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International Measurement Administrator
Western Hemisphere

Henk C. W. Koolen
Director LOC WRR 98
CBAT
Av. Sete de Setembro, 874 - 4.º Andar
69.005 - 140 Manaus
BRASIL

Dear Henk,

July 22, 1997

I have checked the work we did in Manaus. I found no mistakes, so my original recommendations remain in effect. I enclose calculations, narrative report, photographs and sketches made during the course of the work.

- 1) The 2.5 km loop was found to be short by 4.24 metres. The center of its north turn point must be moved 2.12 metres to lengthen the course to a full 2500 metres.
- 2) The 2.195 km loop was found to be short by 2.71 metres. The center of its north turn point must be moved 1.36 metres to lengthen the course to a full 2195 metres.
- 3) The center points define the centers of arcs having 4.0 metre radius. This radius does not define the runners' path. Cones or curbing must be placed on the 4.0 metre radius. The measured runners' path is 30 cm outside the 4.0 metre arcs.

I recommend that Wietse do the work of moving the center points. He is a skilled and competent measurer.

In addition, I recommend that the 7.195 km distance be run as the first part of the relay. This will permit the short loop to be used on the very first lap, and closed when the last runner passes. After this first lap, each lap will be run on the 2.5 km lap. This will eliminate traffic problems that will occur between runners of different speeds using different paths near the end of the race. Also, it will make things simpler for the people who must count laps and keep account of the runners.

If you have any questions, please contact me. I will be happy to help in any way I can.

Best regards,

Copy:
Pierre Weiss - IAAF - Monaco
Martinho Nobre dos Santos
Euclides Jose de Almeida Cavalcanti
Wietse Marco Jurgen Hoornweg van Rij
Paulo Silva

MEASUREMENT OF 4TH IAAF AMAZON GOVERNMENT WORLD ROAD RELAY CHAMPIONSHIPS MANAUS, AMAZONAS, BRAZIL

I got the word about the trip about a month before, in a phone call from Henk Koolen, the Executive Director of CBAT, the Brazilian Athletic Federation. He said there was to be an IAAF World Championship Road Relay next year, and could I come down and measure the course? I said yes, and he set up the ticket. I had it in my hand two weeks before I left, a nice contrast to the last-minute panic situations common to these kinds of trip. I left Columbus at 3 PM July 9

At 7 AM on the 10th, in Manaus, I was met at the plane by Euclides Jose de Almeida Cavalcanti, who is in the technical department of CBAT. He took me to the Tropical Hotel, and said the rest of the day was mine, to rest. He showed me some maps and we talked about the course enough so that I could be mentally prepared for the next day's work. We were to meet the next day to measure the course.

Next morning I was picked up at 8:30 and taken to the course. We toured it. It was quite simple, being a 2500 meter loop which the runners would circle 16 times. A 17th lap on a 2195 meter loop would complete the marathon distance. The loop was to be run on either side of the central divider of the Estrada da Ponta Negra, with three turning points to be cut through the median as needed. The southern turning point was fixed, and would not move. It was marked with a nail and washer in the central divider, marking the center of a half-circle of 4 meter radius on which cones would be placed to define the turn. The two northern turning points were considered as adjustable. Their centers were marked with stakes driven into the dirt of the central divider. Arcs of 4 meter radius had been painted on the roadway.



Wietse, Pete, Paulo after the measurement in which everyone had good agreement.

I believed the best way to measure the course was to ignore the turning radii, and calculate them mathematically rather than try to actually measure around them and across the median. At each turn I marked points, one on each side of the median, which lined up with the center point, and 4 meters from it. These points would be used as data points.

I laid out a 300 meter calibration course on Estrada da Ponta Negra near the start/finish of the loops, using the solo method where the tape is hooked over succeeding nails. I double-checked all readings, but paranoia drove me to do a complete recheck 6 days later, which confirmed the initial layout within 2 cm.

Those who measured the course were:

Pete Riegel - Columbus, Ohio, USA

Wietse Marco Jurgen Hoornweg van Rij - Manaus, AM, BRASIL

Paulo Silva - Porto Alegre, RS, BRASIL

I had brought a Goodyear foam-filled wheel with me, but after I gave it to Paulo he discovered a soft spot in it where the rubber had not completely filled the tire. Thus it was junk. We used Wietse's bike, which had a thin, high-pressure tire.



