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October 4, 1991

P. Solomon - PO Box 58 - 05700 Alor Setar - Kedah - MALAYSIA

Dear Solomon,

Here is my report of the Penang International Measurement Seminar. It was the best of the four seminars at which I have taught. A good part of the credit must go to you and Balan, since you two organized the affair, and took the time and trouble to find an excellent venue for the instruction. As a result, things went smoothly, reflecting your good planning.

The students showed a fine attitude. All were keen to learn, even though most were not recently experienced bicycle riders. There was a perceptible improvement between the first day and the second, and I am sure that with practice all should be able to become good course measurers, and provide MAAU with a cadre of dependable people.

All it will take now is to put into practice what has been learned. The students showed that they know how to calculate properly, and all they need now is some more experience on the bicycle.

I have summarized the calibration and measurement data in the report. I urge you to copy the report and send it to each of the participants as soon as possible, possibly as an appendix to your own report of the seminar.

The hospitality extended to me was most enjoyable, and I thank you, Balan and Podim for the wonderful care you took of me. I hope some day I may return the favor.

My especial gratitude also to Tuan Syed and to MAS, without whose financial support my trip to Malaysia would not have been possible.

Best regards,

Peter S. Riegel
IAAF Course Measurement Instructor

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ROAD RACE COURSE MEASUREMENT SEMINAR

Penang, Malaysia
26-28 September 1991

SEMINAR PROCEDURE

The seminar was held over four 4-hour periods in two locations in Penang.

Thursday Afternoon
Instruction began on Thursday afternoon at the RECSAM Centre. Mutual introductions were made, and I gave a brief summary of what we would be doing. Then we went outside to the waiting bicycles, and affixed a Jones counter to each. This completed, the group drove and cycled to a nearby short stretch of unused highway.

I had the participants lay down a 150 metre calibration course. While they were doing this, I set out cones to define a practice course of about 367 metres length, all that space would permit.

I demonstrated the calibration procedure, and then rode over the practice course to show the layout. Each of the students then took two calibration rides, followed by one ride of the practice course, taking measurement data as they did so. After each had finished gathering data, we returned to RECSAM where I demonstrated the calculation procedure, and had each student calculate his own estimate of the length of the practice course.

This abbreviated form of measurement was intended to get the students on the bikes as soon as possible, to give them hands-on experience. It was hoped that this would prepare them for the full-scale measurement to be conducted the next day.

Friday Morning
On Friday we assembled at the Youth Park, and immediately proceeded to the site of another practice course located in the area of Jesselton Crescent. I had the students lay down two 200 metre calibration courses, one on each side of the road. This was all the length available in the area. A standard 500 metre calibration course would have taken time we did not have.

With calibration course layouts finished, each of us calibrated his bike, doing the standard four rides. We proceeded one way on one calibration course, returning in the opposite direction on the other course, which reduced congestion during calibration, since we had 20 calibrations to perform.

With calibrations completed, we assembled at the "finish Line." Since we were sharing bicycles, I led three rides around the course, riding from finish to start. I instructed the students to follow me, and ride as I rode, along the Shortest Possible Route (SPR). On the first ride I laid down a 1 km split and a start line, and had each student take a count at each point. Students on the other rides also took data at those points.

Upon conclusion of the data-taking, we recalibrated and returned to the Youth Park for a picnic lunch, arriving just in time to avoid the rain.

Friday Afternoon
After a break for midday religious devotions, we reassembled at RECSAM Centre in the classroom. Using my own measurement data, I showed on the blackboard how to do the calibration and measurement calculations. Then each student was instructed to use his own data to arrive at a measured length for the course. While they did this, I circulated around the classroom to answer individual questions which arose.

As each student produced a calculated length, I wrote them on the blackboard so that the students could see the various lengths that had been determined. I also recorded the calibration variations of the students on the blackboard. I explained that with practice the calibrations would become less varied, and the measurements would more closely approach my own.

Saturday Morning
We met at RECSAM again, and I recapitulated what we had done and answered a few questions. I also attempted to discuss the philosophy of the Short Course Prevention Factor (1.001), and pointed out that it was simply an insurance against getting a short course, and that it is standard practice everywhere in the world.

We took a steel tape and a fibreglass tape to the balcony, and compared their behavior. Over 25 metres, the fibreglass tape stretched 10 mm over a 0 to 4.5 kg tension range, while the steel tape stretched only 1 mm. This demonstrated the unsuitability of fibreglass tapes for accurate measurement. Only steel tapes should be used for calibration course layout. Fibreglass is suitable for final adjustments and other rough measurements.

