INTERNATIONAL ROAD DYNAMICS INC.

LTPP WIM DATA COLLECTION SYSTEMS

INSTALLATION AND CALIBRATION FOR KANSAS SPS-2 LTPP ID 200200

June 23, 2006

CLIN 2004A TASK ORDER # 9

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 Kansas SPS-2 Weigh-in-Motion (WIM) site located on I-70 at mile post 287.5 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 west bound outside lane is instrumented for WIM data collection consisting of two inductive loops and two bending plates. The WIM system will use a landline phone for communication and 120V A.C. to power the equipment. The utilities service drop is located approximately 430' upstream of the WIM cabinet at the existing Weather Station. As of June 19, 2006 the phone line had not been installed in the WIM cabinet.

The WIM equipment installation began on June 6, 2006 and was completed on June 8, 2006. The WIM system was calibrated on June 9, 2006.

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*. The speed and classification tests demonstrate the classification algorithm still needs improvement on class 4 and 5 vehicles. The classification test was carried out with the latest classification algorithm from LTPP's Expert Task Group installed in the ISINC WIM electronic.

2.0 POINT OF CONTACTS

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

- Kansas DOT
  - Bill Hughes
  - ph: (785) 296-6863
  - bhughes@ksdot.org

- FHWA Division Office, Division Representative
  - Jean Wallace
  - ph: (303) 969-6730

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

- De Bruce Grain – Calibration Truck Provider
  - Brent Martin –
  - ph: (785) 263-7275

3.0 SHEET 16 – SITE CALIBRATION SUMMARY

SITE CALIBRATION INFORMATION

1. DATE OF CALIBRATION (MONTH/DAY/YEAR): **June 9, 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 **25**

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 **2.2%** STANDARD DEVIATION **1.8%**
   SINGLE AXLE MEAN DIFFERENCE **2.3%** STANDARD DEVIATION **2.3%**
   DOUBLE AXLES MEAN DIFFERENCE **0.5%** STANDARD DEVIATION **4.0%**

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

9. DEFINE THE SPEED RANGES USED (MPH): **58 - 62, 63 - 67, 68 – 71**

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 **2 hour**
    NUMBER OF VEHICLES **150**
    NUMBER OF TRUCKS **54**

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
    FHWA CLASS 2 **0%**
    FHWA CLASS 3 **100%**
    FHWA CLASS 4&5 **92%**
    FHWA CLASS 8 **0%**
    FHWA CLASS 9 **0%**
    FHWA CLASS 12 **0%**
    "UNCLASSIFIED" VEHICLES: **0%**

15. PICTURES: _____

16. NOTES:
    _____

PERSON LEADING CALIBRATION EFFORT: **Tim Weber, Travis Holton**
CONTACT INFORMATION: **717-264-2077**

3.1.1 FINAL SITE CALIBRATION FACTORS KANSAS SPS-2 200200, I-70, MP 287.5

Time of Change : 6-9-2006 4:00 pm

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) **720**

Axle Sensors

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

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

Calibration

Lane **1**

Axle Sensor **1**
- Threshold **40**
- WIM Calib Factors
  - Speed Bin **1**
  - Max Speed **88 kph (55 mph)**
  - Calibration Factor **3625**
  - Speed Bin **2**
  - Max Speed **96 kph (60 mph)**
  - Calibration Factor **3625**
  - Speed Bin **3**
  - Max Speed **105 kph (65 mph)**
  - Calibration Factor **3590**
  - Speed Bin **4**
  - Max Speed **112 kph (70 mph)**
  - Calibration Factor **3665**
  - Speed Bin **5**
  - Max Speed **120 kph (75 mph)**
  - Calibration Factor **3700**

Axle Sensor **2**
- Threshold **40**
- WIM Calib Factors
  - Speed Bin **1**
  - Max Speed **88 kph (55 mph)**
  - Calibration Factor **3625**
  - Speed Bin **2**
  - Max Speed **96 kph (60 mph)**
  - Calibration Factor **3625**
  - Speed Bin **3**
  - Max Speed **105 kph (65 mph)**
  - Calibration Factor **3590**
  - Speed Bin **4**
  - Max Speed **112 kph (70 mph)**
  - Calibration Factor **3665**
  - Speed Bin **5**
  - Max Speed **120 kph (75 mph)**
  - Calibration Factor **3700**

3.1.2 INITIAL SITE CALIBRATION FACTORS KANSAS SPS-2 200200, I-70, MP 287.5

Time of Change : 6-9-2006 900 am

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) **720**

Axle Sensors

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

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

Calibration

Lane **1**

Axle Sensor **1**
- Threshold **40**

WIM Calib Factors
- Speed Bin **1**
- Max Speed **88 kph (55 mph)**
- Calibration Factor **3700**
- Speed Bin **2**
- Max Speed **96 kph (60 mph)**
- Calibration Factor **3700**
- Speed Bin **3**
- Max Speed **105 kph (65 mph)**
- Calibration Factor **3700**
- Speed Bin **4**
- Max Speed **112 kph (70 mph)**
- Calibration Factor **3700**
- Speed Bin **5**
- Max Speed **120 kph (75 mph)**
- Calibration Factor **3700**

Axle Sensor **2**
- Threshold **40**

WIM Calib Factors
- Speed Bin **1**
- Max Speed **88 kph (55 mph)**
- Calibration Factor **3700**
- Speed Bin **2**
- Max Speed **96 kph (60 mph)**
- Calibration Factor **3700**
- Speed Bin **3**
- Max Speed **105 kph (65 mph)**
- Calibration Factor **3700**
- Speed Bin **4**
- Max Speed **112 kph (70 mph)**
- Calibration Factor **3700**
- Speed Bin **5**
- Max Speed **120 kph (75 mph)**
- Calibration Factor **3700**

4.0 WIM SITE INVENTORY

1. ROUTE I-70 MILEPOST:287.5.7 LTPP DIRECTION: N S E **W**

2. SITE DESCRIPTION
   GRADE: <1%
   ☐ Sag vertical
   Nearest SPS section upstream of the site: 200212
   Distance from sensor to nearest upstream SPS Section: 1500 feet

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: 14inch jointed PCC- doweled

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

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: 70 ft
    Distance from sensors: 75 ft
    Type: 336
    Access controlled by: ☐ LTPP / ☒ State / ☐ Joint
    Primary contact: Bill Hughes (785) 296-6863
    Alternate contact:

11. POWER:
    Power type: ☐ Overhead / ☒ Underground / ☐ Solar
    Distance from cabinet to drop: 430 ft
    Service provider: A.C.

