Evaluation of Lightweight Non-Contact Profilers for Use in Quality Assurance Specifications on Pavement Smoothness

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16. Abstract

Various devices that qualify as lightweight profilers were evaluated as part of a FHWA cooperative partnership with nine states. Connecticut offered the opportunity to seven companies to showcase their equipment. Five vendors accepted this offer, four golf-cart type devices and one hitch mounted device were evaluated. In addition, ConnDOT ran its two ARAN vehicles and an ARRB TR Walking Profiler over three test sections used for the study. All data were collected between July 7 and October 19, 1999.

This report summarizes the data collection and analysis efforts. An analysis of repeatability (precision) is included. Comparisons of the lightweight profilers with the ConnDOT ARAN and the Walking Profiler are also made.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

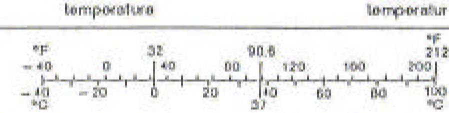
Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimetres	mm
ft	feet	0.305	metres	m
yd	yards	0.914	metres	m
mi	miles	1.61	kilometres	km
		AREA		
in^2	square inches	645.2	millimetres squared	mm^2
ft^2	square feet	0.093	metres squared	m^2
yd^2	square yards	0.836	metres squared	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	kilometres squared	km^2
		VOLUME		
fl oz	fluid ounces	29.57	millilitres	mL
gal	gallons	3.785	litres	L
ft^3	cubic feet	0.028	metres cubed	m^3
yd^3	cubic yards	0.765	metres cubed	m^3

NOTE: Volumes greater than 1000 L shall be shown in m^3.

Symbol	When You Know	Multiply By	To Find	Symbol
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5(F-32)/9	Celcius temperature	°C

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimetres	0.039	inches	in
m	metres	3.28	feet	ft
m	metres	1.09	yards	yd
km	kilometres	0.621	miles	mi
		AREA		
mm^2	millimetres squared	0.0016	square inches	in^2
m^2	metres squared	10.764	square feet	ft^2
ha	hectares	2.47	acres	ac
km^2	kilometres squared	0.386	square miles	mi^2
		VOLUME		
mL	millilitres	0.034	fluid ounces	fl oz
L	litres	0.264	gallons	gal
m^3	metres cubed	35.315	cubic feet	ft^3
m^3	metres cubed	1.308	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams	1.102	short tons (2000 lb)	T
		TEMPERATURE (exact)		
°C	Celcius temperature	1.8C + 32	Fahrenheit temperature	°F



* SI is the symbol for the International System of Measurement

(Revised April 1989)

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Introduction and Background

As far back as the AASHO Road Test in 1958-1960 in Illinois, it was found that pavement roughness was the greatest contributing factor in defining a pavement serviceability index /ref.1/. Many subsequent studies confirmed that highway users judge the condition of the highway system primarily by the ride that they experience when traveling over the roadway.

In Connecticut, devices such as the 25-ft profilometer were specified for use on a few PCC pavement construction projects in the 1980s. Otherwise, roughness was primarily controlled by specifications requiring measurements with a 10-ft straightedge. Traditionally, roughness was not a primary consideration in this state for paving operations. It was assumed that the contractor would produce a pavement with acceptable roughness.

ConnDOT's first experience with inventory roughness measurement was with a photolog vehicle obtained in 1980, which contained an on-board sensor to measure accumulated vertical movement of the rear axle. This device was similar to a response-type device developed in the 1960s by the Portland Cement Association called the PCA Roadmeter. When the FHWA required roughness data for Highway Performance Monitoring System (HPMS) sections, ConnDOT converted to using a South Dakota Road Profiler in 1986. This profiler contained a "vehicle-independent device" to measure roughness more objectively. The index calculated from the profile measurement was called the International Roughness Index (IRI), which is a statistic established by the World Bank, based upon the results of a study in Brazil in 1982. Finally, in 1995 ConnDOT obtained two Automatic Road Analyzers (ARANs) to perform system wide annual roadway inventories. These devices also measure IRI and/or Ride Number and Profile.

A recently renewed national emphasis on pavement smoothness has caused ConnDOT to re-evaluate the various options for specifying, constructing, and monitoring hot mix asphalt (HMA) pavement construction. A study by the New England Transportation Consortium in 1996 summarized the New England states activities with performance-based specifications, some of which included the use of penalties and bonuses for smoothness /ref. 2/. At about the same time, the use of Quality Assurance Specifications was starting to be emphasized by FHWA as well.

In 1997, ConnDOT developed and utilized, on a trial basis, a special provision for construction of HMA pavements, which considered pavement smoothness or rideability. The special provision, which supplemented construction methods for Bituminous Concrete, was used on a few paving jobs that year. Pay factor adjustments in the special provision were expanded to include a disincentive (penalty) in 1998. Once again the special provision was incorporated into paving projects on a trial basis during the 1998 and 1999 construction seasons. The 1998 version of the special provision (see Appendix A) requires ConnDOT to perform the testing using the ARAN vehicle. The IRI data are then used to determine any payment adjustments for placement of HMA pavement.

Because of a recent initiative by the Department to develop Quality Assurance specifications, the Department will likely require that the contractor perform the Quality Control in the future. This change may require that the contractor be responsible for measuring smoothness. Since the cost of an ARAN vehicle is relatively high, and it contains many other sensors and modules not required for roughness measurement, it is assumed that contractors would prefer to utilize smaller, less expensive portable devices, such as a lightweight profiler.

A typical lightweight profiler features state-of-the-art measuring equipment mounted on a “golf-cart” type vehicle or the bumper/hitch of any conventional vehicle. A non-contact sensor such as laser, infrared or optical, collects data as the profiler travels along the pavement surface. The profile data collected can be analyzed using various roughness indices, including the IRI, Profile Index (PI), and Ride Number (RN), and the results can be viewed on screen or output to a printer in near real time /ref. 3/.

Problem Statement and Study Objectives

ConnDOT has had little or no experience with lightweight non-contact profilers. The only portable device used by ConnDOT was the Face Technologies Dipstick. The Dipstick, which is a contact device that measures elevations at one-foot increments, has been used on an annual basis to “check” the IRI values measured with the ConnDOT ARANs for purposes of verifying that the ARAN worked properly, prior to submitting HPMS data to FHWA.

The need existed to evaluate alternative lightweight non-contact profilers for use on paving projects in Connecticut so that a determination could be made of whether the portable devices can be used in lieu of or in conjunction with the ARAN for Quality Assurance purposes. In addition, FHWA, in partnership with the Road Profilers User Group (RPUG), AASHTO, American Concrete Pavement Association (ACPA), National Asphalt Pavement Association (NAPA), and equipment manufacturers was soliciting participants from up to six states to evaluate the devices so that ultimately a technical guide could be developed to include information on:

- The costs and benefits of constructing smoother pavements;
- the most appropriate methods of measuring pavement smoothness; and,
- guidelines for smoothness specifications for both contractor quality control and agency acceptance testing.

Therefore, the objective of the ConnDOT project is to field test, evaluate and document the effectiveness of at least three lightweight non-contact profile measurement devices for potential use in Quality Assurance (Quality Control and Acceptance Testing) of HMA pavement construction in Connecticut. The data collected for the study will also be submitted to FHWA for their use in the partnership study. The FHWA study is part of an initiative to evaluate techniques, methods, and devices that increase efficiency, accelerate operations, reduce delay and disruption, and enhance safety. This program is entitled

"Optimizing Highway Performance: Meeting the Customer's Needs"/ref. 3/. ConnDOT received a $15,000 grant from FHWA to help defray the costs of vendor participation.

Expected Benefits

The motorists or highway users are the major benefactors of smoother pavements. Pavement roughness contributes to premature deterioration of pavement, increased user costs from energy use and vehicle repairs, and decreased comfort of the vehicle occupants. A smoothness specification encourages the construction of smoother pavements. The use of lightweight profilers would allow the contractor and/or owner to monitor pavement smoothness during construction. Contractors could potentially save time and money by taking immediate corrective action when warranted.

Field Site Locations

The original intent for the field sites was to use three different paving contracts for data collection with the profilers. However, one of the recommendations from the FHWA was to select new pavements that were preferably less than 30 days old. ConnDOT elected to have each profiler vendor collect data on different days with a goal to have all data collected within 4 weeks. It was immediately apparent that finding three active or recently completed paving projects that were within a reasonable distance of each other, and in addition, to know two months in advance what the status of the paving would be on these projects for a given period of time, was not feasible. Therefore, it was decided to use one paving project. The project selected, only because it was at the appropriate phase at the needed time, was on CT State Route 9 (Project 33-120).

Three 0.1-mile sections were selected in the southbound direction of the low-speed lane of Route 9 in Cromwell/Berlin. The construction stations for the three sections using the construction contract stationing as a reference are:

Section 1, Sta. 162+00 to 167+28;
Section 2, sta. 173+00 to 178+28;
Section 3, sta. 186+00 to 191+28.

The ADT on route 9 at this location is 42,800 vehicles per day (total both directions for 1997.) Sections 1 and 2 were paved with a 2-in. top course on the night and early morning of June 22/23, 1999. Section 3 was paved on June 23/24th. A RoadTec Model SB2500 Material Transfer Vehicle was used during the paving. Earlier in the month the sections had been milled to remove the top 2 inches of existing pavement. Then a 1-inch ConnDOT Class 2 layer was placed prior to the ConnDOT Class 1 surface layer mentioned above.

The three sections used for this study were marked on July 7, 1999. Paint marks were placed in the lanes to delineate the wheel paths every 25 ft (see Photos 1 & 2). These marks were placed in both wheel paths at 68-7/8 inches apart, which is the measured distance between the right and left laser sensors on the ConnDOT ARAN. Each section was 528 ft long. There was a 572-ft gap between sections 1 and 2, and 772 feet between sections 2 and 3. Section 2 was partially on a bridge over the Sebethe River at the Cromwell/Berlin town line (see photo 2).

Photo 1,   Section 1, Route 9 Southbound, Berlin, CT


Photo 2, Section 2 Contains Bridge Over Sebethe River

Photo 3,   Section 3 Wheel Paths are Delineated by Paint Marks Every 25 ft

Field Data Collection

Consideration had been given to having all the vendors collect data on the same day. There were a number of advantages and disadvantages to this. The advantages would have been a showcase for the various vendors, lane closures for only one day, and identical field conditions for all vendors at time of testing. Some of the disadvantages were safety issues for spectators, because the site was an open highway with fairly heavy traffic, and less time for ConnDOT personnel to spend with each device if several were together at once.

It was decided to spend one day with each vendor to maximize the opportunity for information exchange. To verify that the roughness did not change over the course of the study, the ConnDOT ARAN van #5 was used to collect data on three occasions, July 7^{th} prior to any other device, July 29th and, August 19^{th}, after the last device was through. As can be seen in Table 1 it is almost certain that the roughness did not change significantly over the six weeks. Virtually identical results were obtained each time.

ConnDOT's van #6 was also run on the section on October 19, 1999. The data collected at that time is also given in Table 1. This also verifies that no change in roughness occurred over the period. It also shows that the two ConnDOT vans produce very similar results. In section 2, there was a bridge joint that was replaced between August 19 and October 19, which would help explain why the data for this one section is slightly different.

Table 2 provides the collection dates and weather conditions for each profiler dataset. Detailed discussion about each profiler follows in a later section of this report. A lane was closed to traffic during data collection for most of the devices. Due to the traffic levels at this site, a lane closure was only allowed between 9:00 am and 3:00 pm. A lane closure was not needed for the ARAN and ARRB TR 3-Laser devices since each collected data at 40 mph or higher. All other equipment collected data at between 10 and 19 mph. The ARAN, ARRB 3-Laser Unit and International Cybernetics MDR4083-LWP collected data in both wheel paths simultaneously. For the other devices, the right wheel path was surveyed in the direction of prevailing traffic, and the left wheel path was surveyed in reverse, i.e., against prevailing traffic. This was done to save time during data collection.

Each device checked the length of the first section with onboard measurement devices in order to calibrate to the length of the sections. This ensured uniformity between all devices for measuring the correct location on the route. Each profiler then made ten runs for each wheel path. All devices were able to complete data collection during a single day. However, the Pathway PathRunner LITE PSI-35 repeated the data collection on a second day because the operators determined that the accelerometer was not functioning properly after all the runs were completed the first day.

Table 1 ConnDOT ARAN IRI Data for Route 9 Study Sections on Multiple Days

Connecticut DOT ARAN Van 5 – July 7, 1999

	L IRI SECTION 1 (in/mile)	R IRI SECTION 1 (in/mile)	AVE IRI SECTION 1 (in/mile)	L IRI SECTION 2 (in/mile)	R IRI SECTION 2 (in/mile)	AVE IRI SECTION 2 (in/mile)	L IRI SECTION 3 (in/mile)	R IRI SECTION 3 (in/mile)	AVE IRI SECTION 3 (in/mile)
Pass 1	74	127	101	97	128	112	59	63	61
Pass 2	72	116	94	97	126	112	59	68	64
Pass 3	71	119	95	101	130	115	59	68	64
Pass 4	73	117	95	92	125	109	58	69	64
Pass 5	71	118	94	98	140	119	57	74	66
Pass 6	73	122	97	94	126	110	62	68	65
Pass 7	73	114	94	96	122	109	60	71	65
Pass 8	74	121	98	100	133	116	59	73	66
Pass 9	72	118	95	94	130	112	58	76	67
Pass 10	75	118	96	98	135	116	58	67	62
AVERAGE	**73**	**119**	**96**	**97**	**130**	**113**	**59**	**70**	**64**
STDEV	1.3	3.6	2.2	2.8	5.3	3.4	1.4	3.8	1.8

Connecticut DOT ARAN Van 5 – July 29, 1999

	L IRI SECTION 1 (in/mile)	R IRI SECTION 1 (in/mile)	AVE IRI SECTION 1 (in/mile)	L IRI SECTION 2 (in/mile)	R IRI SECTION 2 (in/mile)	AVE IRI SECTION 2 (in/mile)	L IRI SECTION 3 (in/mile)	R IRI SECTION 3 (in/mile)	AVE IRI SECTION 3 (in/mile)
Pass 1	71	117	94	99	129	114	57	72	65
Pass 2	71	115	93	99	124	111	60	72	66
Pass 3	70	117	94	98	128	113	60	71	65
Pass 4	71	118	94	97	128	113	59	70	64
Pass 5	71	114	93	98	130	114	57	70	64
Pass 6	76	123	99	98	128	113	60	69	65
Pass 7	72	116	94	102	128	115	58	71	64
Pass 8	75	118	97	100	128	114	60	70	65
Pass 9	72	120	96	97	136	116	59	71	65
Pass 10	72	113	92	95	134	114	58	69	64
AVERAGE	**72**	**117**	**95**	**98**	**129**	**114**	**59**	**71**	**65**
STDEV	1.9	2.9	2.1	1.9	3.4	1.3	1.2	1.1	0.7

Table 1 Continued

Connecticut DOT ARAN Van 5 - August 19, 1999

	L IRI SECTION 1 (in/mile)	R IRI SECTION 1 (in/mile)	AVE IRI SECTION 1 (in/mile)	L IRI SECTION 2 (in/mile)	R IRI SECTION 2 (in/mile)	AVE IRI SECTION 2 (in/mile)	L IRI SECTION 3 (in/mile)	R IRI SECTION 3 (in/mile)	AVE IRI SECTION 3 (in/mile)
Pass 1	75	120	98	99	128	114	56	70	63
Pass 2	72	117	95	102	125	114	55	75	65
Pass 3	75	115	95	100	119	110	62	70	66
Pass 4	72	114	93	97	121	109	59	69	64
Pass 5	71	113	92	98	120	109	59	76	67.5
Pass 6	72	117	95	101	122	112	60	69	64.5
Pass 7	72	113	93	100	123	112	60	68	64
Pass 8	71	115	93	97	123	110	56	71	63.5
Pass 9	73	108	91	98	121	110	59	70	64.5
Pass 10	75	109	92	102	124	113	60	70	65
AVERAGE	**73**	**114**	**93**	**99**	**123**	**111**	**59**	**71**	**65**
STDEV	1.6	3.6	2.0	1.9	2.6	1.8	2.2	2.6	1.3

Connecticut DOT ARAN Van 6 - October 19, 1999

	L IRI SECTION 1 (in/mile)	R IRI SECTION 1 (in/mile)	AVE IRI SECTION 1 (in/mile)	L IRI SECTION 2 (in/mile)	R IRI SECTION 2 (in/mile)	AVE IRI SECTION 2 (in/mile)	L IRI SECTION 3 (in/mile)	R IRI SECTION 3 (in/mile)	AVE IRI SECTION 3 (in/mile)
Pass 1	71	114	93	103	132	118	55	74	65
Pass 2	73	111	92	103	132	118	56	72	64
Pass 3	71	112	92	103	132	118	58	73	66
Pass 4	70	115	93	100	135	118	55	75	65
Pass 5	70	112	91	101	130	116	57	73	65
Pass 6	70	116	93	100	129	115	56	72	64
Pass 7	72	109	91	97	134	116	53	75	64
Pass 8	71	117	94	102	137	120	52	77	65
Pass 9	71	117	94	103	133	118	58	74	66
Pass 10	72	119	96	100	129	115	55	74	65
AVERAGE	**71**	**114**	**93**	**101**	**132**	**117**	**56**	**74**	**65**
STDEV	1.0	3.2	1.5	2.0	2.6	1.7	2.0	1.5	0.7

Table 2 Profiler Devices and Dates of Data Collection

Profiling Device	**Data Collection Dates**	**Weather Conditions**
International Cybernetics Corporation, MDR4083-LWP	July 12, 1999	Sunny, 70-75 F
Ames Engineering Inc., Lightweight Inertial Surface Analyzer(LISA) 6000	July 15, 1999	Sunny, 72-90 F
K.J. Law Engineers, Inc., T6400 Light Weight Profiler	July 22, 1999	M. Cloudy, 75-85 F
Pathway Services Inc., PathRunner LITE PSI-35	July 26, & July 27, 1999	P. Cloudy, 78-88 F
Australian Road Research Board (ARRB) Transport Research 3-Laser Profiler	August 16, 1999	P. Cloudy, 73-80 F
ConnDOT Automatic Road Analyzer (ARAN) #5	July 7, July 29, August 19, 1999	Not Available (N/A)
ARRB TR Walking Profiler (MassHighways)	September 23, 1999	N/A
ConnDOT ARAN #6	October 19, 1999	N/A

Description of Profiler Equipment

In the spring of 1999, FHWA personnel provided a list of potential profilers for evaluation. This list contained contacts from seven companies. Each vendor on the list was subsequently contacted to determine the interest level, and suitability to participate in this study. Six vendors that indicated an initial interest were asked to provide cost estimates for collecting the data. Five of the vendors were approved for participation, as listed in Table 2.

The five vendors that participated were provided an equipment questionnaire to complete and return. This questionnaire required them to provide information on make, model, retail prices, output data, specifications on equipment components, expected accuracies and other areas. Table 3 provides a comparison of the devices based upon the questionnaire responses received. Photos 4-8 show the actual lightweight profiler vehicles used in Connecticut on the dates indicated in Table 2. A ConnDOT ARAN vehicle is also shown in Photo 9.

Equipment Costs

According to the information provided by the vendors, shown in Table 3, the variation in costs between the lightweight profilers is not very significant. With the inclusion of the transport vehicle, the least expensive device is the PathRunner LITE at $47,500. The most expensive ATV device is the ICC MDR4083-LWP at approximately $62,000 – $69,500 (depending on the haul vehicle option chosen). The ARRB 3LP is shown at $68,000. The ARAN vehicle used by ConnDOT is by far the most costly device. This particular model contains modules for geometric data, geographic positioning, videologging, texture measurement, roughness, video distress measurement, right-of-way video, rut depths and other systems, which put the price tag at over $800,000. The price of an ARAN that would only collect roughness data was not obtained for

Table 3
Comparison of Profiler Equipment

Make	International Cybernetics Corp.	Ames Engineering	KJ Law Engineers	Path Runner LITE	ARRB TR
Model	MDR4083-LWP	LISA 6000	T6400	PSI-35	3LP
Distributor	International Cybernetics Corp.	Ames Engineering Inc.	KJ Law Engineers Inc.	Pathway Services Inc.	Trigg Industries Intl Inc.
Vehicle Platform	Kawasaki Mule ATV	John Deere 4x2 Gator	Kawasaki 550	Ingerson Carryall	Any vehicle with tow bar and hitch
Retail Price	$59,500	$45,000	$55,000	$42,500	$68,000
Transport Trailer Price	$2,500 – 10,000	$4,300	Included	$3,000	N/A
Device Simulated					
Road Meter	PCA & Mays	X	Mays		
Straightedge	Vehicle Length Rolling Straightedge	X	X		
Profilograph	California Style	X	X	X	
Other	Texture	Bitfil Program	Must grind locations	Profiler	
Output (Real Time)					
IRI	X	X		X	X
PI	X	X			X
RN	X	X	X		
Other		RQI		Profiler	Profile, faulting

Table 3 (continued)

Make	International Cybernetics Corp.	Ames Engineering	KJ Law Engineers	Path Runner LITE	ARRB TR
Optional Output Post Process					
IRI	X	X	X	X	?
PI	X	X	?	X	?
RN	X	X	?	X	?
Other		RQI		Profile	
Measurement Path (1 or 2)	1 or 2 Simultaneously	1 or 2 Simultaneously	1 or 2 Simultaneously	1 Standard 2 Optional	2
Vertical Displacement Transducer	Infrared	Laser	Infrared	Laser	Laser
Measurement Footprint Area	2x2 mm	0.6 mm dia	0.5 in x 1.5 in.	5 mm x 5 mm	1.5 mm x 5 mm
ASTM E950-94 Classification					
Longitudinal Sampling Class	1	1	1	1	1
Sampling Rate	0.5 in	Continuous	1 in	1 in	2 in
Vert. Measurement Resolution Class	1	1	1	1	2
Sampling Rate	0.002 in	0.002 in	0.001 in	0.005 in	0.2% of measurement range
Make & Model of Computer	Industrial Hardened PC	ICP Industrial PC	IBM Compatible	Compaq Presario Laptop	Toshiba
Memory Storage Device	RAM & Hard Drive	Flash Drive	Hard Disk	Hard Disk	Hard Disk

Table 3 (Continued)

Make	International Cybernetics Corp.	Ames Engineering	KJ Law Engineers	Path Runner LITE	ARRB TR
Printer Type	Canon Bubble Jet 80	Thermal, B&G Instruments	Epson LX 300	Canon	Owner's Choice
Monitor Type	Active Matrix Color Flat Panel	Cristel ATM High Intensity	Waterproof Industrial Hardened	Laptop Display	Toshiba
Data Transfer Mode					
3.5" Floppy	X	X	X	X	X
Zip Drive	X		Upon Request	X	X
Other				jaz	
Speed at Data Collection					
Min.	5 mph	8 mph	10 mph	5 mph	20 mph
Max.	20 mph	12 mph	18 mph	15 mph	60 mph
Item that could affect data collection accuracy	Standing Water	Moisture Spray	Standing Water	Sudden accel or deceleration	Standing Water
Event Marker Capable	X	X	X	X	X


Photo 4, ICC MDR4083 Lightweight Profiler, July 12, 1999


Photo 5, Ames LISA 6000 Lightweight Profiler, July 15, 1999

Photo 6, K. J. Law T6400 Lightweight Profiler, July 22, 1999


Photo 7,   Pathway LITE PSI-35 Lightweight Profiler, July 26, 1999

Photo 8, ARRB TR 3LP Profiler, August 16, 1999

Photo 9,   ConnDOT ARAN Vehicle

this study. That information should be available from The Roadware Group, in Paris Ontario, Canada.

Observations on Data Collection

It appears that all of the profilers were capable of delivering what was specified. Each ran 10 passes per wheel path and provided raw profile data as well as IRI data. The general operation of the four all-terrain type devices (ATV) was similar. The ARRB TR 3-LP, which was a hitch mounted device, collected data at Approximately 40 mph, whereas, the other four generally between 10-15 mph. All devices contained on-board computers for data acquisition and analysis, accelerometers for measuring vehicle movement in the vertical direction, sensors that measured distance to the pavement, and an ability to measure longitudinal distance traveled. All of the ATV devices proved maneuverable and functioned without breakdown during the data collection. All were delivered to the project in covered trailers hauled by other vehicles.

Some of the noteworthy differences were: ability to see the computer monitor in ambient daylight, the format of the input and output screens, the lead-in distance prior to collecting data, the type of tires on the vehicle and the custom software programs used to collect and process data. The Ames LISA 6000 appeared to have the only monitor that could be read easily under most lighting conditions. Only the ICC unit contained nubby off-road type tires. It was the only vehicle to use a fifth wheel for distance measurement as well. In general, ease of use and setup did not seem to be significantly different for any of the devices. The setup time for the ARRB TR 3-LP was considerably longer than for other “pre-assembled” ATVs. All devices were set up and ready to test within 30 minutes except the ARRB TR 3-LP, which required over 1 hour setup time.

After the data were collected, it was decided to borrow a Walking Profiler to run the sections as well. It was felt that this may be more representative of ground truth. The Walking Profiler from ARRB Transport Research was borrowed from the Massachusetts Highway Department. Two runs of each wheel path were made for all three sections On September 23, 1999. The Walking Profiler is shown in Photo 10. Additional photographs of each device are given in Appendix B.

Data Analysis

The average IRI values obtained with each profiler are given in Table 4. The values presented are the average of the ten runs for each wheel path and the average for both wheel paths combined. Also given in this table are the grand average of all the devices and the standard deviation of the averages. This overall grand average shows that there was a significant difference in IRI between the left and right wheel paths in the three sections, particularly in section 1. This variation, which is as high as 35 in/mile or approximately 40%, is higher than would be expected on most new pavements. The reason, however, was not identified. The wheel paths did not appear visually to be different.

There is also a relatively significant difference in overall IRI (average of both wheel paths) between the three sections. Section 2

Photo 10, ARRB Transport Research Walking Profiler, September 23, 1999 (Manufacturers Cover was Removed During Testing)

Table 4 Summary Table for IRI Data Collected on Route 9

PROFILER	L IRI SECTION 1 (in/mile)	R IRI SECTION 1 (in/mile)	AVE IRI SECTION 1 (in/mile)	L IRI SECTION 2 (in/mile)	R IRI SECTION 2 (in/mile)	AVE IRI SECTION 2 (in/mile)	L IRI SECTION 3 (in/mile)	R IRI SECTION 3 (in/mile)	AVE IRI SECTION 3 (in/mile)
ARAN - July 7	73	119	96	97	130	113	59	70	64
ARAN - July 29	72	117	95	98	129	114	59	71	65
ARAN - August 19	73	114	93	99	123	111	59	71	65
Ames LISA	71	103	87	89	111	99	52	65	59
ICC MDR4083	86	114	100	91	113	102	54	67	61
KJ Law T6400	71	97	84	90	117	104	62	72	67
Pathways LITE PSI-35	64	85	75	88	86	87	62	71	67
ARRB TR 3LP	69	110	90	96	121	108	55	70	63
Overall Grand Average	**72**	**107**	**90**	**93**	**116**	**105**	**58**	**70**	**64**
Standard Deviation(+-)	6.2	11.6	7.9	4.8	14.0	8.9	2.9	1.7	2.1

	L IRI SECTION 1 (in/mile)	R IRI SECTION 1 (in/mile)	AVE IRI SECTION 1 (in/mile)	L IRI SECTION 2 (in/mile)	R IRI SECTION 2 (in/mile)	AVE IRI SECTION 2 (in/mile)	L IRI SECTION 3 (in/mile)	R IRI SECTION 3 (in/mile)	AVE IRI SECTION 3 (in/mile)
ARRB Walking Profiler	78	117	98	99	121	110	66	74	70

NOTE: Walking Profiler Data not Included in Overall Grand Average contains a bridge within 50 percent of the section length. This could explain why overall Section 2 is rougher than section 3, which does not contain a bridge. However, it was not obvious why section 1 is considerably rougher than section 3. The same contractor used the same equipment to pave all three sections, although section 3 was paved a day later than sections 1 and 2.

Variation between profilers can also be seen in Table 4. The variation was the greatest in Section 2, where the range in averages was 87-114 in/mile. The least variation occurred in Section 3, (61-67 in/mile). Section 1 also showed a significant range in averages between profilers from 75-100 in/mile. However, the reason for a difference in measured IRI between devices for any of the sections is not obvious. Some of the factors that could come into play are driver ability to stay within the wheel paths, ability of the equipment to measure the profile, and other variables that were not identified.

The IRI data obtained with the ARRB TR Walking Profiler, which was borrowed from Massachusetts, are also given in Table 4 in the bottom row. These values are obtained as an average of two runs per wheel path with the Walking Profiler. If the Walking Profiler is used as “ground truth”, i.e. what we believe is the correct IRI value for each section, then the devices that most closely reproduce or match the datasets from the Walking Profiler, based on the average, are: the ConnDOT ARAN and the ICC MDR4083 in section 1; The ARAN and ARRB TR 3-LP in Section 2; and, the Pathway LITE and KJ Law T6400 in Section 3. In all of these cases the average IRI of both wheel paths combined, which also represents the average of 10 runs, fell within 5 IRI (English measurement units) of the Walking Profiler. This is a significant finding because it shows that there is no tendency for any one device to be consistently better than any other device. The measured results appear to be influenced in some way by the section being measured. This makes the possibility of using a standard set of road sections in the future for comparison, certification and/or correlation testing of devices somewhat problematic. This is discussed in a later section of this report.

If the grand average values obtained and listed in Table 4 were utilized with the ConnDOT Special Provision given in Appendix A as a hypothetical case, it is noteworthy that for Section 3, 100 percent payment would have been allowed. In Section 1, a 5 percent penalty would have been imposed. In Section 2, a 10 percent penalty results. (Of course this is based upon the assumptions that each 0.1 mile section is a complete paving project, and that the Special Provision is applicable for the Route 9 construction project. Both of which are not true.)

What may be more significant, however, is the variation in IRI obtained with the different profilers. Again, using the data from Table 4, and assuming the hypothetical situation above, in Section 2 the pay adjustment would have ranged from a 5 percent penalty (Pathway LITE data) to as much as a 25 percent penalty (ConnDOT ARAN data), depending on which profiler data set is used. If one device were used for Quality Control and the other for Agency Acceptance, this amount of variation would likely lead to a dispute between the contractor and the pavement owner.

The IRI data for all passes with every device are included as tables in Appendix C for reference.

Each vendor also supplied profile data. It was expected that this would represent the raw data collected. When these data were plotted using Excel™ graphing there is considerable variation in the plots for two of the devices, Pathway LITE and ARRB TR 3-LP, compared to the other three lightweight profilers and the ARAN. However, when the ARRB data are plotted using a 100-ft high-pass filter with "ROADRUF" software that is available through the University of Michigan, the profile plots appear to be more consistent with those from other devices. When the ARRB 3-LP data were plotted with RoadRuf software using 'elevation unfiltered' the profile appeared similar to the Excel™ plots. Accordingly, ConnDOT personnel concluded that Ames LISA, KJLaw T6400, ICC MDR4083 and ARAN all provided 100 ft high pass (or similar) filtered data, while ARRB (Trigg Industries) provided unfiltered elevation data. It could not be determined whether the Pathway LITE data provided was filtered or unfiltered, as its graphs did not fit with either graph configuration. Walking Profiler data plotted using Excel™ appeared to be consistent with the elevation unfiltered type configuration.

Being that ConnDOT Research personnel have not had much experience with profile plotting, and we did not wish to expend a large amount of time on this topic, the plots produced are given in Appendix D for reference. No analysis was done or explanation provided here for these graphs.

Statistical Analyses of Repeatability and Mean IRI

The repeatability (or precision) for each device can be evaluated by looking at the standard deviation. The repeatability, of course, will be affected by the ability of the vehicle's driver to maintain a consistent path. Dots were painted in each wheel path every 25 feet in order to alleviate this variable from the study. However, it was observed that some of the drivers deviated from the path. Therefore, some of the variation in runs may be due to the errant positioning.

The standard deviations appearing in Appendix C are replicated in Table 5. This shows that the standard deviations are lowest with the Ames LISA, followed by the ARRB TR 3-LP and ConnDOT's ARAN. The repeatability of the devices appears to best on section 3, which has the lowest average IRI. It is likely that the rougher the pavement the more important it is to follow an exact track when analyzing repeatability.

Overall, the amount of variability as determined from the standard deviations in Table 5 is not very different between the various devices. The worst case produced a standard deviation that ranges from +/- 2.3 – 4.1 in/mile. This is not extremely different from the best case, +/- 1.0 - 2.2 in/mile.

To compare the average or mean IRI value obtained by the various devices used in this study an analysis of variance (ANOVA,) Student's t test, and the variance ratio test (F test) were performed. The intent is to determine if the differences between IRI obtained with each device are significant or due to chance only. ANOVA is used to compare the devices as a group. The t test is used to make this determination on a one-to-one basis. With the t test a null hypothesis is developed such as “mean IRI obtained with device A = Mean IRI obtained with device B” or in other words, the means are not significantly different. The t statistic is used to either accept or reject the hypotheses. As can be seen in Table 4, the means for each device for each of the three sections are almost never numerically equivalent. However at a specified level of significance, for example five percent or one percent, the absolute difference may be small enough to be statistically insignificant. The significance of the difference in the means is what is determined from the statistical methods.

Table 5 Comparison of Repeatability Using Standard Deviations

Profiler	Section 1 Standard Deviation (in/mile)	Section 2 Standard Deviation (in/mile)	Section 3 Standard Deviation (in/mile)	# of passes
ConnDOT ARAN #5 (July 7)	2.2	3.4	1.8	10
ConnDOT ARAN #5 July 29)	2.1	1.3	0.7	10
ConnDOT ARAN #5 (Aug. 19)	2.0	1.8	1.3	10
ICC MDR4083	3.7	1.2	1.1	7-10 (3 runs deleted for Section 1 as outliers)
KJ Law T6400	2.8	2.9	3.9	10
Pathway LITE	2.3	3.9	4.1	10
ARRB TR 3-LP	2.8	2.6	0.5	10
Ames LISA	2.2	1.1	1.0	10
Average Standard Deviation of all Devices	2.5	2.3	1.8	

One of the assumptions in applying the t-test is that the sample variances (standard deviation squared) are homogeneous, i.e., the samples belong to the same population. In this study all measurements were made on the same three sites using different pieces of equipment and with different operators, which in the case of profilers also means different drivers. The drivers ability to follow the painted marks comes into play, as well the variability of the equipment. The t statistic is modified depending on whether the variances determined from an F-test show the same or different populations, i.e., the variances are equal or unequal.

The results of the ANOVA are presented in Table 6. A one percent significance level is used. The table shows that the average of the multiple runs of the ARAN van #5 that were obtained on July 7, July 29 and August 19 are equal, i.e. the null hypothesis is accepted, for all three sites. This provides statistical evidence that our previous statement about the smoothness not changing over time is correct. It also shows that the van produces the same result over a time interval

Table 6, Part 1
ANOVA Results for ARAN #5
SECTION 1
ALPHA = 0.01

Anova: Single Factor

SUMMARY

Groups	*Count*	*IRI Sum*	*Average IRI*	*IRI Variance*
ARAN 1	10	959.0	95.9	4.99
ARAN 2	10	946.0	94.6	4.49
ARAN 3	10	934.5	93.5	3.91

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	30.05	2	15.025	3.365899191	0.049531	5.488118
Within Groups	120.525	27	4.46388889			
Total	150.575	29				

The alternatives here are:
H_0: $\underline{IRI1} = \underline{IRI2} = \underline{IRI3}$
H_1: Not all $\underline{IRI}$ are equal.
where,
$\underline{IRI}$ = mean IRI,
$\underline{IRI1}$ = mean IRI for ARAN 1 (5),
$\underline{IRI2}$ = mean IRI for ARAN 2 (5), and
$\underline{IRI3}$ = mean IRI for ARAN 3 (5).

It is desired to control the risk at 0.01, therefore $F_{crit} = 5.488$.

If $F <= F_{crit}$, conclude H_0
If $F > F_{crit}$, conclude H_1

$F = 3.366 < F_{crit} = 5.488$

Conclude H_0 - that mean IRI are the same for three tests performed with ARAN Van 5.

Table 6, Part 1, Continued
ANOVA Reslts for ARAN #5
SECTION 2
ALPHA = 0.01

Anova: Single Factor

SUMMARY

Groups	*Count*	*IRI Sum*	*Average IRI*	*IRI Variance*
ARAN 1 (5)	10	1130.0	113.0	11.33
ARAN 2 (5)	10	1137.0	113.7	1.79
ARAN 3 (5)	10	1110.0	111.0	3.39

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	39.26667	2	19.63333333	3.567294751	0.042197	5.488118
Within Groups	148.6	27	5.503703704			
Total	187.8667	29				

The alternatives here are:

H_0: <u>IRI1</u> = <u>IRI2</u> = <u>IRI3</u>

H_1: Not all <u>IRI</u> are equal.

where,

<u>IRI</u> = mean IRI,
<u>IRI1</u> = mean IRI for ARAN 1 (5),
<u>IRI2</u> = mean IRI for ARAN 2 (5), and
<u>IRI3</u> = mean IRI for ARAN 3 (5).

It is desired to control the risk at 0.01, therefore F_{crit} = 5.488.

If F <= F_{crit}, conclude H_0
If F > F_{crit}, conclude H_1

$F = 3.567 < F_{crit} = 5.488$

Conclude H_0 - that mean IRI are the same for three tests performed with ARAN Van 5.

Table 6, Part 1, Continued
ANOVA Results for ARAN #5
SECTION 3
ALPHA = 0.01

Anova: Single Factor

SUMMARY

Groups	*Count*	*IRI Sum*	*Average IRI*	*IRI Variance*
ARAN 1 (5)	10	644.0	64.4	3.38
ARAN 2 (5)	10	647.0	64.7	0.46
ARAN 3 (5)	10	647.0	64.7	1.68

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.6	2	0.3	0.163306452	0.850163	5.488118
Within Groups	49.6	27	1.83703704			
Total	50.2	29				

The alternatives here are:

H_0: $\underline{IRI1} = \underline{IRI2} = \underline{IRI3}$

H_1: Not all $\underline{IRI}$ are equal.

where,

$\underline{IRI}$ = mean IRI,
$\underline{IRI1}$ = mean IRI for ARAN 1 (5),
$\underline{IRI2}$ = mean IRI for ARAN 2 (5), and
$\underline{IRI3}$ = mean IRI for ARAN 3 (5).

It is desired to control the risk at 0.01, therefore $F_{crit} = 5.488$.

If $F \le F_{crit}$, conclude H_0

If $F > F_{crit}$, conclude H_1

$F = 0.163 \ll F_{crit} = 5.488$.

Conclude H_0 - that mean IRI are the same for three tests performed with ARAN Van 5

Table 6, Part 2
ANOVA Results for All Profilers
SECTION 1
ALPHA = 0.01

Anova: Single Factor

SUMMARY

Groups	Count	IRI Sum	Average IRI	IRI Variance
ARAN 1 (5)	10	959.0	95.9	4.99
ARAN 2 (5)	10	946.0	94.6	4.49
ARAN 3 (5)	10	934.5	93.5	3.91
ARAN 4 (6)	10	926.5	92.7	2.34
KJ LAW - T6400	10	841.5	84.1	7.65
PATHWAY - PSI-35	10	746.5	74.7	5.45
ARRB 3-LP	10	899.2	89.9	8.11
ICC - MDR4083	7	698.5	99.8	13.99
AMES - LISA 6000	10	867.8	86.8	4.65

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	4220.508	8	527.5635031	89.80202387	3.77E-36	2.748138
Within Groups	458.2297	78	5.87473957			
Total	4678.738	86				

The alternatives here are:

H_0: $\underline{IRI1} = \underline{IRI2} = \underline{IRI3} = \underline{IRI4} = \underline{IRI5} = \underline{IRI6} = \underline{IRI7} = \underline{IRI8} = \underline{IRI9}$

H_1: Not all $\underline{IRI}$ are equal.

where,

$\underline{IRI}$ = mean IRI,
$\underline{IRI1}$ = mean IRI for ARAN 1 (5),
$\underline{IRI2}$ = mean IRI for ARAN 2 (5),
$\underline{IRI3}$ = mean IRI for ARAN 3 (5),
$\underline{IRI4}$ = mean IRI for ARAN 4 (6),
$\underline{IRI5}$ = mean IRI for KJ LAW - T6400,
$\underline{IRI6}$ = mean IRI for PATHWAY PSI-35
$\underline{IRI7}$ = mean IRI for ARRB 3-LP
$\underline{IRI8}$ = mean IRI for ICC - MDR4083, and
$\underline{IRI9}$ = mean IRI for AMES - LISA 6000.