Wietse at a data point.

I calibrated the bike, rode each loop of the course twice, and recalibrated. This took about an hour. Then Wietse repeated what I had done, and finally Paulo measured. I was puzzled at Paulo's riding outfit, which seemed to be khaki bathing suit and leather street shoes. I learned later that Paulo's luggage had been misplaced and he was making do with what he had. He was hoping the baggage would catch up as he was enroute in two days to Havana to measure a course.

We sat down at the hotel and compared notes. All three of our measurements agreed within 30 meters for the full marathon, and showed that each of the two western turn points



Paulo ready to take a count.

needed to be moved a meter or two to slightly lengthen the course. This movement of the center points, and remarking of the pavement, will be done by Wietse.

I prepared neat handwritten copies of the results of the measurement, a definitive USATF-style course map, an IAAF Measurement Certificate, and a diagram showing how the turning points should be moved. Eucledio made copies for CBAT. I told him I would be double-checking the work when I got home. Fortunately the computer calculations came out the same as those done on site.

In addition to checking the course I recommended that race management reexamine the order of the relay events. As planned, relay teams would run lengths of 5, 10, 5, 10, 5 and finally 7.195 km. I suggested that the 7.195 km event be run first, as this would permit the short loop to be used for the very first lap, closed when the last runner passed through, and never thereafter used in the race. If the 7.195 km event is run last, lapped runners and lap-counting difficulties are likely, in my view to cause problems

John Riegel

Signature

IAAF Approved Course Measurer

15 July 1977
Date



MEASUREMENT OF 4TH IAAF AMAZON GOVERNMENT
WORLD ROAD RELAY CHAMPIONSHIPS
MANAUS, AM - BRASIL

IAAF ROAD RACE COURSE MEASUREMENT CERTIFICATE

Name of Race: 4th IAAF AMAZON GOVERNMENT
WORLD ROAD RELAY CHAMPIONSHIPS

Location: MANAUS, AMANAZONAS, BRASIL
CITY COUNTRY

Date of Race: 18/19 APRIL 1998 Distance of Race: 42.195 KM

Measured Distance of Course: 42.195 KM Date Measured: 11 JULY 1997

Altitude (in metres above sea level):

Start: ~204 Highest: ~206 Lowest: ~200 Finish: ~203

Type of Course (loop, point-to-point, etc): 16 LOOPS @ 2.5 KM + 1 LOOP @ 2.195 KM

Local Race Measurer: WIETSE MARCO JURGEN HOORNWEG VAN RIJ

Address: SHANGRILA II - RUA C QUADRA C CASA 7 - PARQUE 10
CEP - 69.052-00 - C. POSTAL 3687 - MANAUS, AM - BRASIL

Method of Measuring: Bicycle... X Steel Tape.....

IAAF Approved Course Measurer: PETER S. RIEGEL

Address: 3354 KIRKHAM ROAD
COLUMBUS, OH 43221 USA

This is to certify that the course described above and defined by the attached map has been measured and approved for certification. The course measurement complies with IAAF Rules For Road Race Course Measurement and the measured distance is not less than the official distance for the event.

Peter S. Riegel
Signature

IAAF Approved Course Measurer

15 July 1997
Date

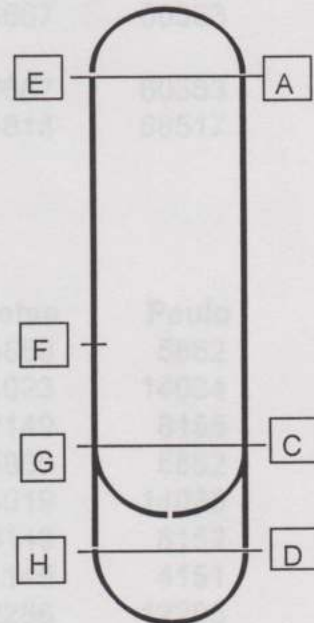
**MEASUREMENT OF 4TH IAAF AMAZON GOVERNMENT
WORLD ROAD RELAY CHAMPIONSHIPS
MANAUS, AMAZONAS, BRASIL**