12. TELEPHONE:
    Telephone type: ☐ Overhead / ☒ Underground / ☐ Cell
    Distance from cabinet to drop: 430 ft
    Service provider: Not installed at this time

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

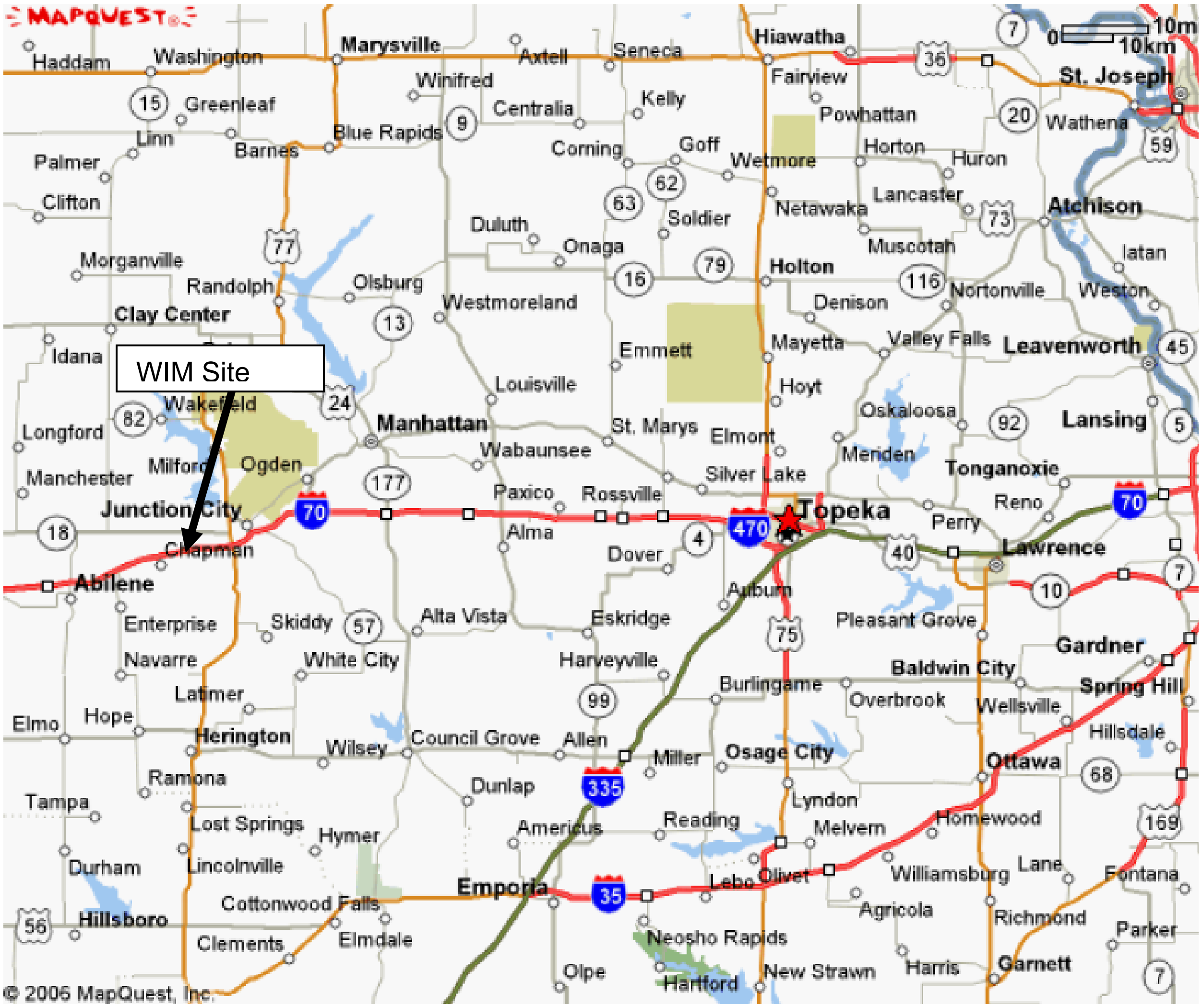
14. TEST TRUCK CYCLE:
    Turnaround time: 12 minutes
    Turnaround distance: 10 miles

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

16. NOTES:

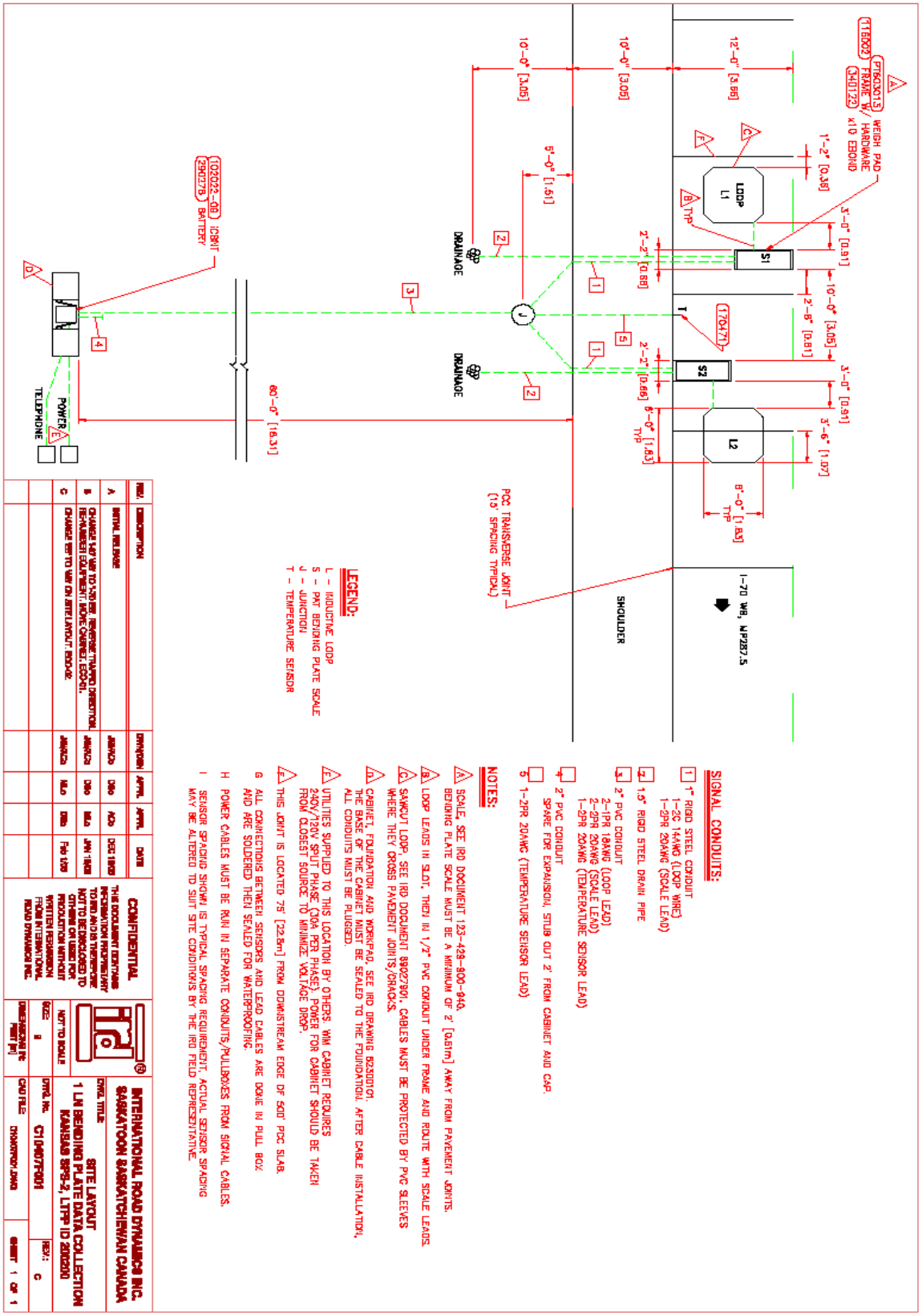
COMPLETED BY: **Bruce Myers**
CONTACT INFORMATION: **717-264-2077**