It is desired to control the risk at 0.01, therefore F_{crit} = 2.748.

If $F <= F_{crit}$, conclude H_0
If $F > F_{crit}$, conclude H_1

$F = 89.802 >> F_{crit} = 2.748$ (highly significant).

Conclude H_1 - that mean IRI are not the same for the different profilers.

Table 6, Part 2, Continued
ANOVA Results for All Profilers
SECTION 2
ALPHA = 0.01

Anova: Single Factor

SUMMARY

Groups	*Count*	*IRI Sum*	*Average IRI*	*IRI Variance*
ARAN 1 (5)	10	1130.0	113.0	11.33
ARAN 2 (5)	10	1137.0	113.7	1.79
ARAN 3 (5)	10	1110.0	111.0	3.39
ARAN 4 (6)	10	1167.5	116.8	2.74
KJ LAW - T6400	10	1036.3	103.6	8.13
PATHWAY - PSI-35	10	869.0	86.9	15.16
ARRB 3-LP	10	1081.4	108.1	6.82
ICC - MDR4083	9	916.0	101.8	1.51
AMES - LISA 6000	10	1002.7	100.3	1.25

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	6724.524	8	840.5654609	143.836359	3.34E-44	2.741956
Within Groups	467.5121	80	5.843901132			
Total	7192.036	88				

The alternatives here are:

H_0: $\underline{IRI1} = \underline{IRI2} = \underline{IRI3} = \underline{IRI4} = \underline{IRI5} = \underline{IRI6} = \underline{IRI7} = \underline{IRI8} = \underline{IRI9}$

H_1: Not all $\underline{IRI}$ are equal.

where,

$\underline{IRI}$ = mean IRI,
$\underline{IRI1}$ = mean IRI for ARAN 1 (5),
$\underline{IRI2}$ = mean IRI for ARAN 2 (5),
$\underline{IRI3}$ = mean IRI for ARAN 3 (5),
$\underline{IRI4}$ = mean IRI for ARAN 4 (6),
$\underline{IRI5}$ = mean IRI for KJ LAW - T6400,
$\underline{IRI6}$ = mean IRI for PATHWAY PSI-35
$\underline{IRI7}$ = mean IRI for ARRB 3-LP
$\underline{IRI8}$ = mean IRI for ICC - MDR4083, and
$\underline{IRI9}$ = mean IRI for AMES - LISA 6000.

It is desired to control the risk at 0.01, therefore F_{crit} = 2.742.

If $F <= F_{crit}$, conclude H_0
If $F > F_{crit}$, conclude H_1

$F = 143.836 >> F_{crit} = 2.742$ (highly significant).

Conclude H_1 - that mean IRI are not the same for the different profilers.

Table 6, Part 2 Continued
ANOVA Results for All Profilers
SECTION 3
ALPHA = 0.01

Anova: Single Factor

SUMMARY

Groups	*Count*	*IRI Sum*	*Average IRI*	*IRI Variance*
ARAN 1 (5)	10	644.0	64.4	3.38
ARAN 2 (5)	10	647.0	64.7	0.46
ARAN 3 (5)	10	647.0	64.7	1.68
ARAN 4 (6)	10	647.0	64.7	0.46
KJ LAW - T6400	10	672.1	67.2	15.38
PATHWAY - PSI-35	10	668.0	66.8	16.90
ARRB 3-LP	10	629.8	63.0	0.27
ICC - MDR4083	9	548.5	60.9	1.28
AMES - LISA 6000	10	586.5	58.7	0.92

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	577.406	8	72.17575532	15.8122027	1E-13	2.741956
Within Groups	365.1648	80	4.564560465			
Total	942.5709	88				

The alternatives here are:

H_0: $\underline{IRI1} = \underline{IRI2} = \underline{IRI3} = \underline{IRI4} = \underline{IRI5} = \underline{IRI6} = \underline{IRI7} = \underline{IRI8} = \underline{IRI9}$

H_1: Not all $\underline{IRI}$ are equal.

where,

$\underline{IRI}$ = mean IRI,
$\underline{IRI1}$ = mean IRI for ARAN 1 (5),
$\underline{IRI2}$ = mean IRI for ARAN 2 (5),
$\underline{IRI3}$ = mean IRI for ARAN 3 (5),
$\underline{IRI4}$ = mean IRI for ARAN 4 (6),
$\underline{IRI5}$ = mean IRI for KJ LAW - T6400,
$\underline{IRI6}$ = mean IRI for PATHWAY PSI-35
$\underline{IRI7}$ = mean IRI for ARRB 3-LP
$\underline{IRI8}$ = mean IRI for ICC - MDR4083, and
$\underline{IRI9}$ = mean IRI for AMES - LISA 6000.

It is desired to control the risk at 0.01, therefore F_{crit} = 2.742.

If $F <= F_{crit}$, conclude H_0
If $F > F_{crit}$, conclude H_1

$F = 15.812 > F_{crit} = 2.742$.

Conclude H_1 - that mean IRI are not the same for the different profilers.

of 5 weeks. On the other hand, the hypothesis that the means of <u>all</u> the profiler devices are equal is rejected (see Table 6, Part 2).

The results of the F and t tests are given in Appendix E. For these tests all two-way combinations of profilers are compared. This includes the Walking Profiler and the ARAN van #6 as well, resulting in 10 devices/days being compared. The number of paired datasets is then equal to 45 combinations of the ten devices/days for each of the three sections.

A summary of the results is given in Table 7. Here it can be seen that the ARAN #5 runs all compare to each other as previously noted with the ANOVA, except for the July 29 and August 19 runs of section 2. The difference in means of 2.7 was deemed significant by the t-test. Van #6 IRI is equivalent to van #5 IRI on section 3, all runs, and section 1, July 29 and August 19 runs only. In other words the difference in means is considered to be significant in section 1 for July 7th and section 2, using the t test.

It can be noted from Table 7 that when other devices are compared one-by-one, the mean IRI is considered equivalent between any given two devices in only 13% to 24% of the cases depending on which section is being compared. The best comparison occurs for section 3 (24%). In Table 7, the devices that produced statistically equivalent mean IRI data to the Walking Profiler are given in **boldface** type. The devices that produced statistically equivalent mean IRI data to at least one of the ARAN 5 runs are given in ***bold italics***.

The IRI data used in the analysis discussed above was that submitted by each vendor. ConnDOT did not re-calculate IRI values from the submitted profile data for this study.

<u>Recommendations on ConnDOT Smoothness Specifications</u>

The results of a literature search, indicate that most State construction specifications are based on the use of the profile index or similar profilograph statistic. A study performed by South Carolina DOT, which surveyed all fifty states, obtained information from 34 agencies. This survey summarized in reference/4/ found that three states use lightweight profilers for HMA pavement construction: Michigan, Pennsylvania and Texas. The International Roughness Index is shown as being used in four states: Connecticut, Maine, Vermont and Virginia. This report also indicates that 22 states use a bonus and penalty in their construction specifications. The report prepared for South Carolina DOT noted that IRI and lightweight profilers were viable candidates for consideration by SCDOT /ref. 4/.

The Pennsylvania DOT is also in the process of converting from Profile Index to IRI using the lightweight profilers. PennDOT plans to certify the profilers and the drivers using established pavement test sections near Harrisburg, PA./ref. 5/ The current draft plan for this activity indicates that the standard sections will be profiled with a ARRB TR Walking Profiler; the reference values (IRI) obtained will then be used to certify Lightweight Profilers. The profilers will be

Table 7
Section 1 - Results of Statistics to Prove Hypotheses

Hypothesis	Difference in Means	Accept Hypothesis	Reject Hypothesis
ARAN5(1)=ARAN5(2)	1.3	X	
ARAN5(1)=ARAN5(3)	2.4	X	
ARAN5(1)=ARAN6	3.3		X
ARAN5(1)=LISA	9.1		X
ARAN5(1)=T6400	11.8		X
ARAN5(1)=LITE	21.2		X
ARAN5(1)=MDR4083	3.9	X	
ARAN5(1)=ARRB3-LP	6.0		X
ARAN5(1)=WalkProfile	1.9	X	
ARAN5(2)=ARAN5(3)	1.1	X	
ARAN5(2)=ARAN6	1.9	X	
ARAN5(2)=LISA	7.8		X
ARAN5(2)=T6400	10.5		X
ARAN5(2)=LITE	19.9		X
ARAN5(2)=MDR4083	5.2		X
ARAN5(2)=ARRB3-LP	4.7		X
ARAN5(2)=WalkProfile	3.2		X
ARAN5(3)=ARAN6	0.8	X	
ARAN5(3)=LISA	6.7		X
ARAN5(3)=T6400	9.4		X
ARAN5(3)=LITE	18.8		X
ARAN5(3)=MDR4083	6.3		X
ARAN5(3)=ARRB3-LP	3.6		X
ARAN5(3)=WalkProfile	4.3	X	
ARAN6=LISA	5.9		X
ARAN6=T6400	8.6		X
ARAN6=LITE	18.0		X
ARAN6=MDR4083	7.1		X
ARAN6=ARRB3-LP	2.8	X	
ARAN6=WalkProfile	5.1		X
LISA=T6400	8.6		X
LISA=LITE	12.1		X
LISA=MDR4083	13.0		X
LISA=ARRB3-LP	3.1	X	
LISA=WalkProfile	11.0		X
T6400=LITE	9.4		X
T6400=MDR4083	15.7		X
T6400=ARRB3-LP	5.8		X
T6400=WalkProfile	13.7		X
LITE=MDR4083	25.1		X
LITE=ARRB3-LP	15.2		X
LITE=WalkProfile	23.1		X
MDR4083=ARRB3-LP	9.9		X
MDR4083=WalkProfile	2.0	X	
ARRB3-LP=WalkProfile	7.9		X

Table 7 Continued
Section 2 - Results of Statistics to Prove Hypotheses

Hypothesis	Difference in Means	Accept Hypothesis	Reject Hypothesis
ARAN5(1)=ARAN5(2)	0.7	X	
ARAN5(1)=ARAN5(3)	2.0	X	
ARAN5(1)=ARAN6	3.8		X
ARAN5(1)=LISA	12.7		X
ARAN5(1)=T6400	9.4		X
ARAN5(1)=LITE	26.1		X
ARAN5(1)=MDR4083	11.2		X
ARAN5(1)=ARRB3-LP	4.9		X
ARAN5(1)=WalkProfile	3.0	X	
ARAN5(2)=ARAN5(3)	2.7		X
ARAN5(2)=ARAN6	3.1		X
ARAN5(2)=LISA	13.4		X
ARAN5(2)=T6400	10.1		X
ARAN5(2)=LITE	26.8		X
ARAN5(2)=MDR4083	11.9		X
ARAN5(2)=ARRB3-LP	5.6		X
ARAN5(2)=WalkProfile	3.7	X	
ARAN5(3)=ARAN6	5.8		X
ARAN5(3)=LISA	10.7		X
ARAN5(3)=T6400	7.4		X
ARAN5(3)=LITE	24.1		X
ARAN5(3)=MDR4083	9.2		X
ARAN5(3)=ARRB3-LP	2.9	X	
ARAN5(3)=WalkProfile	1.0	X	
ARAN6=LISA	16.5		X
ARAN6=T6400	13.2		X
ARAN6=LITE	29.9		X
ARAN6=MDR4083	15.0		X
ARAN6=ARRB3-LP	8.7		X
ARAN6=WalkProfile	6.8		X
LISA=T6400	3.3		X
LISA=LITE	13.4		X
LISA=MDR4083	1.5	X	
LISA=ARRB3-LP	7.8		X
LISA=WalkProfile	9.7		X
T6400=LITE	16.7		X
T6400=MDR4083	1.8	X	
T6400=ARRB3-LP	4.5		X
T6400=WalkProfile	6.4	X	
LITE=MDR4083	14.9		X
LITE=ARRB3-LP	21.2		X
LITE=WalkProfile	23.1		X
MDR4083=ARRB3-LP	6.3		X
MDR4083=WalkProfile	8.2		X
ARRB3-LP=WalkProfile	1.9	X	

Table 7 Continued
Section 3 - Results of Statistics to Prove Hypotheses

Hypothesis	Difference in Means	Accept Hypothesis	Reject Hypothesis
ARAN5(1)=ARAN5(2)	0.3	X	
ARAN5(1)=ARAN5(3)	0.3	X	
ARAN5(1)=ARAN6	0.3	X	
ARAN5(1)=LISA	5.7		X
ARAN5(1)=T6400	2.8	X	
ARAN5(1)=LITE	2.4	X	
ARAN5(1)=MDR4083	3.5		X
ARAN5(1)=ARRB3-LP	1.4	X	
ARAN5(1)=WalkProfile	5.5		X
ARAN5(2)=ARAN5(3)	0.0	X	
ARAN5(2)=ARAN6	0.0	X	
ARAN5(2)=LISA	6.0		X
ARAN5(2)=T6400	2.5	X	
ARAN5(2)=LITE	2.1	X	
ARAN5(2)=MDR4083	3.8		X
ARAN5(2)=ARRB3-LP	1.7		X
ARAN5(2)=WalkProfile	5.2		X
ARAN5(3)=ARAN6	0.0	X	
ARAN5(3)=LISA	6.0		X
ARAN5(3)=T6400	2.5		X
ARAN5(3)=LITE	2.1	X	
ARAN5(3)=MDR4083	3.8		X
ARAN5(3)=ARRB3-LP	1.7		X
ARAN5(3)=WalkProfile	5.2		X
ARAN6=LISA	6.0		X
ARAN6=T6400	2.5		X
ARAN6=LITE	2.1		X
ARAN6=MDR4083	3.8		X
ARAN6=ARRB3-LP	1.7		X
ARAN6=WalkProfile	5.2	X	
LISA=T6400	8.5		X
LISA=LITE	8.5		X
LISA=MDR4083	2.2		X
LISA=ARRB3-LP	4.3		X
LISA=WalkProfile	11.2		X
T6400=LITE	0.4	X	
T6400=MDR4083	6.3		X
T6400=ARRB3-LP	4.2		X
T6400=WalkProfile	2.7	X	
LITE=MDR4083	5.9		X
LITE=ARRB3-LP	3.8	X	
LITE=WalkProfile	3.1		X
MDR4083=ARRB3-LP	2.1		X
MDR4083=WalkProfile	9.0		X
ARRB3-LP=WalkProfile	6.9	X	

required to collect five passes per wheel path on the same standard sections, and produce an output average that is within +/- 3% of the reference IRI value, and a standard deviation for each device that is within +/- 3% of its collected mean IRI, in order to be approved for testing on construction projects. Accepted Profilers would be issued a decal, and approved drivers would be issued a card that is good for one construction season. This proposed certification process is expected to begin during the 2000 season.

The existing ConnDOT special provision for pavement smoothness that is dated May 1998, and given in Appendix A of this report, appears to suffer from two issues that may make the use of lightweight profilers difficult. First of all, the variability obtained with the various devices could lead to disputes between the state and the contractor and possibly between the contractor and subcontractor that might be hired to obtain the quality control data. Obviously if ConnDOT continues to use the ARAN data for some type of acceptance testing, while allowing other profilers for quality control, then statistics performed to compare with the QC data, will likely indicate discrepancies as was found during this study on route 9.

With the current pay adjustment table, the incremental steps used could lead to situations where one device will indicate a significant penalty and another a 100 percent payment. At this point in time it is recommended that the ConnDOT special provision for pavement smoothness be utilized for at least another year before any major changes are incorporated that would allow the use of Lightweight Profilers. The Payment Adjustment Schedule should be adjusted to allow for a graduated change in pay adjustment. In other words, the increments that result in 5 to 10% jumps in adjusted payment in Table 1 (Appendix A) should be eliminated by using an equation relating payment to IRI. This recommendation has been presented to ConnDOT’s HMA Task Force for Pavement Improvement, Rideability Section.

Summary of Findings and Conclusions

It appears that all of the profilers used in this study in Connecticut were capable of delivering the data that was specified. All can measure profile and provide an IRI summary output. Most have options for summarizing data in other formats such as Ride Number, profile index (similar to profilographs), and some other indices that are unique to a few states. All were portable enough to allow use on active construction projects on an as–needed basis. The equipment appeared rugged enough to withstand the field environment; although the customized components used for data collection such as the on-board computer, monitor, keyboard and printer varied significantly from device to device. Some used ruggedized industrial computers, but some used adapted laptop computers and office-environment printers and keyboards. Being caught in a sudden unexpected downpour would likely cause data collection to be ceased immediately, if not only for the fact that water on the pavement would affect the results, but also because some of the equipment did not appear waterproofed.

The analysis of IRI provided by the vendors, obtained from three field sites in Connecticut, showed reasonable repeatability or precision. More variability is found between ten runs made on a section that is rougher than one that is smoother. It would appear that roughness varies laterally across the lane. It was found that the roughness between the left and right wheel path for the three sections studied varied from as little as 17% to as much as 40% depending on the section measured. It was noted that some of the profilers also varied their position within the wheel path on multiple runs by as much as several inches. This is probably the single greatest factor affecting the repeatability measurements.

The difference in IRI measured as an average of ten runs, both wheel paths combined, was significant for almost all of the profilers. The only runs that were found to be not significantly different were obtained with ConnDOT's ARAN vehicle, which collected data on three different days. This does not mean that any of the Lightweight Profilers would not produce similar data on different days; only that significant differences <u>between</u> devices were obtained. (Each lightweight profiler was run on a single but differing day.) The importance of this finding is in regards to ConnDOT's special provision on pavement smoothness that currently exists. If ConnDOT allows other profilers to be used simultaneously with the ARAN for quality control and agency acceptance testing, the current payment adjustment factors could lead to disputes between the State and paving Contractor.

In order to accommodate the use of lightweight profilers for quality control or agency acceptance the current special provision needs to be revised, and a procedure to certify lightweight profilers developed. It is hoped that the pavement smoothness guidelines currently being developed for AASHTO by the FHWA Smoothness Expert Task Group will provide useful guidance to ConnDOT in this area as well. In the mean time it is recommended that ConnDOT continue the exclusive use of the ARAN for quality assurance during the 2000 construction season. The results of the other eight states who participated in this FHWA study will be of obvious interest to ConnDOT, as will the PennDOT experience with Profiler certification in the year 2000.

On the other hand, the purchase of another profiler (lightweight or otherwise) by ConnDOT will need to be addressed within the next two years. The expansion of the use of the special provision on pavement smoothness to routes other than interstates will negatively impact the photolog unit's ability to provide network-level data if the ARAN is used on more than three construction projects per season.

<u>References Cited</u>

1. Larsen, D.A., "Pavement Management in Connecticut, Phase – 1, Feasibility," ConnDOT, December 1982.

2. Collura, J. et al. "Guidelines for Ride Quality Acceptance of Pavements – Final Report," New England Transportation Consortium, April 1997.

3. Federal Highway Administration, Office of Engineering, Highway Operations Division, "Improved Construction and Maintenance Operations," August 1998.

4. Baus, R.L., Hong, W., "Investigation and Evaluation of Roadway Rideability Equipment and Specifications," University of South Carolina, November 1999.

5. PennDOT, “Lightweight Profiling System – Calibration and Operator Certification Program, DRAFT” November 1999.

SECTION 4.06 - BITUMINOUS CONCRETE

Article 4.06.03 - Construction Methods, Subarticle 10 - Surface Test of Pavement, is amended as follows: **After the last paragraph of the Subarticle add the following:**

(a) Pavement Smoothness (Rideability): The Engineer shall evaluate the final pavement surface for smoothness by testing in accordance with Section 4.06 and as stated herein. This provision will apply to projects requiring a minimum of two (2) courses of Hot Mix Asphalt (HMA) in which the compacted depth of each is 1.5 inches (40 mm) or greater.

Prior to the placement of the final course of pavement, the Engineer will furnish the Contractor with an International Roughness Index (IRI) value that results from the Engineer's evaluation of the material placed to date. The actual time of this "trial" evaluation will be coordinated between the Engineer and the Contractor. This evaluation will be limited to one (1) test in each direction of travel. The IRI value will serve as a guide to the Contractor in evaluating his current level of conformance with the smoothness specification.

The IRI value for the final course of pavement will be the basis for determining any payment adjustment(s) in accordance with Table 1, Schedule of Adjusted Payment of Section, 4.06.04 - Method of Measurement, Subarticle 4.06.04 - 7 "Adjustment for Rideability."

Evaluation Method - The final pavement surface shall be evaluated for smoothness using an "Automated Road Analyzer" vehicle or **ARAN**. Computers aboard the ARAN contain software that simulates the traversing of a so-called "quarter car" over the adjusted profile, and calculates an average IRI value as defined by the World Bank, for each lane of travel over the project. This ARAN is a Class II device as defined by the World Bank. The IRI represents the vertical (upward and downward) displacement that a passenger would experience traveling at 48 MPH (77 km/hr) in a standard vehicle over the profile established by the device. A zero IRI value would indicate a perfectly smooth pavement surface, while increasing IRI values would correspond to an increasingly rough pavement surface. The ARAN has the capability to measure longitudinal profile in each wheelpath simultaneously. IRI values shall be calculated in inches (meters) of vertical displacement every 0.01 mile (16 meters) and normalized over one (1) mile in inches/mile, or 1.6 km in m/km. For example, a 0.01-mile section yielding an actual vertical displacement of one (1) inch would be normalized to an IRI value of 100 inches/mile.

The final pavement surface will be divided into 0.10 mile (160 meter) segments representing the total lane miles of the project. The total lane miles are equal to the miles of resurfacing multiplied by the number of lanes being evaluated. The final segment will include any remaining portion of a segment not equaling 0.10 miles (160 meters) [Example: 1.52 miles of pavement would have 15 segments with the last one measuring 0.12 miles]. The IRI calculated from each wheelpath for each 0.10 mile (160 meter) segment will be averaged to determine the IRI value for that segment.

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The evaluation shall be subject to the following:

1. Only mainline travel lanes will be evaluated. This shall include climbing lanes, operational lanes, and turning roadways that are 0.4 miles (644 meters) or greater in length.

2. Smoothness data will not be computed for the following project sections:

   - Climbing and operational lanes and turning roadways less than 0.4 miles (644 meters) in length
   - Acceleration and deceleration lanes
   - Shoulders and gore areas
   - Pavement on horizontal curves which have a 900 foot (274.32 meters) or less centerline radius of curvature, and pavement within the superelevation transition of these curves.

3. Bridge decks shall be included **only** if paved as part of the project. If the bridge decks are not included in the project, profile testing will be suspended two hundredths of a mile (0.02) [32 meters] prior to the first expansion joint and after the last expansion joint on the bridge decks.

4. Ramps are specifically excluded from the requirements of this Section.

5. Measurement will start two-hundredths of a mile (0.02) [32 meters] prior to and after the transverse joints at the project limits.

6. Data will be collected within 30 days of completion of the entire final course of pavement, or within 30 days of completion of any corrective work on the pavement. If the entire final course of pavement can not be completed prior to December 1 (winter shutdown), then data will be collected for any portion of the roadway in which the <u>**final**</u> course of pavement has been placed. These data will be saved and stored by the Department. Once the remainder of the final course has been placed, the data will be collected and combined with the data taken previously.

   If the Engineer determines that any pavement corrective work is required, the Contractor will be notified in writing within five (5) working days after the completion of the final course of pavement. The Contractor shall have thirty (30) days following such notification to make any repairs to the pavement before smoothness measurements are taken.

7. No testing shall be conducted during rain or under other conditions deemed inclement by the Engineer. During testing, the roadway must be free of moisture and other deleterious materials which might affect the evaluation. Any work associated with preparing the roadway for the evaluation, such as but not limited to sweeping, will <u>not</u> be measured for payment.

GENERAL

Article 4.06.04 - Method of Measurement:

Add the following Subarticle:

7—Adjustment for Rideability: Payment to the Contractor shall be based on the IRI, according to the following table. The percent adjustment will be applied to payment(s) for the total quantity of HMA surface course, excluding ramps, complete-in-place, and shall conform to the requirements of Section 4.06 and this provision.

TABLE 1
SCHEDULE FOR
PAYMENT

IRI (inches per mile)	IRI (meters per kilometer)	PERCENT ADJUSTMENT
< 50	< 0.79	+ 10
51 - 60	0.80 - 0.95	+ 05
61 - 80	0.96 - 1.26	0
81 - 100	1.27 - 1.58	- 05
101 - 110	1.59 - 1.74	- 10
111 - 120	1.75 - 1.89	- 25
> 120	> 1.89	- 50

<u>NOTE</u>: All values in the English system will be rounded to the nearest whole number.
(Example: 75.5 shall be rounded to 76.)

All values in the metric system will be rounded to the nearest hundredth.
(Example: 0.826 shall be rounded to 0.83.)

Article 4.06.05 - Basis of Payment is amended as follows:

Add the following at the end of the first sentence:

…except as noted herein. An adjustment in payment shall apply to the quantity of HMA for the surface course, excluding ramps, furnished and placed in accordance with Section 4.06.

Positive adjustments for rideability <u>**shall not be made**</u> for those areas reviewed and determined by the Engineer to be defective as stipulated in Subarticles 1.05.11 and 1.06.04.

GENERAL

Appendix B

Photographs of Light Weight Profilers

Photo B1 ICC MDR4083 Unloading from Trailer

Photo B2 ICC MDR4083 Sensors in Bumper

Photo B3 ICC MDR4083 Data Collection Computer

Photo B4   ICC MDR4083

Photo B5 Ames LISA 6000 Trailer and Tow Vehicle

Photo B6 Ames LISA 6000

Photo B7 Ames LISA 6000 Data Collection Computer Monitor

Photo B8 Ames LISA 6000 Laser and Accelerometer Compartment


Photo B9 Unloading KJLaw T6400


Photo B10 KJLaw Engineers Inc. T6400 Lightweight Profiler


Photo B11 KJLaw T6400 Data Collection System


Photo B12 KJLaw T6400 Infrared Sensor Enclosure


Photo B13 Unloading PathRunner LITE PSI-35


Photo B14 Pathway Services PathRunner LITE PSI-35

Photo B15 Data Collection PC for PathRunner LITE PSI-35

Photo B16 Laser Enclosure and Visual Guide on PathRunner LITE PSI-35


Photo B17 ARRB TR 3-LP Vehicle (rented) with Sensors

Photo B18 Assembling the Sensors for ARRB TR 3-LP

Photo B19 Laser Sensors Mounted for ARRB TR 32-LP

Photo B20 ARRB Walking Profiler

Photo B21   ARRB Walking Profiler


Photo B22 ARRB Walking Profiler

Appendix C

International Roughness Index Data Collected on State Route 9

Connecticut DOT ARAN Van 5 - July 7, 1999									
	L IRI	**R IRI**	**AVE IRI**	**L IRI**	**R IRI**	**AVE IRI**	**L IRI**	**R IRI**	**AVE IRI**
	SECTION 1	**SECTION 1**	**SECTION 1**	**SECTION 2**	**SECTION 2**	**SECTION 2**	**SECTION 3**	**SECTION 3**	**SECTION 3**
	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)
Pass 1	74	127	101	97	128	112	59	63	61
Pass 2	72	116	94	97	126	112	59	68	64
Pass 3	71	119	95	101	130	115	59	68	64
Pass 4	73	117	95	92	125	109	58	69	64
Pass 5	71	118	94	98	140	119	57	74	66
Pass 6	73	122	97	94	126	110	62	68	65
Pass 7	73	114	94	96	122	109	60	71	65
Pass 8	74	121	98	100	133	116	59	73	66
Pass 9	72	118	95	94	130	112	58	76	67
Pass 10	75	118	96	98	135	116	58	67	62
AVERAGE	**73**	**119**	**96**	**97**	**130**	**113**	**59**	**70**	**64**
STDEV	1.3	3.6	2.2	2.8	5.3	3.4	1.4	3.8	1.8

Connecticut DOT ARAN Van 5 - July 29, 1999									
	L IRI	**R IRI**	**AVE IRI**	**L IRI**	**R IRI**	**AVE IRI**	**L IRI**	**R IRI**	**AVE IRI**
	SECTION 1	**SECTION 1**	**SECTION 1**	**SECTION 2**	**SECTION 2**	**SECTION 2**	**SECTION 3**	**SECTION 3**	**SECTION 3**
	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)
Pass 1	71	117	94	99	129	114	57	72	65
Pass 2	71	115	93	99	124	111	60	72	66
Pass 3	70	117	94	98	128	113	60	71	65
Pass 4	71	118	94	97	128	113	59	70	64
Pass 5	71	114	93	98	130	114	57	70	64
Pass 6	76	123	99	98	128	113	60	69	65
Pass 7	72	116	94	102	128	115	58	71	64
Pass 8	75	118	97	100	128	114	60	70	65
Pass 9	72	120	96	97	136	116	59	71	65
Pass 10	72	113	92	95	134	114	58	69	64
AVERAGE	**72**	**117**	**95**	**98**	**129**	**114**	**59**	**71**	**65**
STDEV	1.9	2.9	2.1	1.9	3.4	1.3	1.2	1.1	0.7

Connecticut DOT ARAN Van 5 - August 19, 1999									
	L IRI	**R IRI**	**AVE IRI**	**L IRI**	**R IRI**	**AVE IRI**	**L IRI**	**R IRI**	**AVE IRI**
	SECTION 1	**SECTION 1**	**SECTION 1**	**SECTION 2**	**SECTION 2**	**SECTION 2**	**SECTION 3**	**SECTION 3**	**SECTION 3**
	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)
Pass 1	75	120	98	99	128	114	56	70	63
Pass 2	72	117	95	102	125	114	55	75	65
Pass 3	75	115	95	100	119	110	62	70	66
Pass 4	72	114	93	97	121	109	59	69	64
Pass 5	71	113	92	98	120	109	59	76	67.5
Pass 6	72	117	95	101	122	112	60	69	64.5
Pass 7	72	113	93	100	123	112	60	68	64
Pass 8	71	115	93	97	123	110	56	71	63.5
Pass 9	73	108	91	98	121	110	59	70	64.5
Pass 10	75	109	92	102	124	113	60	70	65
AVERAGE	**73**	**114**	**93**	**99**	**123**	**111**	**59**	**71**	**65**
STDEV	1.6	3.6	2.0	1.9	2.6	1.8	2.2	2.6	1.3

AMES - LISA 6000									
	L IRI	**R IRI**	**AVE IRI**	**L IRI**	**R IRI**	**AVE IRI**	**L IRI**	**R IRI**	**AVE IRI**
	SECTION 1	**SECTION 1**	**SECTION 1**	**SECTION 2**	**SECTION 2**	**SECTION 2**	**SECTION 3**	**SECTION 3**	**SECTION 3**
	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)
Pass 1	70	106	88	89	111	100	53	64	58
Pass 2	68	112	90	90	112	101	51	66	58
Pass 3	71	107	89	89	112	100	51	64	57
Pass 4	70	103	87	89	115	102	53	64	59
Pass 5	68	104	86	91	111	101	54	66	60
Pass 6	72	106	89	88	111	99	52	68	60
Pass 7	71	97	84	90	113	101	52	65	59
Pass 8	72	96	84	89	112	100	52	65	58
Pass 9	72	101	86	90	110	100	53	67	60
Pass 10	71	99	85	90	106	98	52	63	58
AVERAGE	**71**	**103**	**87**	**89**	**111**	**100**	**52**	**65**	**59**
STDEV	1.5	5.0	2.2	0.9	2.3	1.1	1.0	1.5	1.0

ICC - MDR4083									
	L IRI	**R IRI**	**AVE IRI**	**L IRI**	**R IRI**	**AVE IRI**	**L IRI**	**R IRI**	**AVE IRI**
	SECTION 1	**SECTION 1**	**SECTION 1**	**SECTION 2**	**SECTION 2**	**SECTION 2**	**SECTION 3**	**SECTION 3**	**SECTION 3**
	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)
Pass 1	~~165~~	~~137~~	~~151~~	90	110	100	56	67	62
Pass 2	82	117	99.5	89	112	101	56	70	63
Pass 3	95	119	107	90	113	102	56	68	62
Pass 4	84	107	95.5	91	115	103	53	68	61
Pass 5	85	110	97.5	91	113	102	53	69	61
Pass 6	89	111	100	91	111	101	54	65	60
Pass 7	~~144~~	~~128~~	~~136~~	91	113	102	55	67	61
Pass 8	81	114	97.5	92	112	102	54	67	61
Pass 9	86	117	101.5	93	115	104	53	66	60
Pass 10									
AVERAGE	**86**	**114**	**100**	**91**	**113**	**102**	**54**	**67**	**61**
STDEV	4.8	4.4	3.7	1.2	1.7	1.2	1.3	1.5	1.1

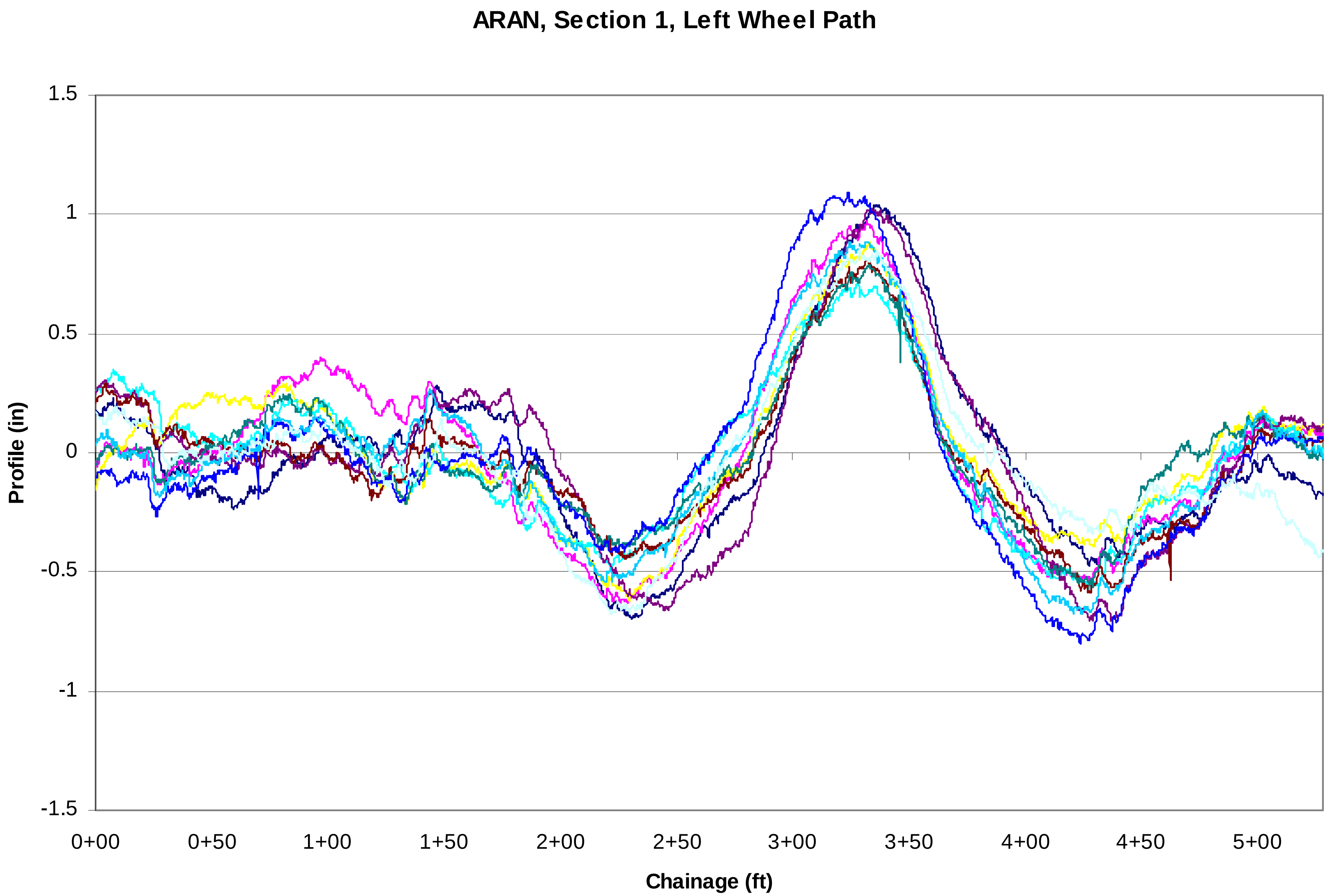
KJ Law - T6400									
	L IRI	**R IRI**	**AVE IRI**	**L IRI**	**R IRI**	**AVE IRI**	**L IRI**	**R IRI**	**AVE IRI**
	SECTION 1	**SECTION 1**	**SECTION 1**	**SECTION 2**	**SECTION 2**	**SECTION 2**	**SECTION 3**	**SECTION 3**	**SECTION 3**
	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)
Pass 1	73	100	86	95	119	107	58	60	59
Pass 2	65	99	82	87	123	105	60	74	67
Pass 3	73	104	89	99	109	104	66	70	68
Pass 4	69	107	88	87	114	100	60	75	68
Pass 5	71	93	82	94	117	105	60	68	64
Pass 6	74	94	84	81	120	100	59	77	68
Pass 7	71	94	82	91	123	107	62	74	68
Pass 8	75	95	85	89	117	103	61	74	68
Pass 9	69	93	81	85	112	99	71	79	75
Pass 10	69	94	82	91	120	106	64	73	68
AVERAGE	**71**	**97**	**84**	**90**	**117**	**104**	**62**	**72**	**67**
STDEV	3.0	4.9	2.8	5.3	4.4	2.9	3.9	5.2	3.9

Pathways - Path Runner Lite PSI-35									
	L IRI	**R IRI**	**AVE IRI**	**L IRI**	**R IRI**	**AVE IRI**	**L IRI**	**R IRI**	**AVE IRI**
	SECTION 1	**SECTION 1**	**SECTION 1**	**SECTION 2**	**SECTION 2**	**SECTION 2**	**SECTION 3**	**SECTION 3**	**SECTION 3**
	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)
Pass 1	60	89	74.50	82	81	82	67	64	66
Pass 2	69	81	75.00	91	85	88	68	77	73
Pass 3	64	83	73.50	86	88	87	60	64	62
Pass 4	65	88	76.50	99	89	94	65	67	66
Pass 5	67	89	78.00	76	86	81	59	64	62
Pass 6	63	87	75.00	88	91	90	57	75	66
Pass 7	65	85	75.00	82	86	84	59	86	73
Pass 8	66	87	76.50	95	81	88	65	69	67
Pass 9	58	81	69.50	93	85	89	64	79	72
Pass 10	63	83	73.00	86	88	87	58	69	64
AVERAGE	**64**	**85**	**75**	**88**	**86**	**87**	**62**	**71**	**67**
STDEV	3.2	3.1	2.3	6.9	3.2	3.9	4.0	7.5	4.1

