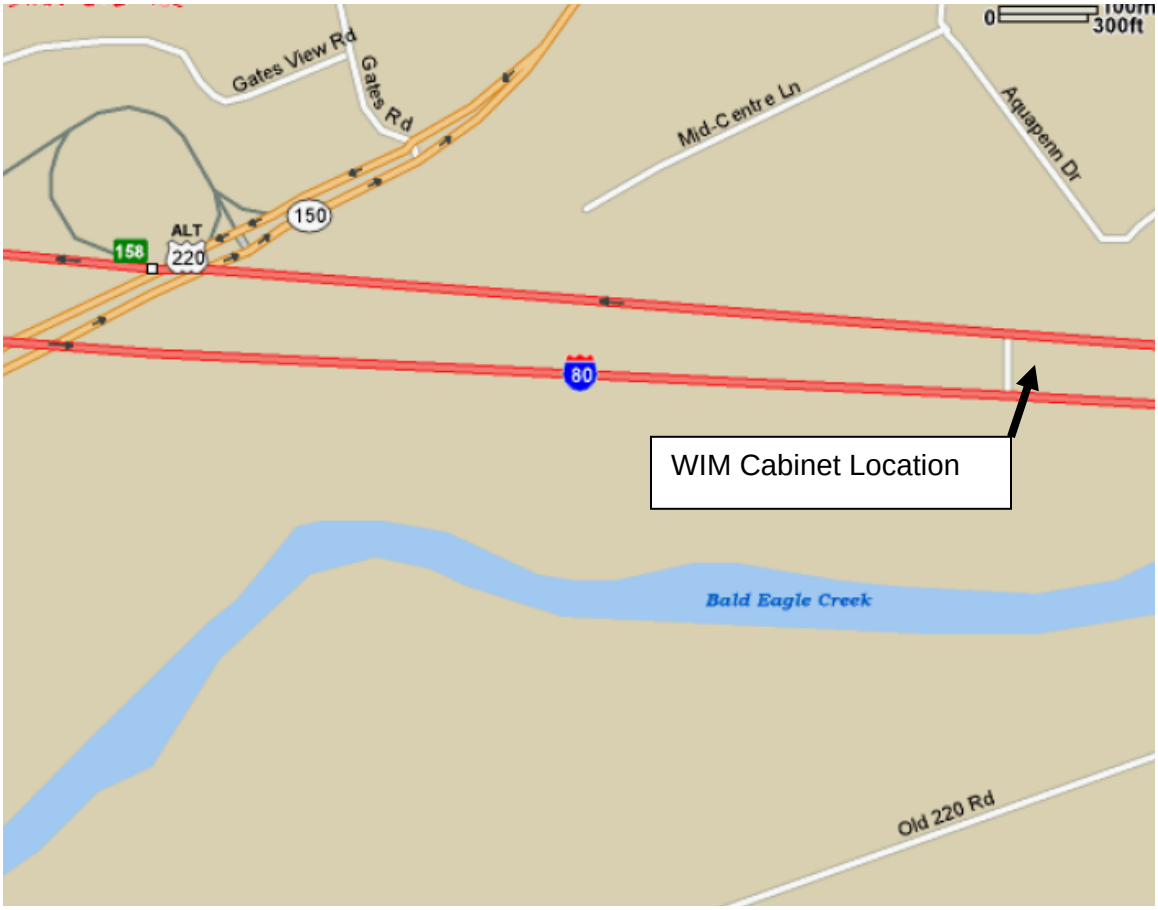
16. NOTES:

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

4.1.1 SITE MAP


Site Location
Eagleton Fields
Birch
Piper
Twin Hollows
Pottersdale
Oak Hill
Spruce
Clinton
Centre
Bear Swamp
Lock Haven
East Ferney
Woolrich
Farrandsville
Karthaus
Panther
Orviston
Keewaydin
Pine Glen
Kato
Big Run
Guenot Settlement
German Settlement
Romola
Parvin
Mowry
Moshannon
Snow Shoe
Eagleville
Sylvan Grove
Butts
Howard
Lamar
Logan Mills
Kylertown
Peale
Gorton
Rhoads
Yarnell
Jacksonville
Tylersville
Lanse
Gum Stump
Fetzertown
Huckenberry
Hublersburg
Wolfs Store
Munson
Milesburg
Rebersburg
Mingoville
Spring Bank
Bellefonte
Forest
Madisonburg
Unionville
Beaver Mills
Millheim
Valley View
Us Hwy 220 Byp
Farmers Mills
Coburn
Hunter Park
Peru
Centre Hall
Penn Hall
Ingleby
Martha Furnace
Matternville
Houserville
Beaverdam
Park Forest Village
Old Fort
Red Mill
Locust Grove
State College
Tusseyville
Port Matilda
Scotia
Fruittown
Hannah
Panorama Village
Boalsburg
Rothrock
State Forest
Centre
Mifflin
Centre
Blair
Gatesburg
Marengo
Musser
Pine Grove Mills
Siglerville
Knobville
Milroy
Snook
Warriors Mark
Rockspring
Monroe Furnace
Seeger Place
Honey
Decatur
0
4km
4m