4.1.1 SITE MAP

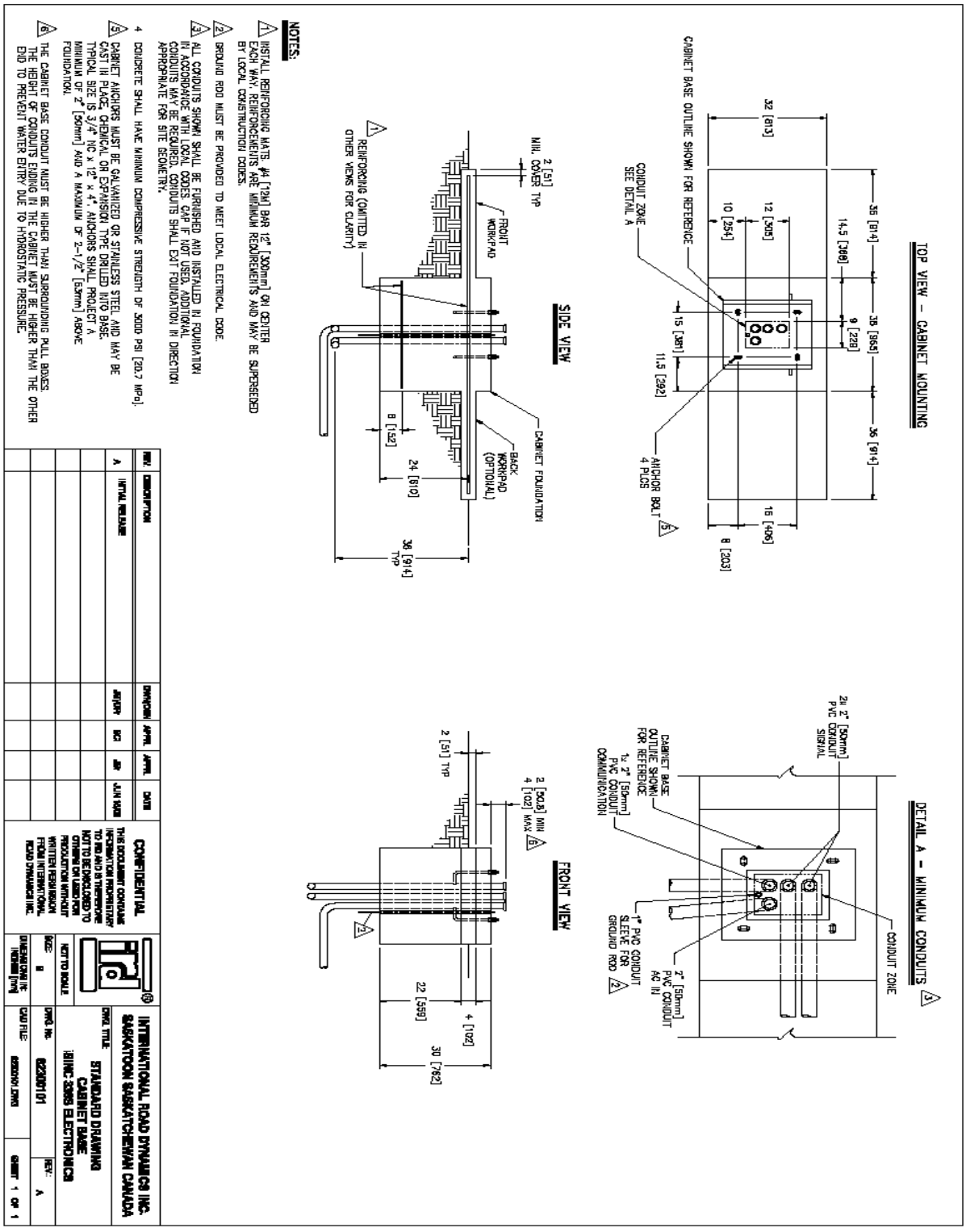

MAPQUEST
WIM Site
0 10m 10km
Haddam
Washington
Marysville
Axtell
Seneca
Hiawatha
St. Joseph
Fairview
Winifred
Greenleaf
Centralia
Kelly
Powhattan
Wathena
Linn
Blue Rapids
Barnes
Corning
Goff
Wetmore
Horton
Huron
Palmer
Clifton
Netawaka
Lancaster
Atchison
Duluth
Onaga
Soldier
Muscotah
Morganville
Randolph
Olsburg
Holton
Iatan
Nortonville
Weston
Westmoreland
Denison
Clay Center
Emmett
Mayetta
Valley Falls
Leavenworth
Idana
Louisville
Hoyt
Wakefield
Manhattan
St. Marys
Elmont
Oskaloosa
Lansing
Longford
Wabaunsee
Meriden
Tonganoxie
Manchester
Milford
Ogden
Silver Lake
Paxico
Rossville
Reno
Junction City
Topeka
Perry
Alma
Dover
Lawrence
Chapman
Abilene
Auburn
Enterprise
Skiddy
Alta Vista
Eskridge
Pleasant Grove
Gardner
Navarre
White City
Harveyville
Baldwin City
Burlingame
Spring Hill
Latimer
Overbrook
Wellsville
Elmo
Hope
Herington
Wilsey
Council Grove
Allen
Miller
Osage City
Hillsdale
Ottawa
Ramona
Dunlap
Tampa
Lyndon
Lost Springs
Hymer
Americus
Reading
Melvern
Homewood
Durham
Lincolnville
Lebo
Olivet
Williamsburg
Lane
Fontana
Emporia
Cottonwood Falls
Agricola
Hillsboro
Clements
Elmdale
Neosho Rapids
Richmond
Parker
Olpe
Hartford
New Strawn
Harris
Garnett
© 2006 MapQuest, Inc.