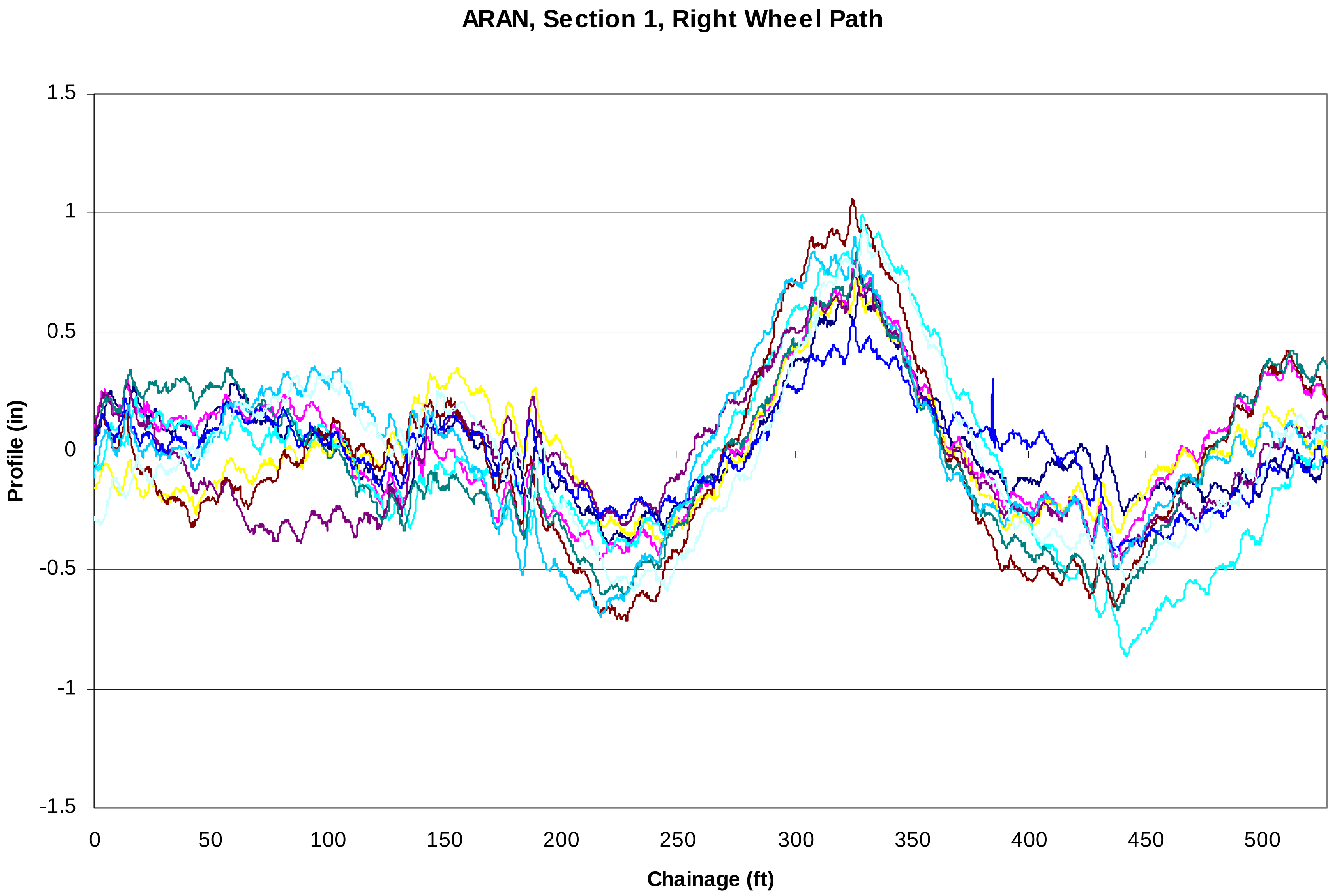
Trigg - ARRB TR 3LP									
	L IRI	**R IRI**	**AVE IRI**	**L IRI**	**R IRI**	**AVE IRI**	**L IRI**	**R IRI**	**AVE IRI**
	SECTION 1	**SECTION 1**	**SECTION 1**	**SECTION 2**	**SECTION 2**	**SECTION 2**	**SECTION 3**	**SECTION 3**	**SECTION 3**
	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)	(in/mile)
Pass 1	70	113	91	95	129	112	53	72	62
Pass 2	70	115	92	94	119	106	55	71	63
Pass 3	69	98	84	96	111	104	56	69	63
Pass 4	71	103	87	96	115	105	57	68	63
Pass 5	68	109	89	95	123	109	56	71	63
Pass 6	68	115	92	96	123	109	55	69	62
Pass 7	69	115	92	97	120	108	56	72	64
Pass 8	69	114	92	97	122	109	54	73	64
Pass 9	71	106	89	95	118	107	58	67	63
Pass 10	69	115	92	95	128	112	53	73	63
AVERAGE	**69**	**110**	**90**	**96**	**121**	**108**	**55**	**70**	**63**
STDEV	1.1	6.2	2.8	0.8	5.4	2.6	1.8	2.0	0.5

Appendix D

Profile Plots for State Route 9

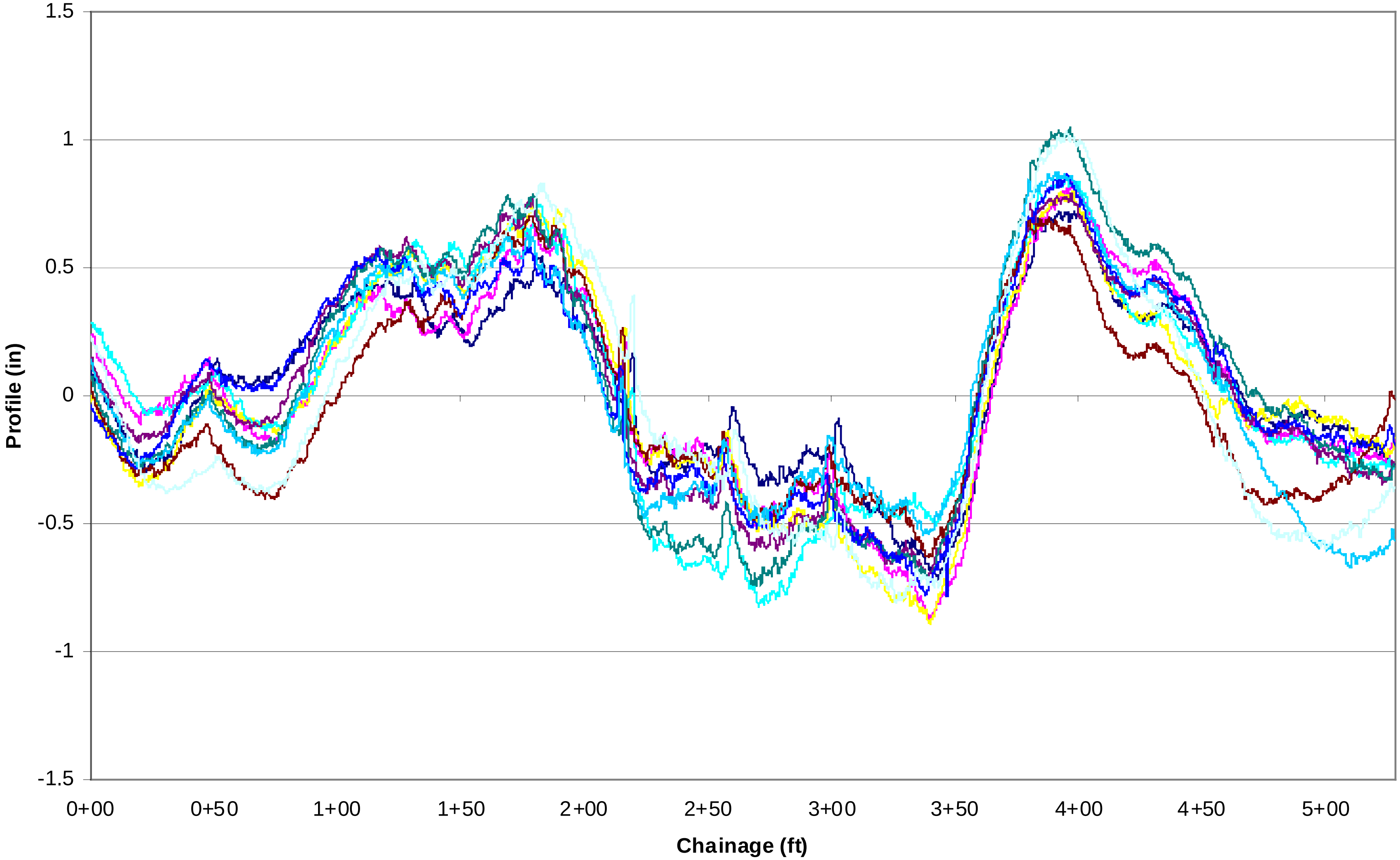

ARAN, Section 1, Left Wheel Path
Profile (in)
1.5
1
0.5
0
-0.5
-1
-1.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

D1

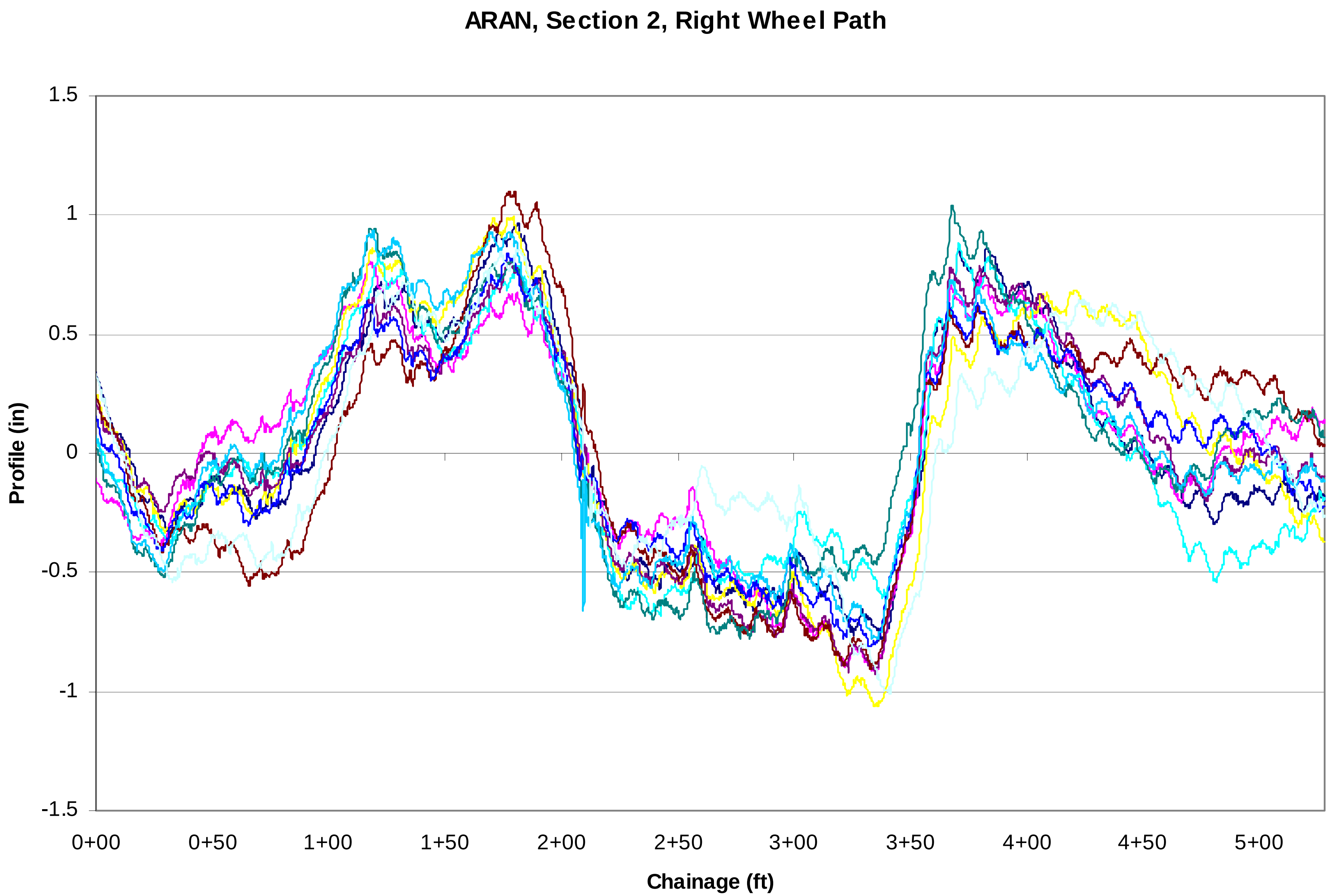

ARAN, Section 1, Right Wheel Path
Profile (in)
1.5
1
0.5
0
-0.5
-1
-1.5
0
50
100
150
200
250
300
350
400
450
500
Chainage (ft)

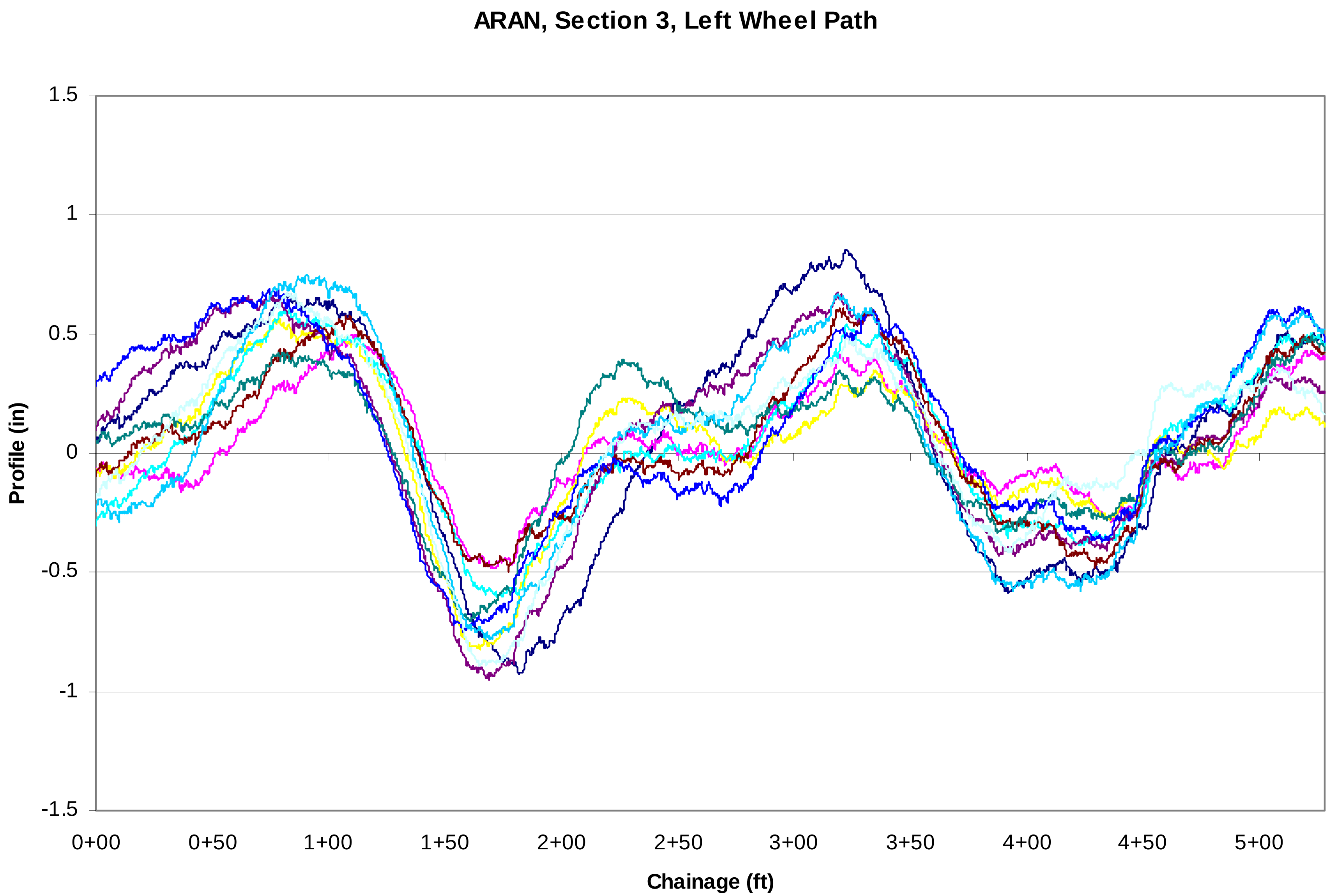
D3

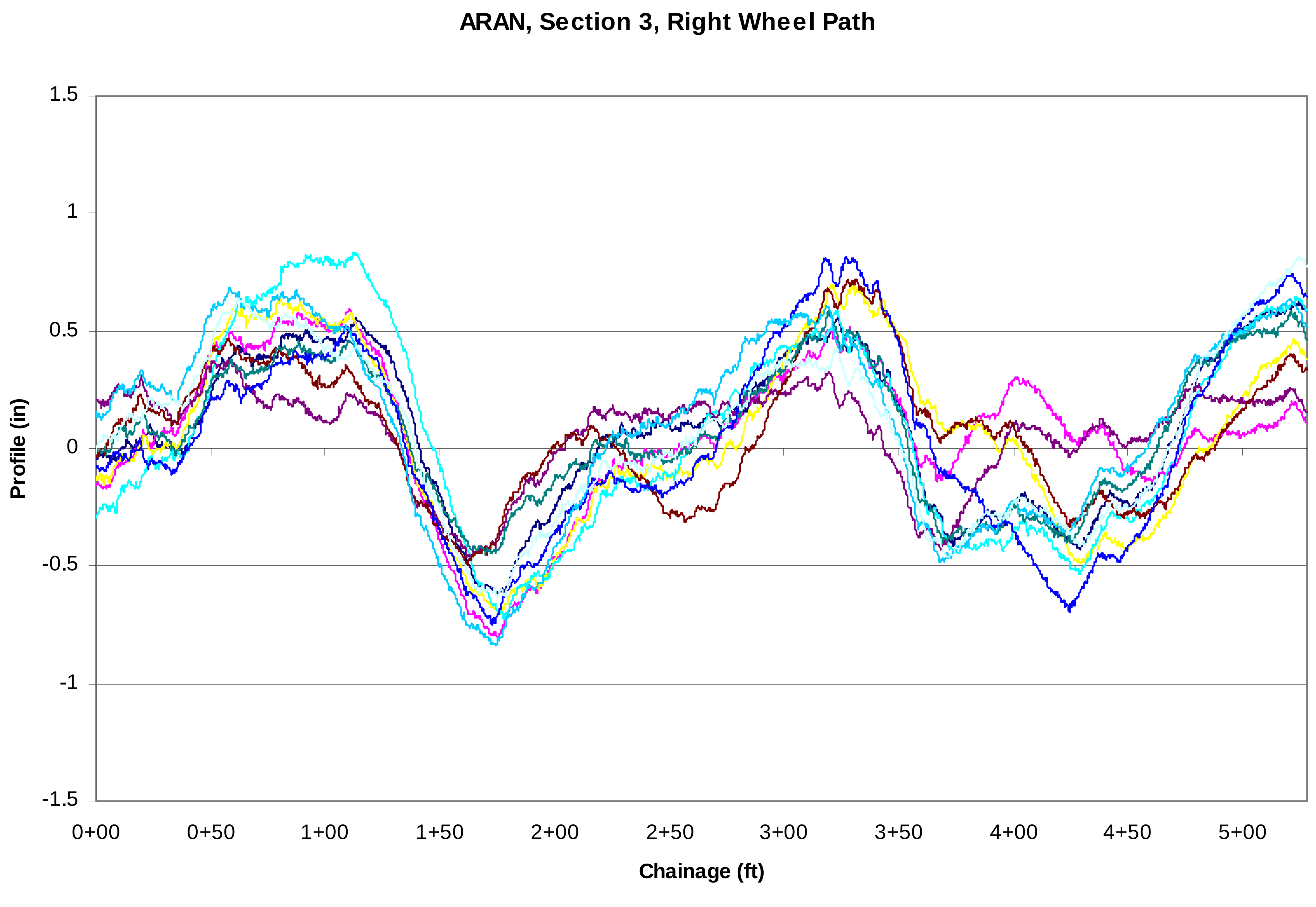
ARAN, Section 2, Left Wheel Path



D4


ARAN, Section 2, Right Wheel Path
Profile (in)
1.5
1
0.5
0
-0.5
-1
-1.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

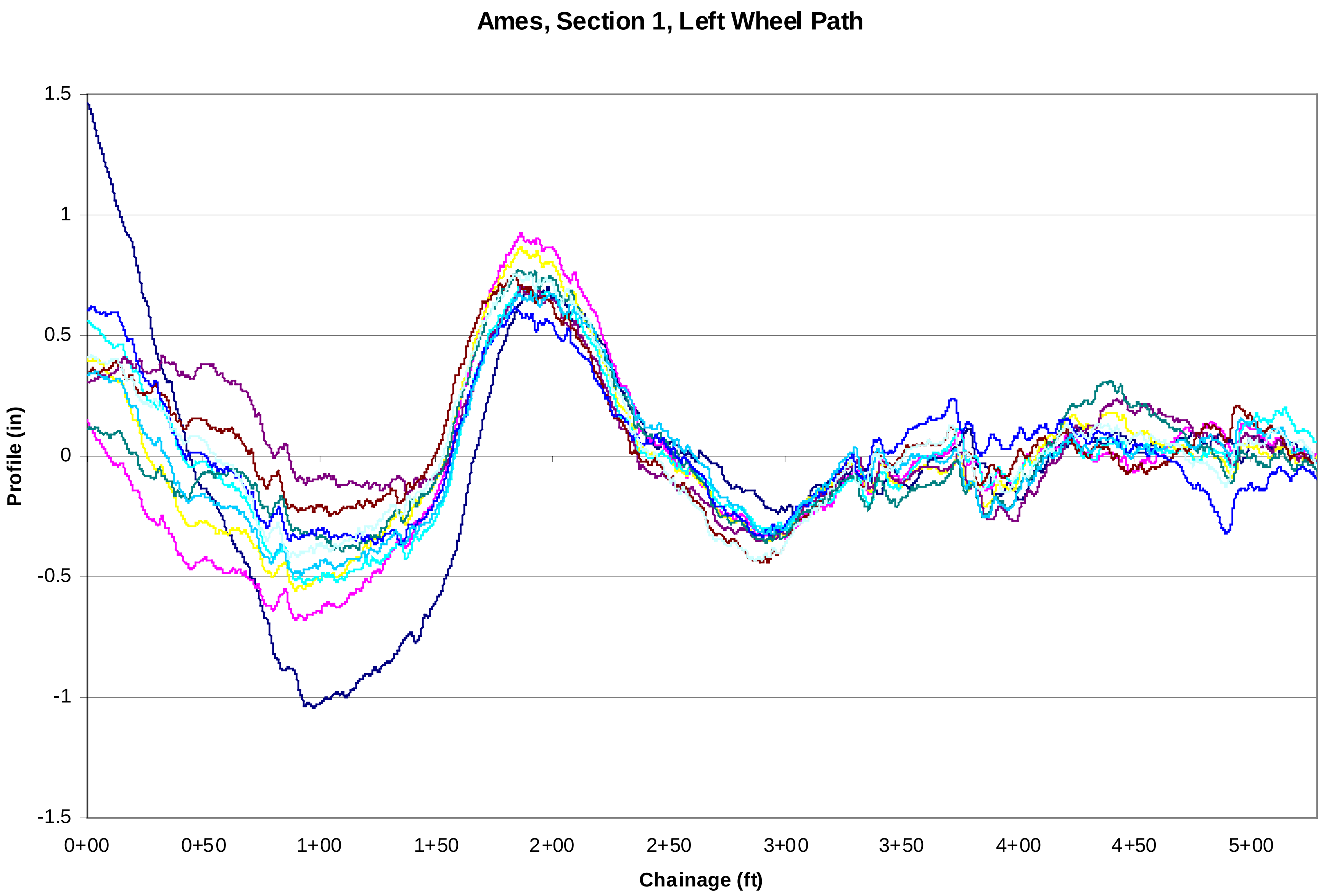

ARAN, Section 3, Left Wheel Path
Profile (in)
1.5
1
0.5
0
-0.5
-1
-1.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)



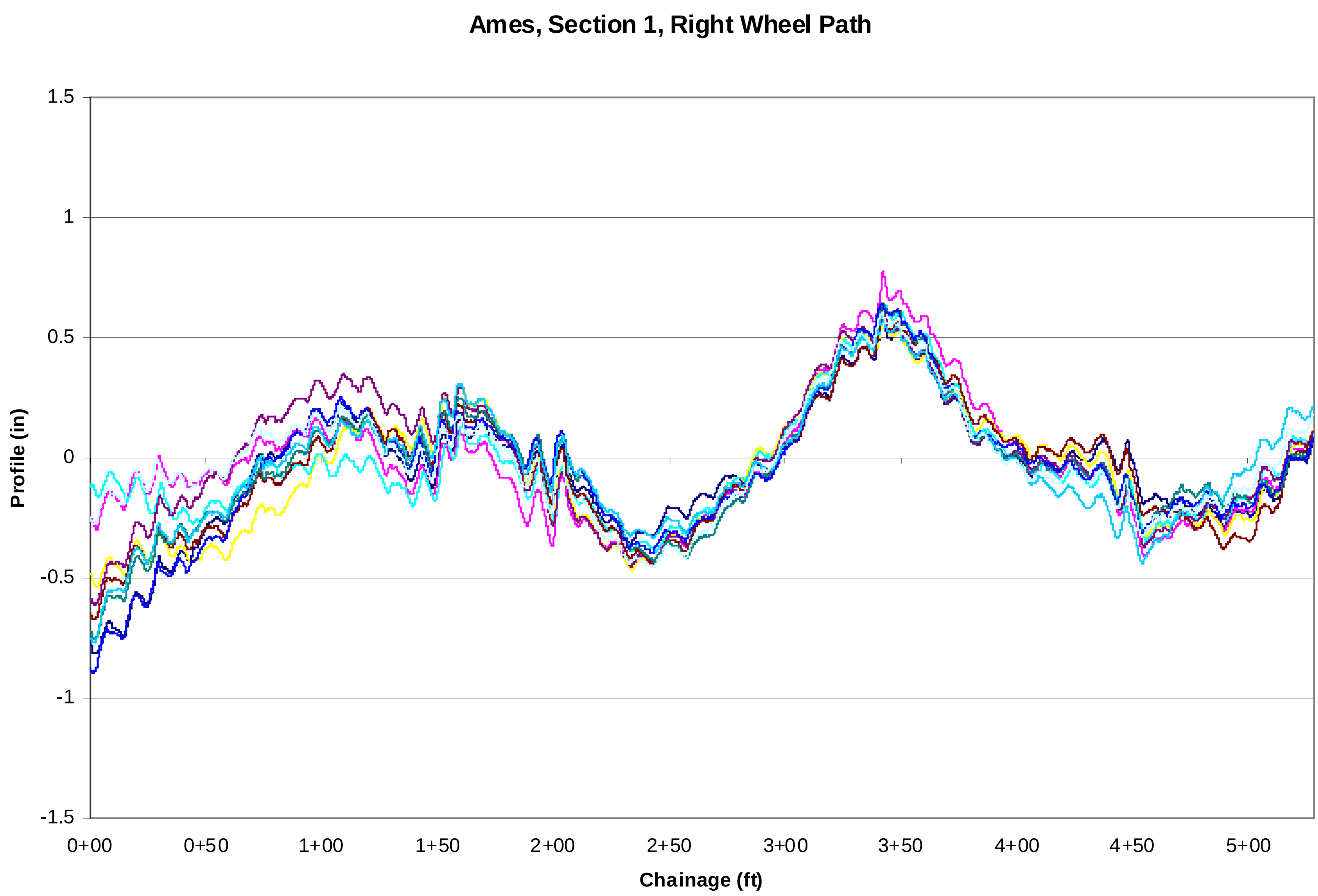
ARAN, Section 3, Right Wheel Path
1.5
1
0.5
0
-0.5
-1
-1.5
Profile (in)
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

D6

D7

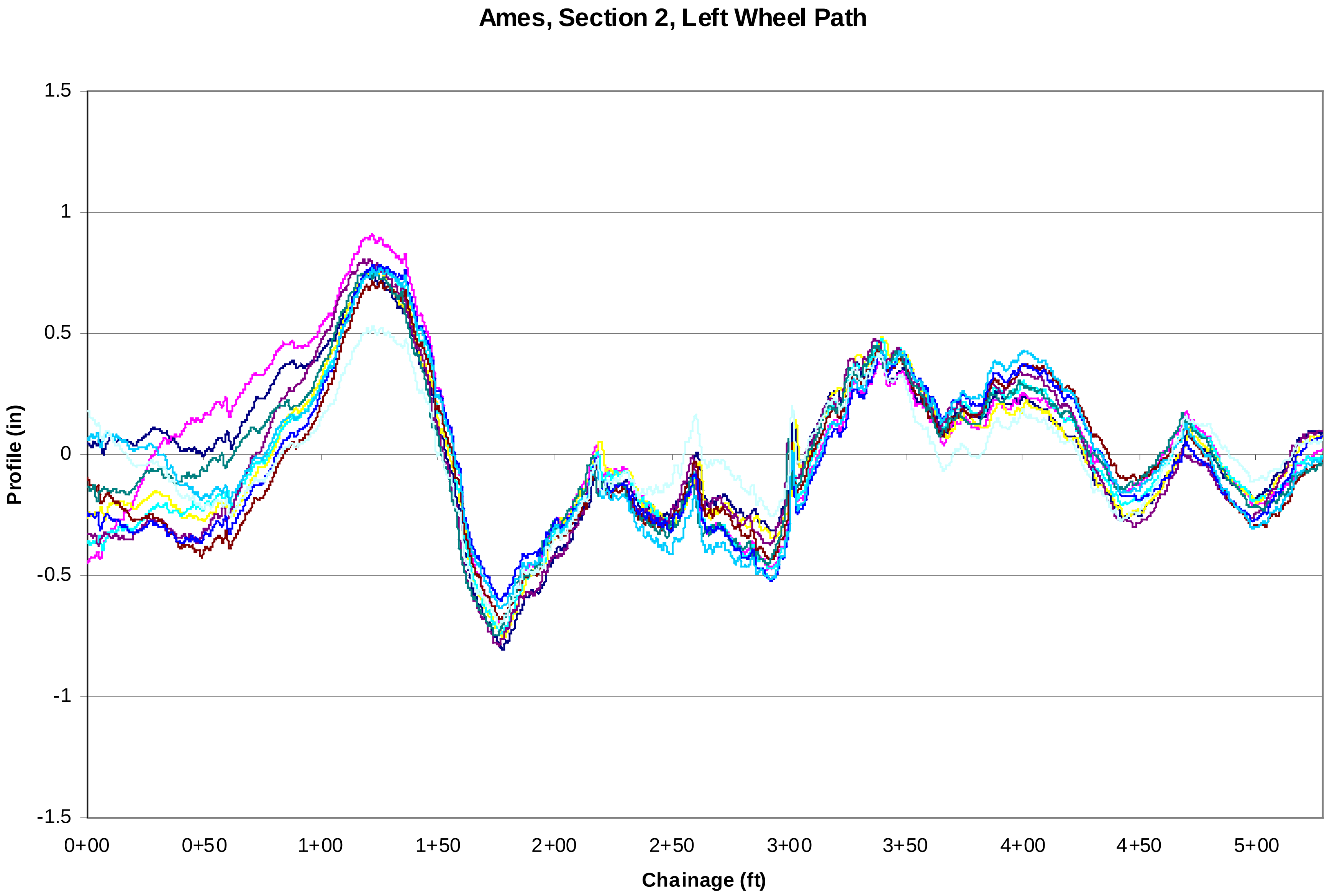


Ames, Section 1, Left Wheel Path
Profile (in)
1.5
1
0.5
0
-0.5
-1
-1.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

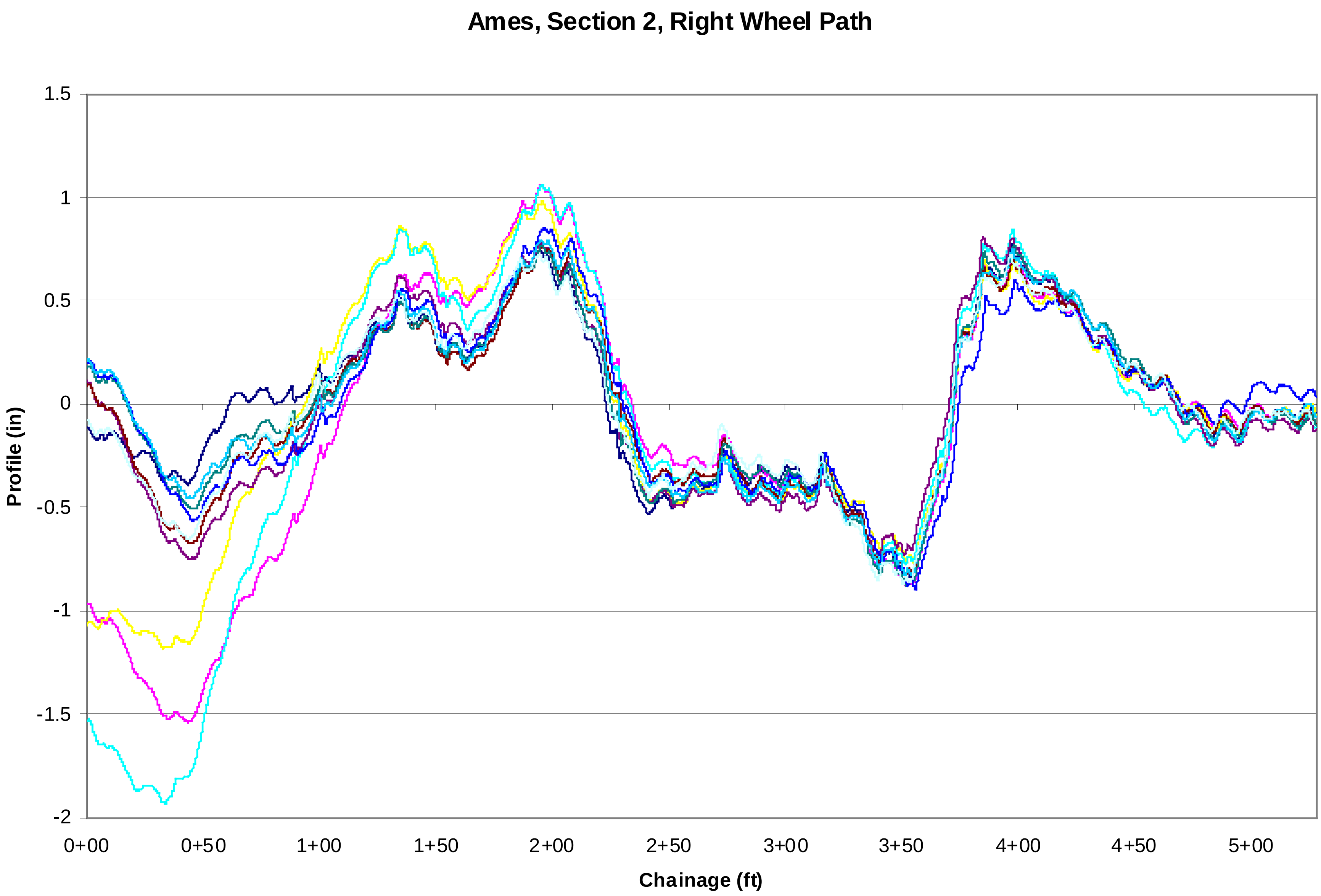


Ames, Section 1, Right Wheel Path
1.5
1
0.5
0
-0.5
-1
-1.5
Profile (in)
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

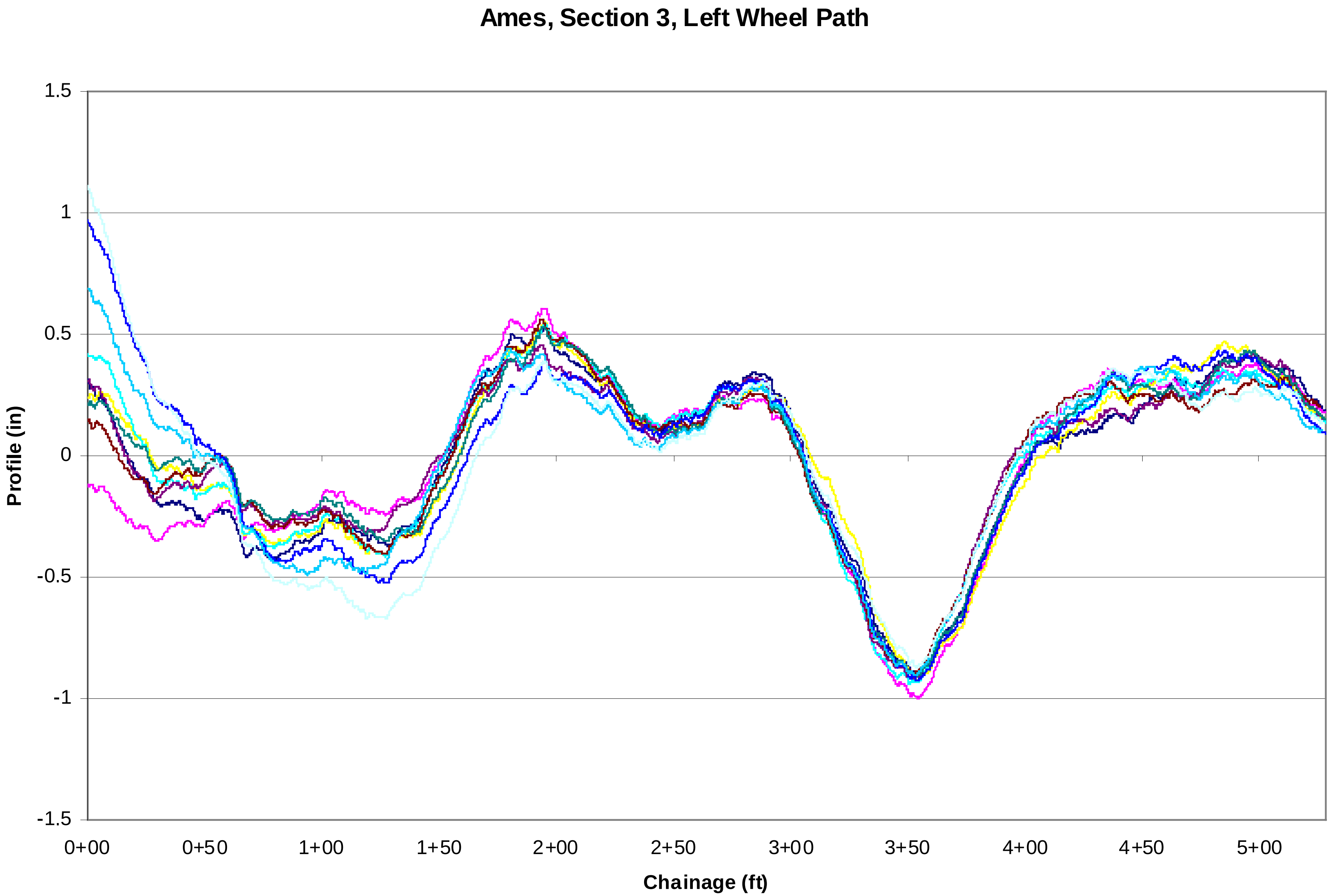
D8


Ames, Section 2, Left Wheel Path
Profile (in)
1.5
1
0.5
0
-0.5
-1
-1.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