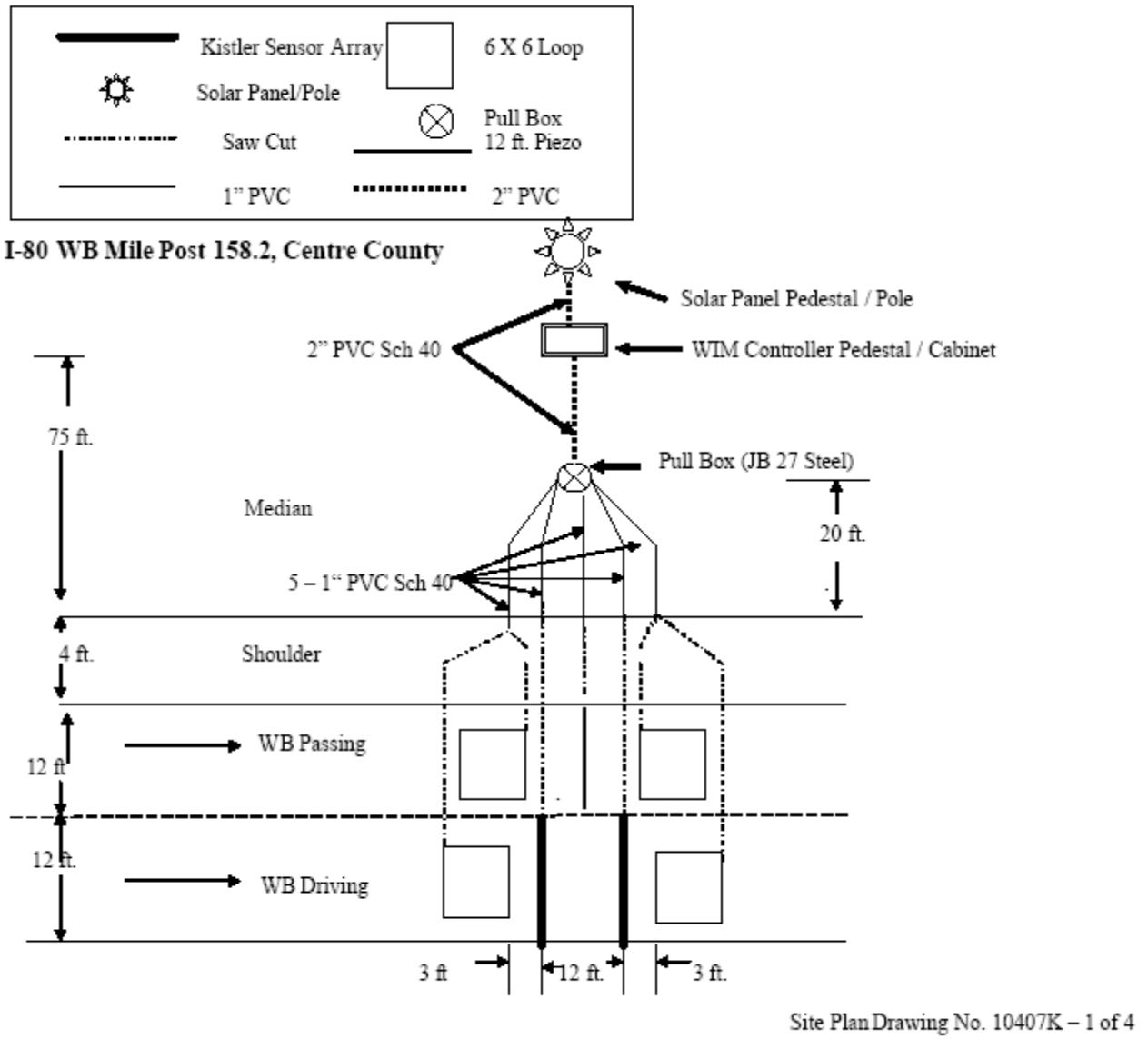
4.1.2 SITE MAP DETAILED



4.1.3 PICTURES, WIM SITE

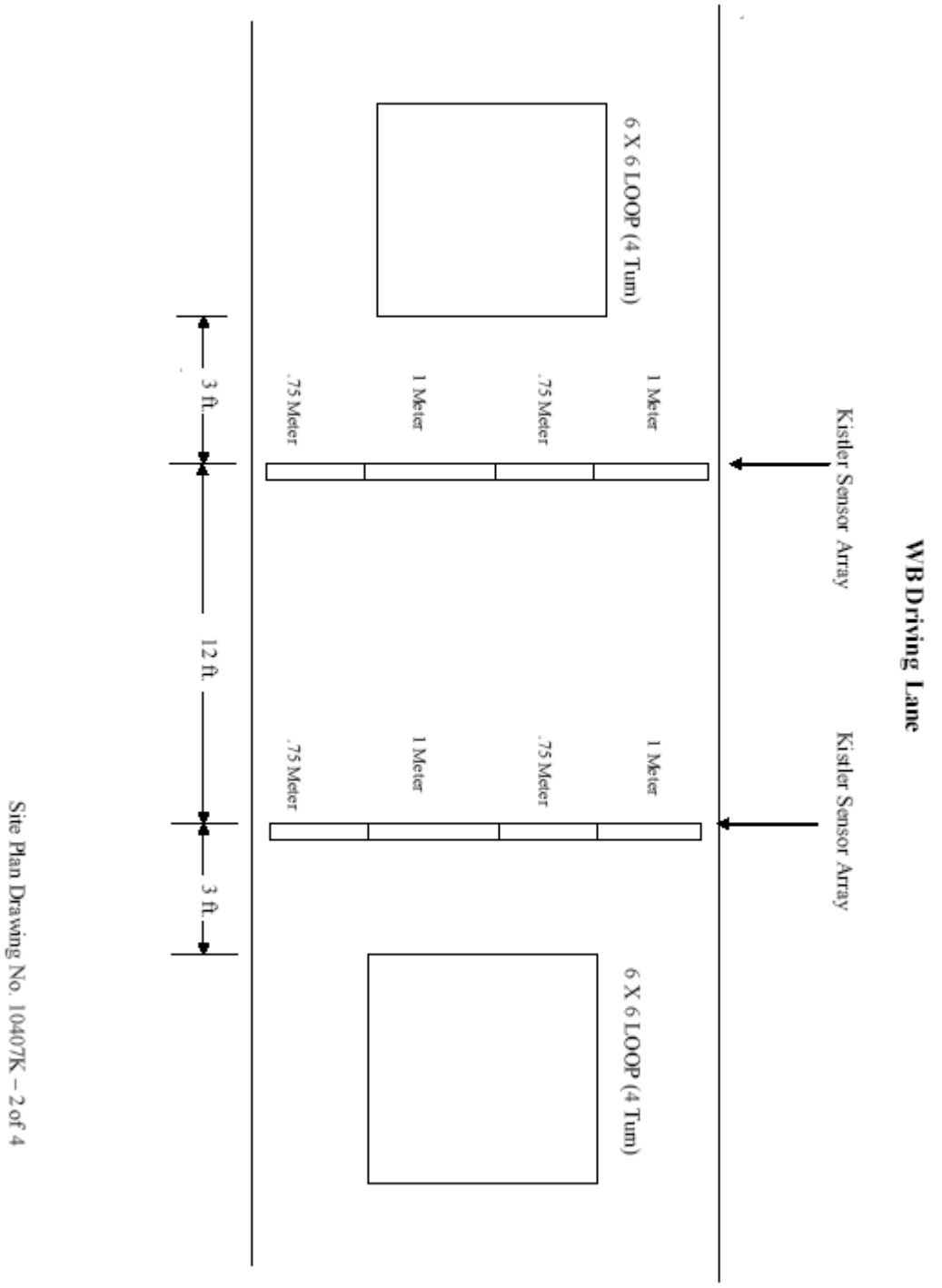
4.1.4 PICTURES, INSTALLATION

4.1.5 STE LAYOUT

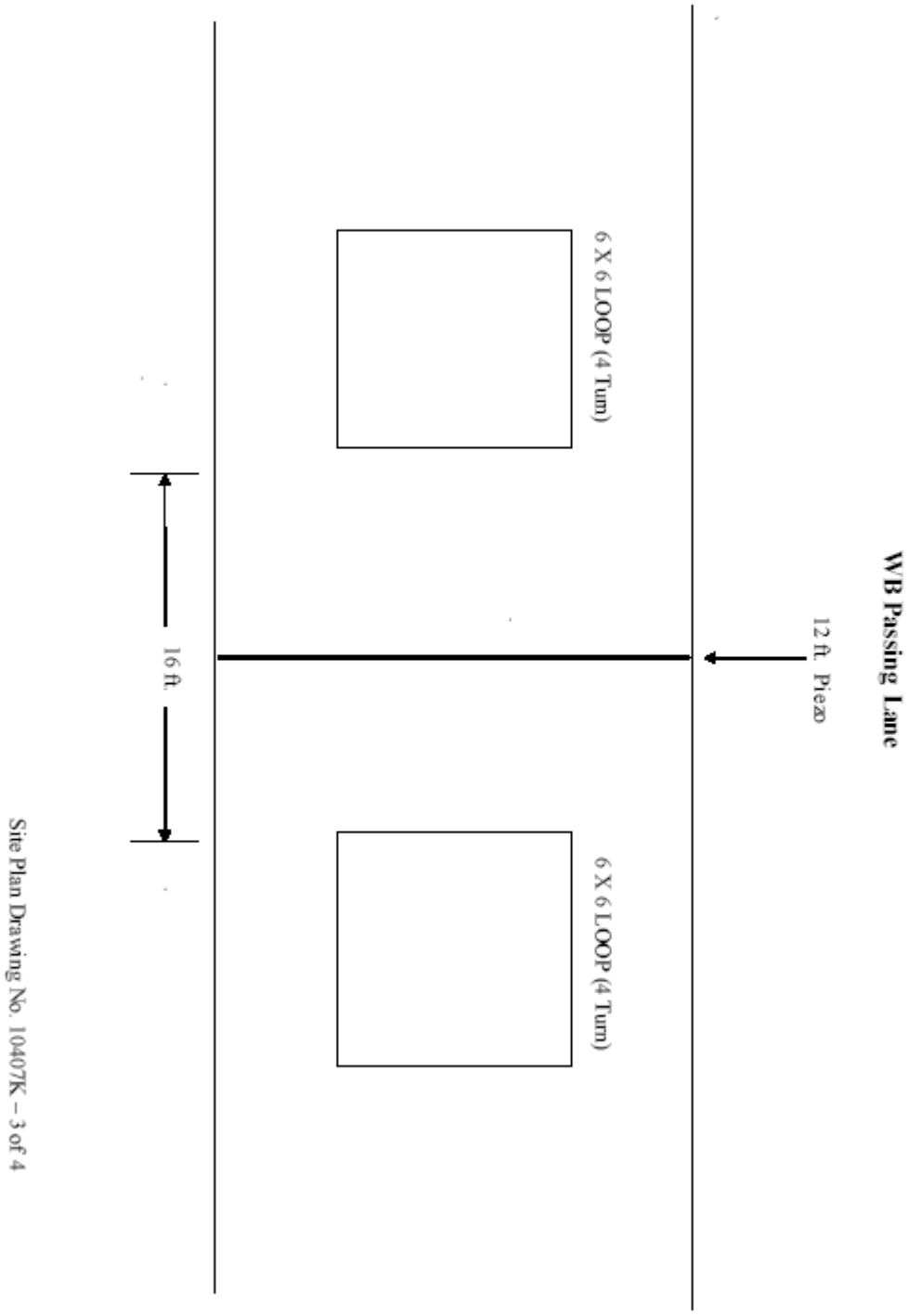


Site Plan Drawing No. 10407K – 1 of 4

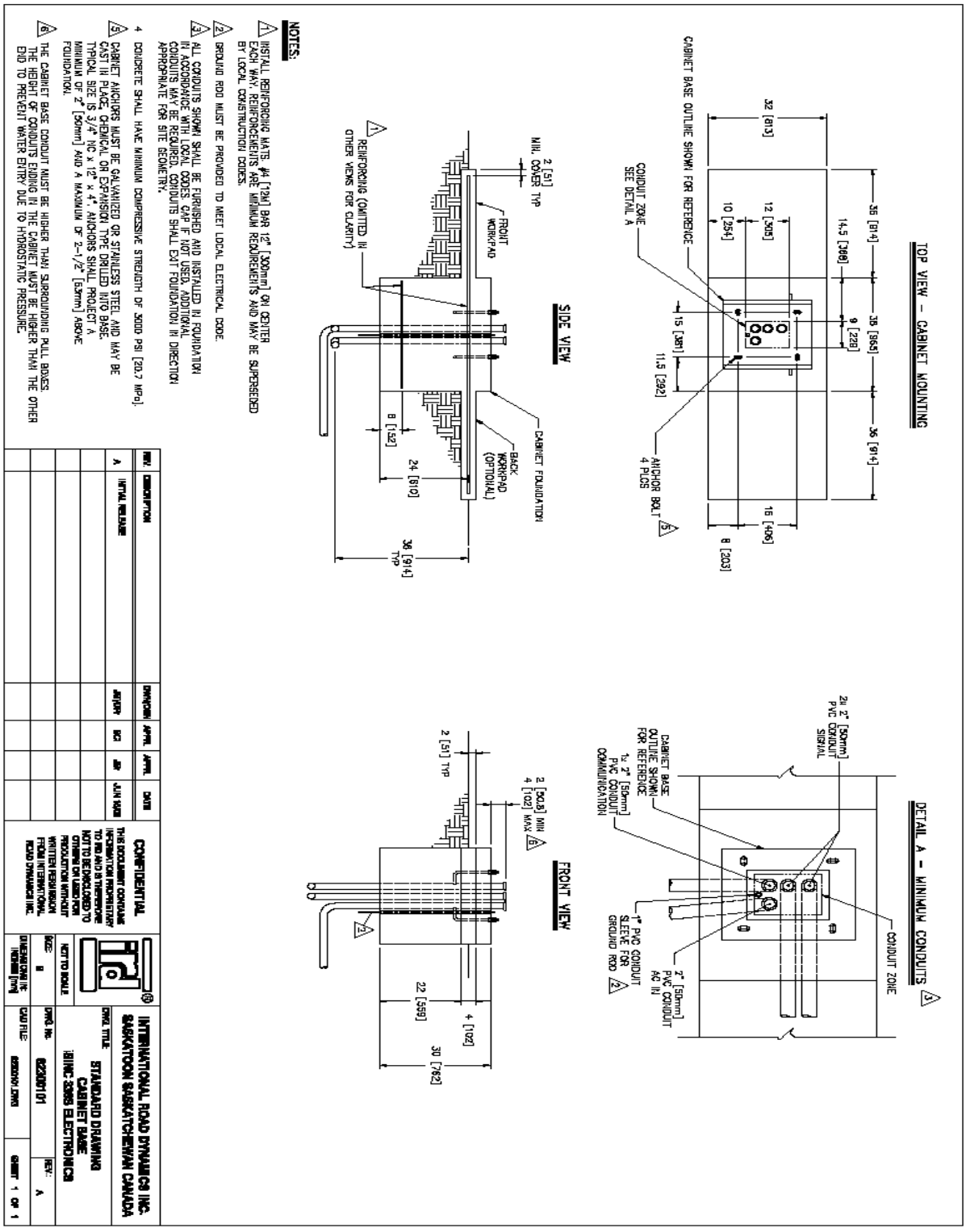
4.1.6 LTPP LANE SENSOR LAYOUT



4.1.7 CLASSIFICATION LANE



4.1.8 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	APPVL	APPVL	DATE
A	INITIAL RELEASE	ANTHONY	BCC	JBH	JUN 14/05

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DIMENSIONS IN: INCHES [mm]
SCALE: NOT TO SCALE

INTERNATIONAL ROAD DYNAMICS INC.
SASKATOON SASKATCHEWAN CANADA

DWG. TITLE: STANDARD DRAWING CABINET BASE IBIINC-3305 ELECTRONICS

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

4.1.9 ELECTRICAL READINGS

IRD

Site Service Sheet

Clear

System Type: iSINC / Kistler Quartz