4.1.2 PICTURES, WIM SITE

4.1.3 SITE LAYOUT



4.1.4 WIM CABINET CONCRETE PEDESTAL



NOTES:

1. INSTALL REINFORCING MATS, #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	ANTHONY	BCC	JBH	JUN 14/05

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DIMENSIONS IN: MILLIMETERS [inches] | NOT TO SCALE | SIZE: B | DWG. No: 6230101 | REV: A | CAD FILE: 6230101.DWG | SHEET 1 OF 1

INTERNATIONAL ROAD DYNAMICS INC.
SASKATOON SASKATCHEWAN CANADA

DWG. TITLE: STANDARD DRAWING
CABINET BASE
IRD INC. 2305 ELECTRONICS

4.1.5 ELECTRICAL READINGS

International Road Dynamics Inc.

Site Service Sheet

Clear

Bending Plate **System Type: iSINC**

Date: 6/9/2006 **State: KS** **Location: I-70 Mile Post 287.5**
Job #: 10407F **Site #:** **Directions: ~10 Miles west of Junction City**

Loops	**Lane - 1**		**Lane -**		**Lane -**		**Lane -**	
	Lead	**Trail**	**Lead**	**Trail**	**Lead**	**Trail**	**Lead**	**Trail**
Resistance	1.0	1.0						
Leakage	inf.	inf.						
Inductance	845mH	845mH						
Frequency	N/A	N/A						

Weighpads	**Lane -** 1		**Lane -**		**Lane -**		**Lane -**	
	Lead	**Trail**	**Lead**	**Trail**	**Lead**	**Trail**	**Lead**	**Trail**
Supply	994Ω	994Ω						
Signal	845Ω	845Ω						
Shield	inf.	inf.						
Zero Pt	0.4 mV	0.1 mV						
Serial #	7086	7023						

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	N/A
Phone on hook	N/A

Not available as state had not connected phone service*

Temp Sensor

Red to Blk	6 MΩ
Red to Wht	6.07MΩ
Wht to Blk	40KΩ

Technician: **Travis Holton** **Date:** **6/9/2006**

5.0 WIM CALIBRATION

5.1.1 TEST TRUCK #1 INFORMATION

DATE OF CALIBRATION: **June 9, 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		12160	11780	D
B		31360	31400	D (B&C combined)
C				
D		34360	34380	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)
	77880	77560	320

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

9. TRACTOR MANUFACTURER:
   Make: Kenworth
   Model: T600

10. TRAILER LOAD DESCRIPTION: Grain

11. TRAILER TARE WEIGHT (lb): _____

12. AXLE SPACINGS

Axle	Spacing (feet & inches)
A-B	16’ 7”
B-C	4’ 3”
C-D	30’ 2”
D-E	4’ 1”

KINGPIN OFFSET FROM AXLE B (ft, + towards rear): +1 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: **June 9, 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		11240	11280	D
B		25560	25420	D (B&C combined)
C				
D		24980	24960	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)
	61780	61660	120

Special Note! – Truck 2 filled up on gas with 5 passes to go

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

9. TRACTOR MANUFACTURER:
   Make: Peterbuilt
   Model: 379

10. TRAILER LOAD DESCRIPTION: Grain

11. TRAILER TARE WEIGHT (lb): _____

12. AXLE SPACINGS

Axle	Spacing (feet & inches)
A-B	19’ 7”
B-C	4’ 4”
C-D	30’ 6”
D-E	4’ 1”

KINGPIN OFFSET FROM AXLE B (ft, + towards rear): +1 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 SHEET 20 – SPEED AND CLASSIFICATION CHECKS

Sheet 20	* STATE_CODE Kansas
LTPP Traffic Data	*SPS PROJECT_ID
Speed and Classification Checks * 1 of* 3	* DATE 09/06/2006

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
68	9	6265	68	9	63	3	6379	64	4
71	2	6267	71	2	73	3	6521	71	3
75	2	6271	74	2	72	3	6524	69	3
68	9	6276	68	9	71	2	6530	69	2
71	2	6280	71	2	75	2	6531	74	2
65	4	6284	63	4	65	11	6532	63	11
70	8	6290	67	8	65	13	6533	63	13
70	2	6342	68	2	62	13	6534	58	13
75	2	6343	76	2	64	10	6535	67	10
71	2	6345	70	2	64	9	6536	63	9
71	5	6346	70	5	64	3	6537	66	3
74	2	6347	73	2	65	11	6538	65	11
64	9	6348	64	9	73	2	6539	72	2
75	2	6350	73	2	67	4	6540	67	4
73	3	6351	73	3	71	3	6541	73	3
74	2	6355	72	2	77	2	6542	75	2
71	2	6361	72	2	70	2	6544	71	2
73	2	6364	71	2	66	11	6547	63	11
54	9	6366	57	9	57	3	6548	56	3
74	2	6367	75	2	70	5	6549	67	5
67	2	6368	65	2	72	9	6556	72	9
79	2	6369	78	2	71	2	6562	71	2
78	5	6370	78	5	65	9	6667	63	9
76	2	6371	73	2	70	2	6671	72	2
63	11	6372	62	11	77	2	6675	75	2

Recorded by Tim Weber Direction WB Lane 1 Time from 10:00 to 11:03

Sheet 20	* STATE_CODE Kansas
LTPP Traffic Data	*SPS PROJECT_ID
Speed and Classification Checks * 2 of* 3	* DATE 09/06/2006