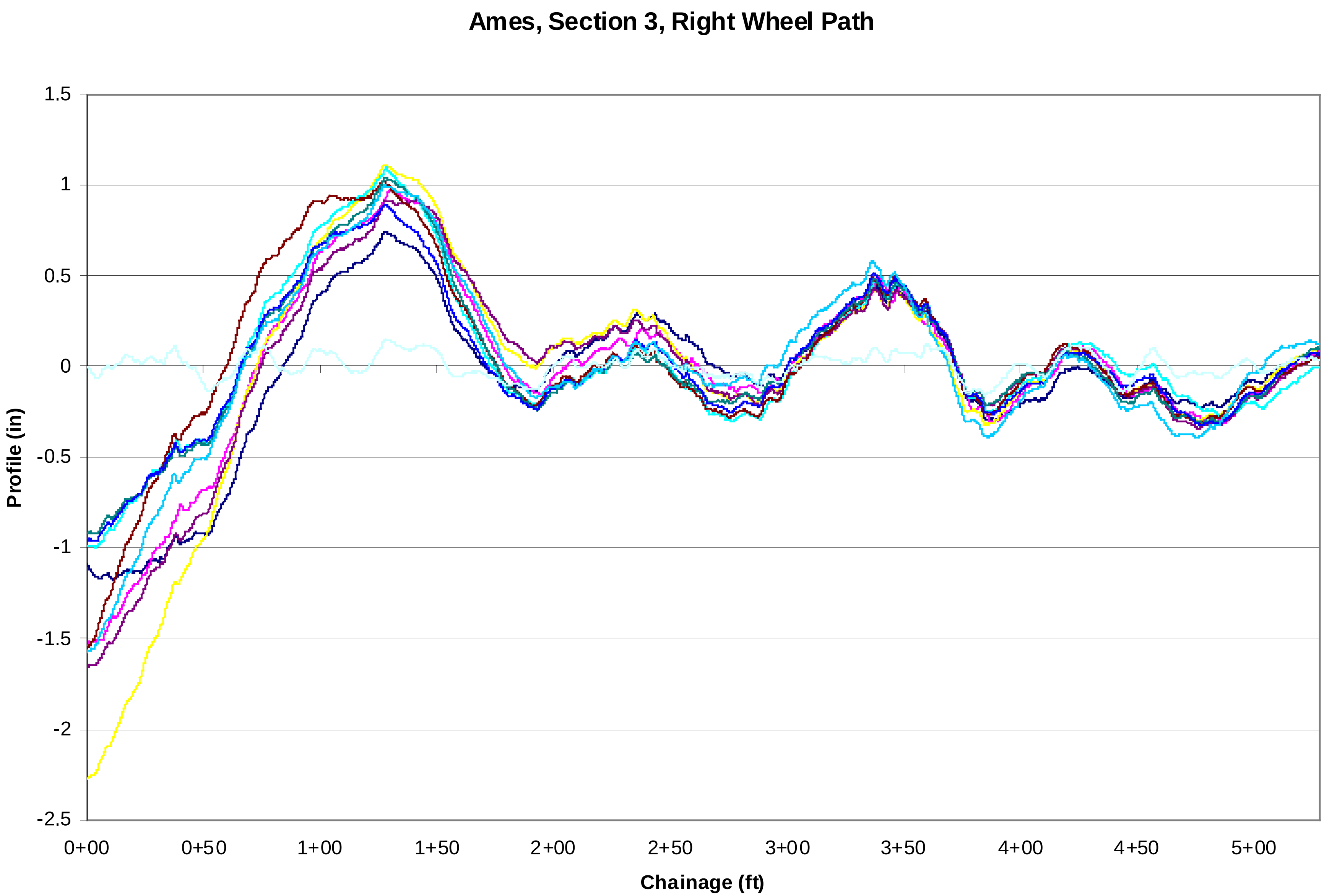
D10


Ames, Section 2, Right Wheel Path
Profile (in)
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

D11

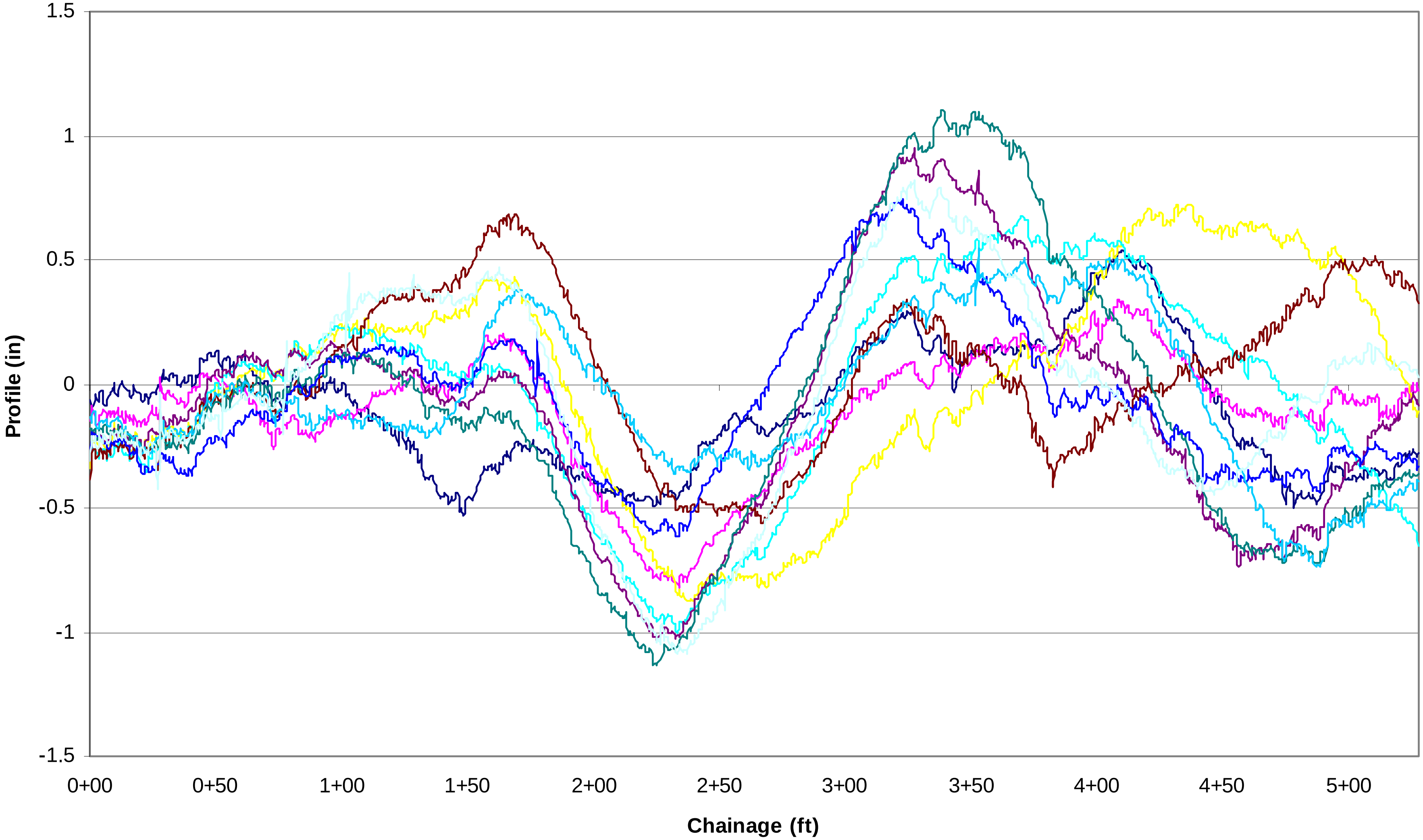


Ames, Section 3, Left Wheel Path
Profile (in)
1.5
1
0.5
0
-0.5
-1
-1.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

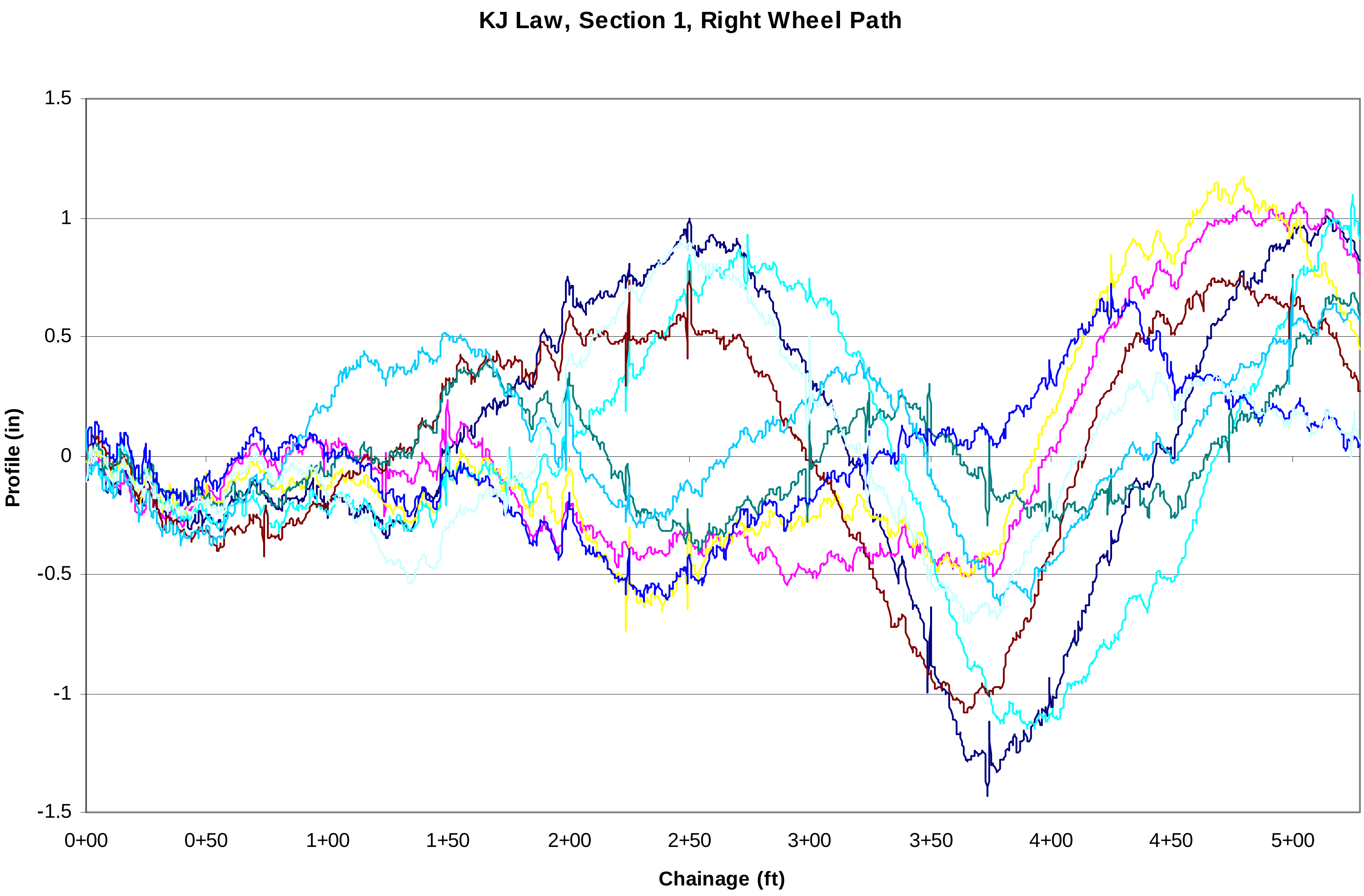

Ames, Section 3, Right Wheel Path
Profile (in)
Chainage (ft)
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00

D13

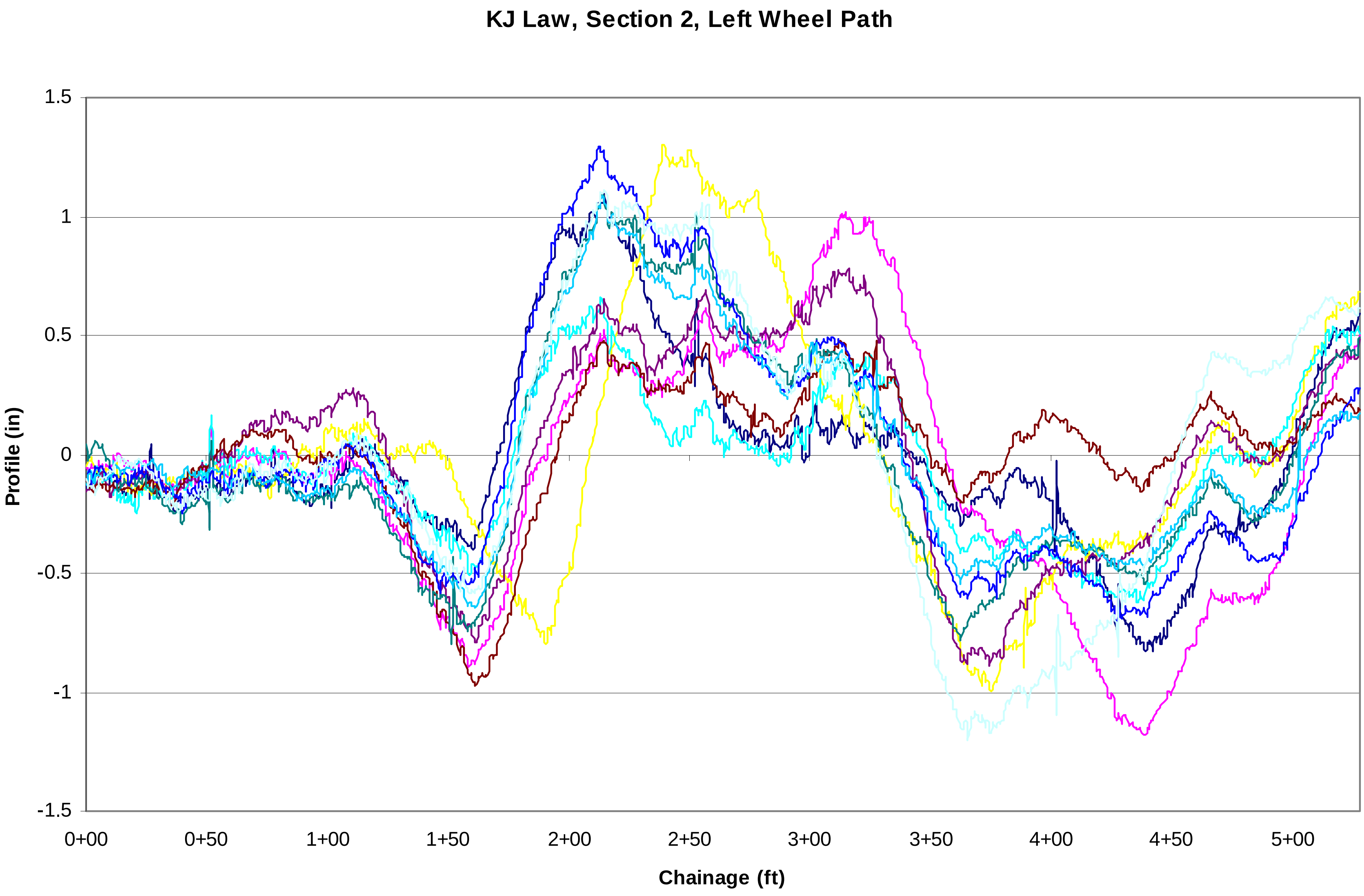
KJ Law, Section 1, Left Wheel Path



D14

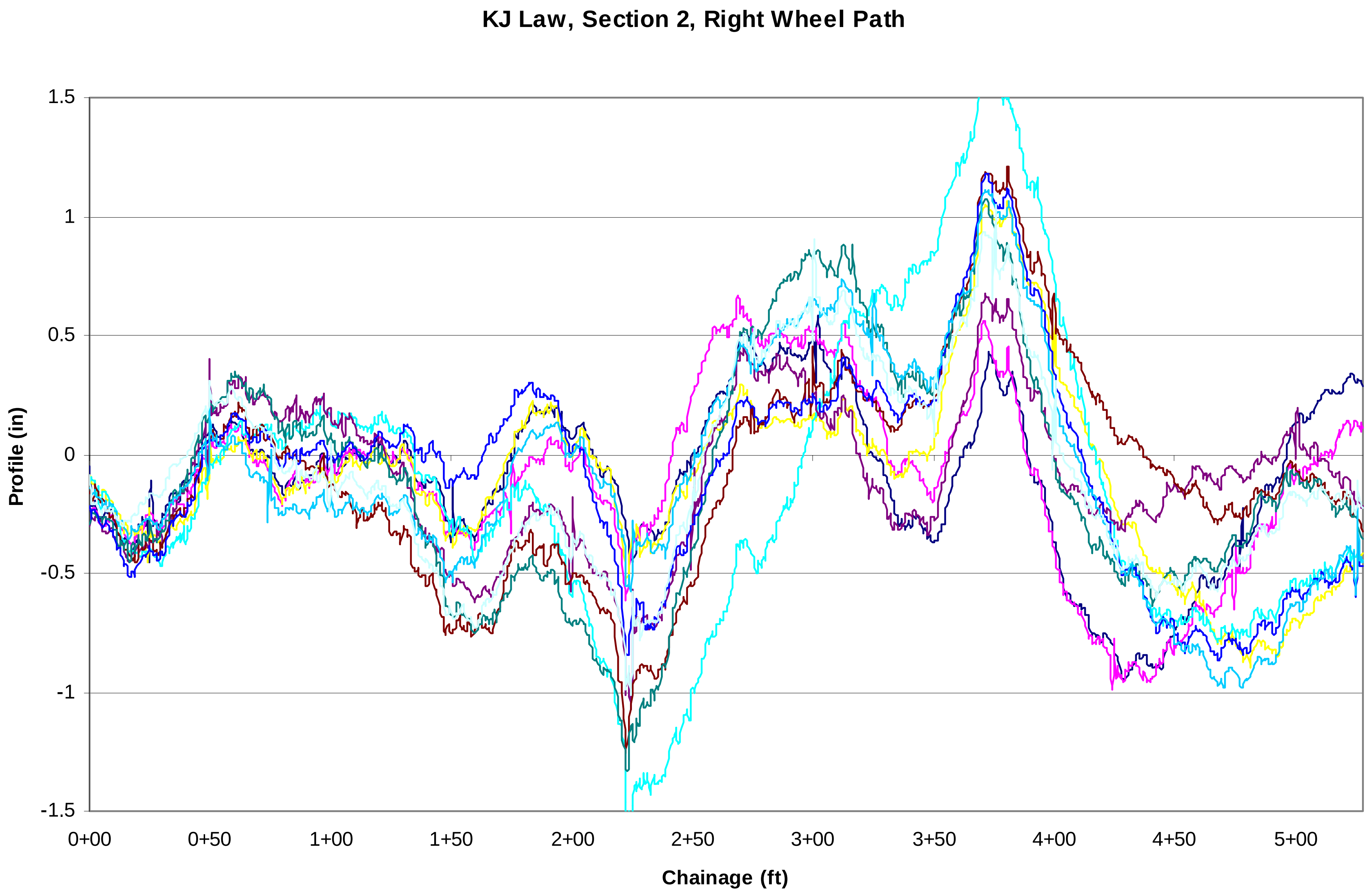

KJ Law, Section 1, Right Wheel Path
Profile (in)
1.5
1
0.5
0
-0.5
-1
-1.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

D15

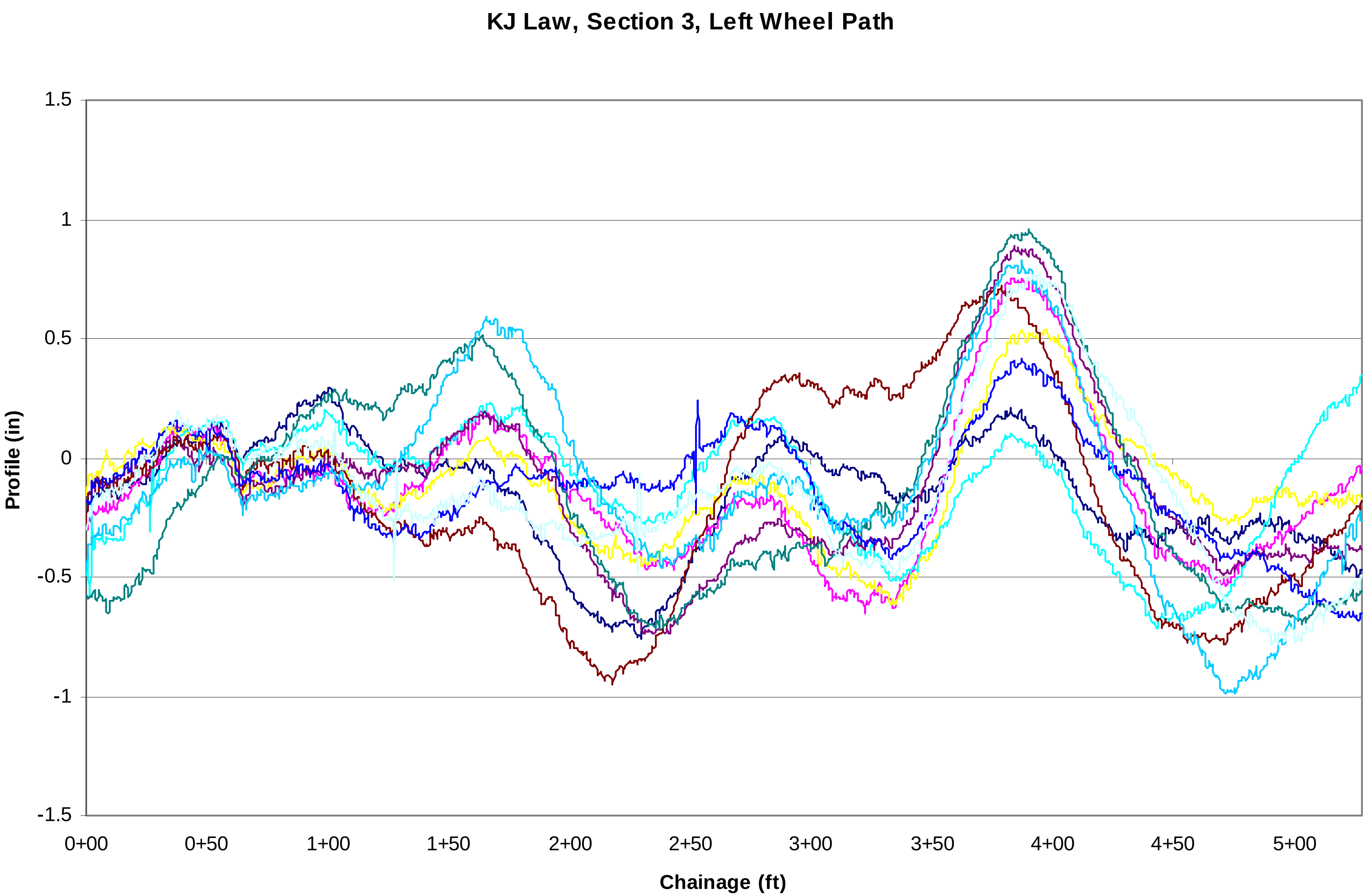


KJ Law, Section 2, Left Wheel Path
Profile (in)
1.5
1
0.5
0
-0.5
-1
-1.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

D16

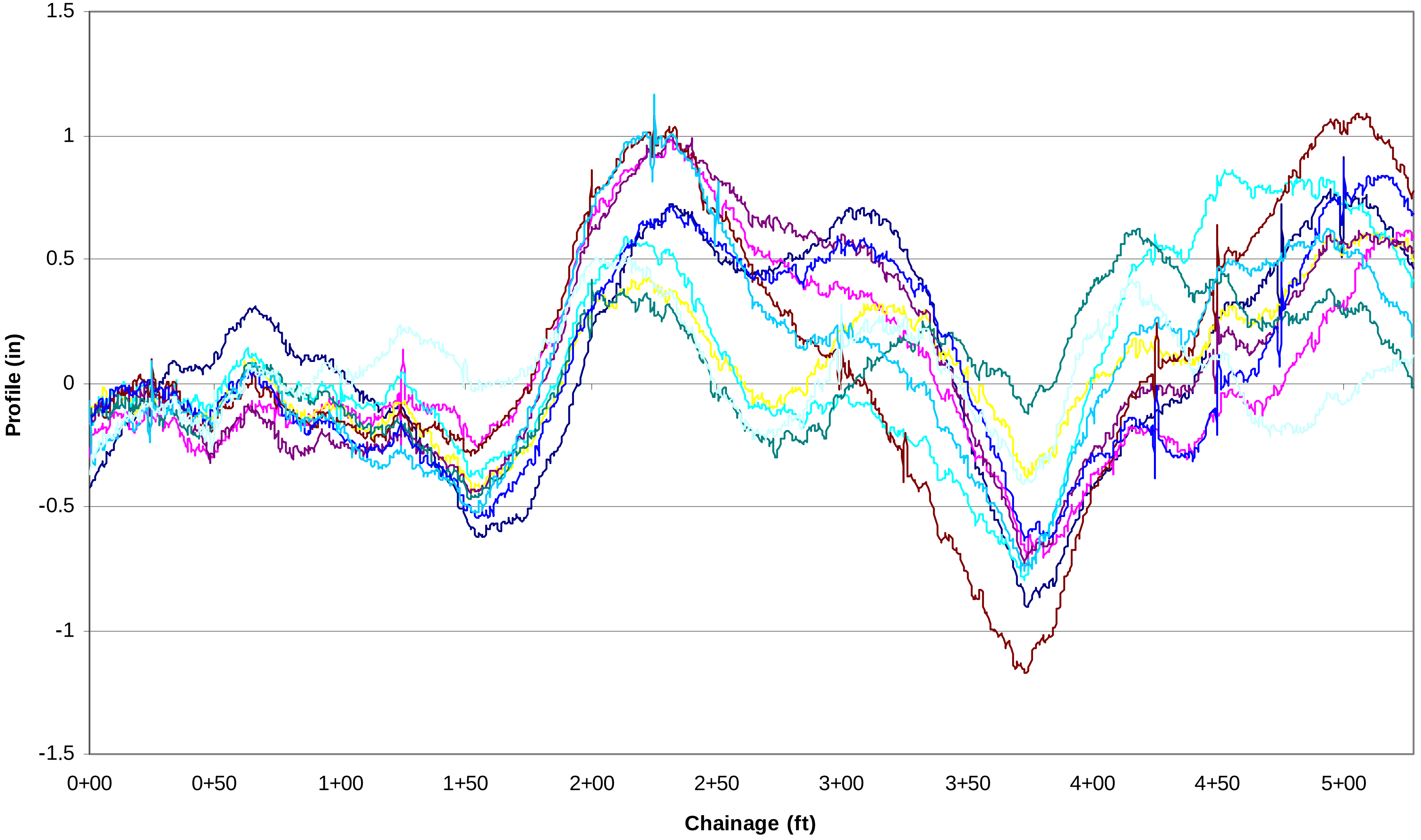

KJ Law, Section 2, Right Wheel Path
Profile (in)
1.5
1
0.5
0
-0.5
-1
-1.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

D17

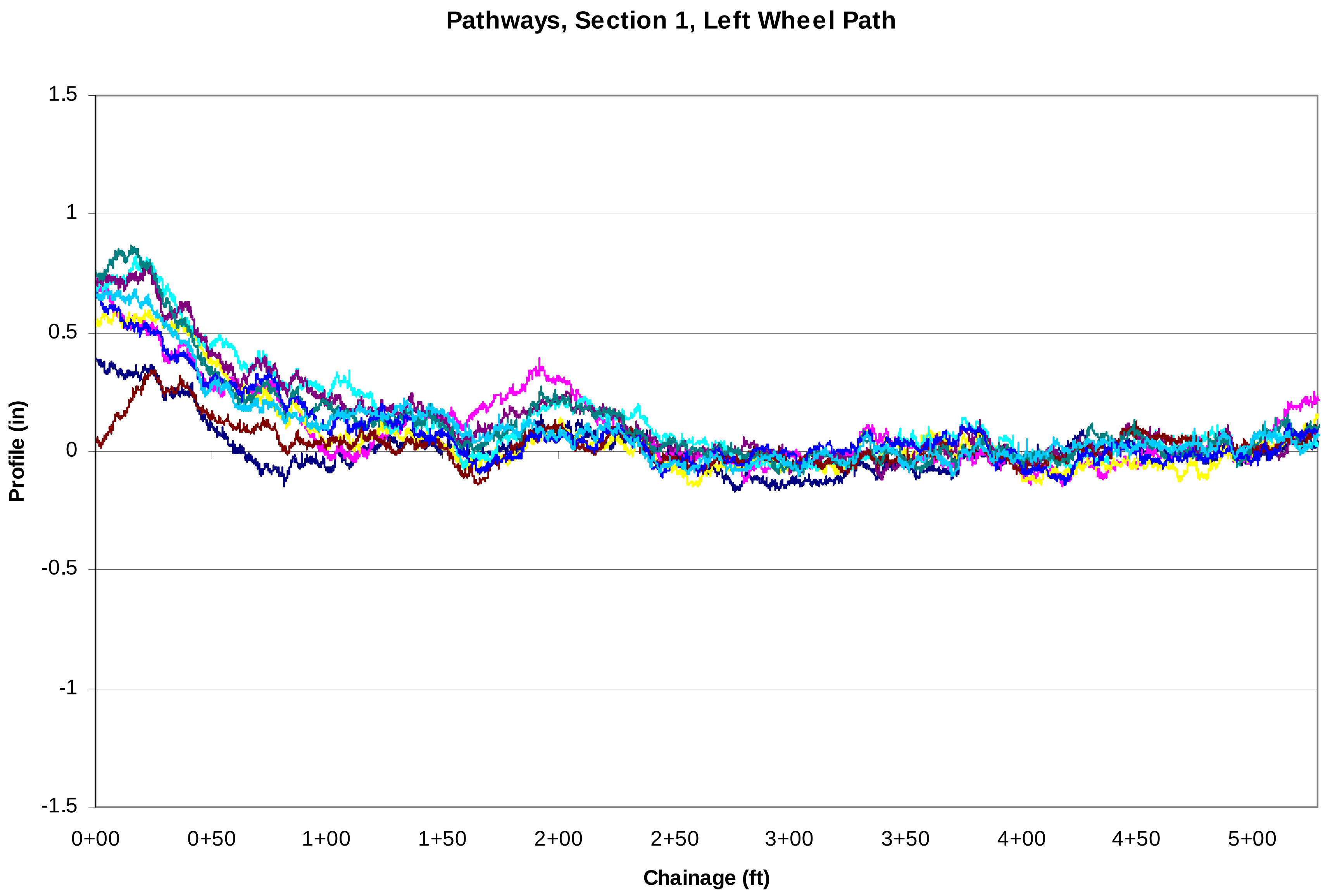


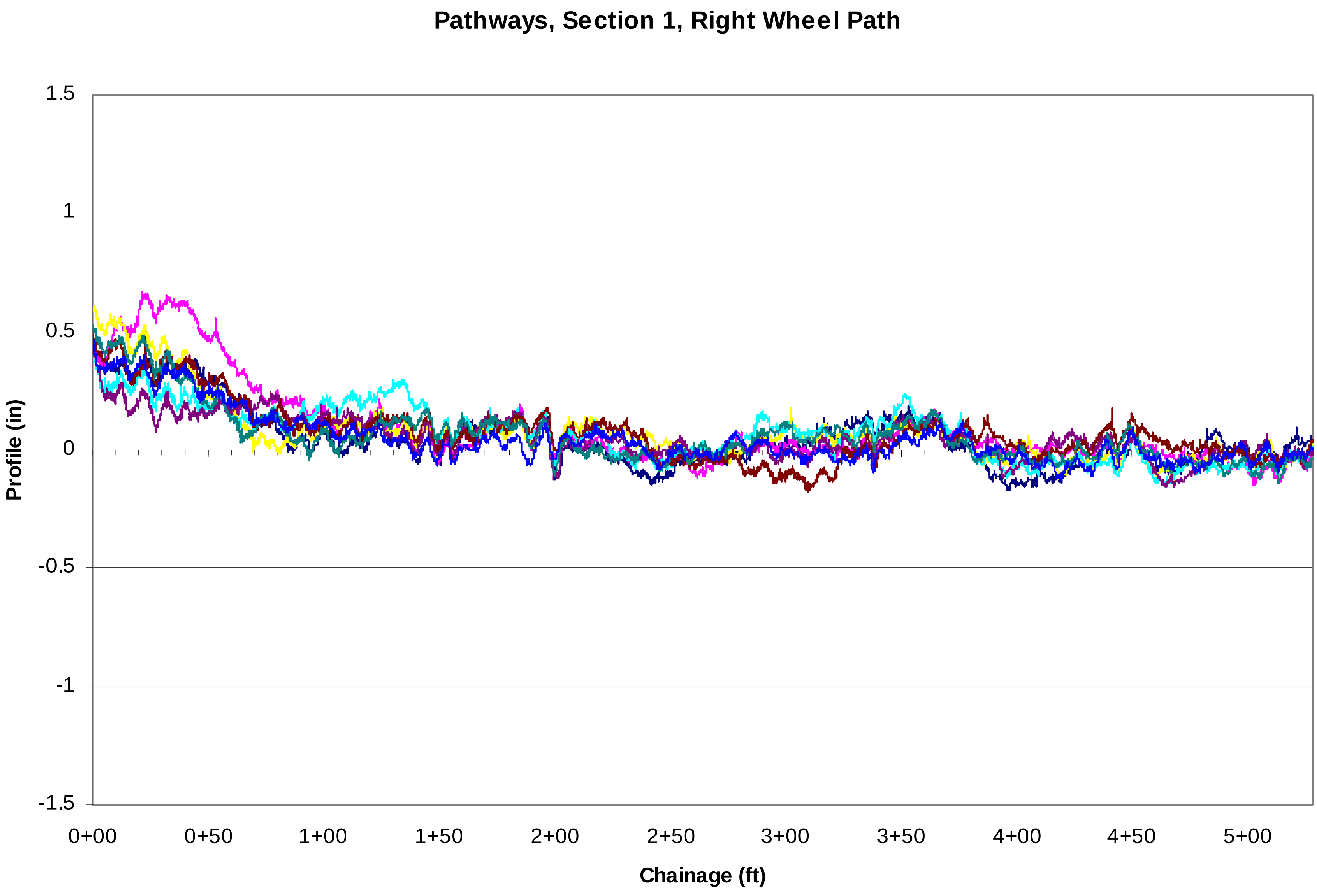
KJ Law, Section 3, Left Wheel Path
Profile (in)
1.5
1
0.5
0
-0.5
-1
-1.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

KJ Law, Section 3, Right Wheel Path



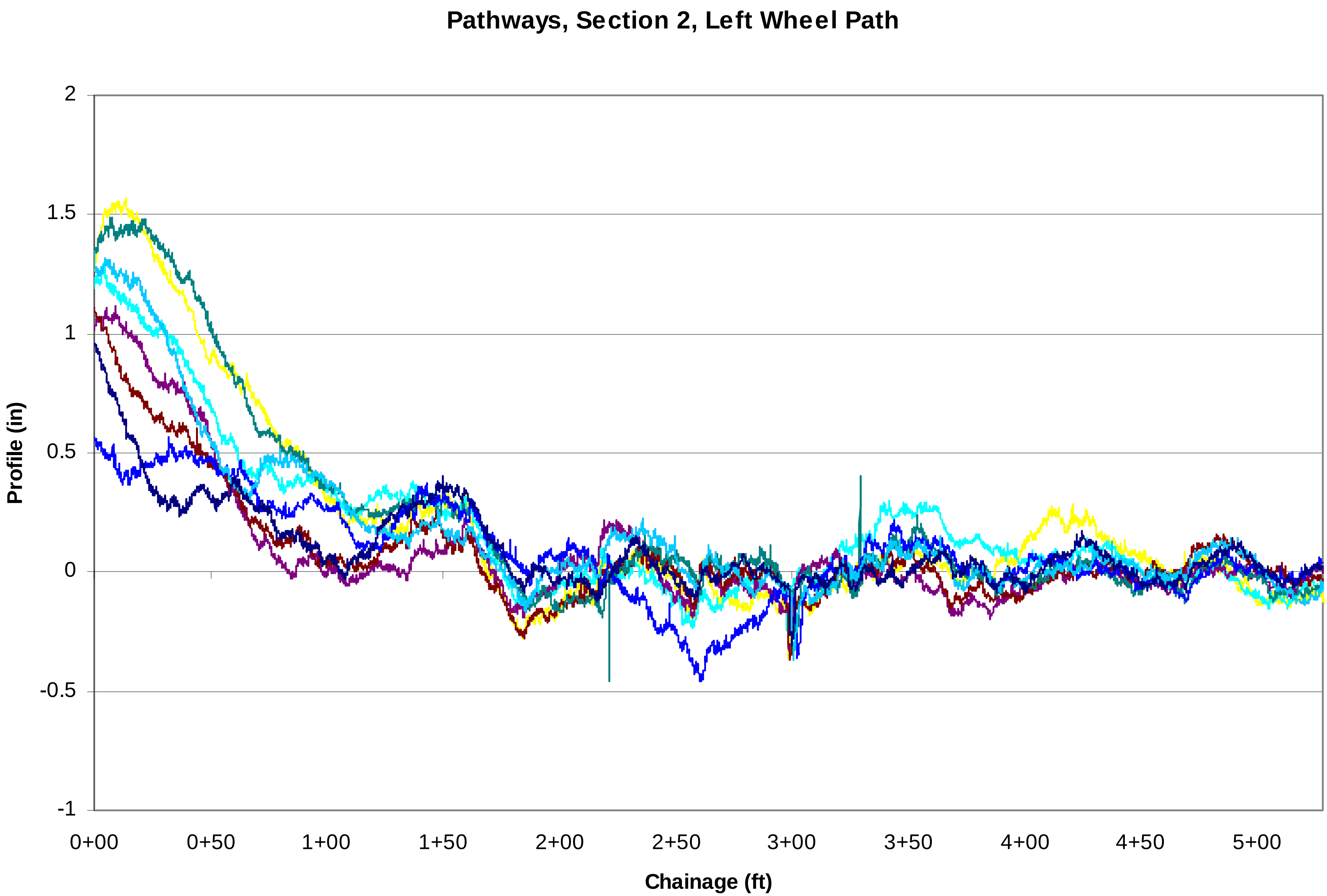
D18

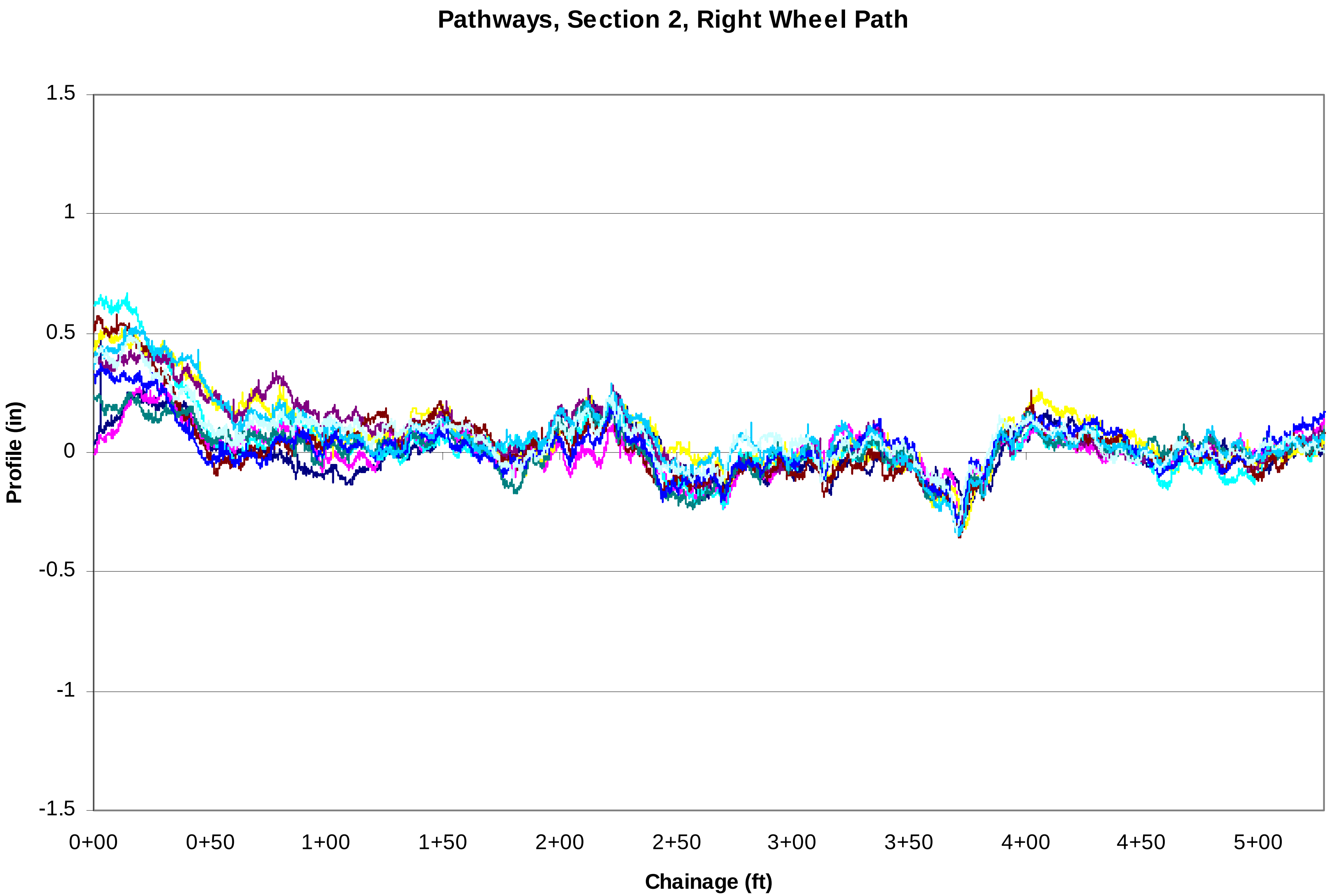

Pathways, Section 1, Left Wheel Path
Profile (in)
1.5
1
0.5
0
-0.5
-1
-1.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)