Then we associated freely for a friendly hour. The seminar concluded with presentation of certificates to all students and closing formalities.

DISCUSSION OF RESULTS

I have summarized the data taken, and calculated the measurement results, on following pages. Examination of the data submitted by each student shows a remarkable ability on the part of all students to calculate properly. Each student correctly used his data to arrive at the right answer. Other observations include:

Use of Proper Constant
There was some confusion here. Some students used precalibration constant, some used postcalibration constant, and most used the average, which is proper for IAAF standard measurements. Students had been given the IAAF measurement book, and the TAC/USA measurement book. TAC recommends the use of the larger constant, which is slightly more conservative than IAAF, giving a slightly longer laid-out course. I explained the difference to the students.

Calibration Variation
Most of the students had not used a bicycle recently, and some were wobbly when they calibrated. An experienced measurer will only rarely experience a spread of more than 2 counts on a series of four rides. Most of the students stayed within an acceptable range (the average variation was 2.2 counts per 4

rides), but a few had wider ranges. This is not a serious problem, since with practice steady riding is achieved.

Measurement Variation

Estimates of course length ranged from my own of 2000.3 metres to a maximum of 2010 metres, with the average at 2004.5 metres. In a group of experienced measurers of this size (20) an expected range might be 3 metres. I explained that normally the average measurement would be proper, but in this case my own was probably most indicative of true length, since two others confirmed it, and the group was composed of novices. I would estimate the true course length to be about 2001 metres. Most students were not skilled at riding the Shortest Possible Route, and this resulted in their obtaining a larger value for the measured path. In similar groups of experienced measurers my own measurement is generally near the average, and the measurements are more tightly grouped.

The students would probably have ridden a better line if I had used the course map beforehand to explain what we would be doing. In the confusion of the moment I simply asked them to follow me. If I had prepared them better they would have done better. For this omission I apologize.

PROGNOSIS FOR THE FUTURE

The students all demonstrated competence at following the standard IAAF procedures. All shortcomings were solely the result of lack of bicycle riding experience. This is easily rectified by going out and practicing what was learned. If the students do this they will almost certainly calibrate more steadily and adhere better to the proper measurement line.

When this has been done, Malaysia will have at its disposal a cadre of experienced, knowledgeable, and skilled measurers to assist with the layout of accurate road racing courses.

I remain eager to assist in answering any questions concerning course measurement, and look forward to further correspondence.