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
41	13	6700	37	13	67	3	6729	66	3
70	2	6701	67	2	68	3	6730	65	3
66	11	6703	65	11	72	2	6731	69	2
64	9	6705	67	9	68	2	6733	65	2
72	2	6706	71	2	69	9	6734	69	9
78	2	6707	77	2	78	2	6788	75	2
74	2	6708	70	2	70	2	6790	70	2
73	2	6709	71	2	72	9	6793	71	9
65	2	6710	64	2	71	3	6794	71	3
67	2	6711	66	2	72	3	6795	70	3
68	9	6712	69	9	65	2	6796	64	2
67	3	6713	65	3	76	2	6797	73	2
60	2	6714	58	2	69	2	6798	71	2
67	2	6715	65	2	75	3	6801	72	3
69	2	6716	69	2	66	3	6804	65	3
71	2	6717	70	2	73	3	6807	71	3
78	5	6718	79	5	67	9	6809	66	9
72	5	6719	70	5	73	2	6810	72	2
68	2	6720	65	2	78	2	6811	76	2
69	2	6723	66	2	77	2	6812	75	2
73	8	6724	73	8	74	2	6813	73	2
78	2	6725	76	2	75	2	6815	73	2
72	2	6726	70	2	70	9	6818	70	9
63	9	6727	60	9	60	3	6819	60	3
68	9	6728	65	9	73	2	6820	71	2

Recorded by Tim Weber Direction WB Lane 1 Time from 11:00 to 11:20

Sheet 20	* STATE_CODE Kansas
LTPP Traffic Data	*SPS PROJECT_ID
Speed and Classification Checks * 3 of* 3	* DATE 09/06/2006

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
71	9	6986	70	9	74	3	7040	75	3
65	9	6987	68	9	67	9	7041	65	9
65	2	6992	62	2	73	3	7042	70	3
65	8	6995	64	8	75	2	7047	74	2
72	9	6997	72	9	66	2	7048	67	2
63	9	6998	62	9	72	2	7049	64	2
59	2	6999	60	2	72	2	7053	71	2
60	2	7000	60	2	65	9	7054	65	9
64	2	7001	60	2	65	2	7055	65	2
74	2	7006	73	2	70	2	7056	69	2
69	2	7007	70	2	70	5	7057	70	5
75	2	7008	74	2	62	2	7078	60	2
68	3	7010	70	3	75	2	7079	74	2
66	11	7011	65	11	68	2	7080	70	2
68	9	7016	67	9	70	5	7085	70	5
70	12	7026	70	12	71	9	7086	70	2
72	5	7028	71	5	70	2	7089	69	2
64	9	7029	64	9	73	5	7092	73	5
70	9	7031	71	9	62	8	7093	60	8
73	2	7032	75	2	71	5	7097	68	5
70	9	7034	70	9	69	9	7099	68	9
72	2	7035	70	2	72	2	7100	71	2
71	3	7037	70	3	75	2	7123	75	2
74	3	7038	74	3	67	2	7125	65	2
71	2	7039	70	2	72	2	7127	69	2

Recorded by Tim Weber Direction WB Lane 1 Time from 11:40 to 12:00

7.0 TEST TRUCK CALIBRATION RECORDS

7.1.1 VALIDATION RUNS 6-9-2006

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				77.7	12.0	31.4	34.4	16.6	4.3	30.2	4.1
2				61.7	11.2	25.5	25.0	19.6	4.3	30.5	4.1

Dynamic Test Vehicle Measurements

ID	V#	Speed	Temp	GVW	F/A	T1	T2	1>2	2>3	3>4	4>5
2	5954	59	88	63.7	10.5	26.5	26.7	19.6	4.3	30.8	4.0
1	5958	60	88	77.8	11.5	32.2	34.0	16.4	4.3	30.2	4.0
2	6029	58	89	63.7	10.5	26.5	26.7	19.5	4.3	30.7	4.0
1	6032	60	89	78.5	11.4	32.2	34.8	16.4	4.3	30.3	4.0
2	6110	61	91	62.9	10.9	26.3	25.6	19.5	4.3	30.7	4.0
1	6115	66	91	80.1	12.7	32.8	34.6	16.4	4.3	30.3	4.0
2	6199	64	93	66.1	12.2	27.5	26.5	19.7	4.3	31.0	4.0
1	6209	67	93	79.8	12.4	32.7	34.7	16.4	4.3	30.4	4.0
2	6292	65	93	63.0	11.5	26.2	25.3	19.6	4.3	30.8	4.0
1	6310	71	93	78.7	11.8	31.6	35.3	16.4	4.3	30.0	4.0
2	6385	68	93	62.1	11.2	26.0	24.9	19.6	4.3	30.9	4.0
1	6399	71	93	78.4	12.0	31.2	35.3	16.4	4.3	30.2	4.0
2	6472	68	93	61.4	11.1	25.5	24.8	19.6	4.4	30.9	4.0
1	6481	71	93	77.0	11.8	31.6	33.7	16.4	4.3	30.3	4.0
2	6566	68	93	63.2	11.8	25.7	25.7	19.6	4.3	30.7	4.0
1	6607	69	93	79.1	12.6	31.7	34.8	16.4	4.3	30.2	4.0
2	6657	68	93	63.9	11.9	26.1	25.9	19.5	4.3	30.7	4.0
1	6686	70	93	78.8	11.9	32.4	34.6	16.4	4.3	30.3	4.0
2	6738	68	90	64.4	11.8	26.6	26.0	19.5	4.3	30.7	4.0
1	6772	71	90	77.8	11.9	31.0	34.9	16.4	4.3	30.3	4.0
2	6832	68	94	61.8	11.5	25.2	25.1	19.6	4.3	30.8	4.0
1	6867	70	94	79.6	11.9	31.6	36.1	16.4	4.3	30.3	4.0
2	6920	69	99	64.3	11.5	26.9	25.8	19.5	4.3	30.8	4.0
1	6969	67	99	80.1	12.4	31.9	35.8	16.4	4.3	30.3	4.0
2	7016	68	102	63.8	11.8	26.0	26.0	19.6	4.3	30.7	4.0
1	7062	70	102	78.9	12.0	31.1	35.9	16.4	4.3	30.3	4.0
2	7099	69	102	61.5	11.1	25.7	24.7	19.6	4.3	30.9	4.0
1	7163	71	102	77.6	11.5	31.5	34.6	16.4	4.3	30.3	4.0
2	7192	64	99	65.3	12.2	27.0	26.1	19.5	4.3	30.7	4.0
1	7817	60	107	79.9	12.7	32.5	34.8	16.4	4.3	30.3	4.1
2	7852	64	107	63.7	11.6	26.0	26.1	19.6	4.3	30.9	4.0
1	7920	60	112	78.5	11.8	32.0	34.7	16.4	4.3	30.4	4.1
2	7951	65	112	64.9	11.5	26.8	26.6	19.6	4.3	30.8	4.0
1	8019	61	109	78.9	12.5	32.4	34.0	16.5	4.3	30.4	4.1
2	8062	65	109	62.0	11.5	25.4	25.1	19.7	4.4	31.0	4.0
1	8129	66	109	80.1	12.3	32.9	34.9	16.4	4.3	30.3	4.0
2	8178	59	106	61.6	10.6	25.2	25.9	19.6	4.3	30.8	4.0
1	8253	66	106	79.8	12.1	31.8	35.9	16.4	4.3	30.3	4.0
2	8286	60	113	64.2	11.1	26.8	26.3	19.5	4.3	30.7	4.0
1	8361	66	113	79.7	12.5	32.6	34.7	16.4	4.3	30.3	4.0