Pathways, Section 1, Right Wheel Path
1.5
1
0.5
0
-0.5
-1
-1.5
Profile (in)
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

D20

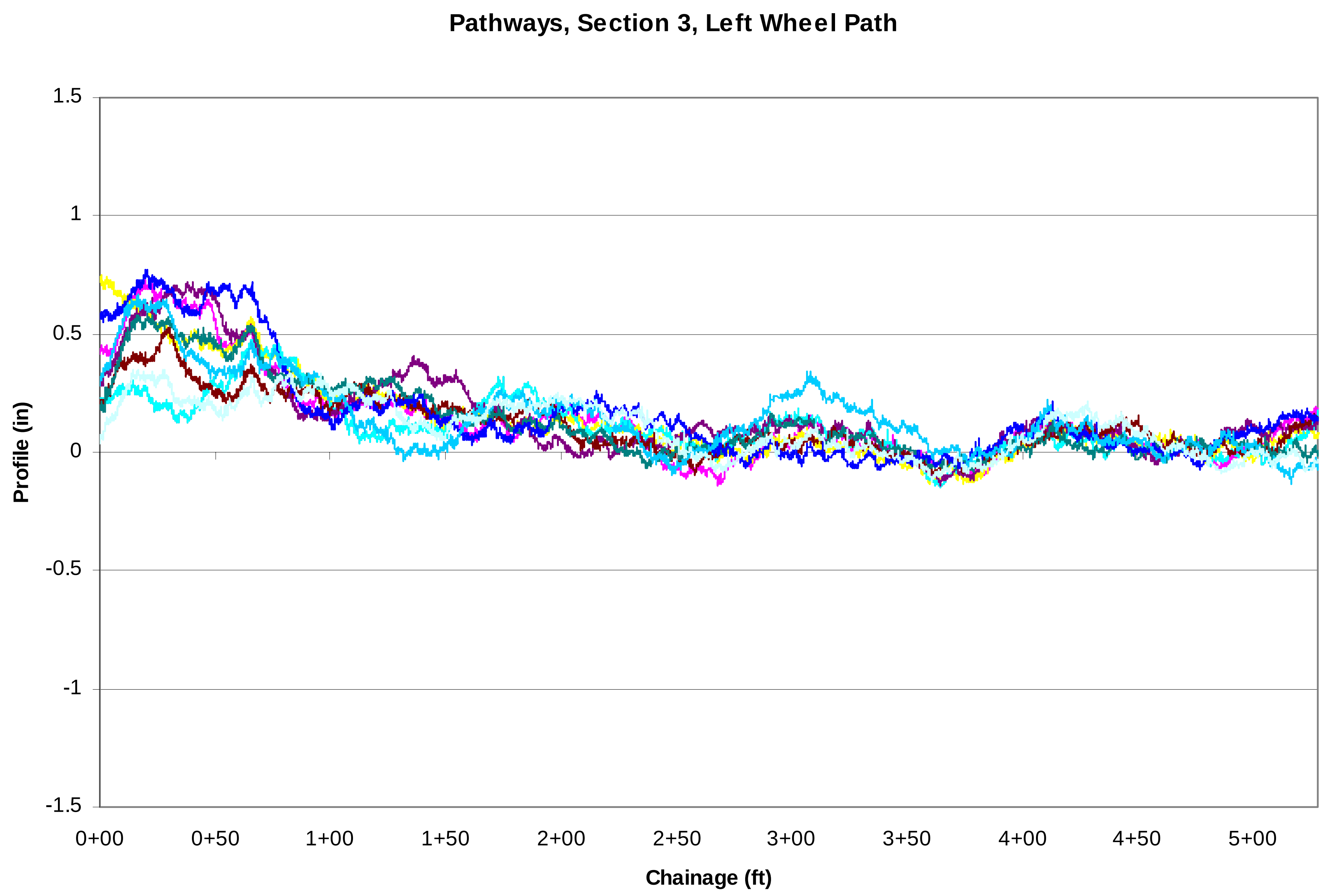

Pathways, Section 2, Left Wheel Path
Profile (in)
2
1.5
1
0.5
0
-0.5
-1
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)



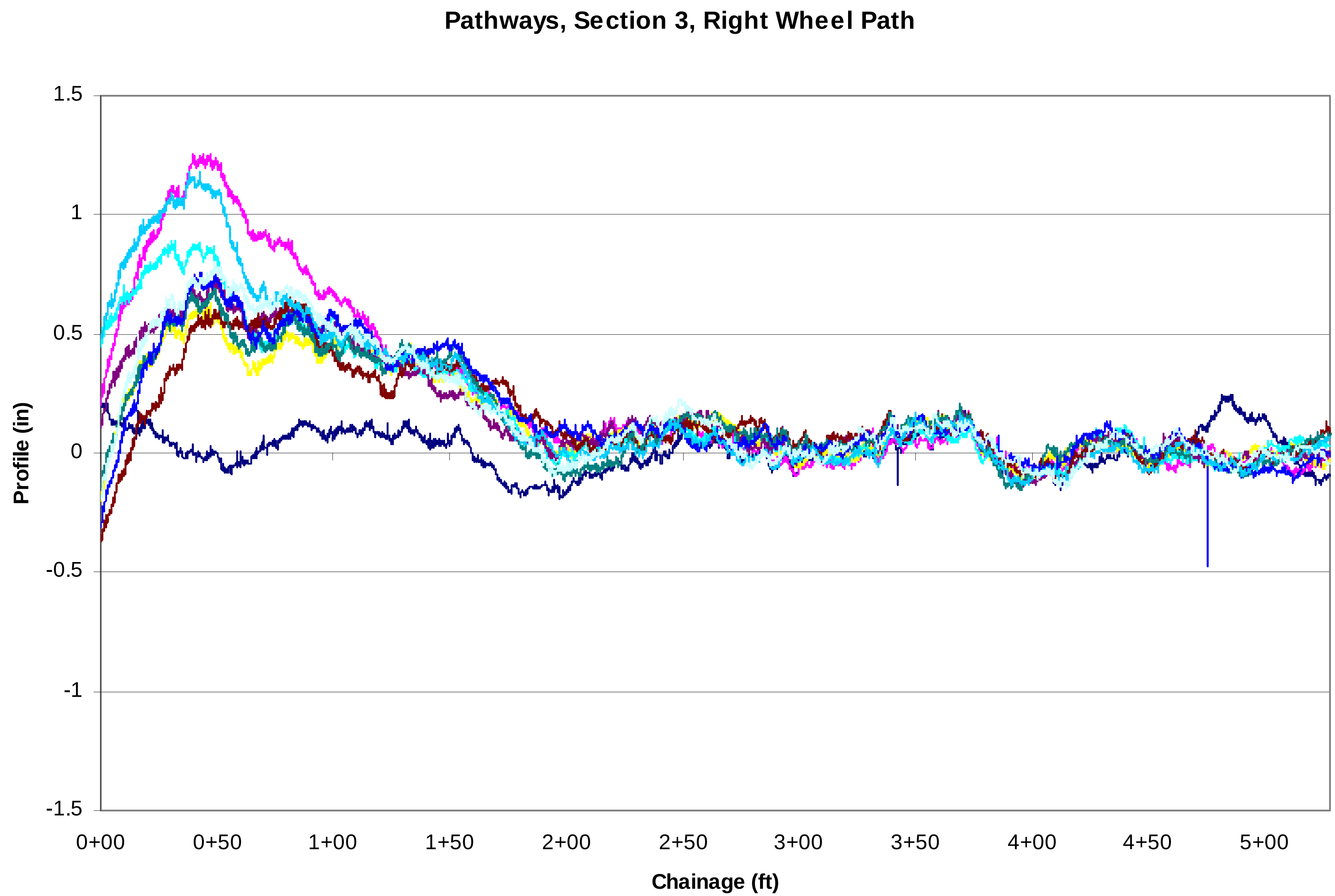
Pathways, Section 2, Right Wheel Path
Profile (in)
1.5
1
0.5
0
-0.5
-1
-1.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

D22

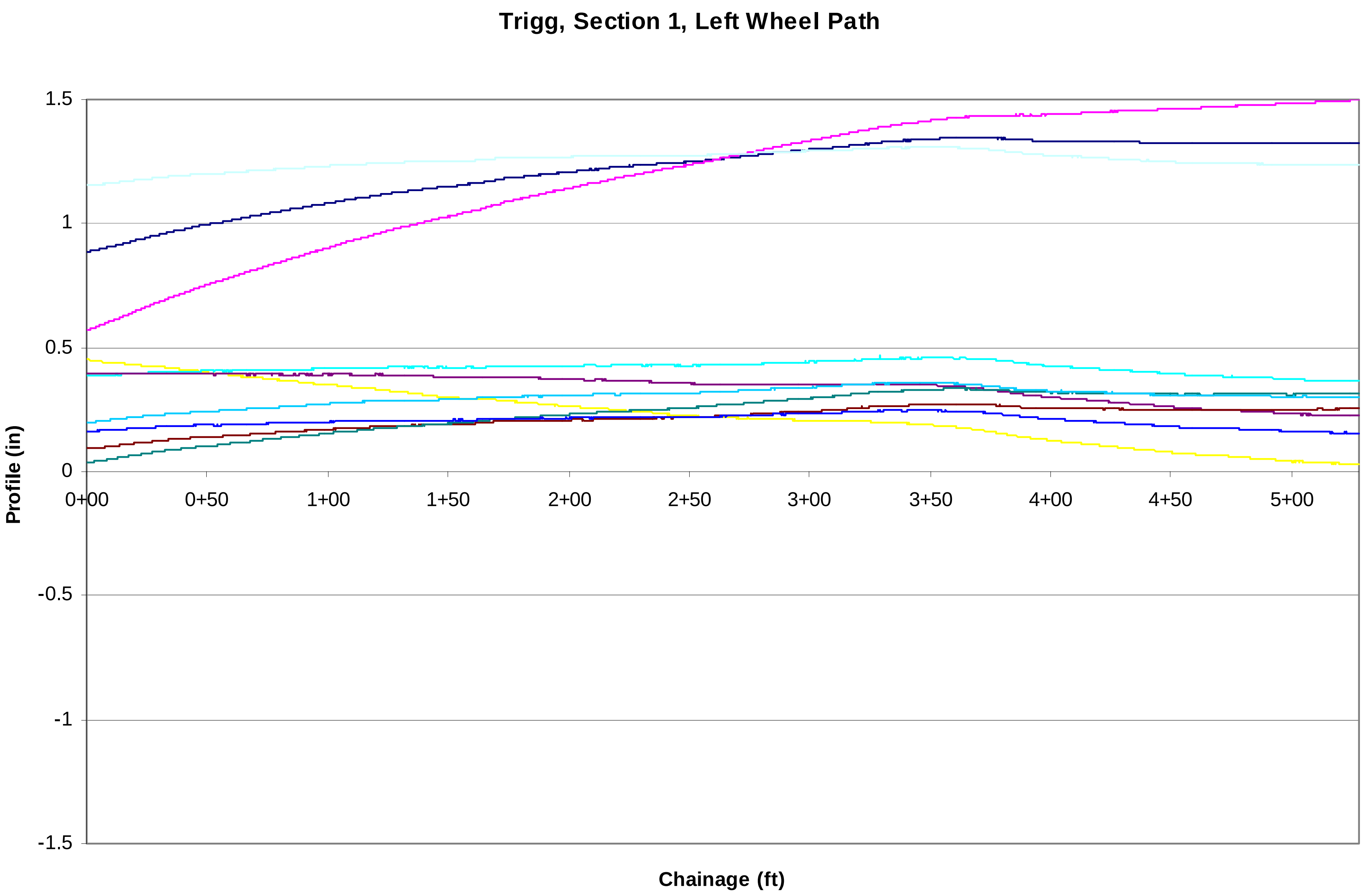
D23

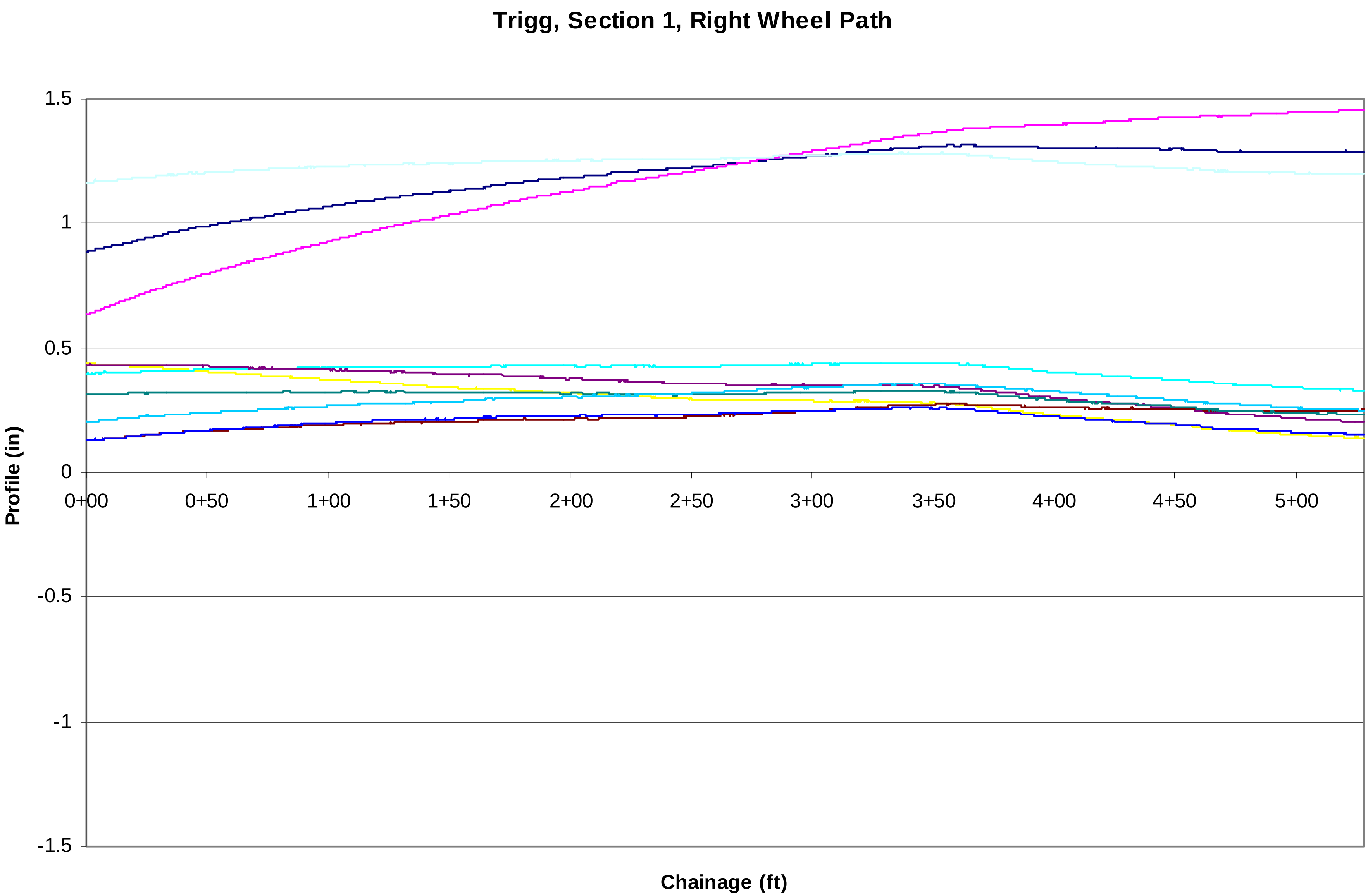

Pathways, Section 3, Left Wheel Path
Profile (in)
1.5
1
0.5
0
-0.5
-1
-1.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

D24


Pathways, Section 3, Right Wheel Path
Profile (in)
1.5
1
0.5
0
-0.5
-1
-1.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

D25

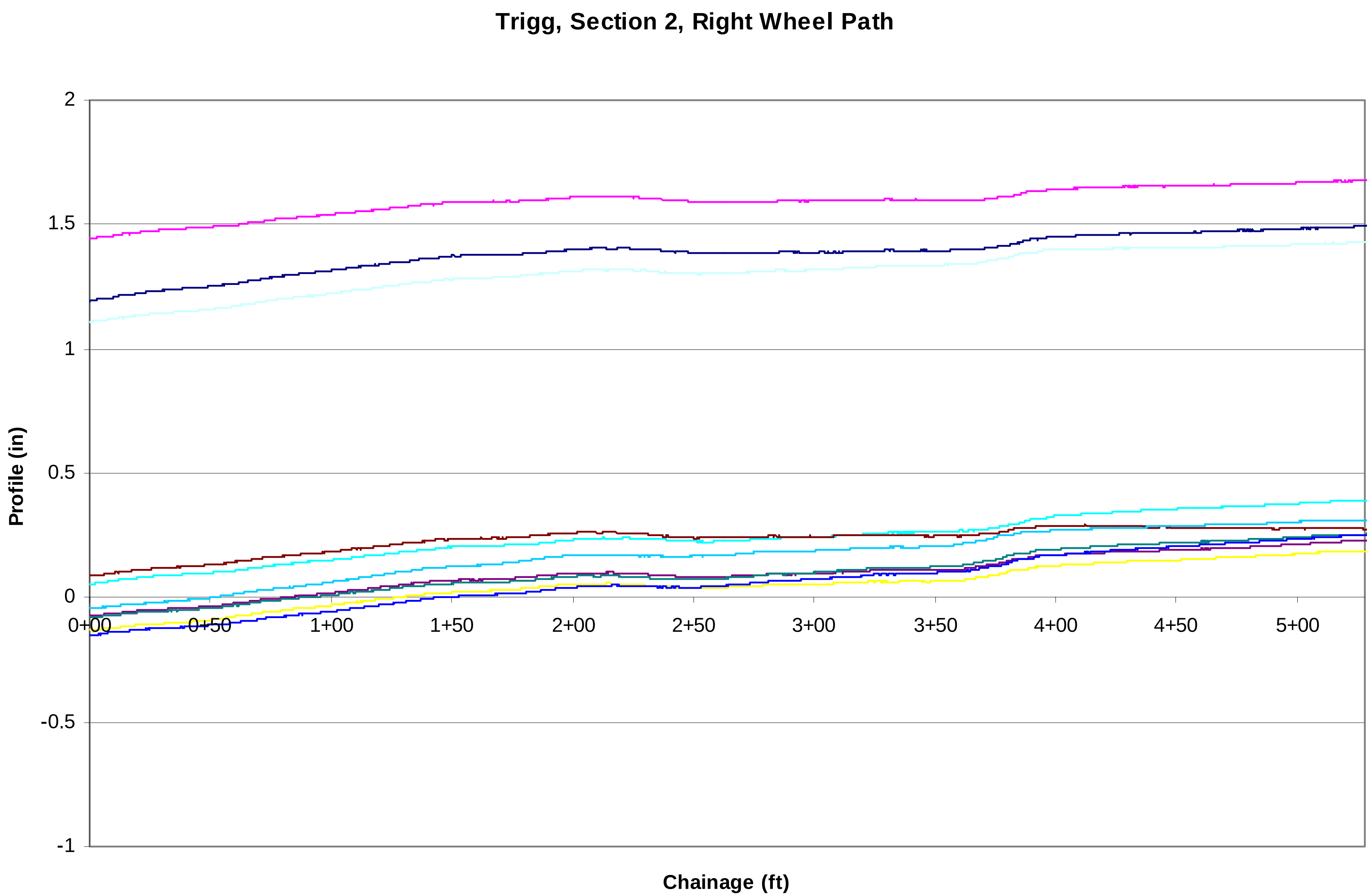

Trigg, Section 1, Left Wheel Path
Profile (in)
Chainage (ft)
1.5
1
0.5
0
-0.5
-1
-1.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00


Trigg, Section 1, Right Wheel Path
Profile (in)
Chainage (ft)
1.5
1
0.5
0
-0.5
-1
-1.5
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00

D26

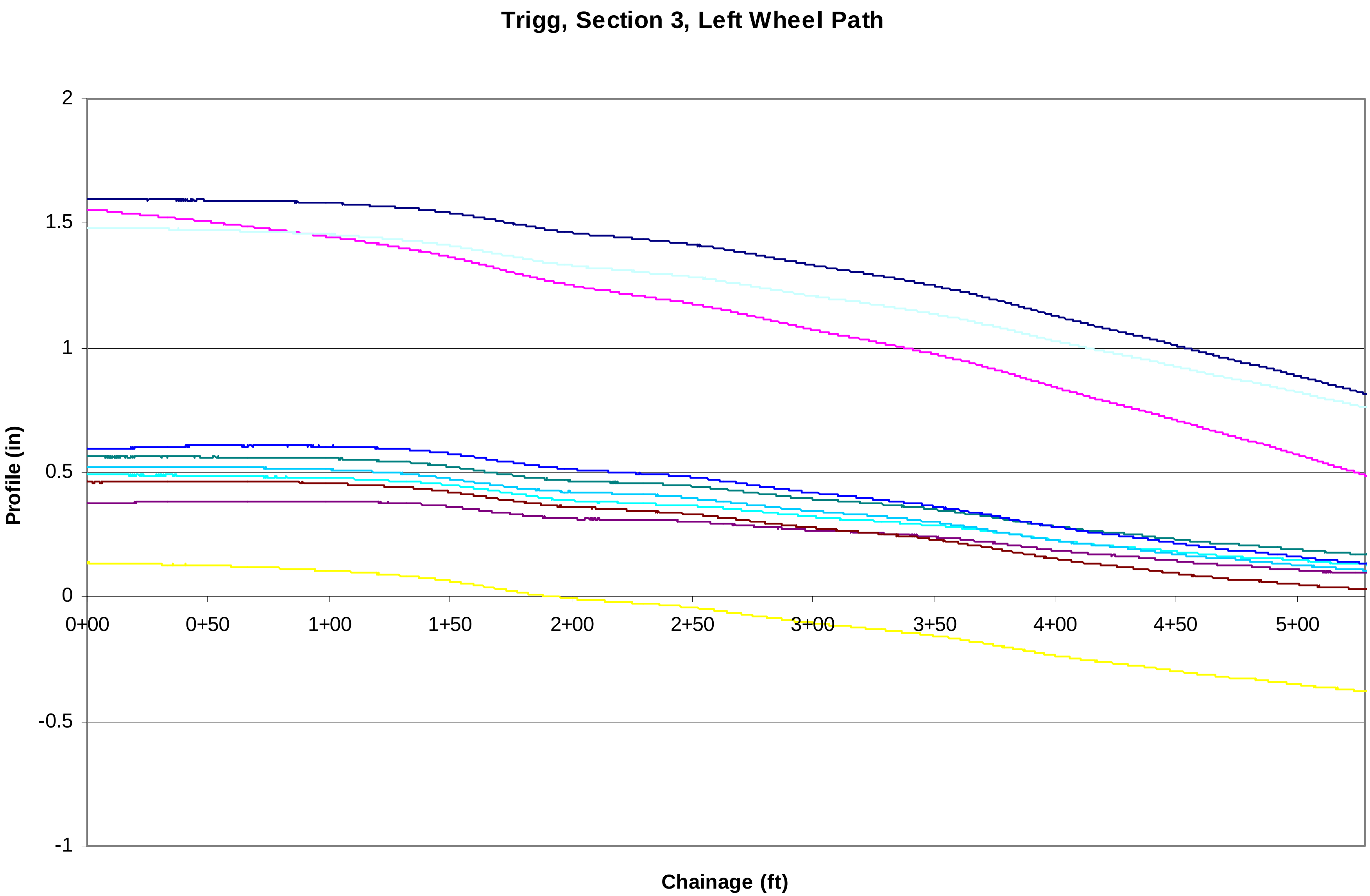

Trigg, Section 2, Left Wheel Path
Profile (in)
Chainage (ft)
2
1.5
1
0.5
0
-0.5
-1
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00

D27



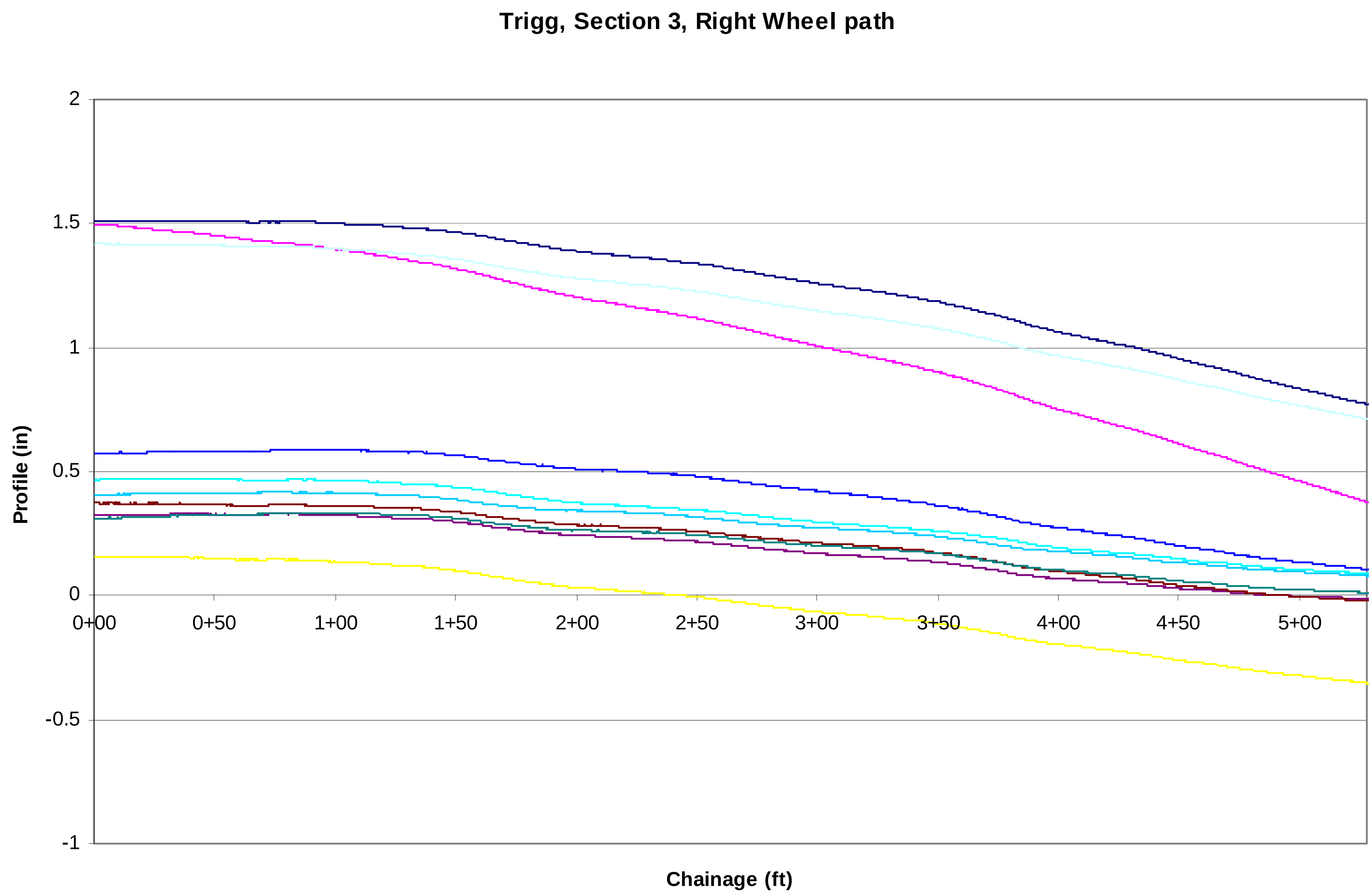
Trigg, Section 2, Right Wheel Path
Profile (in)
Chainage (ft)
2
1.5
1
0.5
0
-0.5
-1
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00

D28


Trigg, Section 3, Left Wheel Path
Profile (in)
2
1.5
1
0.5
0
-0.5
-1
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

D29

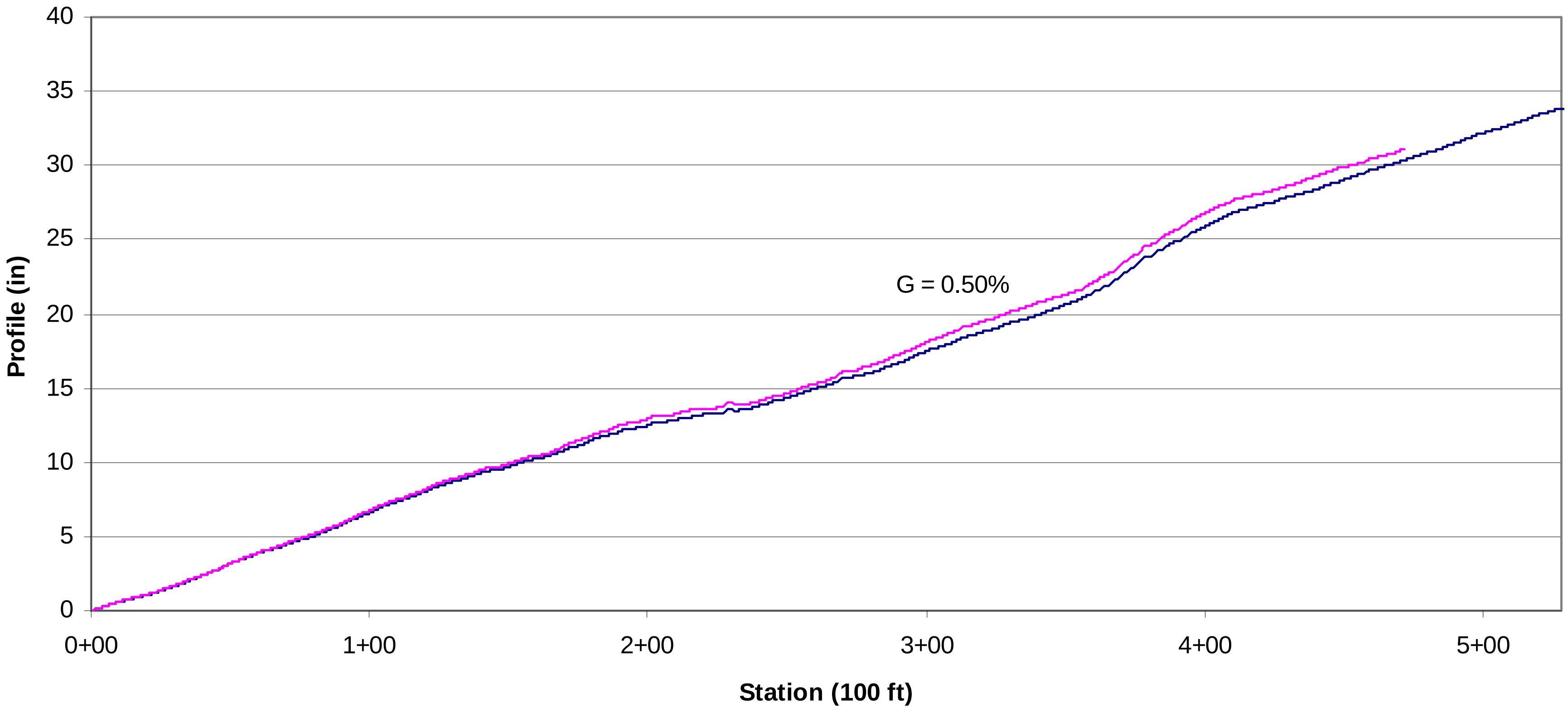
D30


Trigg, Section 3, Right Wheel path
Profile (in)
2
1.5
1
0.5
0
-0.5
-1
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

Elevation Difference = -31.86 inches (from survey)
Elevation Difference = -28.84 inches (from profiler)

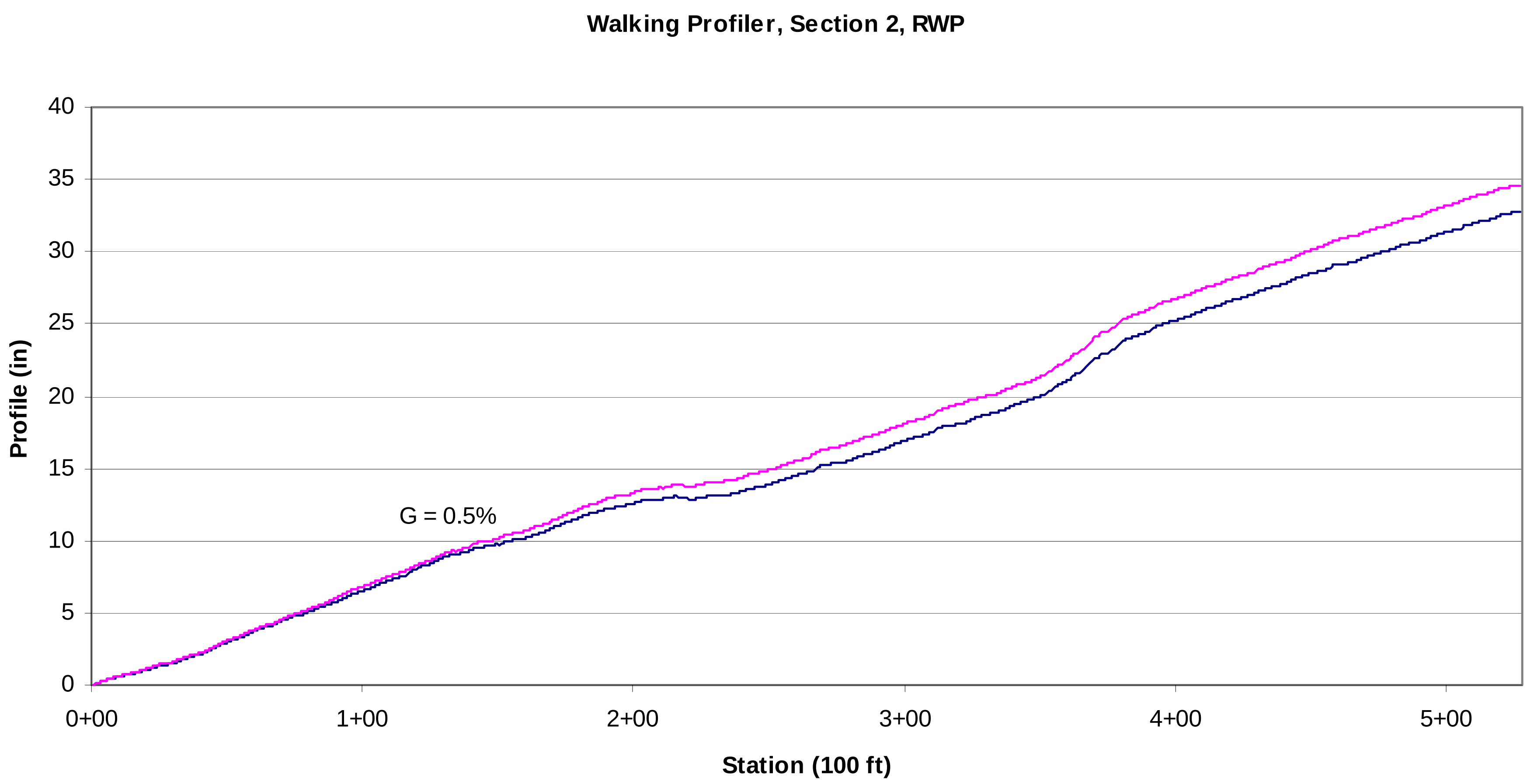
Elevation Difference = -31.50 inches (from survey)
Elevation Difference = -29.21 inches (from profiler)

Walking Profiler, Section 2, LWP



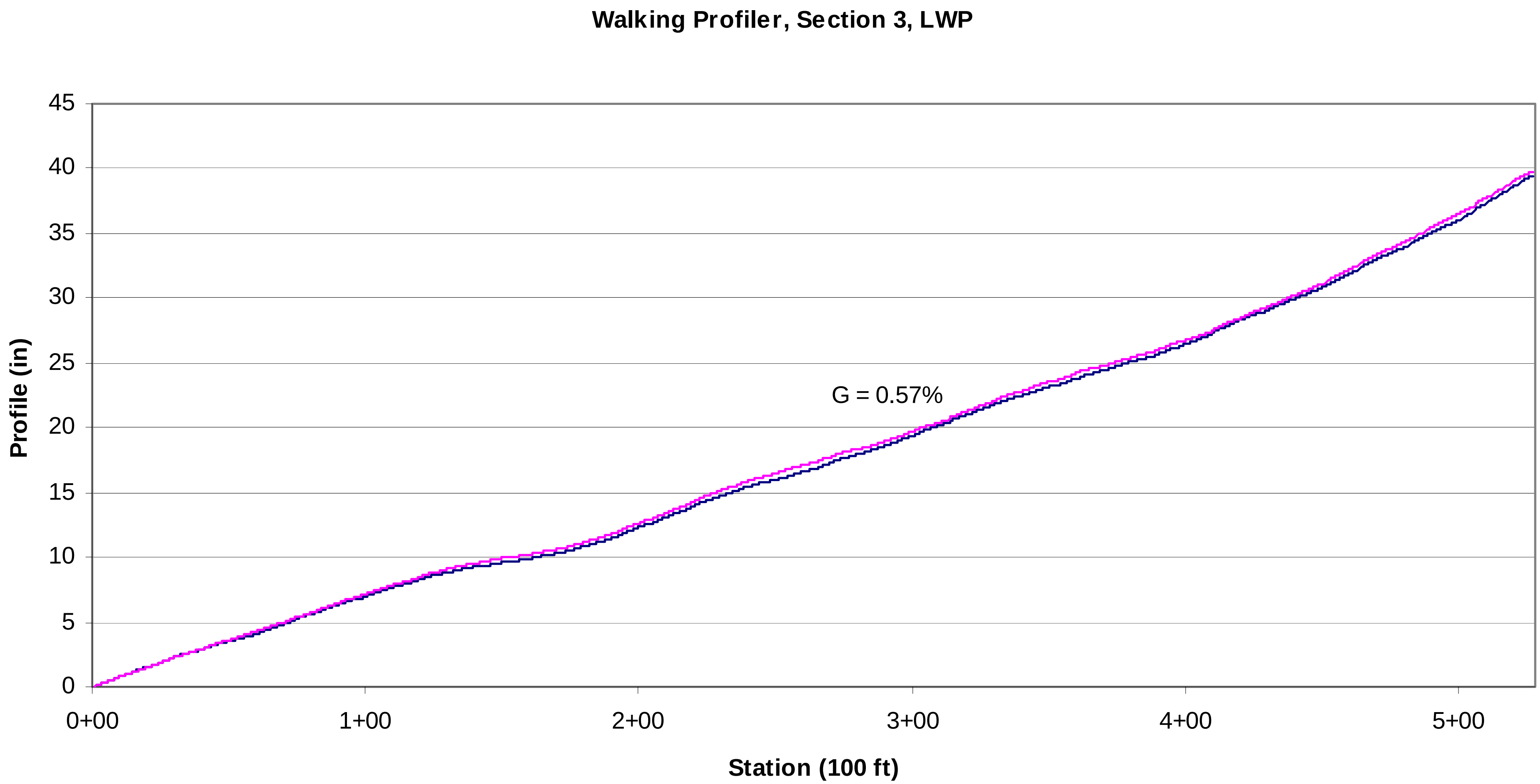
Elevation Difference = 31.98 inches (from survey)
Elevation Difference = 33.87 inches (from profiler)