Respectfully submitted,

Peter S. Riegel
IAAF Course Measurement Instructor

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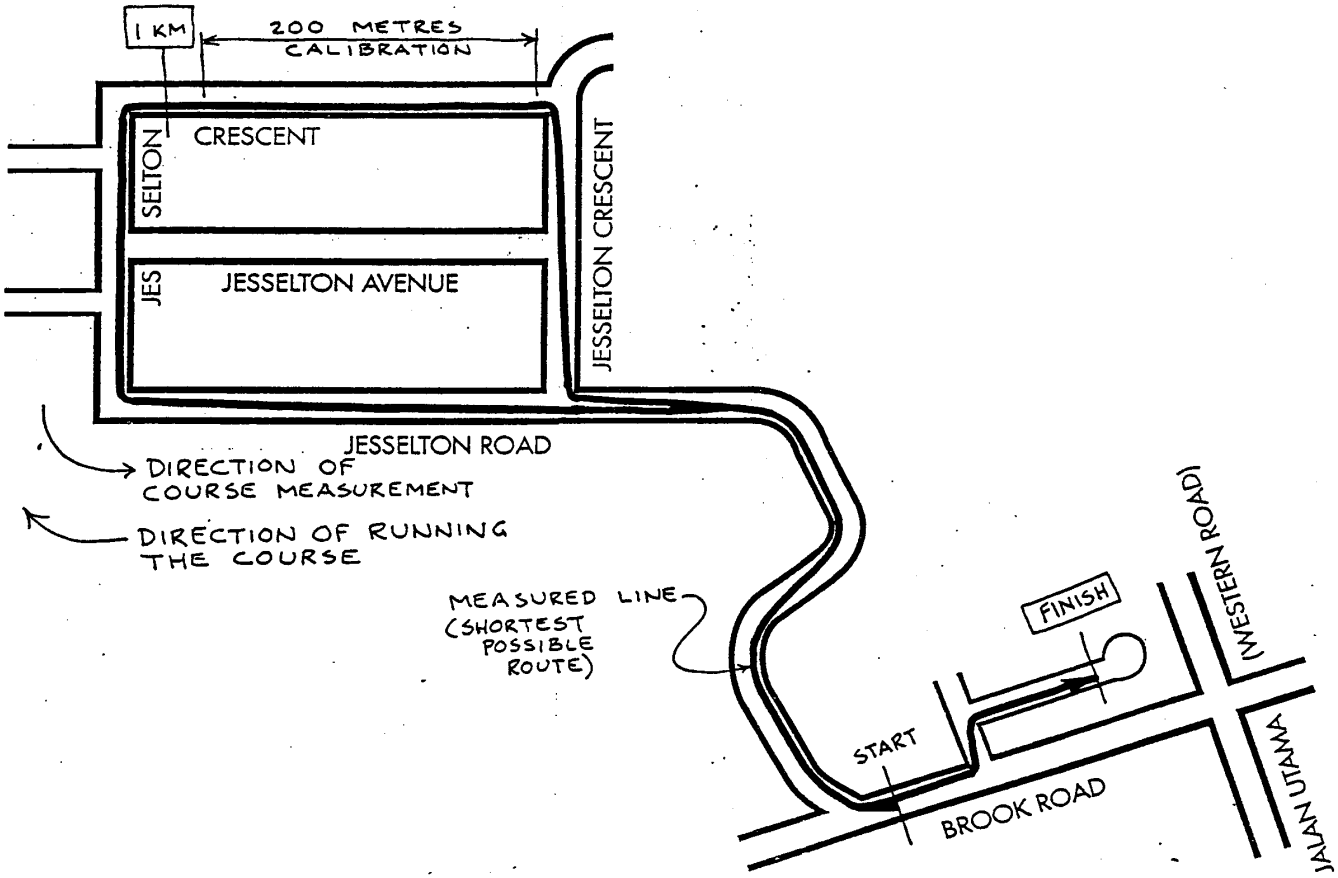
USA

ROAD RACE COURSE MEASUREMENT SEMINAR

26-09-91 – 28-09-91

TEST COURSE



HOW PETE RIEGEL LAID OUT THE TEST COURSE:

First he calibrated his bike:

1877
1878
1877
1878

Average = 1877.5 counts per 200 metres

Layout constant = (1877.5/0.2)*1.001 = 9396.888 counts per kilometre

For layout purposes, Pete rounded this off to an even 9397.

Pete decided that the finish line was a fixed location, and decided to lay out the course from finish to start. At the finish line his count was 68500.

Finish (2 km) = 68500 counts
1 km = 68500 + 9397 = 77897 counts
When Pete reached this count, he stopped and made the 1 km mark.

Start = 77897 + 9397 = 87294 counts
When Pete reached this count, he stopped and made the start mark.

At this point the rough layout was complete. The exact distance is not known until recalibration is done, and the constant for the day is used to determine final distance.

After the distance is determined, final small adjustments may be made to put the course at the exact desired length.

PENANG SEMINAR - CALCULATED VALUES

MEASURER		PRECAL CTS/KM	POSTCAL CTS/KM	AVERAGE CTS/KM	METRES START TO 1 KM	METRES 1 KM TO FINISH	METRES OVERALL COURSE LENGTH
MUREGESU	MU	9395.636	9390.631	9393.134	1002.9	1001.6	2004.4
SILVARAJ	SI	9480.721	9476.968	9478.844	1003.1	1003.0	2006.0
THANABALAN	TH	9411.903	9403.144	9407.523	1001.9	1000.8	2002.7
ONG CHIN CHIEW	OC	9489.480	9484.475	9486.978	1000.2	1000.3	2000.5
IBRAHIM	IB	9508.249	9504.495	9506.372	1001.4	1002.0	2003.4
PODIMHATIA	PO	9414.405	9425.666	9420.036	1003.1	1003.1	2006.1
LIM HONG CHAI	LI	9433.174	9431.923	9432.548	1002.9	1002.6	2005.5
PALACHANDRAN	PA	9483.224	9475.716	9479.470	1002.6	1002.6	2005.2
SUBRAMANIAM	SU	9386.878	9390.631	9388.754	1004.8	1002.8	2007.6
ONG KA AUN	OK	9435.676	9433.174	9434.425	1002.4	1001.5	2003.9
JAYAPRAKAS	JA	9491.983	9491.983	9491.983	1004.5	1005.5	2010.0
PONNIAH	PN	9488.229	9481.973	9485.101	1003.2	1003.2	2006.3
NOOKARAJOO	NO	9411.903	9409.400	9410.651	1000.9	1000.9	2001.8
APPAN	AP	9493.234	9488.229	9490.731	1002.2	1002.6	2004.8
SIVALINGAM	SV	9484.475	9479.470	9481.973	1002.1	1001.9	2004.0
GOVINDARAJOO	GO	9396.888	9386.878	9391.883	1002.9	1001.3	2004.2
KASIM	KA	9559.550	9558.299	9558.924	1002.2	1002.6	2004.8
HALIM	HA	9544.535	9537.028	9540.781	1003.1	1001.9	2005.0
MUNIANDY	MN	9413.154	9413.154	9413.154	1002.3	1002.1	2004.4
RIEGEL	RI	9396.888	9394.385	9395.636	1000.1	1000.1	2000.3