Date:	2006/06/09
Technician:	Tim Weber
Location:	Kansas I-70 MM 287.5

7.1.2 TEST TRUCK ERROR CALCULATIONS 6-9-2006

Truck	V#	Speed	Temp	GVW	F/A	T1	T2	1>2	2>3	3>4	4>5
2	5954	59	88	3.3%	-6.2%	3.9%	6.8%	0.0	0.0	0.3	-0.1
1	5958	60	88	0.1%	-4.2%	2.5%	-1.0%	-0.2	0.0	0.0	-0.1
2	6029	58	89	3.3%	-6.2%	3.9%	6.8%	-0.1	0.0	0.2	-0.1
1	6032	60	89	1.0%	-5.0%	2.5%	1.3%	-0.2	0.0	0.1	-0.1
2	6110	61	91	2.0%	-2.7%	3.1%	2.4%	-0.1	0.0	0.2	-0.1
1	6115	66	91	3.1%	5.8%	4.5%	0.7%	-0.2	0.0	0.1	-0.1
2	6199	64	93	7.2%	8.9%	7.8%	6.0%	0.1	0.0	0.5	-0.1
1	6209	67	93	2.7%	3.3%	4.1%	1.0%	-0.2	0.0	0.2	-0.1
2	6292	65	93	2.1%	2.7%	2.7%	1.2%	0.0	0.0	0.3	-0.1
1	6310	71	93	1.3%	-1.7%	0.6%	2.7%	-0.2	0.0	-0.2	-0.1
2	6385	68	93	0.7%	0.0%	2.0%	-0.4%	0.0	0.0	0.4	-0.1
1	6399	71	93	0.9%	0.0%	0.6%	2.7%	-0.2	0.0	0.0	-0.1
2	6472	68	93	-0.5%	-0.9%	0.0%	-0.8%	0.0	0.1	0.4	-0.1
1	6481	71	93	-0.9%	-1.7%	0.6%	-1.9%	-0.2	0.0	0.1	-0.1
2	6566	68	93	2.5%	5.4%	0.8%	2.8%	0.0	0.0	0.2	-0.1
1	6607	69	93	1.8%	5.0%	1.0%	1.3%	-0.2	0.0	0.0	-0.1
2	6657	68	93	3.6%	6.3%	2.4%	3.6%	-0.1	0.0	0.2	-0.1
1	6686	70	93	1.4%	-0.8%	3.2%	0.7%	-0.2	0.0	0.1	-0.1
2	6738	68	90	4.4%	5.4%	4.3%	4.0%	-0.1	0.0	0.2	-0.1
1	6772	71	90	0.1%	-0.8%	1.3%	1.6%	-0.2	0.0	0.1	-0.1
2	6832	68	94	0.2%	2.7%	1.2%	0.4%	0.0	0.0	0.3	-0.1
1	6867	70	94	2.4%	-0.8%	0.6%	5.1%	-0.2	0.0	0.1	-0.1
2	6920	69	99	4.2%	2.7%	5.5%	3.2%	-0.1	0.0	0.3	-0.1
1	6969	67	99	3.1%	3.3%	1.6%	4.2%	-0.2	0.0	0.1	-0.1
2	7016	68	102	3.4%	5.4%	2.0%	4.0%	0.0	0.0	0.2	-0.1
1	7062	70	102	1.5%	0.0%	1.0%	4.5%	-0.2	0.0	0.1	-0.1
2	7099	69	102	-0.3%	-0.9%	0.8%	-1.2%	0.0	0.0	0.4	-0.1
1	7163	71	102	-0.1%	-4.2%	0.3%	0.7%	-0.2	0.0	0.1	-0.1
2	7192	64	99	5.9%	8.9%	5.9%	4.4%	-0.1	0.0	0.2	-0.1
1	7817	60	107	2.8%	5.8%	3.5%	1.3%	-0.2	0.0	0.1	0.0
2	7852	64	107	3.3%	3.6%	2.0%	4.4%	0.0	0.0	0.4	-0.1
1	7920	60	112	1.0%	-1.7%	1.9%	1.0%	-0.2	0.0	0.2	0.0
2	7951	65	112	5.2%	2.7%	5.1%	6.4%	0.0	0.0	0.3	-0.1
1	8019	61	109	1.5%	4.2%	3.2%	-1.0%	-0.1	0.0	0.2	0.0
2	8062	65	109	0.5%	2.7%	0.4%	0.4%	0.1	0.1	0.5	-0.1
1	8129	66	109	3.1%	2.5%	4.8%	1.6%	-0.2	0.0	0.1	-0.1
2	8178	59	106	-0.1%	-5.4%	1.2%	3.6%	0.0	0.0	0.3	-0.1
1	8253	66	106	2.7%	0.8%	1.3%	4.5%	-0.2	0.0	0.1	-0.1
2	8286	60	113	4.1%	-0.9%	5.1%	5.2%	-0.1	0.0	0.2	-0.1
1	8361	66	113	2.6%	4.2%	3.8%	1.0%	-0.2	0.0	0.1	-0.1

7.1.3 OVERALL PERFORMANCE

International Road Dynamics Inc.