Layout of Calibration Course on Estrada da Ponta Negra						
11 July 1997 - Pavement Temp 33 C			16 July 1997 - Pavement Temp 27 C			
Temperature Measured			Temperature Estimated by feel			
Reading	Offset	Total	Reading	Offset	Total	
29.929	0.097	30.026	29.803	0.097	29.900	
29.791	0.097	29.888	29.797	0.097	29.894	
29.911	0.097	30.008	29.919	0.097	30.016	
29.915	0.097	30.012	29.923	0.097	30.020	
29.883	0.097	29.980	29.884	0.097	29.981	
29.928	0.097	30.025	29.933	0.097	30.030	
29.941	0.097	30.038	29.944	0.097	30.041	
29.935	0.097	30.032	29.939	0.097	30.036	
29.947	0.097	30.044	29.949	0.097	30.046	
29.93	0.097	30.027	29.932	0.097	30.029	
Raw Total		300.080			299.993	
Temp Corr		0.045			0.024	
Removed 13 cm		-0.130				
Adjusted length		299.995			300.017	

13 cm was removed from the course, in the first interval, before the nails were driven.
The course was checked a week later.

A length of 300.000 m is used in subsequent calculations

	10:15	11:15	12:15
Precalibration	Pete	Wietse	Paulo
11 July 1997	3411	3401	3406
	3408	3400.5	3404
	3409	3399.5	3404
	3408	3400	3403
Avg Cts/300 m	3409	3400.25	3404.25
Cts/km	11363.33	11334.17	11347.5
1.001 x Cts/km	11374.7	11345.5	11358.85
Postcalibration	3408	3398.5	3402
11 July 1997	3406	3399	3401
	3407.5	3399	3403
	3407.5	3399.5	3403
Avg Cts/300 m	3407.25	3399	3402.25
Cts/km	11357.5	11330	11340.83
1.001 x Cts/km	11368.86	11341.33	11352.17
Day's Constant:	11371.78	11343.42	11355.51



Counter Readings obtained during the measurements

	Pete	Wietse	Paulo
F	95380	29600	63225
H	101252	35458	69087
D	1400	35458	69087
A	15449	49481	83121
E	15500	49481	83121
F	23665	57630	91276
H	29535	63490	97138
D	29640	63490	97138
A	43681	77509	111168
E	43800	77509	11168
F	51964	85658	19320
F	51964	85658	19320
G	56118	89803	23471
C	56130	89803	23471
A	68438	102089	35766
E	68460	2089	35766
F	76623	10238	43920
G	80777	14382	48070
C	80900	14382	48070
A	93206	26667	60363
E	93300	26667	60363
F	101464	34814	68517

Interval distances in counts

	Pete	Wietse	Paulo
F to H	5872	5858	5862
D to A	14049	14023	14034
E to F	8165	8149	8155
F to H	5870	5860	5862
D to A	14041	14019	14030
E to F	8164	8149	8152
F to G	4154	4145	4151
C to A	12308	12286	12295
E to F	8163	8149	8154
F to G	4154	4144	4150
C to A	12306	12285	12293
E to F	8164	8147	8154

Interval distances in meters

	Pete	Wietse	Paulo	Minimum
F to H (1)	516.37	516.42	516.23	
F to H (2)	516.19	516.60	516.23	516.19
D to A (1)	1235.43	1236.22	1235.88	
D to A (2)	1234.72	1235.87	1235.52	1234.72
E to F (1)	718.01	718.39	718.15	
E to F (2)	717.92	718.39	717.89	
E to F (3)	717.83	718.39	718.07	
E to F (4)	717.92	718.21	718.07	717.83
F to G (1)	365.29	365.41	365.55	
F to G (2)	365.29	365.32	365.46	365.29
C to A (1)	1082.33	1083.10	1082.73	
C to A (2)	1082.15	1083.01	1082.56	1082.15

	Pete	Wietse	Paulo	Minimum
2.500 km loop				
E to F	717.83	718.21	718.07	717.83
F to H	516.19	516.42	516.23	516.19
D to A	1234.72	1235.87	1235.52	1234.72
2 x 4.3 x pi	27.02	27.02	27.02	27.02