RAW MEASUREMENT DATA FOR ALL PARTICIPANTS
CALIBRATION COURSE LENGTH = 200 METRES

	Precalibration Rides				Postcalibration Rides				COUNT AT FINISH	COUNT AT 1 KM	COUNT AT START
	1	2	3	4	1	2	3	4			
MU	1877	1877	1877	1878	1875	1877	1877	1876	3000	12408	21828
SI	1894	1894	1893	1896	1894	1893	1894	1893	34100	43607	53115
TH	1879	1881	1881	1881	1879	1879	1878	1879	92000	101415	110840
OC	1896	1896	1896	1896	1895	1895	1895	1895	5000	14490	23979
IB	1904	1898	1899	1898	1900	1897	1900	1899	20430	29955	39475
PO	1881	1879	1881	1883	1884	1883	1883	1883	53034	62483	71932
LI	1885	1885	1884	1885	1883	1885	1885	1885	3000	12457	21917
PA	1895	1894	1895	1895	1894	1892	1893	1894	84530	94034	103538
SU	1874	1876	1878	1874	1875	1877	1878	1875	15755	25170	34604
OK	1886	1885	1885	1885	1885	1884	1886	1884	83000	92449	101906
JA	1900	1895	1896	1895	1896	1897	1898	1895	54600	64144	73679
PN	1895	1897	1899	1892	1896	1894	1897	1891	64000	73515	83030
NO	1881	1880	1880	1881	1878	1882	1878	1882	26000	35419	44838
AP	1897	1895	1898	1897	1896	1897	1894	1896	13550	23065	32577
SV	1897	1895	1894	1894	1894	1894	1894	1894	0	9500	19002
GO	1878	1877	1878	1877	1877	1876	1874	1875	89470	98874	108293
KA	1910	1910	1910	1910	1909	1910	1911	1909	93300	102884	112464
HA	1907	1907	1907	1907	1906	1905	1906	1905	35000	44559	54129
MN	1880	1881	1880	1882	1880	1881	1881	1881	12320	21753	31188
RI	1877	1878	1877	1878	1877	1877	1877	1878	68500	77897	87294

AN EXAMPLE OF A CORRECT CALCULATION USING THE DATA OF LIM HONG CHAI:

Pre-measurement calibrations on a course of 200 metres (0.2 km):

Ride 1	1885
Ride 2	1885
Ride 3	1884
Ride 4	1885

Precalibration average 1884.75 counts per 200 metres

(1884.75/0.2)x1.001 = 9433.174 counts per kilometre

Note: this is the constant that would be used for laying out a course.

Post-measurement calibrations on a course of 200 metres (0.2 km):

Ride 1	1883
Ride 2	1885
Ride 3	1885
Ride 4	1885

Postcalibration average 1884.5 counts per 200 metres

(1884.5/0.2)x1.001 = 9431.923 counts per kilometre

Constant for the day - average of precal and postcal:

(9433.174+9431.923)/2 = 9432.549 counts per kilometre
Use this value for calculating
the final length of the course

Measurement data - the course was measured from finish to start

Count at finish	3000
Count at 1 km	12457
Count at start	21917

Start to 1 km = 9460 counts
9460/9432.549 = 1.00291 kilometres = 1002.91 metres

1 km to finish = 9457 counts
9457/9432.549 = 1.002592 kilometres = 1002.59 metres

Start to finish = 18917 counts
18917/9432.549 = 2.005502 kilometres = 2005.50 metres

Final adjustments: start-to-finish may now be shortened by 5.5 metres to bring the course to the exact length of 2 km. The 1 km split may also be adjusted if desired.