FHWA VERIFICATION

Specifications						
Confidence	95%	Speed range low	59	to	60
	(1.96)	Speed range medium	64	to	65
Gross vehicle weight	10%	Speed range high	69	to	70
Tandem group weight	15%	Temperature range low	85	to	90
Single axle weight	20%	Temperature range medium	91	to	100
Axle spacings	0.5	Temperature range high	100	to	110

Overall					
Characteristic	Error	StdDev	Specification	Calculated	Pass/Fail
Gross vehicle weight	2.2%	1.8%	10%	5.7%	pass
Tandem group weight	2.3%	2.3%	15%	6.8%	pass
Single axle weight	1.2%	4.0%	20%	9.0%	pass
Axle spacings	0.0	0.1	0.5	0.3	pass

Speed range 59 to 60 (6 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	1.9%	1.8%	10%	5.4%
Tandem group weight	2.7%	2.5%	15%	7.6%
Single axle weight	-2.1%	4.4%	20%	7.7%
Axle spacings	0.0	0.1	0.5	0.3

Speed range 64 to 65 (3 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	2.6%	2.4%	10%	7.5%
Tandem group weight	2.6%	2.7%	15%	7.9%
Single axle weight	2.7%	0.0%	20%	2.7%
Axle spacings	0.1	0.2	0.5	0.5

Speed range 69 to 70 (3 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	1.8%	0.6%	10%	2.9%
Tandem group weight	2.2%	2.4%	15%	7.0%
Single axle weight	-0.6%	0.5%	20%	1.5%
Axle spacings	0.0	0.1	0.5	0.3

Temperature range 85 to 90 (6 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	2.0%	1.8%	10%	5.8%
Tandem group weight	2.9%	2.6%	15%	8.1%
Single axle weight	-2.9%	4.5%	20%	11.9%

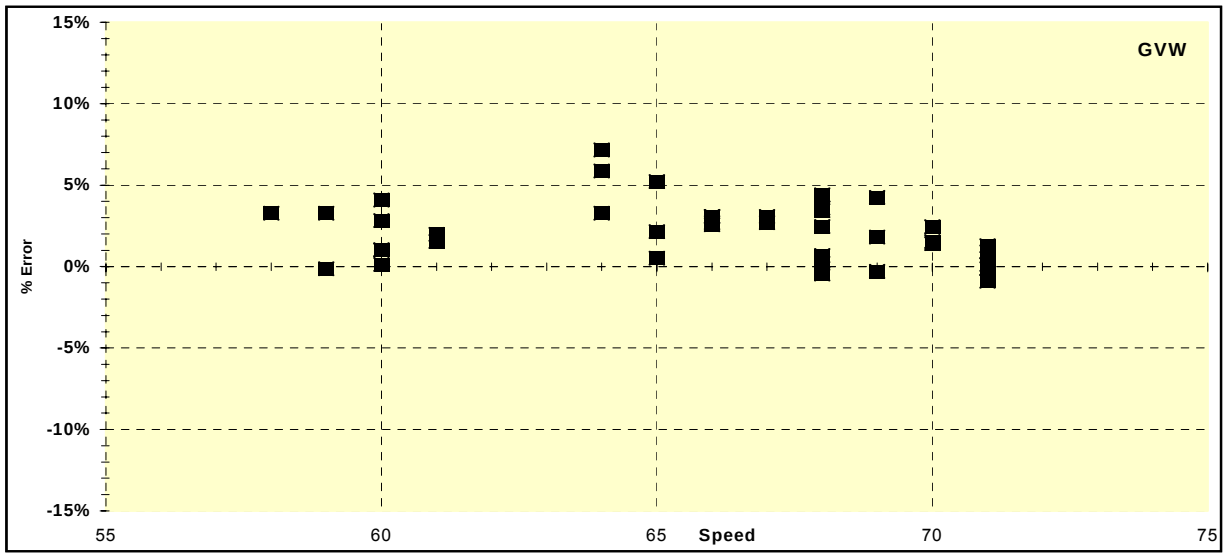
Temperature range 91 to 100 (17 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	2.3%	2.1%	10%	6.6%
Tandem group weight	2.2%	2.3%	15%	6.7%
Single axle weight	2.5%	3.5%	20%	9.6%

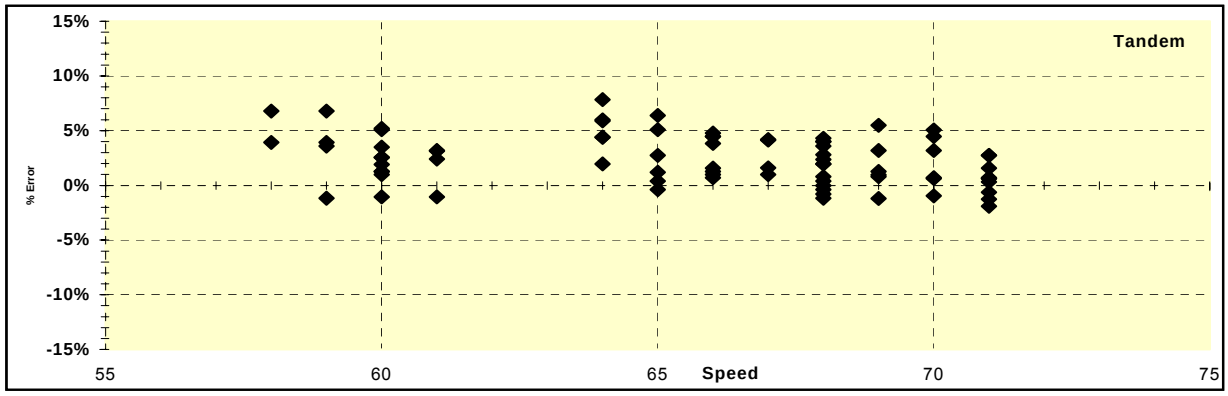
Temperature range 100 to 110 (11 runs)				
Characteristic	Error	StdDev	Specification	Calculated
Gross vehicle weight	1.7%	1.5%	10%	4.7%
Tandem group weight	1.7%	2.0%	15%	5.9%
Single axle weight	1.3%	3.7%	20%	8.7%

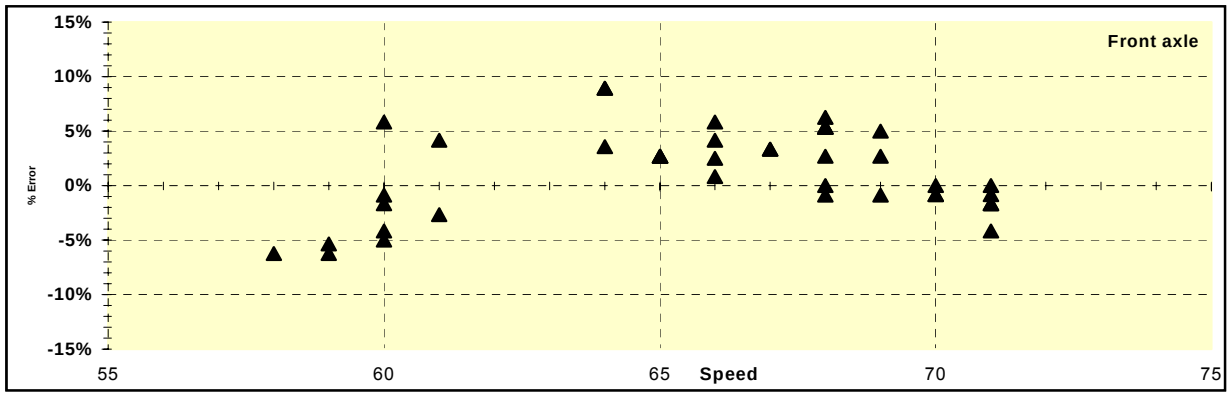
7.1.4 WEIGHT GRAPHS

International Road Dynamics Inc.