D34

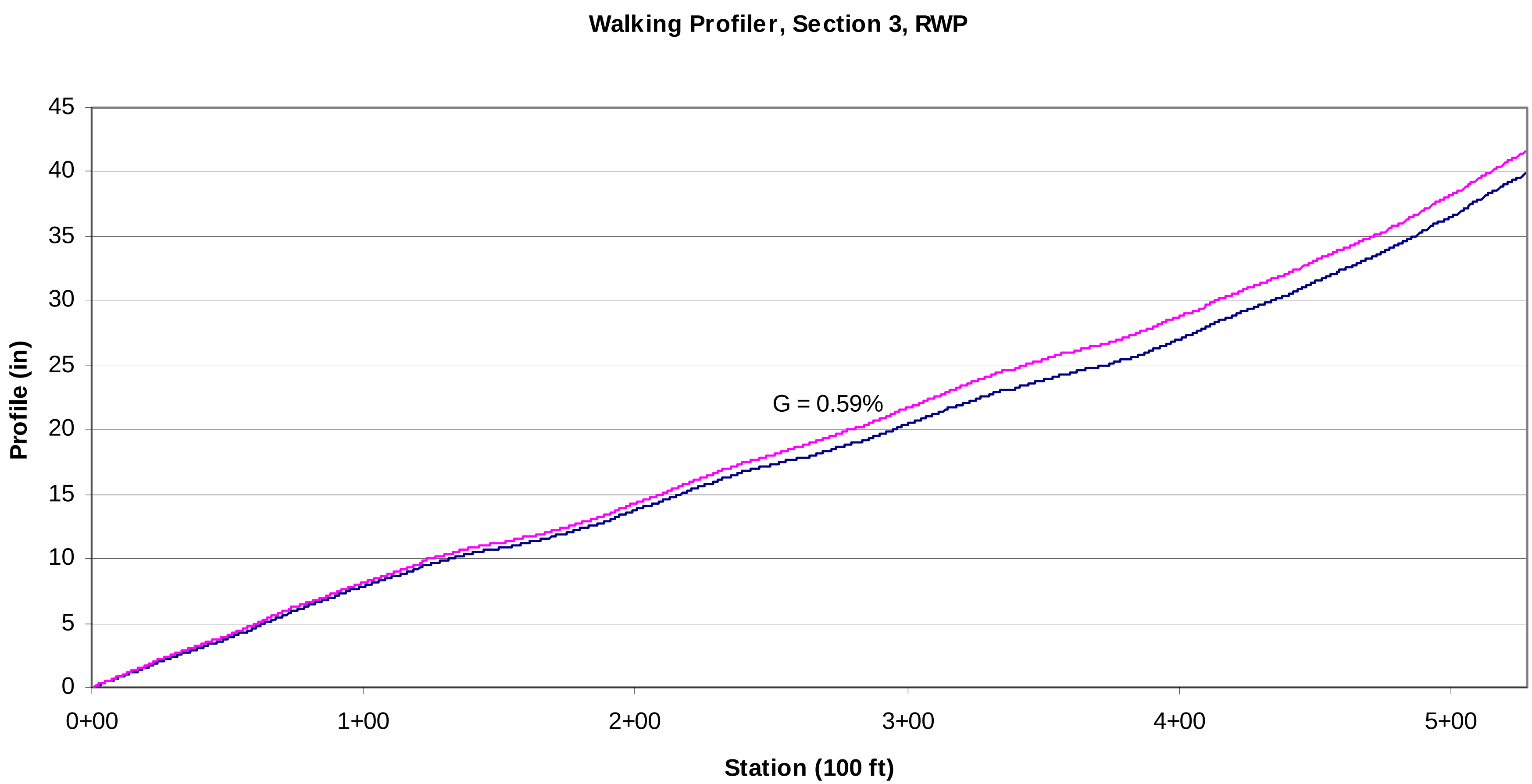


Elevation Difference = 31.68 inches (from survey)
Elevation Difference = 33.70 inches (from profiler)

D35

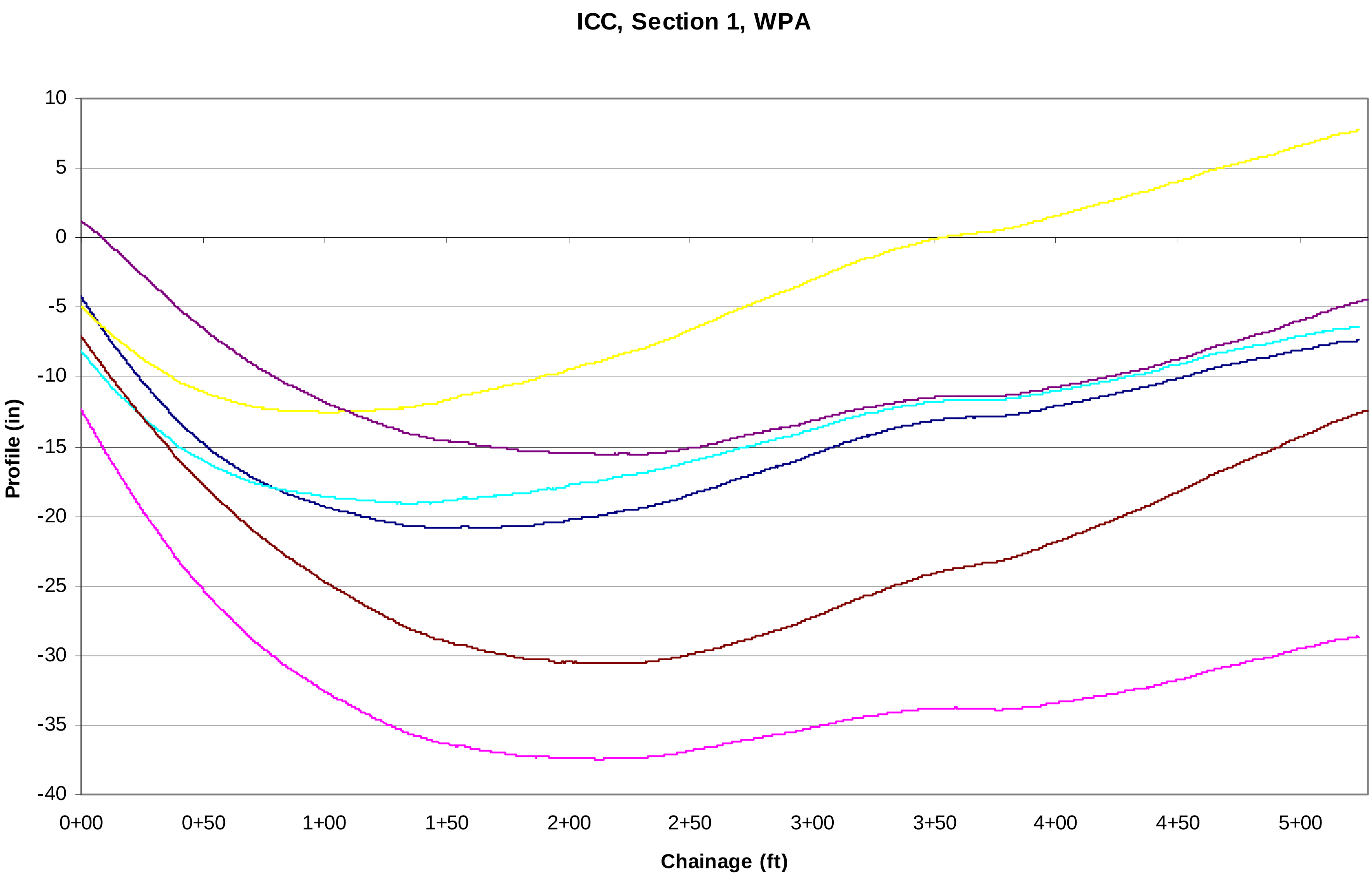


Elevation Difference = 36.36 inches (from survey)
Elevation Difference = 39.62 inches (from profiler)

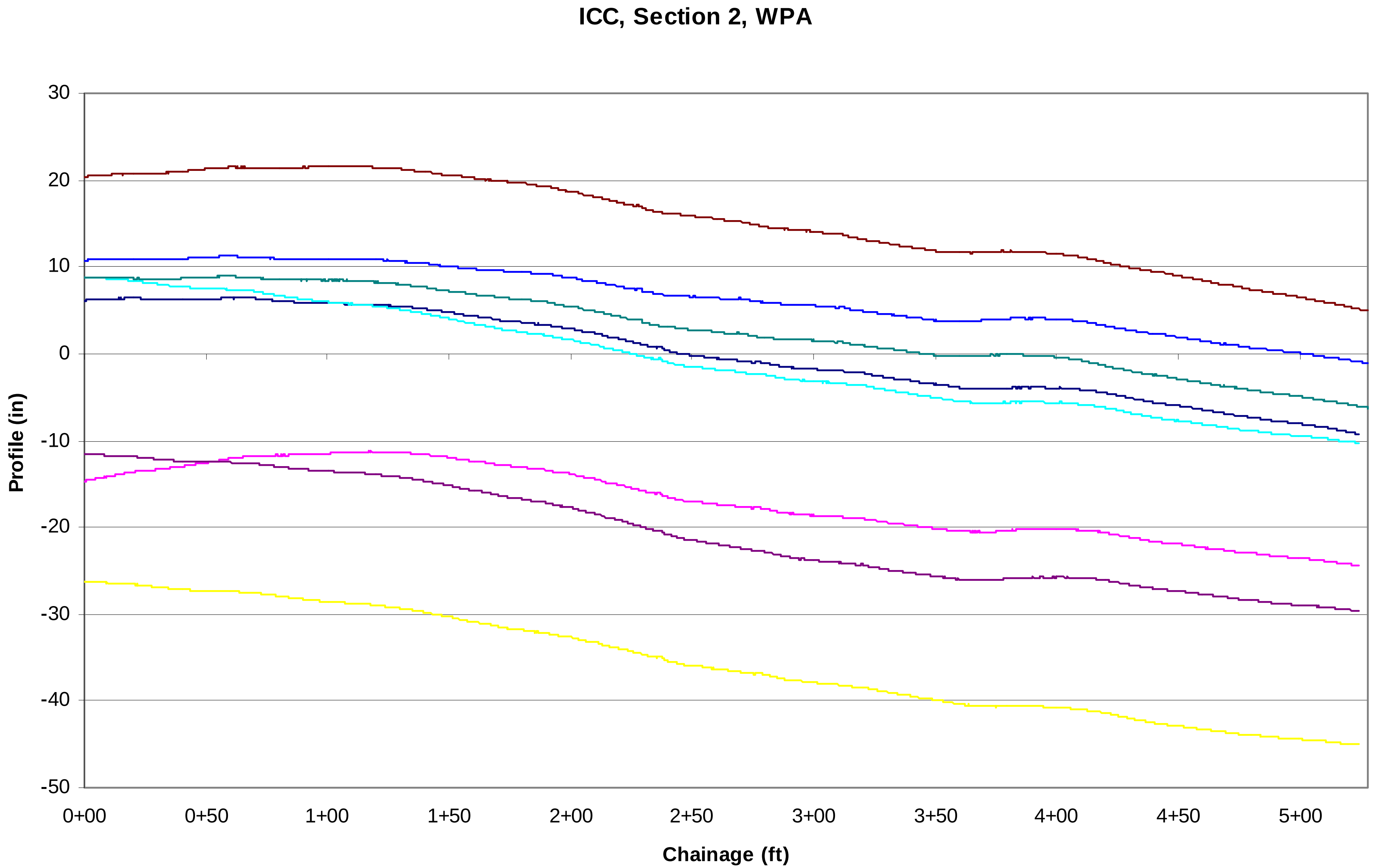


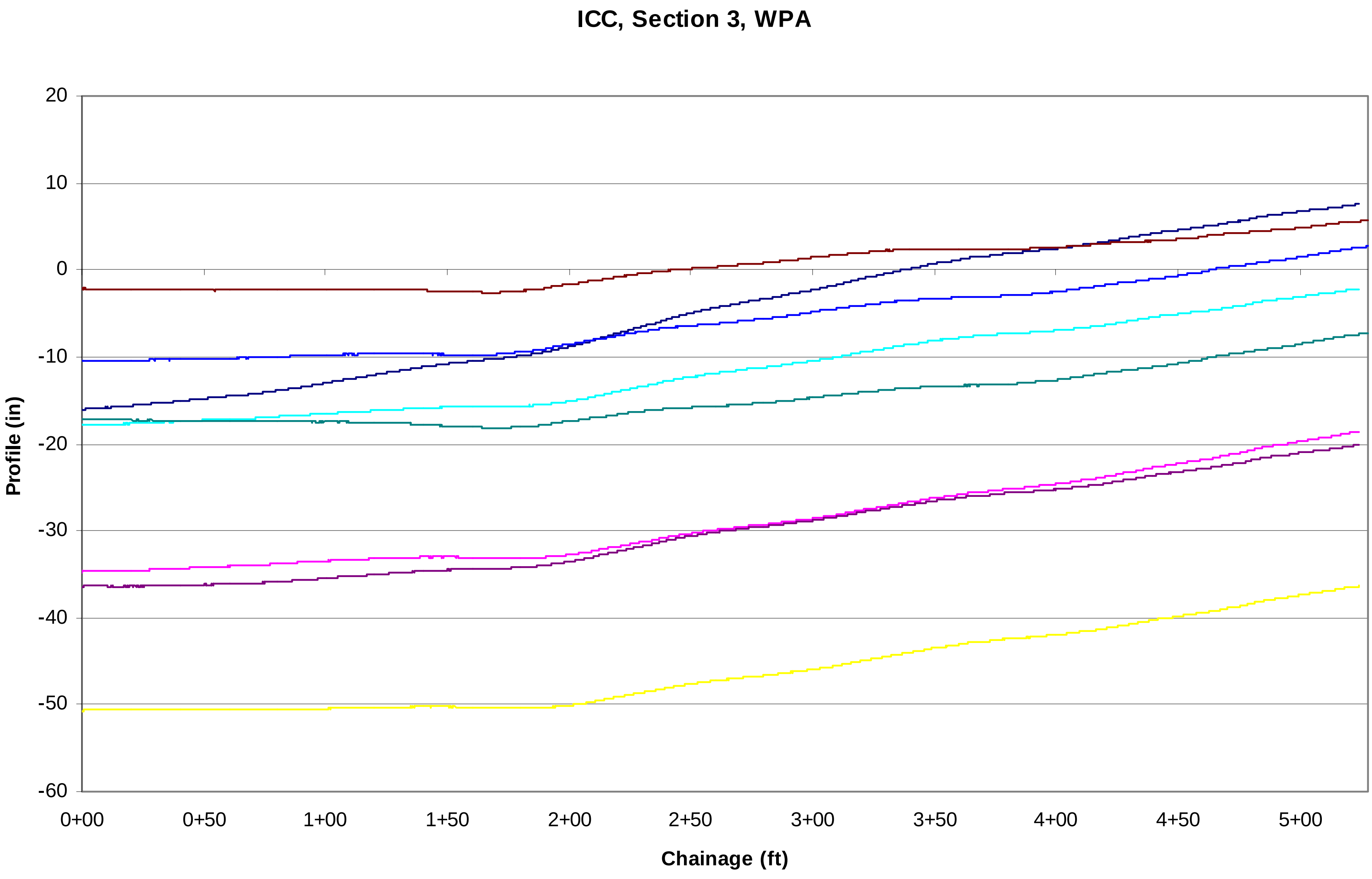
Elevation Difference = 37.26 inches (from survey)
Elevation Difference = 40.69 inches (from profiler)

D37



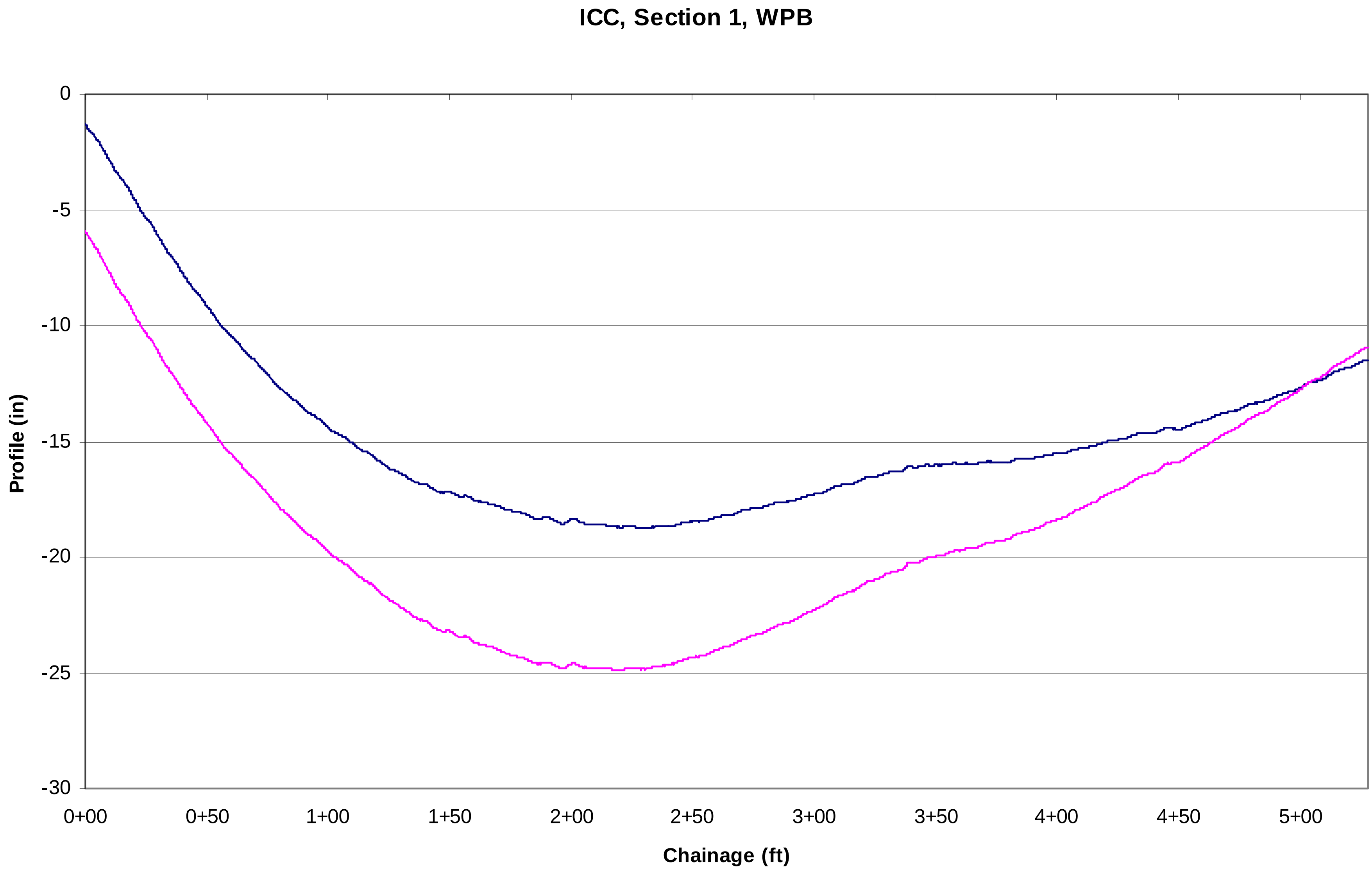
ICC, Section 1, WPA
Profile (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)


ICC, Section 2, WPA
Profile (in)
30
20
10
0
-10
-20
-30
-40
-50
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)


ICC, Section 3, WPA
Profile (in)
20
10
0
-10
-20
-30
-40
-50
-60
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

D39

D40


ICC, Section 1, WPB
Profile (in)
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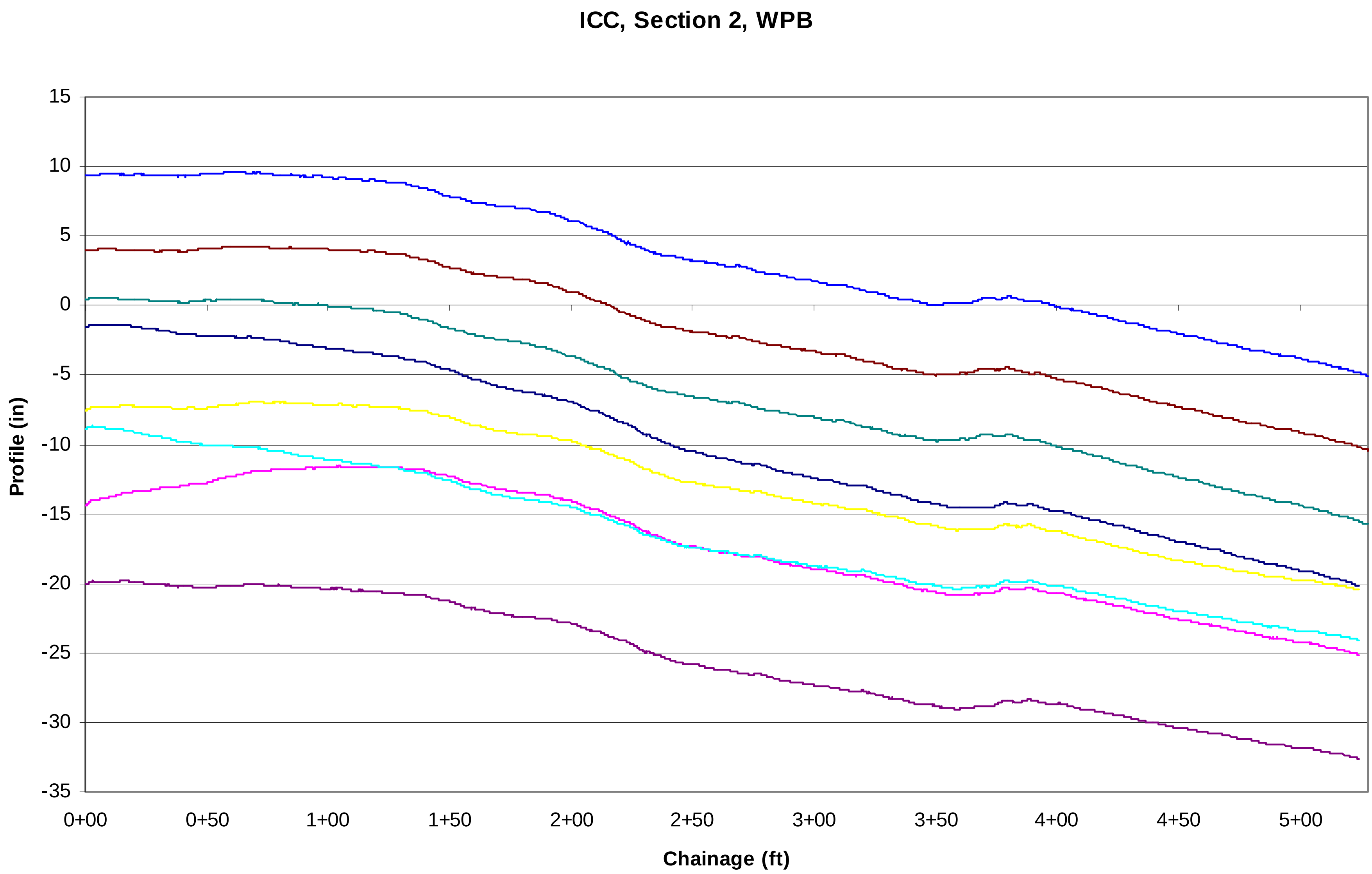
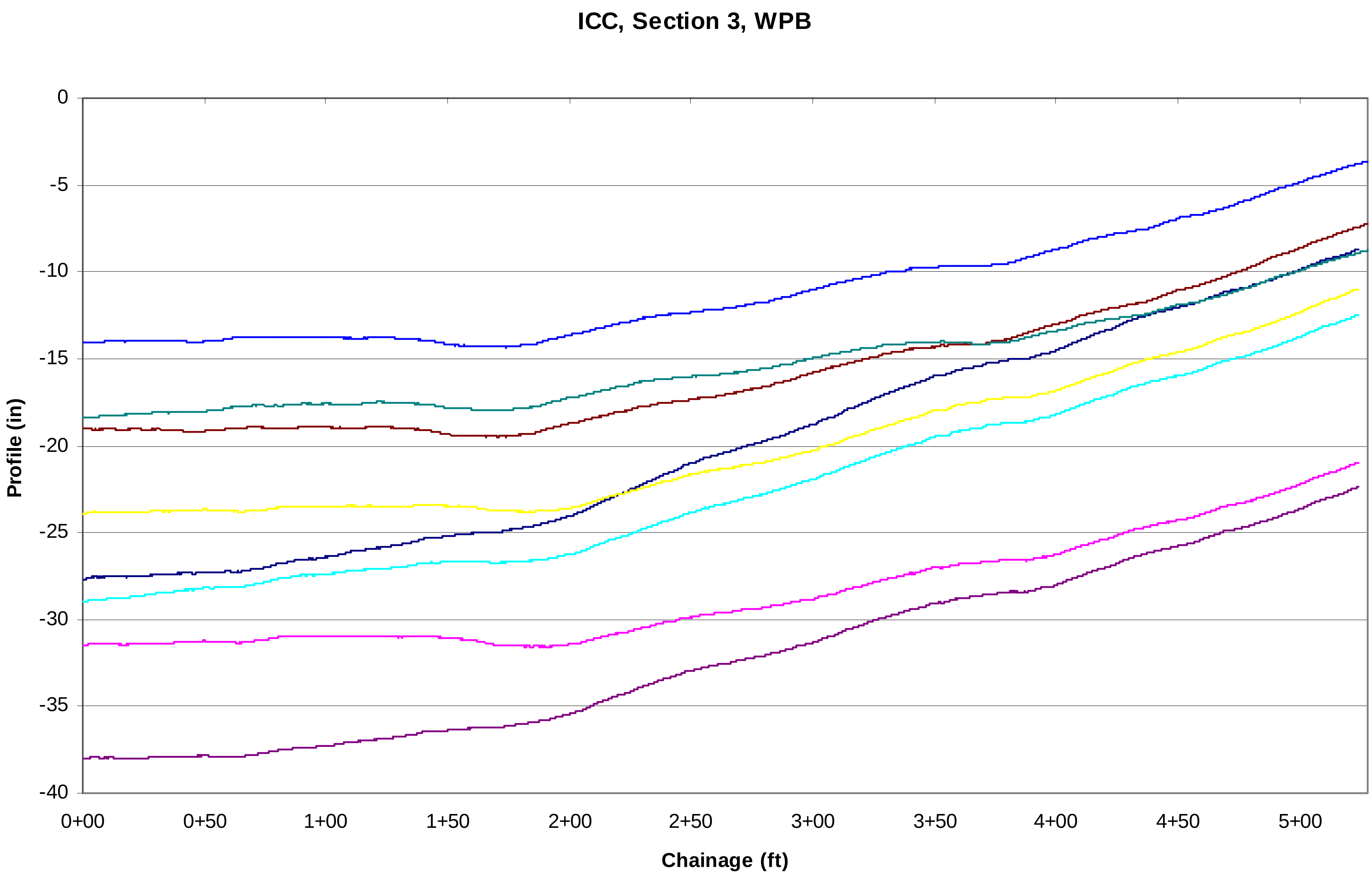
-10
-15
-20
-25
-30
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)



ICC, Section 2, WPB
Profile (in)
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
Chainage (ft)
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00

D41


ICC, Section 3, WPB
Profile (in)
0
-5
-10
-15
-20
-25
-30
-35
-40
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
Chainage (ft)

Appendix E

Statistical Results of IRI Data (F and t Tests)

SECTION 1
TWO-TAILED TEST
ALPHA = 0.01

F-Test Two-Sample for Variances

	ARAN5 (1)	*ARAN5 (2)*
Mean	95.9	94.6
Variance	4.988888889	4.488888889
Observations	10	10
df	9	9
F	1.111386139	0.899777283
P(F<=f) one-tail	0.438786662	
F Critical one-tail	6.541085895	0.152879815

F-Test Two-Sample for Variances

	ARAN5 (1)	*ARAN5 (3)*
Mean	95.9	93.45
Variance	4.988888889	3.913888889
Observations	10	10
df	9	9
F	1.274662881	0.784521158
P(F<=f) one-tail	0.36180075	
F Critical one-tail	6.541085895	0.152879815

F-Test Two-Sample for Variances

	ARAN5 (1)	*ARAN6*
Mean	95.9	92.65
Variance	4.988888889	2.336111111
Observations	10	10
df	9	9
F	2.135552913	0.468262806
P(F<=f) one-tail	0.136871494	
F Critical one-tail	6.541085895	0.152879815

F-Test Two-Sample for Variances

	ARAN5 (1)	*KJ LAW - T6400*
Mean	95.9	84.1465
Variance	4.988888889	7.653094722
Observations	10	10
df	9	9
F	0.651878628	1.534027895
P(F<=f) one-tail	0.266968186	
F Critical one-tail	0.152880375	6.541061924

F-Test Two-Sample for Variances

	ARAN5 (1)	*PATHWAY - PSI-35*
Mean	95.9	74.65
Variance	4.988888889	5.447222222
Observations	10	10
df	9	9
F	0.915859255	1.091870824
P(F<=f) one-tail	0.448989704	
F Critical one-tail	0.152880375	6.541061924

F-Test Two-Sample for Variances

	ARAN5 (1)	*ARRB 3-LP*
Mean	95.9	89.917
Variance	4.988888889	8.107512222
Observations	10	10
df	9	9
F	0.615341519	1.625113808
P(F<=f) one-tail	0.240368368	
F Critical one-tail	0.152880375	6.541061924

F-Test Two-Sample for Variances

	ARAN5 (1)	*ICC - MDR4083*
Mean	95.9	99.78571429
Variance	4.988888889	13.98809524
Observations	10	7
df	9	6
F	0.356652482	2.803849825
P(F<=f) one-tail	0.07999768	
F Critical one-tail	0.140175871	7.133895395

F-Test Two-Sample for Variances

	ARAN5 (1)	*AMES - LISA 6000*
Mean	95.9	86.7815
Variance	4.988888889	4.653405833
Observations	10	10
df	9	9
F	1.072094089	0.932753953
P(F<=f) one-tail	0.459554612	
F Critical one-tail	6.541085895	0.152879815

F-Test Two-Sample for Variances

	ARAN5 (1)	*WALKING PROFILER*
Mean	95.9	97.8
Variance	4.988888889	8.405
Observations	10	2
df	9	1
F	0.593562033	1.684743875
P(F<=f) one-tail	0.226571323	
F Critical one-tail	0.073455908	13.61360886

F-Test Two-Sample for Variances

	ARAN5 (2)	*ARAN5 (3)*
Mean	94.6	93.45
Variance	4.488888889	3.913888889
Observations	10	10
df	9	9
F	1.146912704	0.871905941
P(F<=f) one-tail	0.420774261	
F Critical one-tail	6.541085895	0.152879815

F-Test Two-Sample for Variances

	ARAN5 (2)	*ARAN6*
Mean	94.6	92.65
Variance	4.488888889	2.336111111
Observations	10	10
df	9	9
F	1.921521998	0.520420792
P(F<=f) one-tail	0.172364875	
F Critical one-tail	6.541085895	0.152879815

F-Test Two-Sample for Variances

	ARAN5 (2)	*KJ LAW - T6400*
Mean	94.6	84.1465
Variance	4.488888889	7.653094722
Observations	10	10
df	9	9
F	0.586545581	1.704897339
P(F<=f) one-tail	0.219475175	
F Critical one-tail	0.152880375	6.541061924

SECTION 1
TWO-TAILED TEST
ALPHA = 0.01

F-Test Two-Sample for Variances

	ARAN5 (2)	*PATHWAY - PSI-35*
Mean	94.6	74.65
Variance	4.488888889	5.447222222
Observations	10	10
df	9	9
F	0.824069352	1.213490099
P(F<=f) one-tail	0.388932701	
F Critical one-tail	0.152880375	6.541061924

F-Test Two-Sample for Variances

	ARAN5 (2)	*ARRB 3-LP*
Mean	94.6	89.917
Variance	4.488888889	8.107512222
Observations	10	10
df	9	9
F	0.55367032	1.80612896
P(F<=f) one-tail	0.19584595	
F Critical one-tail	0.152880375	6.541061924

F-Test Two-Sample for Variances

	ARAN5 (2)	*ICC - MDR4083*
Mean	94.6	99.78571429
Variance	4.488888889	13.98809524
Observations	10	7
df	9	6
F	0.320907801	3.11615983
P(F<=f) one-tail	0.06150188	
F Critical one-tail	0.140175871	7.133895395

F-Test Two-Sample for Variances

	ARAN5 (2)	*AMES - LISA 6000*
Mean	94.6	86.7815
Variance	4.488888889	4.653405833
Observations	10	10
df	9	9
F	0.964645907	1.036649814
P(F<=f) one-tail	0.479059676	
F Critical one-tail	0.152880375	6.541061924

F-Test Two-Sample for Variances

	ARAN5 (2)	*WALKING PROFILER*
Mean	94.6	97.8
Variance	4.488888889	8.405
Observations	10	2
df	9	1
F	0.534073633	1.87240099
P(F<=f) one-tail	0.204384838	
F Critical one-tail	0.073455908	13.61360886

F-Test Two-Sample for Variances

	ARAN5 (3)	*ARAN6*
Mean	93.45	92.65
Variance	3.913888889	2.336111111
Observations	10	10
df	9	9
F	1.675386445	0.596877218
P(F<=f) one-tail	0.226956778	
F Critical one-tail	6.541085895	0.152879815

F-Test Two-Sample for Variances

	ARAN5 (3)	*KJ LAW - T6400*
Mean	93.45	84.1465
Variance	3.913888889	7.653094722
Observations	10	10
df	9	9
F	0.511412576	1.955368417
P(F<=f) one-tail	0.166101494	
F Critical one-tail	0.152880375	6.541061924

F-Test Two-Sample for Variances

	ARAN5 (3)	*PATHWAY - PSI-35*
Mean	93.45	74.65
Variance	3.913888889	5.447222222
Observations	10	10
df	9	9
F	0.718510964	1.391767211
P(F<=f) one-tail	0.315171281	
F Critical one-tail	0.152880375	6.541061924

F-Test Two-Sample for Variances

	ARAN5 (3)	*ARRB 3-LP*
Mean	93.45	89.917
Variance	3.913888889	8.107512222
Observations	10	10
df	9	9
F	0.482748441	2.07147225
P(F<=f) one-tail	0.146525543	
F Critical one-tail	0.152880375	6.541061924

F-Test Two-Sample for Variances

	ARAN5 (3)	*ICC - MDR4083*
Mean	93.45	99.78571429
Variance	3.913888889	13.98809524
Observations	10	7
df	9	6
F	0.279801418	3.573963297
P(F<=f) one-tail	0.042813661	
F Critical one-tail	0.140175871	7.133895395

F-Test Two-Sample for Variances

	ARAN5 (3)	*AMES - LISA 6000*
Mean	93.45	86.7815
Variance	3.913888889	4.653405833
Observations	10	10
df	9	9
F	0.841080497	1.188946842
P(F<=f) one-tail	0.400384712	
F Critical one-tail	0.152880375	6.541061924

F-Test Two-Sample for Variances

	ARAN5 (3)	*WALKING PROFILER*
Mean	93.45	97.8
Variance	3.913888889	8.405
Observations	10	2
df	9	1
F	0.465661974	2.147480483
P(F<=f) one-tail	0.176847097	
F Critical one-tail	0.073455908	13.61360886

SECTION 1
TWO-TAILED TESTS
ALPHA = 0.01

F-Test Two-Sample for Variances

	ARAN6	*KJ LAW - T6400*
Mean	92.65	84.1465
Variance	2.336111111	7.653094722
Observations	10	10
df	9	9
F	0.305250516	3.275997741
P(F<=f) one-tail	0.045945	
F Critical one-tail	0.152880375	6.541061924

F-Test Two-Sample for Variances

	ARAN6	*PATHWAY - PSI-35*
Mean	92.65	74.65
Variance	2.336111111	5.447222222
Observations	10	10
df	9	9
F	0.428862825	2.331747919
P(F<=f) one-tail	0.111614808	
F Critical one-tail	0.152880375	6.541061924

F-Test Two-Sample for Variances

	ARAN6	*ARRB 3-LP*
Mean	92.65	89.917
Variance	2.336111111	8.107512222
Observations	10	10
df	9	9
F	0.288141547	3.470516528
P(F<=f) one-tail	0.038947451	
F Critical one-tail	0.152880375	6.541061924

F-Test Two-Sample for Variances

	ARAN6	*ICC - MDR4083*
Mean	92.65	99.78571429
Variance	2.336111111	13.98809524
Observations	10	7
df	9	6
F	0.167007092	5.987769662
P(F<=f) one-tail	0.009018897	
F Critical one-tail	0.140175871	7.133895395

F-Test Two-Sample for Variances

	ARAN6	*AMES - LISA 6000*
Mean	92.65	86.7815
Variance	2.336111111	4.653405833
Observations	10	10
df	9	9
F	0.502021787	1.991945422
P(F<=f) one-tail	0.159625386	
F Critical one-tail	0.152880375	6.541061924

F-Test Two-Sample for Variances

	ARAN6	*WALKING PROFILER*
Mean	92.65	97.8
Variance	2.336111111	8.405
Observations	10	2
df	9	1
F	0.277943023	3.597859691
P(F<=f) one-tail	0.090348765	
F Critical one-tail	0.073455908	13.61360886

F-Test Two-Sample for Variances

	KJ LAW - T6400	*PATHWAY - PSI-35*
Mean	84.1465	74.65
Variance	7.653094722	5.447222222
Observations	10	10
df	9	9
F	1.404953646	0.711767255
P(F<=f) one-tail	0.310331781	
F Critical one-tail	6.541085895	0.152879815

F-Test Two-Sample for Variances

	KJ LAW - T6400	*ARRB 3-LP*
Mean	84.1465	89.917
Variance	7.653094722	8.107512222
Observations	10	10
df	9	9
F	0.943951056	1.05937696
P(F<=f) one-tail	0.466468498	
F Critical one-tail	0.152880375	6.541061924

F-Test Two-Sample for Variances

	KJ LAW - T6400	*ICC - MDR4083*
Mean	84.1465	99.78571429
Variance	7.653094722	13.98809524
Observations	10	7
df	9	6
F	0.547114857	1.827769778
P(F<=f) one-tail	0.199684309	
F Critical one-tail	0.140175871	7.133895395