Total	2495.76	2497.53	2496.83	2495.76
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Add for 2500 m	4.24	2.47	3.17	4.24
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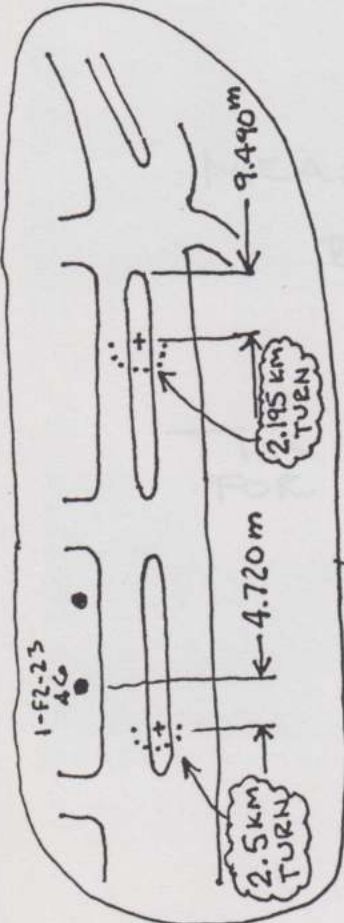
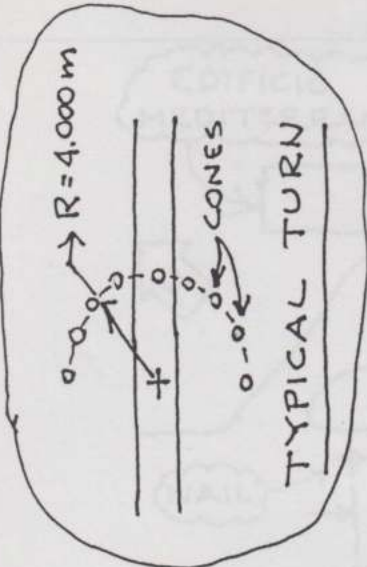
	Pete	Wietse	Paulo	Minimum
2.195 km loop				
E to F	717.83	718.21	718.07	717.83
F to G	365.29	365.32	365.46	365.29
C to A	1082.15	1083.01	1082.56	1082.15
2 x 4.3 x pi	27.02	27.02	27.02	27.02

Total	2192.29	2193.56	2193.10	2192.29
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Add for 2195 m	2.71	1.44	1.90	2.71
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16 x 2500	39932.18	39960.41	39949.31	39932.18
1 x 2195	2192.29	2193.56	2193.10	2192.29

Total	42124.47	42153.97	42142.41	42124.47
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EDIFICIO BARAO DO RIO NEGRO