FHWA VERIFICATION





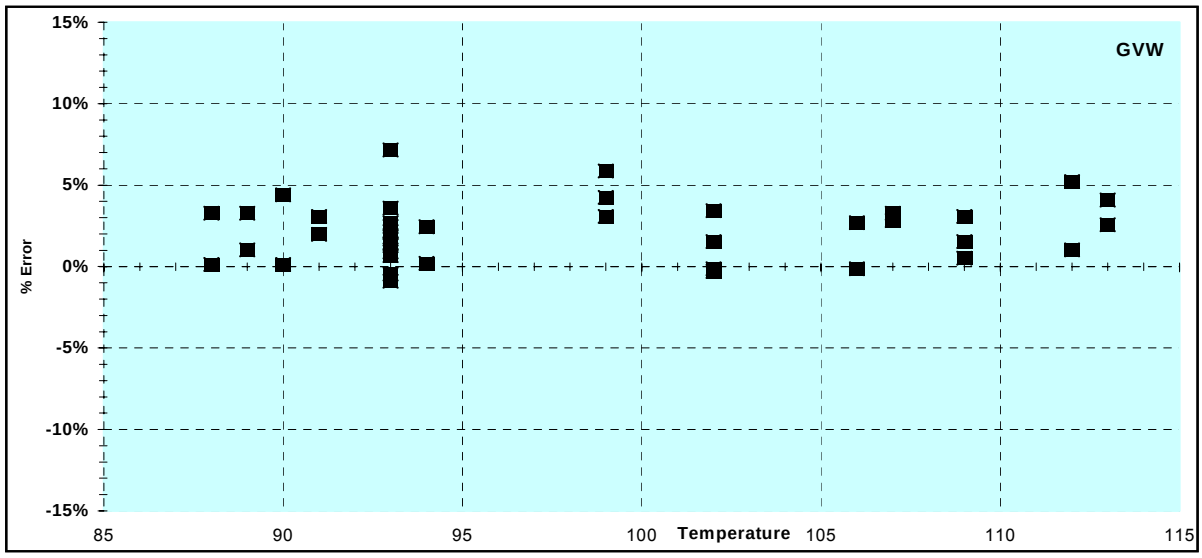


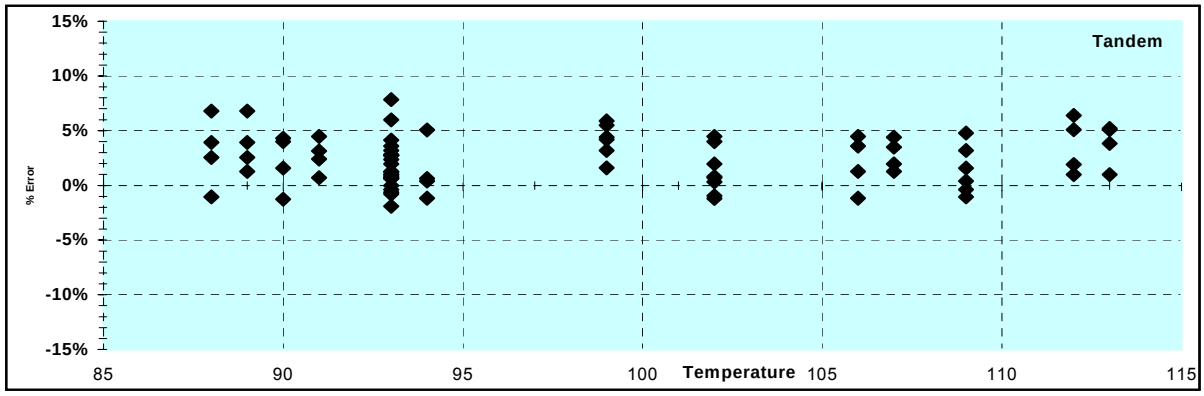
Kansas I-70 MM 287.5 Tim Weber 2006/06/09

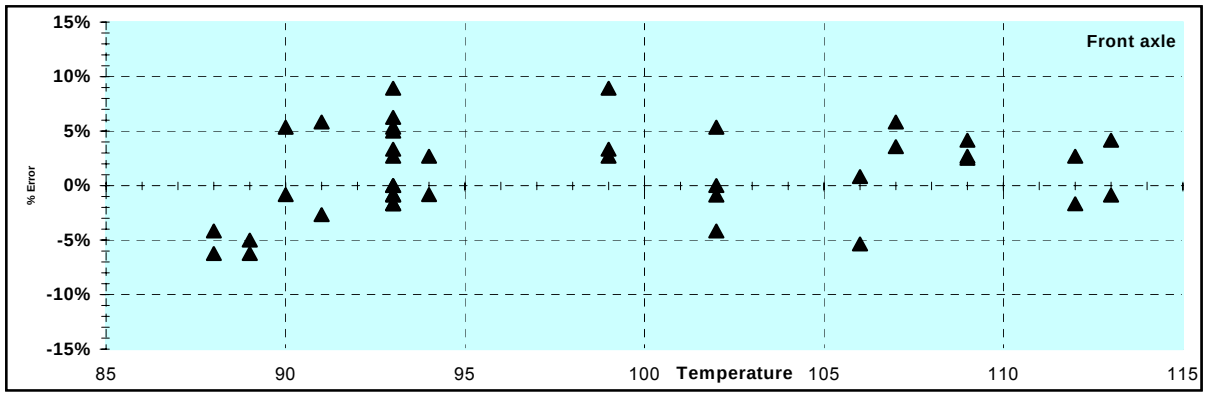
7.1.5 TEMPERATURE INFLUENCE GRAPHS

International Road Dynamics Inc.

FHWA VERIFICATION







Kansas I-70 MM 287.5 Tim Weber 2006/06/09