Date: 5/21/2007 **State:** PA **Location:** Milesburg PA
Job #: 10407K **Site #:** **Directions:** I-80 WB Mile Post 158.2

Loops	**Lane**	**Lead 3 WB**	**Trail 3 WB**	**Lead 4 WB**	**Trail 4 WB**				
Resistance		1.1 ?	1.2?	1.1?	1.2?				
Leakage		inf	inf	inf	inf				
Inductance uH		129.0	135.0	130.0	133.0				
Frequency									

Kistler	**Lane - 1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Amplitude									
Capacitance									
Resistance									
Serial #									

Kistler	**Lane - 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Amplitude									
Capacitance									
Resistance									
Serial #									

Piezo	**Lane - 3**	**1**							
Amplitude		OK							
Capacitance		11.6 nF							
Resistance		inf.							
Serial #									

Kistler	**Lane - 4**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Amplitude		OK	OK	OK	OK	OK	OK	OK	OK
Capacitance		6.7 nF	7.3nF	7.5 nF	7.1 nF	8 nF	7.2 nF	7.8 nF	7.1 nF
Resistance		inf	inf	inf	inf	inf	inf	inf	inf
Serial #		1305664	1381868	1395489	1383815	1397414	1397599	1390000	1381877

System

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

Temp Sensor

White+	
Red +	

Software

System	iSINC

Site Full Operating Capacity **Pass** **Fail**

Technician: Steven Schroader **Date:** 5/21/2007

5.0 WIM CALIBRATION

5.1.1 TEST TRUCK #1 INFORMATION

DATE OF CALIBRATION: **May 22, 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		10280		D
B		30660		D (B&C combined)
C				
D		36780		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)
	77720		77720

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

9. TRACTOR MANUFACTURER:
   Make: Peterbuilt
   Model:

10. TRAILER LOAD DESCRIPTION: Steel Beams

11. TRAILER TARE WEIGHT (lb): _____

12. AXLE SPACINGS

Axle	Spacing (feet & inches)
A-B	16.6'
B-C	4.5'
C-D	27.2’
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	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: **May 22, 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		10680		D
B		20360		D (B&C combined)
C				
D		31640		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)
	62680		62680

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

9. TRACTOR MANUFACTURER:
   Make: Peterbuilt
   Model:

10. TRAILER LOAD DESCRIPTION: Steel Beams

11. TRAILER TARE WEIGHT (lb): _____

12. AXLE SPACINGS

Axle	Spacing (feet & inches)
A-B	15.1’
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	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

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				62.7	10.7	20.4	31.6	15.0	4.2	30.4	10.0
2				77.7	10.3	30.7	36.8	16.5	4.4	27.1	10.0

