Measurement News

September 2000 Issue #103

SYDNEY 2000
OLYMPIC MARATHON COURSE MEASUREMENT

The measurement team at the finish line in Sydney Olympic Stadium on Day 1. Left to right: Norrie Williamson (RSA), Stephen Jackson (AUS), Bob Braid (AUS), Mike Wickiser (USA), Dave Cundy (Race Director, AUS), Fran Seton (AUS), Hugh Jones (GBR), Peter Stewart (AUS).

Photo courtesy Mike Wickiser

MEASUREMENT NEWS

#103 - September 2000

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CHAIRMAN'S CLATTER - AUGUST 2000

For a change I won't be discussing maps or course renewals or even reminding everyone to look over the current course list. Having returned from Sydney, AUS I thought I would pass a long as much as I can regarding the Olympic Marathon and Race Walk measurements. Much of this has been in MNF but the redundant parts are worth repeating for those who don't get MNForum.

Olympic Measurements

Official measurement of the courses for the Olympic Marathon and Race Walks have been completed. Hugh Jones from the UK was appointed the "official measurer" for these courses and it is his responsibility to make final determination. Dave Cundy has been employed by SOCOG as Road Events Manager. Dave was able to get police authorization for a small group to ride along with Hugh on the measurement of the Olympics courses.

The measurement group consisted of Hugh Jones (UK), Mike Wickiser (USA), Norrie Williamson(RSA), Bob Braid (Perth), Peter Steward (SOCOG marathon venue manager), Fran Seton (triathlon results manager & Dave's spouse), Stephen Jackson (Olympic marathon course director) and Dave Cundy. Two 500 meter calibration courses were in place and they were checked during the course of the measurement.

On Saturday morning Aug. 19, 00 the group met at Sydney Olympic Stadium, calibrated bikes and measured the Marathon Finish, Race Walks. This was done to accommodate a short window of time we were allowed in the Olympic Stadium. There wasn't even time to take a lap around the track like several of did in Atlanta. After measuring several segments of the Race Walk and the last 2.75 km of the Marathon it was time to recalibrate and check the measured distances. I soon found out that I had missed a data point and couldn't determine the length of the 2km loop section for the race walk. Thoroughly embarrassed, I drowned my sorrows in some Australian beer.

On Sunday morning the group again met and prepared to measure the bulk of the Marathon course. Riding along somewhere near the half way point Bob Braid had a flat on his measuring wheel. Bob had changed tires on this bike the day before putting a better tire on the front as a safeguard against just such a possibility. While taking a break in Centennial Park Bob had a flat on his rear tire as well. This was definitely not his day. After leaving Centennial Park the measurement headed north, across the Sydney Harbour Bridge and into North Sydney to the Start. Traffic had to be stopped on the Harbour bridge to allow us to ride across it against traffic. Just at the entrance to the bridge Hugh Jones got a flat tire on his front tire. There wasn't even time to repair the tire as traffic had been stopped and we had to move along. A frazzled Hugh rode in the chase van to the Start line. Each of us took our own data and most supplied it to Hugh after completing a post calibration.

Hugh, Norrie, and Dave went out the next two nights so Hugh could ride the course for his own satisfaction and to obtain his own "official" data. When I left on Wednesday, there remained data to be turned in and Hugh and Norrie were working feverishly to make sense of all the data from the Marathon measurements.

From my data the course as measured is 42.1896 km. Short of the required distance by 5.4 meters. As for the final adjustment of the course, as official measurer, that is Hugh's call. After wrestling with several subsequent measurements Hugh finally added 9 meters to the Marathon course.

At the time of the group measurement, about 90% of the course was defined by either a white "spotting' line or the actual, race defining blue line. The blue line on the Marathon course is by far the finest I have ever seen. It is being laid down by a road painting company whose owner is a marathoner and the line follows the SPR beautifully. The only exception is that the line does not get down to 30 cm. at turns. Reason being the special "paint" won't adhere well to concrete. This line is bright enough that it can be seen as well as reflective lane markers in the pre dawn hours. There will be no doubt as to the Olympic Marathon route for competitors.