F-Test Two-Sample for Variances

	KJ LAW - T6400	*AMES - LISA 6000*
Mean	84.1465	86.7815
Variance	7.653094722	4.653405833
Observations	10	10
df	9	9
F	1.644622239	0.608042367
P(F<=f) one-tail	0.235061661	
F Critical one-tail	6.541085895	0.152879815

F-Test Two-Sample for Variances

	KJ LAW - T6400	*WALKING PROFILER*
Mean	84.1465	97.8
Variance	7.653094722	8.405
Observations	10	2
df	9	1
F	0.910540717	1.098248526
P(F<=f) one-tail	0.321977433	
F Critical one-tail	0.073455908	13.61360886

F-Test Two-Sample for Variances

	PATHWAY - PSI-35	*ARRB 3-LP*
Mean	74.65	89.917
Variance	5.447222222	8.107512222
Observations	10	10
df	9	9
F	0.671873452	1.488375523
P(F<=f) one-tail	0.281504228	
F Critical one-tail	0.152880375	6.541061924

SECTION 1
TWO-TAILED TEST
ALPHA = 0.01

F-Test Two-Sample for Variances

	PATHWAY - PSI-35	*ICC - MDR4083*
Mean	74.65	99.78571429
Variance	5.447222222	13.98809524
Observations	10	7
df	9	6
F	0.38941844	2.567931813
P(F<=f) one-tail	0.098475624	
F Critical one-tail	0.140175871	7.133895395

F-Test Two-Sample for Variances

	PATHWAY - PSI-35	*AMES - LISA 6000*
Mean	74.65	86.7815
Variance	5.447222222	4.653405833
Observations	10	10
df	9	9
F	1.170588257	0.854271341
P(F<=f) one-tail	0.409168293	
F Critical one-tail	6.541085895	0.152879815

F-Test Two-Sample for Variances

	PATHWAY - PSI-35	*WALKING PROFILER*
Mean	74.65	97.8
Variance	5.447222222	8.405
Observations	10	2
df	9	1
F	0.648093066	1.542988271
P(F<=f) one-tail	0.245565901	
F Critical one-tail	0.073455908	13.61360886

F-Test Two-Sample for Variances

	ARRB 3-LP	*ICC - MDR4083*
Mean	89.917	99.78571429
Variance	8.107512222	13.98809524
Observations	10	7
df	9	6
F	0.579600874	1.725325211
P(F<=f) one-tail	0.221670881	
F Critical one-tail	0.140175871	7.133895395

F-Test Two-Sample for Variances

	ARRB 3-LP	*AMES - LISA 6000*
Mean	89.917	86.7815
Variance	8.107512222	4.653405833
Observations	10	10
df	9	9
F	1.742274908	0.573962235
P(F<=f) one-tail	0.210394243	
F Critical one-tail	6.541085895	0.152879815

F-Test Two-Sample for Variances

	ARRB 3-LP	*WALKING PROFILER*
Mean	89.917	97.8
Variance	8.107512222	8.405
Observations	10	2
df	9	1
F	0.964605856	1.036692856
P(F<=f) one-tail	0.33518032	
F Critical one-tail	0.073455908	13.61360886

F-Test Two-Sample for Variances

	ICC - MDR4083	*AMES - LISA 6000*
Mean	99.78571429	86.7815
Variance	13.98809524	4.653405833
Observations	7	10
df	6	9
F	3.005990825	0.332669013
P(F<=f) one-tail	0.067375696	
F Critical one-tail	7.133849067	0.140176781

F-Test Two-Sample for Variances

	ICC - MDR4083	*WALKING PROFILER*
Mean	99.78571429	97.8
Variance	13.98809524	8.405
Observations	7	2
df	6	1
F	1.664258803	0.600868085
P(F<=f) one-tail	0.532312634	
F Critical one-tail	23439.52656	4.2663E-05

F-Test Two-Sample for Variances

	AMES - LISA 6000	*WALKING PROFILER*
Mean	86.7815	97.8
Variance	4.653405833	8.405
Observations	10	2
df	9	1
F	0.553647333	1.806203951
P(F<=f) one-tail	0.211860444	
F Critical one-tail	0.073455908	13.61360886

SECTION 2
TWO-TAILED TEST
ALPHA = 0.01

F-Test Two-Sample for Variances

	ARAN 1 (5)	*ARAN 2 (5)*
Mean	113	113.7
Variance	11.33333333	1.788888889
Observations	10	10
df	9	9
F	6.335403727	
P(F<=f) one-tail	0.005596057	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 1 (5)	*ARAN 3 (5)*
Mean	113	111
Variance	11.33333333	3.388888889
Observations	10	10
df	9	9
F	3.344262295	
P(F<=f) one-tail	0.043329378	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 1 (5)	*ARAN 4 (6)*
Mean	113	116.75
Variance	11.33333333	2.736111111
Observations	10	10
df	9	9
F	4.14213198	
P(F<=f) one-tail	0.02289928	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 1 (5)	*KJ LAW - T6400*
Mean	113	103.6265
Variance	11.33333333	8.132783611
Observations	10	10
df	9	9
F	1.39353681	
P(F<=f) one-tail	0.314517187	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 1 (5)	*PATHWAY - PSI-35*
Mean	113	86.9
Variance	11.33333333	15.15555556
Observations	10	10
df	9	9
F	0.747800587	
P(F<=f) one-tail	0.336042243	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 1 (5)	*ARRB 3-LP*
Mean	113	108.1445
Variance	11.33333333	6.823663611
Observations	10	10
df	9	9
F	1.660886875	
P(F<=f) one-tail	0.230737123	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 1 (5)	*ICC - MDR4083*
Mean	113	101.7777778
Variance	11.33333333	1.506944444
Observations	10	9
df	9	8
F	7.520737327	
P(F<=f) one-tail	0.004613275	
F Critical one-tail	7.338712749	

F-Test Two-Sample for Variances

	ARAN 1 (5)	*AMES - LISA 6000*
Mean	113	100.273
Variance	11.33333333	1.247056667
Observations	10	10
df	9	9
F	9.088066033	
P(F<=f) one-tail	0.001499086	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 1 (5)	*WALKING PROFILER*
Mean	113	109.98
Variance	11.33333333	#DIV/0!
Observations	10	1
df	9	0
F	0.103049039	
P(F<=f) one-tail	#NULL!	
F Critical one-tail	#NUM!	

F-Test Two-Sample for Variances

	ARAN 2 (5)	*ARAN 3 (5)*
Mean	113.7	111
Variance	1.788888889	3.388888889
Observations	10	10
df	9	9
F	0.527868852	
P(F<=f) one-tail	0.177578146	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 2 (5)	*ARAN 4 (6)*
Mean	113.7	116.75
Variance	1.788888889	2.736111111
Observations	10	10
df	9	9
F	0.653807107	
P(F<=f) one-tail	0.268371622	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 2 (5)	*KJ LAW - T6400*
Mean	113.7	103.6265
Variance	1.788888889	8.132783611
Observations	10	10
df	9	9
F	0.219960222	
P(F<=f) one-tail	0.017075956	
F Critical one-tail	0.152880375	

SECTION 2
TWO-TAILED TEST
ALPHA = 0.01

F-Test Two-Sample for Variances

	ARAN 2 (5)	*PATHWAY - PSI-35*
Mean	113.7	86.9
Variance	1.788888889	15.15555556
Observations	10	10
df	9	9
F	0.118035191	
P(F<=f) one-tail	0.001951146	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 2 (5)	*ARRB 3-LP*
Mean	113.7	108.1445
Variance	1.788888889	6.823663611
Observations	10	10
df	9	9
F	0.262159595	
P(F<=f) one-tail	0.029457985	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 2 (5)	*ICC - MDR4083*
Mean	113.7	101.7777778
Variance	1.788888889	1.506944444
Observations	10	9
df	9	8
F	1.187096774	
P(F<=f) one-tail	0.409769416	
F Critical one-tail	7.338712749	

F-Test Two-Sample for Variances

	ARAN 2 (5)	*AMES - LISA 6000*
Mean	113.7	100.273
Variance	1.788888889	1.247056667
Observations	10	10
df	9	9
F	1.434488854	
P(F<=f) one-tail	0.299777796	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 2 (5)	*WALKING PROFILER*
Mean	113.7	109.98
Variance	1.788888889	#DIV/0!
Observations	10	1
df	9	0
F	0.016265584	
P(F<=f) one-tail	#NULL!	
F Critical one-tail	#NUM!	

F-Test Two-Sample for Variances

	ARAN 3 (5)	*ARAN 4 (6)*
Mean	111	116.75
Variance	3.388888889	2.736111111
Observations	10	10
df	9	9
F	1.23857868	
P(F<=f) one-tail	0.377564524	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 3 (5)	*KJ LAW - T6400*
Mean	111	103.6265
Variance	3.388888889	8.132783611
Observations	10	10
df	9	9
F	0.416694831	
P(F<=f) one-tail	0.104157528	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 3 (5)	*PATHWAY - PSI-35*
Mean	111	86.9
Variance	3.388888889	15.15555556
Observations	10	10
df	9	9
F	0.223607038	
P(F<=f) one-tail	0.017996303	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 3 (5)	*ARRB 3-LP*
Mean	111	108.1445
Variance	3.388888889	6.823663611
Observations	10	10
df	9	9
F	0.496637742	
P(F<=f) one-tail	0.155938857	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 3 (5)	*ICC - MDR4083*
Mean	111	101.7777778
Variance	3.388888889	1.506944444
Observations	10	9
df	9	8
F	2.248847926	
P(F<=f) one-tail	0.133836923	
F Critical one-tail	7.338712749	

F-Test Two-Sample for Variances

	ARAN 3 (5)	*AMES - LISA 6000*
Mean	111	100.273
Variance	3.388888889	1.247056667
Observations	10	10
df	9	9
F	2.717509941	
P(F<=f) one-tail	0.076267337	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 3 (5)	*WALKING PROFILER*
Mean	111	109.98
Variance	3.388888889	#DIV/0!
Observations	10	1
df	9	0
F	0.030813683	
P(F<=f) one-tail	#NULL!	
F Critical one-tail	#NUM!	

SECTION 2
TWO-TAILED TEST
ALPHA = 0.01

F-Test Two-Sample for Variances

	ARAN 4 (6)	*KJ LAW - T6400*
Mean	116.75	103.6265
Variance	2.736111111	8.132783611
Observations	10	10
df	9	9
F	0.336429843	
P(F<=f) one-tail	0.060143576	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 4 (6)	*PATHWAY - PSI-35*
Mean	116.75	86.9
Variance	2.736111111	15.15555556
Observations	10	10
df	9	9
F	0.180535191	
P(F<=f) one-tail	0.008899301	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 4 (6)	*ARRB 3-LP*
Mean	116.75	108.1445
Variance	2.736111111	6.823663611
Observations	10	10
df	9	9
F	0.400973915	
P(F<=f) one-tail	0.094796274	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 4 (6)	*ICC - MDR4083*
Mean	116.75	101.7777778
Variance	2.736111111	1.506944444
Observations	10	9
df	9	8
F	1.815668203	
P(F<=f) one-tail	0.20652388	
F Critical one-tail	7.338712749	

F-Test Two-Sample for Variances

	ARAN 4 (6)	*AMES - LISA 6000*
Mean	116.75	100.273
Variance	2.736111111	1.247056667
Observations	10	10
df	9	9
F	2.194055157	
P(F<=f) one-tail	0.128699071	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 4 (6)	*WALKING PROFILER*
Mean	116.75	109.98
Variance	2.736111111	#DIV/0!
Observations	10	1
df	9	0
F	0.024878261	
P(F<=f) one-tail	#NULL!	
F Critical one-tail	#NUM!	

F-Test Two-Sample for Variances

	KJ LAW - T6400	*PATHWAY - PSI-35*
Mean	103.6265	86.9
Variance	8.132783611	15.15555556
Observations	10	10
df	9	9
F	0.53662062	
P(F<=f) one-tail	0.183740594	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	KJ LAW - T6400	*ARRB 3-LP*
Mean	103.6265	108.1445
Variance	8.132783611	6.823663611
Observations	10	10
df	9	9
F	1.19185002	
P(F<=f) one-tail	0.399012817	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	KJ LAW - T6400	*ICC - MDR4083*
Mean	103.6265	101.7777778
Variance	8.132783611	1.506944444
Observations	10	9
df	9	8
F	5.39687023	
P(F<=f) one-tail	0.013246789	
F Critical one-tail	7.338712749	

F-Test Two-Sample for Variances

	KJ LAW - T6400	*AMES - LISA 6000*
Mean	103.6265	100.273
Variance	8.132783611	1.247056667
Observations	10	10
df	9	9
F	6.521583043	
P(F<=f) one-tail	0.005053098	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	KJ LAW - T6400	*WALKING PROFILER*
Mean	103.6265	109.98
Variance	8.132783611	#DIV/0!
Observations	10	1
df	9	0
F	0.073947842	
P(F<=f) one-tail	#NULL!	
F Critical one-tail	#NUM!	

F-Test Two-Sample for Variances

	PATHWAY - PSI-35	*ARRB 3-LP*
Mean	86.9	108.1445
Variance	15.15555556	6.823663611
Observations	10	10
df	9	9
F	2.221029116	
P(F<=f) one-tail	0.125123639	
F Critical one-tail	6.541085895	

SECTION 2
TWO-TAILED TEST
ALPHA = 0.01

F-Test Two-Sample for Variances

	PATHWAY - PSI-35	*ICC - MDR4083*
Mean	86.9	101.7777778
Variance	15.15555556	1.506944444
Observations	10	9
df	9	8
F	10.05714286	
P(F<=f) one-tail	0.001729752	
F Critical one-tail	7.338712749	

F-Test Two-Sample for Variances

	PATHWAY - PSI-35	*AMES - LISA 6000*
Mean	86.9	100.273
Variance	15.15555556	1.247056667
Observations	10	10
df	9	9
F	12.15306085	
P(F<=f) one-tail	0.000487601	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	PATHWAY - PSI-35	*WALKING PROFILER*
Mean	86.9	109.98
Variance	15.15555556	#DIV/0!
Observations	10	1
df	9	0
F	0.137802833	
P(F<=f) one-tail	#NULL!	
F Critical one-tail	#NUM!	

F-Test Two-Sample for Variances

	ARRB 3-LP	*ICC - MDR4083*
Mean	108.1445	101.7777778
Variance	6.823663611	1.506944444
Observations	10	9
df	9	8
F	4.528145438	
P(F<=f) one-tail	0.022366964	
F Critical one-tail	7.338712749	

F-Test Two-Sample for Variances

	ARRB 3-LP	*AMES - LISA 6000*
Mean	108.1445	100.273
Variance	6.823663611	1.247056667
Observations	10	10
df	9	9
F	5.47181519	
P(F<=f) one-tail	0.009275478	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARRB 3-LP	*WALKING PROFILER*
Mean	108.1445	109.98
Variance	6.823663611	#DIV/0!
Observations	10	1
df	9	0
F	0.062044586	
P(F<=f) one-tail	#NULL!	
F Critical one-tail	#NUM!	

F-Test Two-Sample for Variances

	ICC - MDR4083	*AMES - LISA 6000*
Mean	101.7777778	100.273
Variance	1.506944444	1.247056667
Observations	9	10
df	8	9
F	1.208400937	
P(F<=f) one-tail	0.389177353	
F Critical one-tail	6.693198884	

F-Test Two-Sample for Variances

	ICC - MDR4083	*WALKING PROFILER*
Mean	101.7777778	109.98
Variance	1.506944444	#DIV/0!
Observations	9	1
df	8	0
F	0.013701986	
P(F<=f) one-tail	#NULL!	
F Critical one-tail	#NUM!	

F-Test Two-Sample for Variances

	AMES - LISA 6000	*WALKING PROFILER*
Mean	100.273	109.98
Variance	1.247056667	#DIV/0!
Observations	10	1
df	9	0
F	0.01133894	
P(F<=f) one-tail	#NULL!	
F Critical one-tail	#NUM!	

SECTION 3
TWO-TAILED TEST
ALPHA = 0.01

F-Test Two-Sample for Variances

	ARAN 1 (5)	*ARAN 2 (5)*
Mean	64.4	64.7
Variance	3.377777778	0.455555556
Observations	10	10
df	9	9
F	7.414634146	
P(F<=f) one-tail	0.00318887	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 1 (5)	*ARAN 3 (5)*
Mean	64.4	64.7
Variance	3.377777778	1.677777778
Observations	10	10
df	9	9
F	2.013245033	
P(F<=f) one-tail	0.155988559	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 1 (5)	*ARAN 4 (6)*
Mean	64.4	64.7
Variance	3.377777778	0.455555556
Observations	10	10
df	9	9
F	7.414634146	
P(F<=f) one-tail	0.00318887	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 1 (5)	*KJ LAW - T6400*
Mean	64.4	67.206
Variance	3.377777778	15.38295444
Observations	10	10
df	9	9
F	0.219579262	
P(F<=f) one-tail	0.016981441	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 1 (5)	*PATHWAY - PSI-35*
Mean	64.4	66.8
Variance	3.377777778	16.9
Observations	10	10
df	9	9
F	0.199868508	
P(F<=f) one-tail	0.012508308	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 1 (5)	*ARRB 3-LP*
Mean	64.4	62.9825
Variance	3.377777778	0.266745833
Observations	10	10
df	9	9
F	12.66290737	
P(F<=f) one-tail	0.000414454	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 1 (5)	*ICC - MDR4083*
Mean	64.4	60.94444444
Variance	3.377777778	1.277777778
Observations	10	9
df	9	8
F	2.643478261	
P(F<=f) one-tail	0.092879852	
F Critical one-tail	7.338712749	

F-Test Two-Sample for Variances

	ARAN 1 (5)	*AMES - LISA 6000*
Mean	64.4	58.6525
Variance	3.377777778	0.921701389
Observations	10	10
df	9	9
F	3.664720286	
P(F<=f) one-tail	0.033201255	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 1 (5)	*WALKING PROFILER*
Mean	64.4	69.8975
Variance	3.377777778	10.0128125
Observations	10	2
df	9	1
F	0.337345554	
P(F<=f) one-tail	0.119223632	
F Critical one-tail	0.073455908	

F-Test Two-Sample for Variances

	ARAN 2 (5)	*ARAN 3 (5)*
Mean	64.7	64.7
Variance	0.455555556	1.677777778
Observations	10	10
df	9	9
F	0.271523179	
P(F<=f) one-tail	0.032716715	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 2 (5)	*ARAN 4 (6)*
Mean	64.7	64.7
Variance	0.455555556	0.455555556
Observations	10	10
df	9	9
F	1	
P(F<=f) one-tail	0.5	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 2 (5)	*KJ LAW - T6400*
Mean	64.7	67.206
Variance	0.455555556	15.38295444
Observations	10	10
df	9	9
F	0.029614308	
P(F<=f) one-tail	7.07262E-06	
F Critical one-tail	0.152880375	

SECTION 3
TWO-TAILED TEST
ALPHA = 0.01

F-Test Two-Sample for Variances

	ARAN 2 (5)	PATHWAY - PSI-35
Mean	64.7	66.8
Variance	0.455555556	16.9
Observations	10	10
df	9	9
F	0.02695595	
P(F<=f) one-tail	4.72078E-06	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 2 (5)	ICC - MDR4083
Mean	64.7	60.94444444
Variance	0.455555556	1.277777778
Observations	10	9
df	9	8
F	0.356521739	
P(F<=f) one-tail	0.072813789	
F Critical one-tail	0.149402268	

F-Test Two-Sample for Variances

	ARAN 2 (5)	AMES - LISA 6000
Mean	64.7	58.6525
Variance	0.455555556	0.921701389
Observations	10	10
df	9	9
F	0.494255039	
P(F<=f) one-tail	0.154313863	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 2 (5)	WALKING PROFILER
Mean	64.7	69.8975
Variance	0.455555556	10.0128125
Observations	10	2
df	9	1
F	0.045497262	
P(F<=f) one-tail	0.001138932	
F Critical one-tail	0.073455908	

F-Test Two-Sample for Variances

	ARAN 3 (5)	ARAN 4 (6)
Mean	64.7	64.7
Variance	1.677777778	0.455555556
Observations	10	10
df	9	9
F	3.682926829	
P(F<=f) one-tail	0.032716715	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 3 (5)	KJ LAW - T6400
Mean	64.7	67.206
Variance	1.677777778	15.38295444
Observations	10	10
df	9	9
F	0.109067331	
P(F<=f) one-tail	0.001449879	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 3 (5)	PATHWAY - PSI-35
Mean	64.7	66.8
Variance	1.677777778	16.9
Observations	10	10
df	9	9
F	0.099276792	
P(F<=f) one-tail	0.001012948	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 3 (5)	ARRB 3-LP
Mean	64.7	62.9825
Variance	1.677777778	0.266745833
Observations	10	10
df	9	9
F	6.289799382	
P(F<=f) one-tail	0.005739719	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 3 (5)	ICC - MDR4083
Mean	64.7	60.94444444
Variance	1.677777778	1.277777778
Observations	10	9
df	9	8
F	1.313043478	
P(F<=f) one-tail	0.355841985	
F Critical one-tail	7.338712749	

F-Test Two-Sample for Variances

	ARAN 3 (5)	AMES - LISA 6000
Mean	64.7	58.6525
Variance	1.677777778	0.921701389
Observations	10	10
df	9	9
F	1.820305142	
P(F<=f) one-tail	0.192773092	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 3 (5)	WALKING PROFILER
Mean	64.7	69.8975
Variance	1.677777778	10.0128125
Observations	10	2
df	9	1
F	0.167563088	
P(F<=f) one-tail	0.037185556	
F Critical one-tail	0.073455908	

F-Test Two-Sample for Variances

	ARAN 4 (6)	KJ LAW - T6400
Mean	64.7	67.206
Variance	0.455555556	15.38295444
Observations	10	10
df	9	9
F	0.029614308	
P(F<=f) one-tail	7.07262E-06	
F Critical one-tail	0.152880375	

SECTION 3
TWO-TAILED TEST
ALPHA = 0.01

F-Test Two-Sample for Variances

	ARAN 4 (6)	*PATHWAY - PSI-35*
Mean	64.7	66.8
Variance	0.455555556	16.9
Observations	10	10
df	9	9
F	0.02695595	
P(F<=f) one-tail	4.72078E-06	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 4 (6)	*ARRB 3-LP*
Mean	64.7	62.9825
Variance	0.455555556	0.266745833
Observations	10	10
df	9	9
F	1.707826322	
P(F<=f) one-tail	0.218747855	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	ARAN 4 (6)	*ICC - MDR4083*
Mean	64.7	60.94444444
Variance	0.455555556	1.277777778
Observations	10	9
df	9	8
F	0.356521739	
P(F<=f) one-tail	0.072813789	
F Critical one-tail	0.149402268	

F-Test Two-Sample for Variances

	ARAN 4 (6)	*AMES - LISA 6000*
Mean	64.7	58.6525
Variance	0.455555556	0.921701389
Observations	10	10
df	9	9
F	0.494255039	
P(F<=f) one-tail	0.154313863	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARAN 4 (6)	*WALKING PROFILER*
Mean	64.7	69.8975
Variance	0.455555556	10.0128125
Observations	10	2
df	9	1
F	0.045497262	
P(F<=f) one-tail	0.001138932	
F Critical one-tail	0.073455908	

F-Test Two-Sample for Variances

	KJ LAW - T6400	*PATHWAY - PSI-35*
Mean	67.206	66.8
Variance	15.38295444	16.9
Observations	10	10
df	9	9
F	0.910233991	
P(F<=f) one-tail	0.445436912	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	KJ LAW - T6400	*ARRB 3-LP*
Mean	67.206	62.9825
Variance	15.38295444	0.266745833
Observations	10	10
df	9	9
F	57.66895869	
P(F<=f) one-tail	6.94781E-07	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	KJ LAW - T6400	*ICC - MDR4083*
Mean	67.206	60.94444444
Variance	15.38295444	1.277777778
Observations	10	9
df	9	8
F	12.03883391	
P(F<=f) one-tail	0.000922382	
F Critical one-tail	7.338712749	

F-Test Two-Sample for Variances

	KJ LAW - T6400	*AMES - LISA 6000*
Mean	67.206	58.6525
Variance	15.38295444	0.921701389
Observations	10	10
df	9	9
F	16.68973773	
P(F<=f) one-tail	0.000136284	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	KJ LAW - T6400	*WALKING PROFILER*
Mean	67.206	69.8975
Variance	15.38295444	10.0128125
Observations	10	2
df	9	1
F	1.536327025	
P(F<=f) one-tail	0.559411728	
F Critical one-tail	24091.45236	

F-Test Two-Sample for Variances

	PATHWAY - PSI-35	*ARRB 3-LP*
Mean	66.8	62.9825
Variance	16.9	0.266745833
Observations	10	10
df	9	9
F	63.35619113	
P(F<=f) one-tail	4.60177E-07	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	PATHWAY - PSI-35	*ICC - MDR4083*
Mean	66.8	60.94444444
Variance	16.9	1.277777778
Observations	10	9
df	9	8
F	13.22608696	
P(F<=f) one-tail	0.000660171	
F Critical one-tail	7.338712749	

SECTION 3
TWO-TAILED TEST
ALPHA = 0.01

F-Test Two-Sample for Variances

	PATHWAY - PSI-35	*AMES - LISA 6000*
Mean	66.8	58.6525
Variance	16.9	0.921701389
Observations	10	10
df	9	9
F	18.33565643	
P(F<=f) one-tail	9.26428E-05	
F Critical one-tail	6.541085895	

F-Test Two-Sample for Variances

	PATHWAY - PSI-35	*WALKING PROFILER*
Mean	66.8	69.8975
Variance	16.9	10.0128125
Observations	10	2
df	9	1
F	1.687837458	
P(F<=f) one-tail	0.538812055	
F Critical one-tail	24091.45236	

F-Test Two-Sample for Variances

	ARRB 3-LP	*ICC - MDR4083*
Mean	62.9825	60.94444444
Variance	0.266745833	1.277777778
Observations	10	9
df	9	8
F	0.208757609	
P(F<=f) one-tail	0.015404872	
F Critical one-tail	0.149402268	

F-Test Two-Sample for Variances

	ARRB 3-LP	*AMES - LISA 6000*
Mean	62.9825	58.6525
Variance	0.266745833	0.921701389
Observations	10	10
df	9	9
F	0.289405914	
P(F<=f) one-tail	0.039444577	
F Critical one-tail	0.152880375	

F-Test Two-Sample for Variances

	ARRB 3-LP	*WALKING PROFILER*
Mean	62.9825	69.8975
Variance	0.266745833	10.0128125
Observations	10	2
df	9	1
F	0.02664045	
P(F<=f) one-tail	0.000173531	
F Critical one-tail	0.073455908	

F-Test Two-Sample for Variances

	ICC - MDR4083	*AMES - LISA 6000*
Mean	60.94444444	58.6525
Variance	1.277777778	0.921701389
Observations	9	10
df	8	9
F	1.386325108	
P(F<=f) one-tail	0.31713355	
F Critical one-tail	6.693198884	

F-Test Two-Sample for Variances

	ICC - MDR4083	*WALKING PROFILER*
Mean	60.94444444	69.8975
Variance	1.277777778	10.0128125
Observations	9	2
df	8	1
F	0.127614272	
P(F<=f) one-tail	0.023222673	
F Critical one-tail	0.068080652	

F-Test Two-Sample for Variances

	AMES - LISA 6000	*WALKING PROFILER*
Mean	58.6525	69.8975
Variance	0.921701389	10.0128125
Observations	10	2
df	9	1
F	0.092052197	
P(F<=f) one-tail	0.00928947	
F Critical one-tail	0.073455908	

F-Test Two-Sample for Variances

	ARAN 2 (5)	*ARRB 3-LP*
Mean	64.7	62.9825
Variance	0.455555556	0.266745833
Observations	10	10
df	9	9
F	1.707826322	
P(F<=f) one-tail	0.218747855	
F Critical one-tail	6.541085895	

SECTION 1
TWO-TAILED TEST
ALPHA = 0.01

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (1)	*ARAN5 (2)*
Mean	95.9	94.6
Variance	4.988888889	4.488888889
Observations	10	10
Pooled Variance	4.738888889	
Hypothesized Mean Difference	0	
df	18	
t Stat	1.335334567	
P(T<=t) one-tail	0.099204589	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.198409179	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (1)	*ARAN5 (3)*
Mean	95.9	93.45
Variance	4.988888889	3.913888889
Observations	10	10
Pooled Variance	4.451388889	
Hypothesized Mean Difference	0	
df	18	
t Stat	2.596589627	
P(T<=t) one-tail	0.009114792	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.018229583	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (1)	*ARAN6*
Mean	95.9	92.65
Variance	4.988888889	2.336111111
Observations	10	10
Pooled Variance	3.6625	
Hypothesized Mean Difference	0	
df	18	
t Stat	3.797340546	
P(T<=t) one-tail	0.000659593	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.001319185	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (1)	*KJ LAW - T6400*
Mean	95.9	84.1465
Variance	4.988888889	7.653094722
Observations	10	10
Pooled Variance	6.320991806	
Hypothesized Mean Difference	0	
df	18	
t Stat	10.45344889	
P(T<=t) one-tail	2.24709E-09	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	4.49418E-09	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (1)	*PATHWAY - PSI-35*
Mean	95.9	74.65
Variance	4.988888889	5.447222222
Observations	10	10
Pooled Variance	5.218055556	
Hypothesized Mean Difference	0	
df	18	
t Stat	20.80125736	
P(T<=t) one-tail	2.4419E-14	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	4.8838E-14	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (1)	*ARRB 3-LP*
Mean	95.9	89.917
Variance	4.988888889	8.107512222
Observations	10	10
Pooled Variance	6.548200556	
Hypothesized Mean Difference	0	
df	18	
t Stat	5.228089562	
P(T<=t) one-tail	2.84098E-05	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	5.68196E-05	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (1)	*ICC - MDR4083*
Mean	95.9	99.78571429
Variance	4.988888889	13.98809524
Observations	10	7
Pooled Variance	8.588571429	
Hypothesized Mean Difference	0	
df	15	
t Stat	-2.690512149	
P(T<=t) one-tail	0.008387405	
t Critical one-tail	2.602482709	
P(T<=t) two-tail	0.016774811	
t Critical two-tail	2.946726454	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (1)	*AMES - LISA 6000*
Mean	95.9	86.7815
Variance	4.988888889	4.653405833
Observations	10	10
Pooled Variance	4.821147361	
Hypothesized Mean Difference	0	
df	18	
t Stat	9.286096693	
P(T<=t) one-tail	1.3786E-08	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	2.7572E-08	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (1)	*WALKING PROFILER*
Mean	95.9	97.8
Variance	4.988888889	8.405
Observations	10	2
Pooled Variance	5.3305	
Hypothesized Mean Difference	0	
df	10	
t Stat	-1.062414531	
P(T<=t) one-tail	0.156515354	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	0.313030709	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (2)	*ARAN5 (3)*
Mean	94.6	93.45
Variance	4.488888889	3.913888889
Observations	10	10
Pooled Variance	4.201388889	
Hypothesized Mean Difference	0	
df	18	
t Stat	1.254545455	
P(T<=t) one-tail	0.112845107	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.225690214	
t Critical two-tail	2.878441592	

SECTION 1
TWO-TAILED TEST
ALPHA = 0.01

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (2)	*ARAN6*
Mean	94.6	92.65
Variance	4.488888889	2.336111111
Observations	10	10
Pooled Variance	3.4125	
Hypothesized Mean Difference	0	
df	18	
t Stat	2.360387377	
P(T<=t) one-tail	0.014871751	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.029743502	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (2)	*KJ LAW - T6400*
Mean	94.6	84.1465
Variance	4.488888889	7.653094722
Observations	10	10
Pooled Variance	6.070991806	
Hypothesized Mean Difference	0	
df	18	
t Stat	9.486737908	
P(T<=t) one-tail	9.98367E-09	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	1.99673E-08	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (2)	*PATHWAY - PSI-35*
Mean	94.6	74.65
Variance	4.488888889	5.447222222
Observations	10	10
Pooled Variance	4.968055556	
Hypothesized Mean Difference	0	
df	18	
t Stat	20.01403617	
P(T<=t) one-tail	4.75814E-14	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	9.51627E-14	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (2)	*ARRB 3-LP*
Mean	94.6	89.917
Variance	4.488888889	8.107512222
Observations	10	10
Pooled Variance	6.298200556	
Hypothesized Mean Difference	0	
df	18	
t Stat	4.172543923	
P(T<=t) one-tail	0.000286038	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.000572076	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (2)	*ICC - MDR4083*
Mean	94.6	99.78571429
Variance	4.488888889	13.98809524
Observations	10	7
Pooled Variance	8.288571429	
Hypothesized Mean Difference	0	
df	15	
t Stat	-3.65504983	
P(T<=t) one-tail	0.001172722	
t Critical one-tail	2.602482709	
P(T<=t) two-tail	0.002345444	
t Critical two-tail	2.946726454	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (2)	*AMES - LISA 6000*
Mean	94.6	86.7815
Variance	4.488888889	4.653405833
Observations	10	10
Pooled Variance	4.571147361	
Hypothesized Mean Difference	0	
df	18	
t Stat	8.17703453	
P(T<=t) one-tail	8.95937E-08	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	1.79187E-07	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (2)	*WALKING PROFILER*
Mean	94.6	97.8
Variance	4.488888889	8.405
Observations	10	2
Pooled Variance	4.8805	
Hypothesized Mean Difference	0	
df	10	
t Stat	-1.870002532	
P(T<=t) one-tail	0.045503788	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	0.091007577	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (3)	*ARAN6*
Mean	93.45	92.65
Variance	3.913888889	2.336111111
Observations	10	10
Pooled Variance	3.125	
Hypothesized Mean Difference	0	
df	18	
t Stat	1.011928851	
P(T<=t) one-tail	0.162491127	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.324982253	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (3)	*KJ LAW - T6400*
Mean	93.45	84.1465
Variance	3.913888889	7.653094722
Observations	10	10
Pooled Variance	5.783491806	
Hypothesized Mean Difference	0	
df	18	
t Stat	8.650402228	
P(T<=t) one-tail	3.95587E-08	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	7.91174E-08	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (3)	*PATHWAY - PSI-35*
Mean	93.45	74.65
Variance	3.913888889	5.447222222
Observations	10	10
Pooled Variance	4.680555556	
Hypothesized Mean Difference	0	
df	18	
t Stat	19.43095514	
P(T<=t) one-tail	7.92227E-14	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	1.58445E-13	
t Critical two-tail	2.878441592	

SECTION 1
TWO-TAILED
ALPHA = 0.01

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (3)	ARRB 3-LP
Mean	93.45	89.917
Variance	3.913888889	8.107512222
Observations	10	10
Pooled Variance	6.010700556	
Hypothesized Mean Difference	0	
df	18	
t Stat	3.222300905	
P(T<=t) one-tail	0.00236248	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.004724961	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (3)	ICC - MDR4083
Mean	93.45	99.78571429
Variance	3.913888889	13.98809524
Observations	10	7
Pooled Variance	7.943571429	
Hypothesized Mean Difference	0	
df	15	
t Stat	-4.561547913	
P(T<=t) one-tail	0.000187251	
t Critical one-tail	2.602482709	
P(T<=t) two-tail	0.000374502	
t Critical two-tail	2.946726454	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (3)	AMES - LISA 6000
Mean	93.45	86.7815
Variance	3.913888889	4.653405833
Observations	10	10
Pooled Variance	4.283647361	
Hypothesized Mean Difference	0	
df	18	
t Stat	7.204540746	
P(T<=t) one-tail	5.26613E-07	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	1.05323E-06	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN5 (3)	WALKING PROFILER
Mean	93.45	97.8
Variance	3.913888889	8.405
Observations	10	2
Pooled Variance	4.363	
Hypothesized Mean Difference	0	
df	10	
t Stat	-2.688568	
P(T<=t) one-tail	0.011377783	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	0.022755567	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Equal Variances

	ARAN6	KJ LAW - T6400
Mean	92.65	84.1465
Variance	2.336111111	7.653094722
Observations	10	10
Pooled Variance	4.994602917	
Hypothesized Mean Difference	0	
df	18	
t Stat	8.508093129	
P(T<=t) one-tail	5.04291E-08	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	1.00858E-07	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN6	PATHWAY - PSI-35
Mean	92.65	74.65
Variance	2.336111111	5.447222222
Observations	10	10
Pooled Variance	3.891666667	
Hypothesized Mean Difference	0	
df	18	
t Stat	20.40279613	
P(T<=t) one-tail	3.41256E-14	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	6.82512E-14	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN6	ARRB 3-LP
Mean	92.65	89.917
Variance	2.336111111	8.107512222
Observations	10	10
Pooled Variance	5.221811667	
Hypothesized Mean Difference	0	
df	18	
t Stat	2.674324061	
P(T<=t) one-tail	0.007735872	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.015471743	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN6	ICC - MDR4083
Mean	92.65	99.78571429
Variance	2.336111111	13.98809524
Observations	10	7
Pooled Variance	6.996904762	
Hypothesized Mean Difference	0	
df	15	
t Stat	-5.474053411	
P(T<=t) one-tail	3.20494E-05	
t Critical one-tail	2.602482709	
P(T<=t) two-tail	6.40987E-05	
t Critical two-tail	2.946726454	

t-Test: Two-Sample Assuming Equal Variances

	ARAN6	AMES - LISA 6000
Mean	92.65	86.7815
Variance	2.336111111	4.653405833
Observations	10	10
Pooled Variance	3.494758472	
Hypothesized Mean Difference	0	
df	18	
t Stat	7.01945716	
P(T<=t) one-tail	7.4839E-07	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	1.49678E-06	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN6	WALKING PROFILER
Mean	92.65	97.8
Variance	2.336111111	8.405
Observations	10	2
Pooled Variance	2.943	
Hypothesized Mean Difference	0	
df	10	
t Stat	-3.875577918	
P(T<=t) one-tail	0.001540519	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	0.003081039	
t Critical two-tail	3.169261618	

SECTION 1
TWO-TAILED
ALPHA = 0.01

t-Test: Two-Sample Assuming Equal Variances

	KJ LAW - T6400	*PATHWAY - PSI-35*
Mean	84.1465	74.65
Variance	7.653094722	5.447222222
Observations	10	10
Pooled Variance	6.550158472	
Hypothesized Mean Difference	0	
df	18	
t Stat	8.297030205	
P(T<=t) one-tail	7.26283E-08	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	1.45257E-07	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	KJ LAW - T6400	*ARRB 3-LP*
Mean	84.1465	89.917
Variance	7.653094722	8.107512222
Observations	10	10
Pooled Variance	7.880303472	
Hypothesized Mean Difference	0	
df	18	
t Stat	-4.59649695	
P(T<=t) one-tail	0.000111984	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.000223967	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	KJ LAW - T6400	*ICC - MDR4083*
Mean	84.1465	99.78571429
Variance	7.653094722	13.98809524
Observations	10	7
Pooled Variance	10.18709493	
Hypothesized Mean Difference	0	
df	15	
t Stat	-9.942928423	
P(T<=t) one-tail	2.69371E-08	
t Critical one-tail	2.602482709	
P(T<=t) two-tail	5.38743E-08	
t Critical two-tail	2.946726454	

t-Test: Two-Sample Assuming Equal Variances

	KJ LAW - T6400	*AMES - LISA 6000*
Mean	84.1465	86.7815
Variance	7.653094722	4.653405833
Observations	10	10
Pooled Variance	6.153250278	
Hypothesized Mean Difference	0	
df	18	
t Stat	-2.375271904	
P(T<=t) one-tail	0.0144262	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.0288524	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	KJ LAW - T6400	*WALKING PROFILER*
Mean	84.1465	97.8
Variance	7.653094722	8.405
Observations	10	2
Pooled Variance	7.72828525	
Hypothesized Mean Difference	0	
df	10	
t Stat	-6.340548045	
P(T<=t) one-tail	4.22704E-05	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	8.45407E-05	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Equal Variances