b

Dynamic Test Vehicle Measurements

ID	V#	Speed	Temp	GVW	F/A	T1	T2	1>2	2>3	3>4	4>5
1	316	49	82	63.9	11.5	21.9	31.0	15.5	4.4	30.8	10.2
2	317	49	82	80.8	10.8	31.7	38.3	16.8	4.4	27.5	10.2
1	453	58	82	65.2	10.9	21.3	33.0	15.5	4.4	30.7	10.1
2	454	59	82	83.1	10.7	31.6	40.7	16.9	4.4	27.6	10.3
1	591	64	86	68.0	10.7	21.1	36.1	15.4	4.3	30.5	10.1
2	591	65	86	79.5	10.3	30.7	38.5	16.8	4.4	27.4	10.2
1	726	47	91	63.2	10.8	20.6	31.8	15.4	4.3	30.5	10.0
2	727	50	91	81.5	11.0	31.7	38.8	16.6	4.3	27.1	10.1
1	859	57	87	66.0	11.1	21.9	33.0	15.4	4.3	30.3	10.0
2	862	58	87	81.0	10.4	31.0	39.6	16.4	4.3	26.9	10.0
1	1035	65	90	64.6	10.7	21.6	32.4	15.3	4.3	30.4	10.0
2	1037	67	90	80.6	10.6	31.4	38.6	16.5	4.3	27.0	10.0
1	1201	57	93	64.1	10.8	20.8	32.6	15.3	4.3	30.3	10.0
2	1202	57	93	81.9	10.6	31.6	39.7	16.7	4.4	27.1	10.1
1	1332	59	91	62.3	10.3	20.1	31.8	15.3	4.3	30.4	10.0
2	1338	60	91	79.3	10.5	30.6	38.3	16.6	4.3	27.1	10.1
1	1480	65	95	62.4	10.4	20.6	31.3	15.3	4.3	30.4	10.0
2	1482	67	95	78.8	10.1	30.7	38.0	16.5	4.3	26.9	10.0
1	2291	55	107	62.8	10.8	20.8	31.2	15.3	4.3	30.4	10.0
2	2293	55	107	77.8	10.2	30.1	37.6	16.7	4.3	27.1	10.1
1	2437	65	108	63.0	10.0	21.1	31.9	15.4	4.3	30.6	10.0
2	2438	65	108	77.9	9.9	30.6	37.4	16.5	4.3	27.0	10.1
1	2617	67	111	62.1	10.3	20.6	31.5	15.3	4.3	30.4	10.0
2	2618	65	111	78.3	10.2	30.8	37.3	16.6	4.3	27.1	10.1
1	2744	65	114	64.5	10.5	21.3	32.7	15.3	4.3	30.5	10.0
2	2746	64	114	76.5	10.2	30.3	36.2	16.5	4.3	26.9	10.0
1	2938	58	113	63.3	11.1	20.7	31.5	15.4	4.4	30.5	10.1
2	2942	60	113	78.0	10.0	30.2	37.8	16.6	4.3	27.1	10.0
1	3099	67	114	64.9	11.0	21.9	32.0	15.3	4.3	30.5	10.0
2	3103	65	114	77.6	9.8	30.0	37.9	16.6	4.3	27.1	10.0
1	3283	60	114	65.2	10.3	21.6	33.3	15.3	4.3	30.3	10.0
2	3284	63	114	76.9	9.8	29.6	37.4	16.5	4.3	27.2	10.0
1	3525	68	118	62.2	10.5	20.0	31.5	15.4	4.3	30.6	10.1
2	3531	69	118	77.7	10.1	30.1	37.5	16.6	4.3	27.1	10.1
1	3762	60	118	61.7	10.2	19.4	32.0	15.3	4.3	30.4	10.0
1	3969	67	116	62.1	10.3	20.2	31.6	15.4	4.4	30.4	10.0
2	3974	67	116	76.5	9.7	29.0	37.9	16.6	4.3	27.2	10.1
1	4144	61	116	61.7	10.1	19.1	32.5	15.3	4.3	30.5	10.0
2	4147	59	116	75.3	9.4	28.2	37.8	16.6	4.3	27.1	10.1