When asked, How was Australia, my answer is simple. I was only in Sydney and only for a short time, so I can't comment in depth but Sydney is one clean city! I never saw a single bit of litter anywhere. The locals are friendly and eager to please. I found pleasant running companions each morning and during the group measurement we came across a section of road at a turn where a construction crew had the road torn up for repairs. The crew graciously stopped work and moved a steel plate into place so the group could pass without leaving the SPR.

Oh, by the way, I lied about looking at the current course list. There are 2 errors that I found. First person to find them gets a t-shirt. Happy hunting!

Mike Wickiser

USGS TOPOGRAPHIC MAPS ONLINE

This may not be news to some, but it was to me. While surfing I discovered Maps.Com, and it has a section where you can click on to all USGS maps, free. This can be very handy for obtaining accurate elevation information.

Caution - some of the maps (Hopkinton, MA, for example) have contour lines in meters. Others (Kidron, OH) have them in feet. No information is given on the page to tell you which is which. Still, it's quite a resource.

Check out: Http://www.maps.com

Pete

EXERPT FROM THE OFFICIAL REPORT OF THE MEASUREMENT
By IAAF Appointed Course Measurer Hugh Jones

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MARATHON OF THE XXVII OLYMPIAD

SYDNEY, AUSTRALIA **WOMEN: 24 September 2000**
MEN: 01 October 2000

Dave Cundy, Road Events Manager of the Sydney Organising Committee for the Olympic Games, had arranged for a measurement of the course in two sections: from the finish line back to a point at about 39.5km on the course on the Saturday; and then from this same point back to the start on the Sunday, again measuring in the reverse direction.

The Saturday measurements were done using a calibration course just outside the stadium, on Edwin Flack Avenue. After measuring on the walks course we measured from the finish line in the reverse of the running direction, moving out to lane 5 in the back straight and taking the top bend in lane 5 before moving to lane 8 approaching the stadium tunnel. The exit to the tunnel is on an 8.3m coned radius. Outside the stadium we observed the course restrictions on Dawn Fraser Blvd, moving into the opposite carriageway (in the running direction) at the first lamp post. We stopped at the next corner to note exactly how it would be barriered, and then measured between chalk marks Dave Cundy laid out. After the 40km reference the turn into Shirley Strickland Ave was also taken with barrier restrictions in mind (see map details). This measured section was completed at the 'mousehole', a tunnel under a road which gives access to the M4 highway.

On Sunday morning we resumed measuring from this point, again in the reverse of the running direction, and stopped at reference landmarks every kilometre to note our counter readings. This proved straightforward up to the 25km point, but from there on we were consistently riding against traffic, which was becoming heavier. The police escort had a difficult task to clear a path through the traffic and we often had to bide our time. Just before the 13km point we froze counters and transferred to a point 27m further down the course, on the other side of a tarmac ramp still to be built. We rode around Centennial Park, still in the reverse direction, and stopped for 30 minutes just past the 10km point. Resuming the route on Anzac Parade and Oxford Street, congestion was severe and progress slowed.

My own progress was halted completely at about 4.5km from the start, at the end of the Cahill Expressway, when I hit a drain grating and punctured. I observed the rest of the group making the crossing of the Sydney Harbour Bridge from the support vehicle. My own data was lost as no recalibration was possible.

I was able to collect data on a second ride undertaken early on Monday morning. The blue line was being laid over the Bridge, and I was able to measure from the south pylon to the start, with references taken at the kilometre points. I made a second ride of the first kilometre as this is sharply downhill, and found the reading 6 counts less. Returning to my south pylon reference I then resumed in the running direction. I paused at the moveable median and we had some discussion about its path of movement before I proceeded.