EDIFICIO MEDITERRANÉE

START FINISH

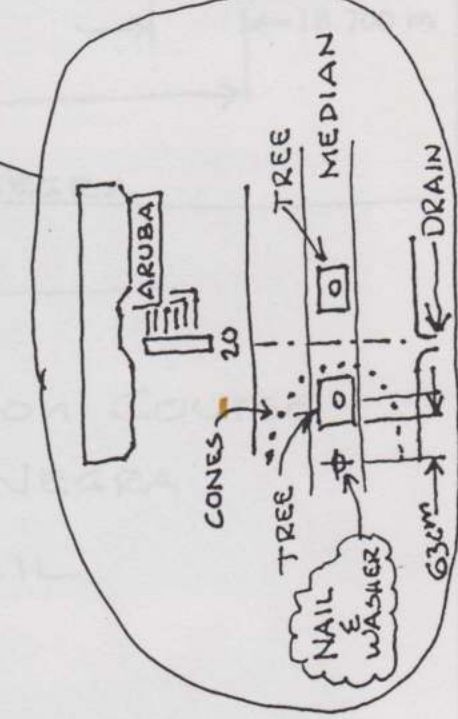
AL. LIBANO
 AL. ANGOLA
 AL. ARABIA

ARUBA

TREES
 CURB DRAIN

ESTRADA
 PONTA NEGRA

TO TROPICAL HOTEL

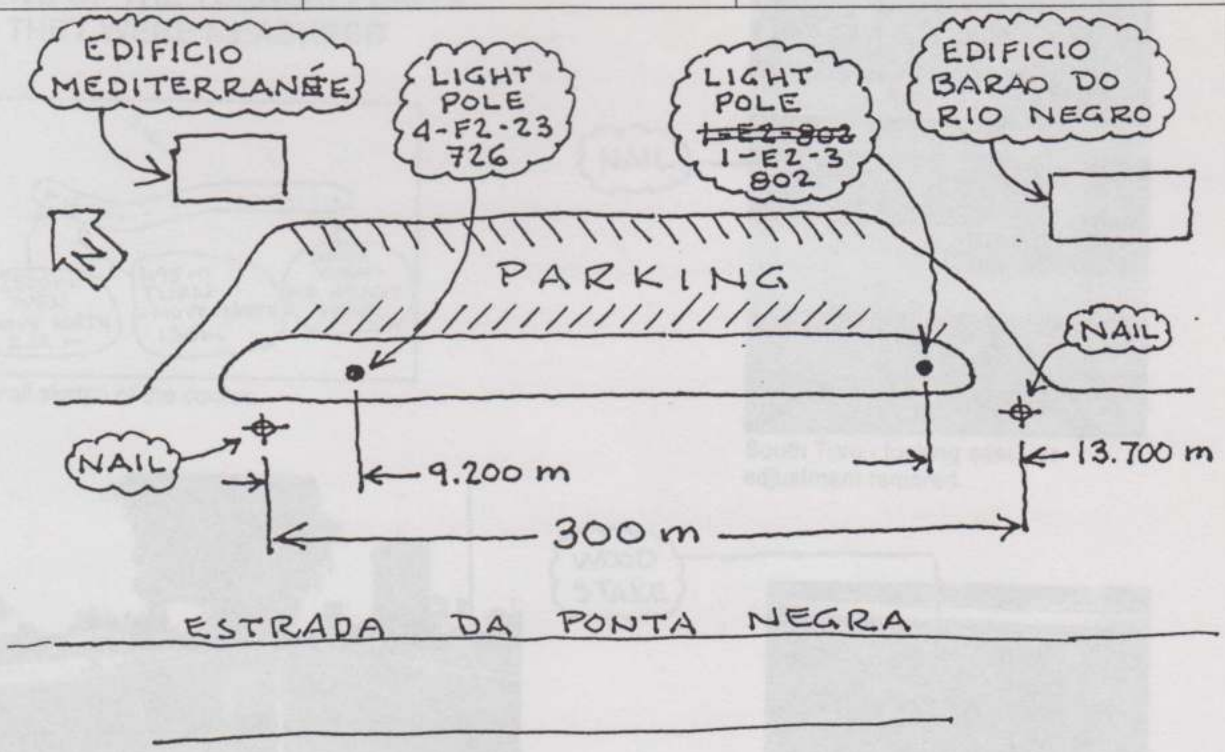
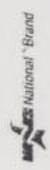


MARATHON
 16 CIRCUITS @ 2.5 KM
 1 CIRCUIT @ 2.195 KM

NOTE: TURNING POINTS ARE SHOWN IN THEIR FINAL (ADJUSTED) POSITIONS
R. Ribeiro
 15-4-97

4th IAAF AMAZON GOVERNMENT WORLD ROAD RELAY CHAMPIONSHIPS
 MANAUS, AMAZONAS BRASIL

10-260 24 SHEETS 25' x 31 1/2" 5 SQUARE
10-261 24 SHEETS 25' x 31 1/2" 5 SQUARE
10-262 24 SHEETS 25' x 31 1/2" 5 SQUARE
10-263 24 SHEETS 25' x 31 1/2" 5 SQUARE
10-264 24 SHEETS 25' x 31 1/2" 5 SQUARE
10-265 24 SHEETS 25' x 31 1/2" 5 SQUARE
10-266 24 SHEETS 25' x 31 1/2" 5 SQUARE
10-267 24 SHEETS 25' x 31 1/2" 5 SQUARE
10-268 24 SHEETS 25' x 31 1/2" 5 SQUARE
10-269 24 SHEETS 25' x 31 1/2" 5 SQUARE
10-270 24 SHEETS 25' x 31 1/2" 5 SQUARE
MADE IN U.S.A.