Date:	2007/05/22
Technician:	Bruce Myers
Location:	LTPP Pennsylvania

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	316	49	82	1.9%	7.5%	7.4%	-1.9%	0.5	0.2	0.4	0.2
2	317	49	82	4.0%	4.9%	3.3%	4.1%	0.3	0.0	0.4	0.2
1	453	58	82	4.0%	1.9%	4.4%	4.4%	0.5	0.2	0.3	0.1
2	454	59	82	6.9%	3.9%	2.9%	10.6%	0.4	0.0	0.5	0.3
1	591	64	86	8.5%	0.0%	3.4%	14.2%	0.4	0.1	0.1	0.1
2	591	65	86	2.3%	0.0%	0.0%	4.6%	0.3	0.0	0.3	0.2
1	726	47	91	0.8%	0.9%	1.0%	0.6%	0.4	0.1	0.1	0.0
2	727	50	91	4.9%	6.8%	3.3%	5.4%	0.1	-0.1	0.0	0.1
1	859	57	87	5.3%	3.7%	7.4%	4.4%	0.4	0.1	-0.1	0.0
2	862	58	87	4.2%	1.0%	1.0%	7.6%	-0.1	-0.1	-0.2	0.0
1	1035	65	90	3.0%	0.0%	5.9%	2.5%	0.3	0.1	0.0	0.0
2	1037	67	90	3.7%	2.9%	2.3%	4.9%	0.0	-0.1	-0.1	0.0
1	1201	57	93	2.2%	0.9%	2.0%	3.2%	0.3	0.1	-0.1	0.0
2	1202	57	93	5.4%	2.9%	2.9%	7.9%	0.2	0.0	0.0	0.1
1	1332	59	91	-0.6%	-3.7%	1.5%	0.6%	0.3	0.1	0.0	0.0
2	1338	60	91	2.1%	1.9%	0.3%	4.1%	0.1	-0.1	0.0	0.1
1	1480	65	95	-0.5%	-2.8%	1.0%	-0.9%	0.3	0.1	0.0	0.0
2	1482	67	95	1.4%	-1.9%	0.0%	3.3%	0.0	-0.1	-0.2	0.0
1	2291	55	107	0.2%	0.9%	2.0%	-1.3%	0.3	0.1	0.0	0.0
2	2293	55	107	0.1%	-1.0%	2.0%	2.2%	0.2	-0.1	0.0	0.1
1	2437	65	108	0.5%	-6.5%	3.4%	0.9%	0.4	0.1	0.2	0.0
2	2438	65	108	0.3%	-3.9%	0.3%	1.6%	0.0	-0.1	-0.1	0.1
1	2617	67	111	-1.0%	-3.7%	1.0%	-0.3%	0.3	0.1	0.0	0.0
2	2618	65	111	0.8%	-1.0%	0.3%	1.4%	0.1	-0.1	0.0	0.1
1	2744	65	114	2.9%	-1.9%	4.4%	3.5%	0.3	0.1	0.1	0.0
2	2746	64	114	-1.5%	-1.0%	1.3%	-1.6%	0.0	-0.1	-0.2	0.0
1	2938	58	113	1.0%	3.7%	1.5%	-0.3%	0.4	0.2	0.1	0.1
2	2942	60	113	0.4%	-2.9%	1.6%	2.7%	0.1	-0.1	0.0	0.0
1	3099	67	114	3.5%	2.8%	7.4%	1.3%	0.3	0.1	0.1	0.0
2	3103	65	114	-0.1%	-4.9%	2.3%	3.0%	0.1	-0.1	0.0	0.0
1	3283	60	114	4.0%	-3.7%	5.9%	5.4%	0.3	0.1	-0.1	0.0
2	3284	63	114	-1.0%	-4.9%	3.6%	1.6%	0.0	-0.1	0.1	0.0
1	3525	68	118	-0.8%	-1.9%	2.0%	-0.3%	0.4	0.1	0.2	0.1
2	3531	69	118	0.0%	-1.9%	2.0%	1.9%	0.1	-0.1	0.0	0.1
1	3762	60	118	-1.6%	-4.7%	4.9%	1.3%	0.3	0.1	0.0	0.0
1	3969	67	116	-1.0%	-3.7%	1.0%	0.0%	0.4	0.2	0.0	0.0
2	3974	67	116	-1.5%	-5.8%	5.5%	3.0%	0.1	-0.1	0.1	0.1
1	4144	61	116	-1.6%	-5.6%	6.4%	2.8%	0.3	0.1	0.1	0.0
2	4147	59	116	-3.1%	-8.7%	8.1%	2.7%	0.1	-0.1	0.0	0.1

6.1.3 OVERALL PERFORMANCE

International Road Dynamics Inc.

FHWA VERIFICATION

Specifications					
Confidence	95%	Speed range low	45	to	52
	(1.96)	Speed range medium	52	to	60
Gross vehicle weight	10%	Speed range high	60	to	70
Tandem group weight	15%	Temperature range low	80	to	93
Single axle weight	20%	Temperature range medium	93	to	106
Axle spacings	0.5	Temperature range high	106	to	120

Overall					
Characteristic	Error	StdDev	Specification	Calculated	Pass/Fail
Gross vehicle weight	1.5%	2.6%	10%	6.7%	pass
Tandem group weight	1.8%	3.6%	15%	8.9%	pass
Single axle weight	-0.8%	3.8%	20%	8.1%	pass
Axle spacings	0.1	0.2	0.5	0.4	pass

Speed range 45 to 52 (4 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	2.9%	1.9%	10%	6.7%
Tandem group weight	2.9%	2.9%	15%	8.7%
Single axle weight	5.0%	2.9%	20%	8.8%
Axle spacings	0.2	0.2	0.5	0.5

Speed range 52 to 60 (14 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	1.7%	2.6%	10%	7.0%
Tandem group weight	1.9%	3.7%	15%	9.2%
Single axle weight	-0.6%	3.7%	20%	8.0%
Axle spacings	0.1	0.1	0.5	0.4

Speed range 60 to 70 (21 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	1.2%	2.8%	10%	6.8%
Tandem group weight	1.6%	3.8%	15%	9.0%
Single axle weight	-2.0%	2.9%	20%	7.9%
Axle spacings	0.1	0.2	0.5	0.4

Temperature range 80 to 93 (16 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	3.7%	2.3%	10%	8.3%
Tandem group weight	3.8%	3.4%	15%	10.6%
Single axle weight	2.2%	2.8%	20%	7.9%