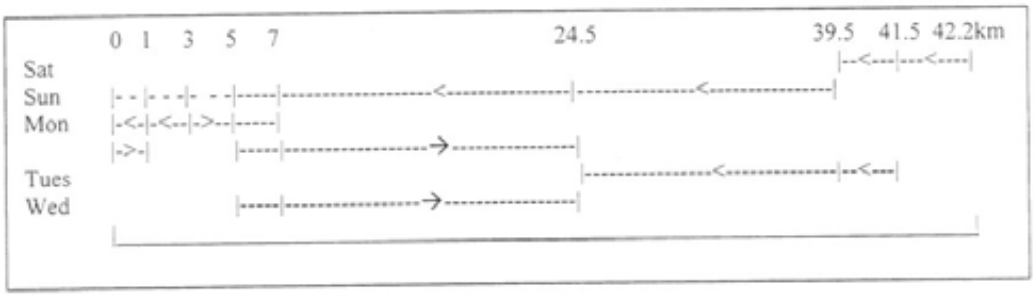
The section from 5-24.5km was done quite quickly as I could be effectively protected from behind by a single vehicle, and there was very light traffic on the roads. The blue liners were also working inside Centennial Park, so I could measure the complete course, without a break and including kilometre references, from the start to 24.5km. Both calibrations were done on the Hickson Road calibration course in the City, but the significance of this fact did not emerge until later.

The next night, accompanied by Norrie Williamson and with Dave Cundy again providing vehicle support and protection, we measured from just outside the Stadium back to the

24.5km reference point. We calibrated on the Edwin Flack Avenue calibration course outside of the stadium and recalibrated on the Hickson Road course. The measurement (including kilometre references) proceeded smoothly and quickly, with only 90 minutes between calibrations and only 0.5C temperature difference

It was therefore surprising to note that the calibration rides consistently showed that there was eight counts of difference over the 500m (16 counts/km). Mike Wickiser and I had previously checked the taping of the Hickson Road calibration course on Friday 18 August, but when Norrie Williamson, Dave Cundy and I taped the Edwin Flack Avenue course it proved to be equally accurate. We again checked the Hickson Road course and set up another 300m calibration course in the middle of the road, which allowed a small bend in the 500m course to be removed. Norrie Williamson and I returned early in the evening of Wednesday 23 August to compare calibrations on these adjacent courses. My results showed that only a single count per kilometre could be accounted for by inadvertent 'shaving' of the taped calibration course line, by taking a more direct route between the end points. This possible explanation of the calibration differences rejected, I was anxious to complete another measurement of the 5-24.5km section of the course, this time with calibrations on both courses before and after the measurement. This involved as much strain on the vehicle driver as the riders, and Chris Robb gave Norrie and I great support in ferrying us out and back to the Olympic Park calibration site as well as providing protection for us during the ride. He also negotiated opening of the Centennial Park gates to allow us access for another unbroken ride.

The various measurement rides of the marathon course are summarised in the diagram below:



Basis for calculation of distance

The group ride used the average of Olympic Park pre-measurement calibration and Hickson Road post-measurement calibration. The large variation I found in my calibration constant between the two courses, required use of the same average to obtain any comparable result. This is why the 5-25km ride was duplicated: to use the data with a constant averaged over both courses. The only section for which I could not get a measurement sandwiched between Olympic Park pre- and Hickson Road post-calibrations was from 0-5km, across the Bridge. I therefore calculated a 'virtual' Olympic Park pre-calibration constant for this ride from the exhaustive calibration data that I had collected (see boxed text below).