300 meter Calibration Course
EST. DA PONTA NEGRA
MANAUS, BRAZIL

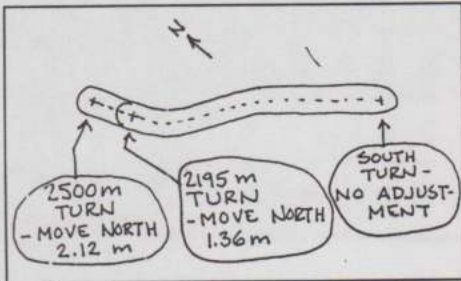
MEASURED 11-7-97

BY: PETE RIEGEL
WIESE MARCO JURGEN HOORNWEG VAN RIJ
PAULO SILVA

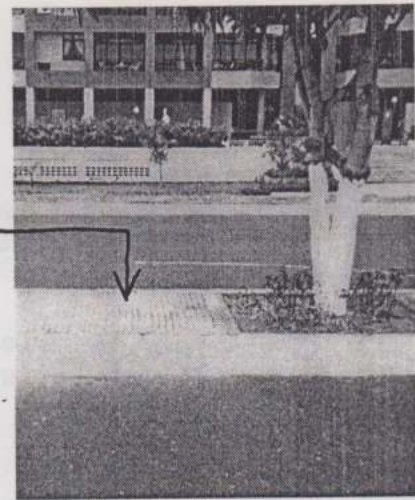
THIS COURSE IS CERTIFIED ACCURATE
FOR BICYCLE/JONES COUNTER MEASUREMENTS

Peter S. Riegel
PETER S. RIEGEL
IAAF MEASUREMENT ADMINISTRATOR
AMERICAS 14/7/97

VIEWS OF THE TURNING POINTS AS THEY WERE MEASURED



Overall sketch of the course



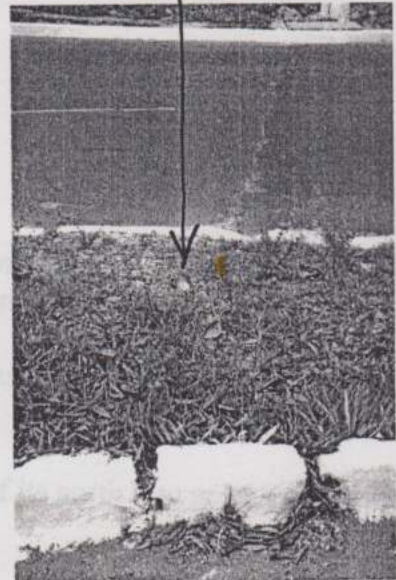
NAIL

South Turn - looking east - no adjustment required.



This is the South turn, looking to the north.

WOOD STAKE

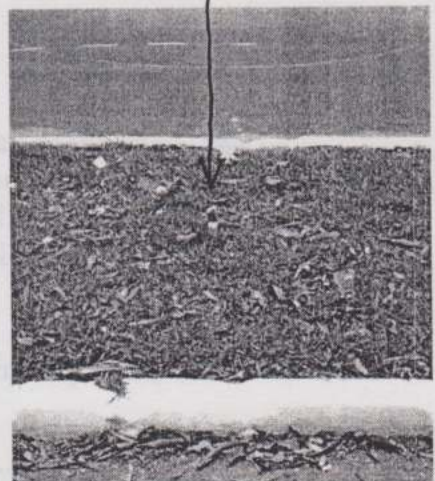


2195 m turn - looking east - this point must be moved north 1.36 m.

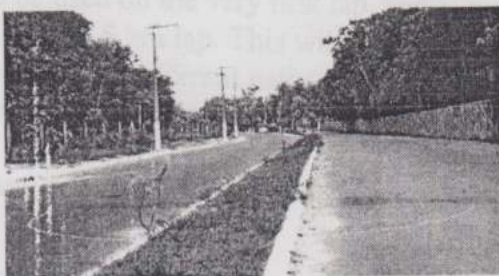


This is the 2195 m turn, looking to the south.

WOOD STAKE



2500 m turn - looking east - this point must be moved north 2.12 m.



This is the 2500 m turn, looking to the south.

Kate Kugel