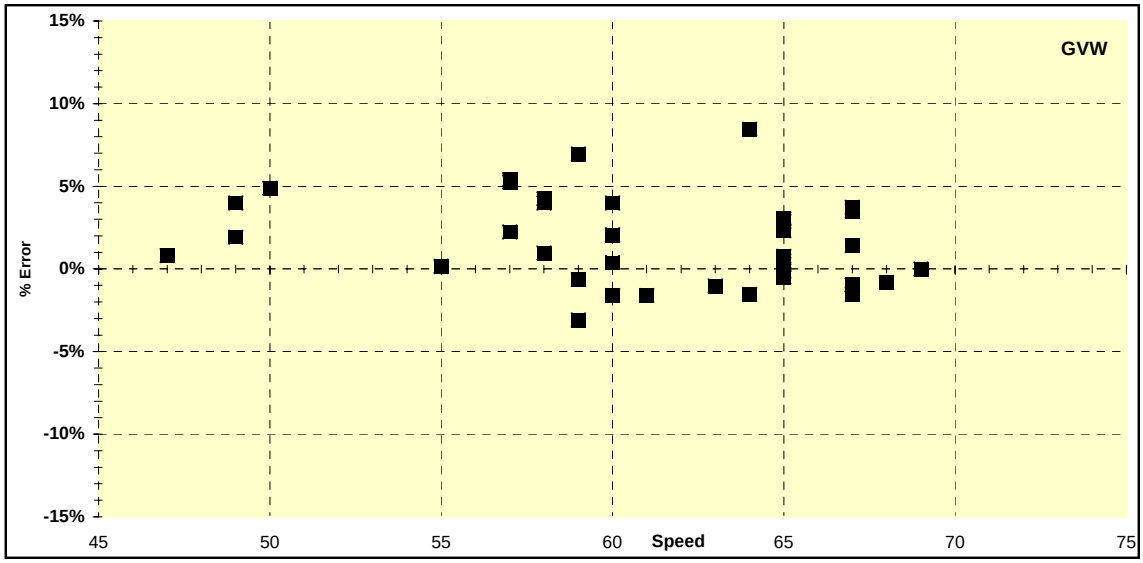
Temperature range 93 to 106 (2 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	0.5%	1.3%	10%	3.2%
Tandem group weight	0.8%	1.8%	15%	4.4%
Single axle weight	-2.4%	0.6%	20%	3.6%

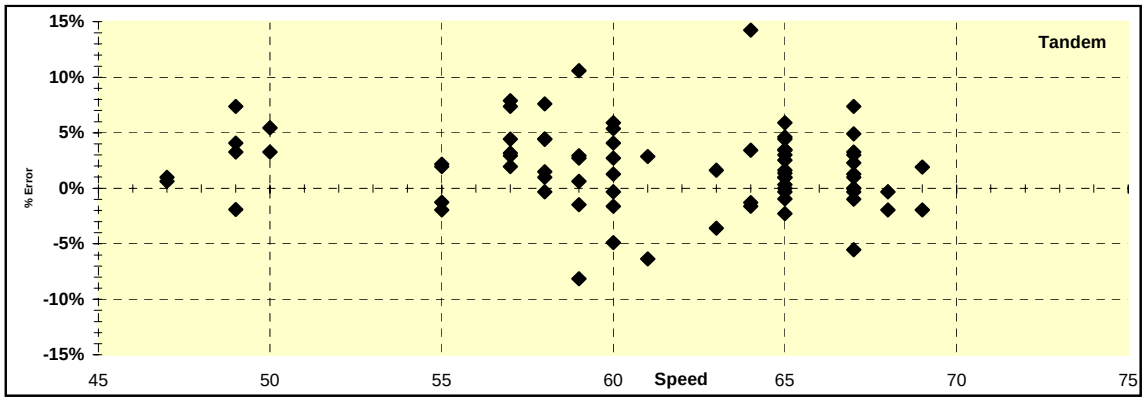
Temperature range 106 to 120 (21 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	0.0%	1.8%	10%	3.6%
Tandem group weight	0.4%	3.2%	15%	6.9%
Single axle weight	-2.9%	3.0%	20%	9.0%

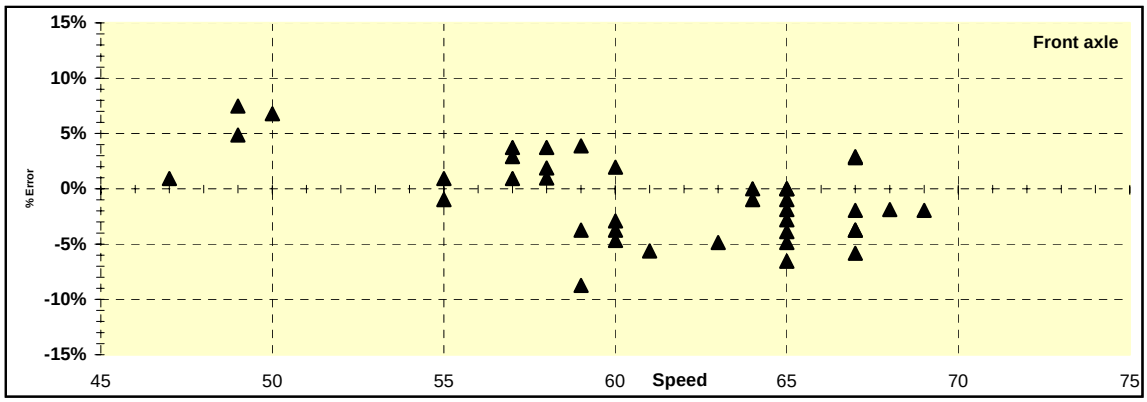
6.1.4 WEIGHT GRAPHS

International Road Dynamics Inc.

FHWA VERIFICATION







6.1.5 TEMPERATURE INFLUENCE GRAPHS

International Road Dynamics Inc.