	PATHWAY - PSI-35	*ARRB 3-LP*
Mean	74.65	89.917
Variance	5.447222222	8.107512222
Observations	10	10
Pooled Variance	6.777367222	
Hypothesized Mean Difference	0	
df	18	
t Stat	-13.11318532	
P(T<=t) one-tail	5.97309E-11	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	1.19462E-10	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	PATHWAY - PSI-35	*ICC - MDR4083*
Mean	74.65	99.78571429
Variance	5.447222222	13.98809524
Observations	10	7
Pooled Variance	8.863571429	
Hypothesized Mean Difference	0	
df	15	
t Stat	-17.13213216	
P(T<=t) one-tail	1.46664E-11	
t Critical one-tail	2.602482709	
P(T<=t) two-tail	2.93328E-11	
t Critical two-tail	2.946726454	

t-Test: Two-Sample Assuming Equal Variances

	PATHWAY - PSI-35	*AMES - LISA 6000*
Mean	74.65	86.7815
Variance	5.447222222	4.653405833
Observations	10	10
Pooled Variance	5.050314028	
Hypothesized Mean Difference	0	
df	18	
t Stat	-12.07091837	
P(T<=t) one-tail	2.29476E-10	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	4.58952E-10	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	PATHWAY - PSI-35	*WALKING PROFILER*
Mean	74.65	97.8
Variance	5.447222222	8.405
Observations	10	2
Pooled Variance	5.743	
Hypothesized Mean Difference	0	
df	10	
t Stat	-12.47113447	
P(T<=t) one-tail	1.01608E-07	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	2.03216E-07	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Equal Variances

	ARRB 3-LP	*ICC - MDR4083*
Mean	89.917	99.78571429
Variance	8.107512222	13.98809524
Observations	10	7
Pooled Variance	10.45974543	
Hypothesized Mean Difference	0	
df	15	
t Stat	-6.191909179	
P(T<=t) one-tail	8.62189E-06	
t Critical one-tail	2.602482709	
P(T<=t) two-tail	1.72438E-05	
t Critical two-tail	2.946726454	

SECTION 1
TWO-TAILED TEST
ALPHA = 0.01

t-Test: Two-Sample Assuming Equal Variances

	ARRB 3-LP	AMES - LISA 6000
Mean	89.917	86.7815
Variance	8.107512222	4.653405833
Observations	10	10
Pooled Variance	6.380459028	
Hypothesized Mean Difference	0	
df	18	
t Stat	2.775657305	
P(T<=t) one-tail	0.006234936	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.012469872	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARRB 3-LP	WALKING PROFILER
Mean	89.917	97.8
Variance	8.107512222	8.405
Observations	10	2
Pooled Variance	8.137261	
Hypothesized Mean Difference	0	
df	10	
t Stat	-3.567605118	
P(T<=t) one-tail	0.002558044	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	0.005116087	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Equal Variances

	ICC - MDR4083	AMES - LISA 6000
Mean	99.78571429	86.7815
Variance	13.98809524	4.653405833
Observations	7	10
Pooled Variance	8.387281595	
Hypothesized Mean Difference	0	
df	15	
t Stat	9.111671721	
P(T<=t) one-tail	8.37381E-08	
t Critical one-tail	2.602482709	
P(T<=t) two-tail	1.67476E-07	
t Critical two-tail	2.946726454	

t-Test: Two-Sample Assuming Equal Variances

	ICC - MDR4083	WALKING PROFILER
Mean	99.78571429	97.8
Variance	13.98809524	8.405
Observations	7	2
Pooled Variance	13.1905102	
Hypothesized Mean Difference	0	
df	7	
t Stat	0.681912617	
P(T<=t) one-tail	0.258606998	
t Critical one-tail	2.997949196	
P(T<=t) two-tail	0.517213996	
t Critical two-tail	3.499480954	

t-Test: Two-Sample Assuming Equal Variances

	AMES - LISA 6000	WALKING PROFILER
Mean	86.7815	97.8
Variance	4.653405833	8.405
Observations	10	2
Pooled Variance	5.02856525	
Hypothesized Mean Difference	0	
df	10	
t Stat	-6.343439554	
P(T<=t) one-tail	4.21132E-05	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	8.42264E-05	
t Critical two-tail	3.169261618	

SECTION 2
TWO-TAILED TEST
ALPHA = 0.01

t-Test: Two-Sample Assuming Equal Variances

	ARAN 1 (5)	ARAN 2 (5)
Mean	113	113.7
Variance	11.33333333	1.788888889
Observations	10	10
Pooled Variance	6.561111111	
Hypothesized Mean Difference	0	
df	18	
t Stat	-0.61107476	
P(T<=t) one-tail	0.274394984	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.548789968	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 1 (5)	ARAN 3 (5)
Mean	113	111
Variance	11.33333333	3.388888889
Observations	10	10
Pooled Variance	7.361111111	
Hypothesized Mean Difference	0	
df	18	
t Stat	1.648326767	
P(T<=t) one-tail	0.058314787	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.116629575	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 1 (5)	ARAN 4 (6)
Mean	113	116.75
Variance	11.33333333	2.736111111
Observations	10	10
Pooled Variance	7.034722222	
Hypothesized Mean Difference	0	
df	18	
t Stat	-3.16149714	
P(T<=t) one-tail	0.002700199	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.005400398	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 1 (5)	KJ LAW - T6400
Mean	113	103.6265
Variance	11.33333333	8.132783611
Observations	10	10
Pooled Variance	9.733058472	
Hypothesized Mean Difference	0	
df	18	
t Stat	6.71834218	
P(T<=t) one-tail	1.33897E-06	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	2.67794E-06	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 1 (5)	PATHWAY - PSI-35
Mean	113	86.9
Variance	11.33333333	15.15555556
Observations	10	10
Pooled Variance	13.24444444	
Hypothesized Mean Difference	0	
df	18	
t Stat	16.03646484	
P(T<=t) one-tail	2.0965E-12	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	4.19301E-12	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 1 (5)	ARRB 3-LP
Mean	113	108.1445
Variance	11.33333333	6.823663611
Observations	10	10
Pooled Variance	9.078498472	
Hypothesized Mean Difference	0	
df	18	
t Stat	3.603395636	
P(T<=t) one-tail	0.001015897	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.002031793	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Unequal Variances

	ARAN 1 (5)	ICC - MDR4083
Mean	113	101.7777778
Variance	11.33333333	1.506944444
Observations	10	9
Hypothesized Mean Difference	0	
df	12	
t Stat	9.839620312	
P(T<=t) one-tail	2.13186E-07	
t Critical one-tail	2.680990292	
P(T<=t) two-tail	4.26373E-07	
t Critical two-tail	3.054537956	

t-Test: Two-Sample Assuming Unequal Variances

	ARAN 1 (5)	AMES - LISA 6000
Mean	113	100.273
Variance	11.33333333	1.247056667
Observations	10	10
Hypothesized Mean Difference	0	
df	11	
t Stat	11.3469461	
P(T<=t) one-tail	1.0316E-07	
t Critical one-tail	2.718079486	
P(T<=t) two-tail	2.06321E-07	
t Critical two-tail	3.105815267	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 1 (5)	WALKING PROFILER
Mean	113	109.98
Variance	11.33333333	#DIV/0!
Observations	10	1
Pooled Variance	11.33333333	
Hypothesized Mean Difference	0	
df	9	
t Stat	0.855326188	
P(T<=t) one-tail	0.207279976	
t Critical one-tail	2.821434464	
P(T<=t) two-tail	0.414559952	
t Critical two-tail	3.249842848	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 2 (5)	ARAN 3 (5)
Mean	113.7	111
Variance	1.788888889	3.388888889
Observations	10	10
Pooled Variance	2.588888889	
Hypothesized Mean Difference	0	
df	18	
t Stat	3.752252542	
P(T<=t) one-tail	0.000729303	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.001458605	
t Critical two-tail	2.878441592	

SECTION 2
TWO-TAILED TEST
ALPHA = 0.01

t-Test: Two-Sample Assuming Equal Variances

	ARAN 2 (5)	*ARAN 4 (6)*
Mean	113.7	116.75
Variance	1.788888889	2.736111111
Observations	10	10
Pooled Variance	2.2625	
Hypothesized Mean Difference	0	
df	18	
t Stat	-4.534094292	
P(T<=t) one-tail	0.000128472	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.000256944	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 2 (5)	*KJ LAW - T6400*
Mean	113.7	103.6265
Variance	1.788888889	8.132783611
Observations	10	10
Pooled Variance	4.96083625	
Hypothesized Mean Difference	0	
df	18	
t Stat	10.11318489	
P(T<=t) one-tail	3.75425E-09	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	7.5085E-09	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Unequal Variances

	ARAN 2 (5)	*PATHWAY - PSI-35*
Mean	113.7	86.9
Variance	1.788888889	15.15555556
Observations	10	10
Hypothesized Mean Difference	0	
df	11	
t Stat	20.58833029	
P(T<=t) one-tail	1.95744E-10	
t Critical one-tail	2.718079486	
P(T<=t) two-tail	3.91488E-10	
t Critical two-tail	3.105815267	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 2 (5)	*ARRB 3-LP*
Mean	113.7	108.1445
Variance	1.788888889	6.823663611
Observations	10	10
Pooled Variance	4.30627625	
Hypothesized Mean Difference	0	
df	18	
t Stat	5.98628254	
P(T<=t) one-tail	5.79561E-06	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	1.15912E-05	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 2 (5)	*ICC - MDR4083*
Mean	113.7	101.7777778
Variance	1.788888889	1.506944444
Observations	10	9
Pooled Variance	1.65620915	
Hypothesized Mean Difference	0	
df	17	
t Stat	20.16248591	
P(T<=t) one-tail	1.31094E-13	
t Critical one-tail	2.566939656	
P(T<=t) two-tail	2.62189E-13	
t Critical two-tail	2.898232196	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 2 (5)	*AMES - LISA 6000*
Mean	113.7	100.273
Variance	1.788888889	1.247056667
Observations	10	10
Pooled Variance	1.517972778	
Hypothesized Mean Difference	0	
df	18	
t Stat	24.36867969	
P(T<=t) one-tail	1.55179E-15	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	3.10358E-15	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 2 (5)	*WALKING PROFILER*
Mean	113.7	109.98
Variance	1.788888889	#DIV/0!
Observations	10	1
Pooled Variance	1.788888889	
Hypothesized Mean Difference	0	
df	9	
t Stat	2.651886387	
P(T<=t) one-tail	0.013197231	
t Critical one-tail	2.821434464	
P(T<=t) two-tail	0.026394462	
t Critical two-tail	3.249842848	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 3 (5)	*ARAN 4 (6)*
Mean	111	116.75
Variance	3.388888889	2.736111111
Observations	10	10
Pooled Variance	3.0625	
Hypothesized Mean Difference	0	
df	18	
t Stat	-7.347080497	
P(T<=t) one-tail	4.03009E-07	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	8.06017E-07	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 3 (5)	*KJ LAW - T6400*
Mean	111	103.6265
Variance	3.388888889	8.132783611
Observations	10	10
Pooled Variance	5.76083625	
Hypothesized Mean Difference	0	
df	18	
t Stat	6.869354377	
P(T<=t) one-tail	9.98617E-07	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	1.99723E-06	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 3 (5)	*PATHWAY - PSI-35*
Mean	111	86.9
Variance	3.388888889	15.15555556
Observations	10	10
Pooled Variance	9.272222222	
Hypothesized Mean Difference	0	
df	18	
t Stat	17.69742697	
P(T<=t) one-tail	3.93361E-13	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	7.86723E-13	
t Critical two-tail	2.878441592	

SECTION 2
TWO-TAILED TEST
ALPHA = 0.01

t-Test: Two-Sample Assuming Equal Variances

	ARAN 3 (5)	*ARRB 3-LP*
Mean	111	108.1445
Variance	3.388888889	6.823663611
Observations	10	10
Pooled Variance	5.10627625	
Hypothesized Mean Difference	0	
df	18	
t Stat	2.825628182	
P(T<=t) one-tail	0.005601778	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.011203557	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 3 (5)	*ICC - MDR4083*
Mean	111	101.7777778
Variance	3.388888889	1.506944444
Observations	10	9
Pooled Variance	2.503267974	
Hypothesized Mean Difference	0	
df	17	
t Stat	12.68604845	
P(T<=t) one-tail	2.13944E-10	
t Critical one-tail	2.566939656	
P(T<=t) two-tail	4.27887E-10	
t Critical two-tail	2.898232196	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 3 (5)	*AMES - LISA 6000*
Mean	111	100.273
Variance	3.388888889	1.247056667
Observations	10	10
Pooled Variance	2.317972778	
Hypothesized Mean Difference	0	
df	18	
t Stat	15.75466297	
P(T<=t) one-tail	2.82701E-12	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	5.65402E-12	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 3 (5)	*WALKING PROFILER*
Mean	111	109.98
Variance	3.388888889	#DIV/0!
Observations	10	1
Pooled Variance	3.388888889	
Hypothesized Mean Difference	0	
df	9	
t Stat	0.528293375	
P(T<=t) one-tail	0.305036521	
t Critical one-tail	2.821434464	
P(T<=t) two-tail	0.610073042	
t Critical two-tail	3.249842848	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 4 (6)	*KJ LAW - T6400*
Mean	116.75	103.6265
Variance	2.736111111	8.132783611
Observations	10	10
Pooled Variance	5.434447361	
Hypothesized Mean Difference	0	
df	18	
t Stat	12.58800725	
P(T<=t) one-tail	1.16374E-10	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	2.32747E-10	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 4 (6)	*PATHWAY - PSI-35*
Mean	116.75	86.9
Variance	2.736111111	15.15555556
Observations	10	10
Pooled Variance	8.945833333	
Hypothesized Mean Difference	0	
df	18	
t Stat	22.31613275	
P(T<=t) one-tail	7.20617E-15	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	1.44123E-14	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 4 (6)	*ARRB 3-LP*
Mean	116.75	108.1445
Variance	2.736111111	6.823663611
Observations	10	10
Pooled Variance	4.779887361	
Hypothesized Mean Difference	0	
df	18	
t Stat	8.801410556	
P(T<=t) one-tail	3.06588E-08	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	6.13177E-08	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 4 (6)	*ICC - MDR4083*
Mean	116.75	101.7777778
Variance	2.736111111	1.506944444
Observations	10	9
Pooled Variance	2.157679739	
Hypothesized Mean Difference	0	
df	17	
t Stat	22.18386568	
P(T<=t) one-tail	2.73342E-14	
t Critical one-tail	2.566939656	
P(T<=t) two-tail	5.46685E-14	
t Critical two-tail	2.898232196	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 4 (6)	*AMES - LISA 6000*
Mean	116.75	100.273
Variance	2.736111111	1.247056667
Observations	10	10
Pooled Variance	1.991583889	
Hypothesized Mean Difference	0	
df	18	
t Stat	26.10741314	
P(T<=t) one-tail	4.63612E-16	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	9.27223E-16	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 4 (6)	*WALKING PROFILER*
Mean	116.75	109.98
Variance	2.736111111	#DIV/0!
Observations	10	1
Pooled Variance	2.736111111	
Hypothesized Mean Difference	0	
df	9	
t Stat	3.902343196	
P(T<=t) one-tail	0.001803262	
t Critical one-tail	2.821434464	
P(T<=t) two-tail	0.003606525	
t Critical two-tail	3.249842848	

SECTION 2
TWO-TAILED TEST
ALPHA = 0.01

t-Test: Two-Sample Assuming Equal Variances

	KJ LAW - T6400	*PATHWAY - PSI-35*
Mean	103.6265	86.9
Variance	8.132783611	15.15555556
Observations	10	10
Pooled Variance	11.64416958	
Hypothesized Mean Difference	0	
df	18	
t Stat	10.96063754	
P(T<=t) one-tail	1.06921E-09	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	2.13842E-09	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	KJ LAW - T6400	*ARRB 3-LP*
Mean	103.6265	108.1445
Variance	8.132783611	6.823663611
Observations	10	10
Pooled Variance	7.478223611	
Hypothesized Mean Difference	0	
df	18	
t Stat	-3.694298684	
P(T<=t) one-tail	0.000829799	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.001659599	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	KJ LAW - T6400	*ICC - MDR4083*
Mean	103.6265	101.7777778
Variance	8.132783611	1.506944444
Observations	10	9
Pooled Variance	5.01474165	
Hypothesized Mean Difference	0	
df	17	
t Stat	1.796767295	
P(T<=t) one-tail	0.045081147	
t Critical one-tail	2.566939656	
P(T<=t) two-tail	0.090162294	
t Critical two-tail	2.898232196	

t-Test: Two-Sample Assuming Equal Variances

	KJ LAW - T6400	*AMES - LISA 6000*
Mean	103.6265	100.273
Variance	8.132783611	1.247056667
Observations	10	10
Pooled Variance	4.689920139	
Hypothesized Mean Difference	0	
df	18	
t Stat	3.462586162	
P(T<=t) one-tail	0.001389047	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.002778093	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	KJ LAW - T6400	*WALKING PROFILER*
Mean	103.6265	109.98
Variance	8.132783611	#DIV/0!
Observations	10	1
Pooled Variance	8.132783611	
Hypothesized Mean Difference	0	
df	9	
t Stat	-2.12420821	
P(T<=t) one-tail	0.03130402	
t Critical one-tail	2.821434464	
P(T<=t) two-tail	0.06260804	
t Critical two-tail	3.249842848	

t-Test: Two-Sample Assuming Equal Variances

	PATHWAY - PSI-35	*ARRB 3-LP*
Mean	86.9	108.1445
Variance	15.15555556	6.823663611
Observations	10	10
Pooled Variance	10.98960958	
Hypothesized Mean Difference	0	
df	18	
t Stat	-14.32980843	
P(T<=t) one-tail	1.38134E-11	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	2.76268E-11	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Unequal Variances

	PATHWAY - PSI-35	*ICC - MDR4083*
Mean	86.9	101.7777778
Variance	15.15555556	1.506944444
Observations	10	9
Hypothesized Mean Difference	0	
df	11	
t Stat	-11.46824087	
P(T<=t) one-tail	9.25497E-08	
t Critical one-tail	2.718079486	
P(T<=t) two-tail	1.85099E-07	
t Critical two-tail	3.105815267	

t-Test: Two-Sample Assuming Unequal Variances

	PATHWAY - PSI-35	*AMES - LISA 6000*
Mean	86.9	100.273
Variance	15.15555556	1.247056667
Observations	10	10
Hypothesized Mean Difference	0	
df	10	
t Stat	-10.44172703	
P(T<=t) one-tail	5.3405E-07	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	1.0681E-06	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Equal Variances

	PATHWAY - PSI-35	*WALKING PROFILER*
Mean	86.9	109.98
Variance	15.15555556	#DIV/0!
Observations	10	1
Pooled Variance	15.15555556	
Hypothesized Mean Difference	0	
df	9	
t Stat	-5.652668687	
P(T<=t) one-tail	0.000156269	
t Critical one-tail	2.821434464	
P(T<=t) two-tail	0.000312537	
t Critical two-tail	3.249842848	

t-Test: Two-Sample Assuming Equal Variances

	ARRB 3-LP	*ICC - MDR4083*
Mean	108.1445	101.7777778
Variance	6.823663611	1.506944444
Observations	10	9
Pooled Variance	4.321678121	
Hypothesized Mean Difference	0	
df	17	
t Stat	6.665521716	
P(T<=t) one-tail	1.99023E-06	
t Critical one-tail	2.566939656	
P(T<=t) two-tail	3.98045E-06	
t Critical two-tail	2.898232196	

SECTION 2
TWO-TAILED TEST
ALPHA = 0.01

t-Test: Two-Sample Assuming Equal Variances

	ARRB 3-LP	AMES - LISA 6000
Mean	108.1445	100.273
Variance	6.823663611	1.247056667
Observations	10	10
Pooled Variance	4.035360139	
Hypothesized Mean Difference	0	
df	18	
t Stat	8.761961733	
P(T<=t) one-tail	3.27607E-08	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	6.55213E-08	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARRB 3-LP	WALKING PROFILER
Mean	108.1445	109.98
Variance	6.823663611	#DIV/0!
Observations	10	1
Pooled Variance	6.823663611	
Hypothesized Mean Difference	0	
df	9	
t Stat	-0.669960567	
P(T<=t) one-tail	0.25985022	
t Critical one-tail	2.821434464	
P(T<=t) two-tail	0.519700441	
t Critical two-tail	3.249842848	

t-Test: Two-Sample Assuming Equal Variances

	ICC - MDR4083	AMES - LISA 6000
Mean	101.7777778	100.273
Variance	1.506944444	1.247056667
Observations	9	10
Pooled Variance	1.369356797	
Hypothesized Mean Difference	0	
df	17	
t Stat	2.798713949	
P(T<=t) one-tail	0.006169373	
t Critical one-tail	2.566939656	
P(T<=t) two-tail	0.012338745	
t Critical two-tail	2.898232196	

t-Test: Two-Sample Assuming Equal Variances

	ICC - MDR4083	WALKING PROFILER
Mean	101.7777778	109.98
Variance	1.506944444	#DIV/0!
Observations	9	1
Pooled Variance	1.506944444	
Hypothesized Mean Difference	0	
df	8	
t Stat	-6.338757906	
P(T<=t) one-tail	0.000111643	
t Critical one-tail	2.896467777	
P(T<=t) two-tail	0.000223286	
t Critical two-tail	3.355380613	

t-Test: Two-Sample Assuming Equal Variances

	AMES - LISA 6000	WALKING PROFILER
Mean	100.273	109.98
Variance	1.247056667	#DIV/0!
Observations	10	1
Pooled Variance	1.247056667	
Hypothesized Mean Difference	0	
df	9	
t Stat	-8.287920811	
P(T<=t) one-tail	8.33471E-06	
t Critical one-tail	2.821434464	
P(T<=t) two-tail	1.66694E-05	
t Critical two-tail	3.249842848	

SECTION 3
TWO-TAILED TEST
ALPHA = 0.01

t-Test: Two-Sample Assuming Unequal Variances

	ARAN 1 (5)	*ARAN 2 (5)*
Mean	64.4	64.7
Variance	3.377777778	0.455555556
Observations	10	10
Hypothesized Mean Difference	0	
df	11	
t Stat	-0.484543712	
P(T<=t) one-tail	0.318752102	
t Critical one-tail	2.718079486	
P(T<=t) two-tail	0.637504204	
t Critical two-tail	3.105815267	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 1 (5)	*ARAN 3 (5)*
Mean	64.4	64.7
Variance	3.377777778	1.677777778
Observations	10	10
Pooled Variance	2.527777778	
Hypothesized Mean Difference	0	
df	18	
t Stat	-0.421926508	
P(T<=t) one-tail	0.339037507	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.678075015	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Unequal Variances

	ARAN 1 (5)	*ARAN 4 (6)*
Mean	64.4	64.7
Variance	3.377777778	0.455555556
Observations	10	10
Hypothesized Mean Difference	0	
df	11	
t Stat	-0.484543712	
P(T<=t) one-tail	0.318752102	
t Critical one-tail	2.718079486	
P(T<=t) two-tail	0.637504204	
t Critical two-tail	3.105815267	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 1 (5)	*KJ LAW - T6400*
Mean	64.4	67.206
Variance	3.377777778	15.38295444
Observations	10	10
Pooled Variance	9.380366111	
Hypothesized Mean Difference	0	
df	18	
t Stat	-2.048626444	
P(T<=t) one-tail	0.02768411	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.055368221	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 1 (5)	*PATHWAY - PSI-35*
Mean	64.4	66.8
Variance	3.377777778	16.9
Observations	10	10
Pooled Variance	10.13888889	
Hypothesized Mean Difference	0	
df	18	
t Stat	-1.68539252	
P(T<=t) one-tail	0.054585166	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.109170332	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Unequal Variances

	ARAN 1 (5)	*ARRB 3-LP*
Mean	64.4	62.9825
Variance	3.377777778	0.266745833
Observations	10	10
Hypothesized Mean Difference	0	
df	10	
t Stat	2.348024821	
P(T<=t) one-tail	0.020388883	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	0.040777766	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 1 (5)	*ICC - MDR4083*
Mean	64.4	60.94444444
Variance	3.377777778	1.277777778
Observations	10	9
Pooled Variance	2.389542484	
Hypothesized Mean Difference	0	
df	17	
t Stat	4.865247697	
P(T<=t) one-tail	7.27027E-05	
t Critical one-tail	2.566939656	
P(T<=t) two-tail	0.000145405	
t Critical two-tail	2.898232196	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 1 (5)	*AMES - LISA 6000*
Mean	64.4	58.6525
Variance	3.377777778	0.921701389
Observations	10	10
Pooled Variance	2.149739583	
Hypothesized Mean Difference	0	
df	18	
t Stat	8.765386195	
P(T<=t) one-tail	3.25724E-08	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	6.51448E-08	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 1 (5)	*WALKING PROFILER*
Mean	64.4	69.8975
Variance	3.377777778	10.0128125
Observations	10	2
Pooled Variance	4.04128125	
Hypothesized Mean Difference	0	
df	10	
t Stat	-3.530450079	
P(T<=t) one-tail	0.002721361	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	0.005442722	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 2 (5)	*ARAN 3 (5)*
Mean	64.7	64.7
Variance	0.455555556	1.677777778
Observations	10	10
Pooled Variance	1.066666667	
Hypothesized Mean Difference	0	
df	18	
t Stat	0	
P(T<=t) one-tail	0.5	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	1	
t Critical two-tail	2.878441592	

SECTION 3
TWO-TAILED TEST
ALPHA = 0.01

t-Test: Two-Sample Assuming Equal Variances

	ARAN 2 (5)	*ARAN 4 (6)*
Mean	64.7	64.7
Variance	0.455555556	0.455555556
Observations	10	10
Pooled Variance	0.455555556	
Hypothesized Mean Difference	0	
df	18	
t Stat	0	
P(T<=t) one-tail	0.5	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	1	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Unequal Variances

	ARAN 2 (5)	*KJ LAW - T6400*
Mean	64.7	67.206
Variance	0.455555556	15.38295444
Observations	10	10
Hypothesized Mean Difference	0	
df	10	
t Stat	-1.991241363	
P(T<=t) one-tail	0.037233271	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	0.074466542	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Unequal Variances

	ARAN 2 (5)	*PATHWAY - PSI-35*
Mean	64.7	66.8
Variance	0.455555556	16.9
Observations	10	10
Hypothesized Mean Difference	0	
df	9	
t Stat	-1.594043008	
P(T<=t) one-tail	0.072695312	
t Critical one-tail	2.821434464	
P(T<=t) two-tail	0.145390624	
t Critical two-tail	3.249842848	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 2 (5)	*ARRB 3-LP*
Mean	64.7	62.9825
Variance	0.455555556	0.266745833
Observations	10	10
Pooled Variance	0.361150694	
Hypothesized Mean Difference	0	
df	18	
t Stat	6.390539459	
P(T<=t) one-tail	2.5578E-06	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	5.11561E-06	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 2 (5)	*ICC - MDR4083*
Mean	64.7	60.94444444
Variance	0.455555556	1.277777778
Observations	10	9
Pooled Variance	0.84248366	
Hypothesized Mean Difference	0	
df	17	
t Stat	8.905081568	
P(T<=t) one-tail	4.11785E-08	
t Critical one-tail	2.566939656	
P(T<=t) two-tail	8.23569E-08	
t Critical two-tail	2.898232196	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 2 (5)	*AMES - LISA 6000*
Mean	64.7	58.6525
Variance	0.455555556	0.921701389
Observations	10	10
Pooled Variance	0.688628472	
Hypothesized Mean Difference	0	
df	18	
t Stat	16.2955263	
P(T<=t) one-tail	1.59916E-12	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	3.19832E-12	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Unequal Variances

	ARAN 2 (5)	*WALKING PROFILER*
Mean	64.7	69.8975
Variance	0.455555556	10.0128125
Observations	10	2
Hypothesized Mean Difference	0	
df	1	
t Stat	-2.31240803	
P(T<=t) one-tail	0.129922507	
t Critical one-tail	31.82096407	
P(T<=t) two-tail	0.259845014	
t Critical two-tail	63.65589797	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 3 (5)	*ARAN 4 (6)*
Mean	64.7	64.7
Variance	1.677777778	0.455555556
Observations	10	10
Pooled Variance	1.066666667	
Hypothesized Mean Difference	0	
df	18	
t Stat	0	
P(T<=t) one-tail	0.5	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	1	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Unequal Variances

	ARAN 3 (5)	*KJ LAW - T6400*
Mean	64.7	67.206
Variance	1.677777778	15.38295444
Observations	10	10
Hypothesized Mean Difference	0	
df	11	
t Stat	-1.918590251	
P(T<=t) one-tail	0.040673555	
t Critical one-tail	2.718079486	
P(T<=t) two-tail	0.08134711	
t Critical two-tail	3.105815267	

t-Test: Two-Sample Assuming Unequal Variances

	ARAN 3 (5)	*PATHWAY - PSI-35*
Mean	64.7	66.8
Variance	1.677777778	16.9
Observations	10	10
Hypothesized Mean Difference	0	
df	11	
t Stat	-1.540715362	
P(T<=t) one-tail	0.075822546	
t Critical one-tail	2.718079486	
P(T<=t) two-tail	0.151645092	
t Critical two-tail	3.105815267	

SECTION 3
TWO-TAILED TEST
ALPHA = 0.01

t-Test: Two-Sample Assuming Equal Variances

	ARAN 3 (5)	*ARRB 3-LP*
Mean	64.7	62.9825
Variance	1.677777778	0.266745833
Observations	10	10
Pooled Variance	0.972261806	
Hypothesized Mean Difference	0	
df	18	
t Stat	3.894844607	
P(T<=t) one-tail	0.000530771	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.001061542	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 3 (5)	*ICC - MDR4083*
Mean	64.7	60.94444444
Variance	1.677777778	1.277777778
Observations	10	9
Pooled Variance	1.489542484	
Hypothesized Mean Difference	0	
df	17	
t Stat	6.697183489	
P(T<=t) one-tail	1.87531E-06	
t Critical one-tail	2.566939656	
P(T<=t) two-tail	3.75062E-06	
t Critical two-tail	2.898232196	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 3 (5)	*AMES - LISA 6000*
Mean	64.7	58.6525
Variance	1.677777778	0.921701389
Observations	10	10
Pooled Variance	1.299739583	
Hypothesized Mean Difference	0	
df	18	
t Stat	11.86131136	
P(T<=t) one-tail	3.04185E-10	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	6.0837E-10	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 3 (5)	*WALKING PROFILER*
Mean	64.7	69.8975
Variance	1.677777778	10.0128125
Observations	10	2
Pooled Variance	2.51128125	
Hypothesized Mean Difference	0	
df	10	
t Stat	-4.234198323	
P(T<=t) one-tail	0.000866123	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	0.001732247	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Unequal Variances

	ARAN 4 (6)	*KJ LAW - T6400*
Mean	64.7	67.206
Variance	0.455555556	15.38295444
Observations	10	10
Hypothesized Mean Difference	0	
df	10	
t Stat	-1.991241363	
P(T<=t) one-tail	0.037233271	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	0.074466542	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Unequal Variances

	ARAN 4 (6)	*PATHWAY - PSI-35*
Mean	64.7	66.8
Variance	0.455555556	16.9
Observations	10	10
Hypothesized Mean Difference	0	
df	9	
t Stat	-1.594043008	
P(T<=t) one-tail	0.072695312	
t Critical one-tail	2.821434464	
P(T<=t) two-tail	0.145390624	
t Critical two-tail	3.249842848	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 4 (6)	*ARRB 3-LP*
Mean	64.7	62.9825
Variance	0.455555556	0.266745833
Observations	10	10
Pooled Variance	0.361150694	
Hypothesized Mean Difference	0	
df	18	
t Stat	6.390539459	
P(T<=t) one-tail	2.5578E-06	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	5.11561E-06	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 4 (6)	*ICC - MDR4083*
Mean	64.7	60.94444444
Variance	0.455555556	1.277777778
Observations	10	9
Pooled Variance	0.84248366	
Hypothesized Mean Difference	0	
df	17	
t Stat	8.905081568	
P(T<=t) one-tail	4.11785E-08	
t Critical one-tail	2.566939656	
P(T<=t) two-tail	8.23569E-08	
t Critical two-tail	2.898232196	

t-Test: Two-Sample Assuming Equal Variances

	ARAN 4 (6)	*AMES - LISA 6000*
Mean	64.7	58.6525
Variance	0.455555556	0.921701389
Observations	10	10
Pooled Variance	0.688628472	
Hypothesized Mean Difference	0	
df	18	
t Stat	16.2955263	
P(T<=t) one-tail	1.59916E-12	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	3.19832E-12	

t-Test: Two-Sample Assuming Unequal Variances

	ARAN 4 (6)	*WALKING PROFILER*
Mean	64.7	69.8975
Variance	0.455555556	10.0128125
Observations	10	2
Hypothesized Mean Difference	0	
df	1	
t Stat	-2.31240803	
P(T<=t) one-tail	0.129922507	
t Critical one-tail	31.82096407	
P(T<=t) two-tail	0.259845014	
t Critical two-tail	63.65589797	

SECTION 3
TWO-TAILED TEST
ALPHA = 0.01

t-Test: Two-Sample Assuming Equal Variances

	KJ LAW - T6400	*PATHWAY - PSI-35*
Mean	67.206	66.8
Variance	15.38295444	16.9
Observations	10	10
Pooled Variance	16.14147722	
Hypothesized Mean Difference	0	
df	18	
t Stat	0.225964074	
P(T<=t) one-tail	0.411887645	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	0.82377529	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Unequal Variances

	KJ LAW - T6400	*ARRB 3-LP*
Mean	67.206	62.9825
Variance	15.38295444	0.266745833
Observations	10	10
Hypothesized Mean Difference	0	
df	9	
t Stat	3.376132529	
P(T<=t) one-tail	0.0040885	
t Critical one-tail	2.821434464	
P(T<=t) two-tail	0.008177001	
t Critical two-tail	3.249842848	

t-Test: Two-Sample Assuming Unequal Variances

	KJ LAW - T6400	*ICC - MDR4083*
Mean	67.206	60.94444444
Variance	15.38295444	1.277777778
Observations	10	9
Hypothesized Mean Difference	0	
df	11	
t Stat	4.830505758	
P(T<=t) one-tail	0.000263469	
t Critical one-tail	2.718079486	
P(T<=t) two-tail	0.000526939	
t Critical two-tail	3.105815267	

t-Test: Two-Sample Assuming Unequal Variances

	KJ LAW - T6400	*AMES - LISA 6000*
Mean	67.206	58.6525
Variance	15.38295444	0.921701389
Observations	10	10
Hypothesized Mean Difference	0	
df	10	
t Stat	6.698661645	
P(T<=t) one-tail	2.68675E-05	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	5.3735E-05	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Equal Variances

	KJ LAW - T6400	*WALKING PROFILER*
Mean	67.206	69.8975
Variance	15.38295444	10.0128125
Observations	10	2
Pooled Variance	14.84594025	
Hypothesized Mean Difference	0	
df	10	
t Stat	-0.901809705	
P(T<=t) one-tail	0.194181197	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	0.388362394	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Unequal Variances

	PATHWAY - PSI-35	*ARRB 3-LP*
Mean	66.8	62.9825
Variance	16.9	0.266745833
Observations	10	10
Hypothesized Mean Difference	0	
df	9	
t Stat	2.913634408	
P(T<=t) one-tail	0.008604577	
t Critical one-tail	2.821434464	
P(T<=t) two-tail	0.017209155	
t Critical two-tail	3.249842848	

t-Test: Two-Sample Assuming Unequal Variances

	PATHWAY - PSI-35	*ICC - MDR4083*
Mean	66.8	60.94444444
Variance	16.9	1.277777778
Observations	10	9
Hypothesized Mean Difference	0	
df	10	
t Stat	4.326216982	
P(T<=t) one-tail	0.000749211	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	0.001498422	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Unequal Variances

	PATHWAY - PSI-35	*AMES - LISA 6000*
Mean	66.8	58.6525
Variance	16.9	0.921701389
Observations	10	10
Hypothesized Mean Difference	0	
df	10	
t Stat	6.103090189	
P(T<=t) one-tail	5.76114E-05	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	0.000115223	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Equal Variances

	PATHWAY - PSI-35	*WALKING PROFILER*
Mean	66.8	69.8975
Variance	16.9	10.0128125
Observations	10	2
Pooled Variance	16.21128125	
Hypothesized Mean Difference	0	
df	10	
t Stat	-0.993177837	
P(T<=t) one-tail	0.172023496	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	0.344046992	
t Critical two-tail	3.169261618	

t-Test: Two-Sample Assuming Equal Variances

	ARRB 3-LP	*ICC - MDR4083*
Mean	62.9825	60.94444444
Variance	0.266745833	1.277777778
Observations	10	9
Pooled Variance	0.742525572	
Hypothesized Mean Difference	0	
df	17	
t Stat	5.147599678	
P(T<=t) one-tail	4.02794E-05	
t Critical one-tail	2.566939656	
P(T<=t) two-tail	8.05588E-05	
t Critical two-tail	2.898232196	

SECTION 3
TWO-TAILED TEST
ALPHA = 0.01

t-Test: Two-Sample Assuming Equal Variances

	ARRB 3-LP	*AMES - LISA 6000*
Mean	62.9825	58.6525
Variance	0.266745833	0.921701389
Observations	10	10
Pooled Variance	0.594223611	
Hypothesized Mean Difference	0	
df	18	
t Stat	12.56024024	
P(T<=t) one-tail	1.20626E-10	
t Critical one-tail	2.552378646	
P(T<=t) two-tail	2.41252E-10	
t Critical two-tail	2.878441592	

t-Test: Two-Sample Assuming Unequal Variances

	ARRB 3-LP	*WALKING PROFILER*
Mean	62.9825	69.8975
Variance	0.266745833	10.0128125
Observations	10	2
Hypothesized Mean Difference	0	
df	1	
t Stat	-3.08230231	
P(T<=t) one-tail	0.099859799	
t Critical one-tail	31.82096407	
P(T<=t) two-tail	0.199719597	
t Critical two-tail	63.65589797	

t-Test: Two-Sample Assuming Equal Variances

	ICC - MDR4083	*AMES - LISA 6000*
Mean	60.94444444	58.6525
Variance	1.277777778	0.921701389
Observations	9	10
Pooled Variance	1.089266748	
Hypothesized Mean Difference	0	
df	17	
t Stat	4.779488461	
P(T<=t) one-tail	8.71263E-05	
t Critical one-tail	2.566939656	
P(T<=t) two-tail	0.000174253	
t Critical two-tail	2.898232196	

t-Test: Two-Sample Assuming Equal Variances

	ICC - MDR4083	*WALKING PROFILER*
Mean	60.94444444	69.8975
Variance	1.277777778	10.0128125
Observations	9	2
Pooled Variance	2.248337191	
Hypothesized Mean Difference	0	
df	9	
t Stat	-7.6380143	
P(T<=t) one-tail	1.59905E-05	
t Critical one-tail	2.821434464	
P(T<=t) two-tail	3.1981E-05	
t Critical two-tail	3.249842848	

t-Test: Two-Sample Assuming Equal Variances

	AMES - LISA 6000	*WALKING PROFILER*
Mean	58.6525	69.8975
Variance	0.921701389	10.0128125
Observations	10	2
Pooled Variance	1.8308125	
Hypothesized Mean Difference	0	
df	10	
t Stat	-10.72906559	
P(T<=t) one-tail	4.15482E-07	
t Critical one-tail	2.7637725	
P(T<=t) two-tail	8.30964E-07	
t Critical two-tail	3.169261618	