Calculation of overall distance

Using the average constant to calculate segments:

finish-mousehole (39.5km): 84697 – 58000 = 2667 / 9.641632		=	2768.93m
mousehole – Liverpool St: 237031 – 94410 = 142621 / 9.5870775		=	14876.37m
Liverpool St – Parlmt Ho:	252442 – 65000 = 187442 / 9.5882035	=	19549.23m
+ taped distance:			27.00m
start ref. – Parliament House:	47669 / 9.5869095*	=	4972.30m
TOTAL		=	42193.83m

*Notes on method of constant calculation:

- For measurement of the first 5km of the course both calibrations were done on the Hickson Road calibration course. Because there was a wide discrepancy between calibrations derived from each course (see account of measurement above), I generated a 'virtual' calibration constant for the Edwin Flack Ave. calibration course and averaged it with the actual average value obtained for the Hickson Road course (9.5783185/m).
- The 'virtual' value was calculated by multiplying the pre-measurement Hickson Road calibration figure (9.5793197/m) by a factor of 1.0016892, obtaining 9.595501/m
  Then (9.595501/m + 9.5783185/m) / 2 = 9.5869095/m
- The multiplication factor is the sum of counts obtained on all calibrations of the Flack course divided by the sum of counts obtained on the Hickson Road calibration course *using same-day calibrations under like temperature conditions only.*
- i.e. $\frac{\text{Flack total counts}}{\text{Hickson total counts}} = \frac{9586.5 + 9588.25 + 9585.5}{9571.5 + 9570.75 + 9569.5} = \frac{28760.25}{28711.75} = 1.0016892$

BUT, using the larger constant for calculation of segments:

finish-mousehole: 84697 – 58000 = 2667 / 9.644635 = 2768.06m
mousehole – Liverpool St: 237031 – 94410 = 142621 / 9.5950855 = 14863.96m
Liverpool St – Parlmt Ho: 252442 – 65000 = 187442 / 9.5978382 = 19529.60m
+ taped distance: 27.00m
start ref. – Parliament House: 47669 / 9.5793197 = 4976.24m
TOTAL = 42164.86m

Difference = approx. 29m or nearly 70% of SCPF
This accounts for only one possible source of error in the measurement – assumed to be the reaction of the bike tyre to different textures of road surface. To bolster the SCPF back up to 0.5m/km I added a further 7.8m in addition to the 1.17m required to bring the measured distance up to 42,195m. **The start line was therefore fixed 9.0m north of the start reference point, lamp-post MO79282 on the east side of Miller Street,** as indicated in the sequential presentation of elapsed distance below:

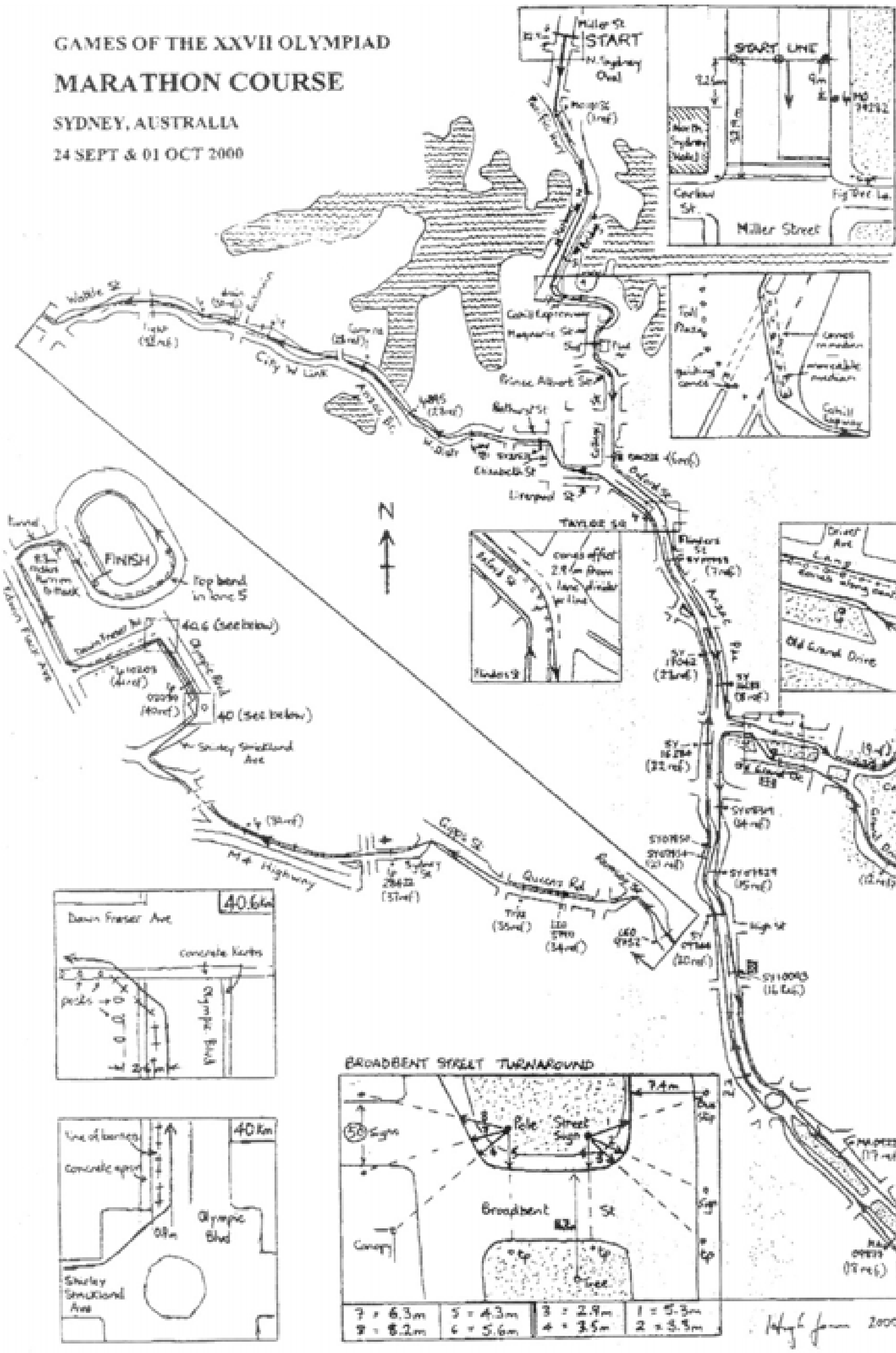
Ed Note: The rest of Hugh's report documents in detail his measurements of the Olympic Marathon and Race Walks.

GAMES OF THE XXVII OLYMPIAD

MARATHON COURSE

SYDNEY, AUSTRALIA

24 SEPT & 01 OCT 2000



Measurements of Sydney Olympic Marathon Course - 19 to 21 August 2000

Name	Hugh	Mike	Dave	Fran	Bob	Norrie	Steven	Peter	Geoff
precal - 19 Aug. 07:30									
	4817	4825	5521	5482	5668	5630.5	5694		
Edwin Flack 500 meters	4818	4825	5519	5483.5	5667	5631.5	5695		
	4817	4825	5521	5482.5	5667	5630.5	5694		
	4818	4824	5522	5484	5666.5	5631.5	5695		
postcal - 19 Aug. 10:00									
	4813.5	4823	5520	5476.5	5660	5628.5	5690		
Edwin Flack 500 meters	4814.5	4822.5	5522	5478	5660	5628.5	5690		
	4813.5	4822.5	5521	5476.5	5660	5626	5689		
	4816.5	4822	5521	5477.5	5659	5628.5	5691		
Counts Obtained									
Finish Line	58000	58000	37876	237000	696100	154630	778072		
41km- LP 10203	69506	69526	51075	250102	709614	168077	791680		
40km LP 02039	79198		62177	261138	720998	179406.5	803138		
End restricted post	84564					185677			
Red Dot	84697	84735	68481	267414	727455	185833.5	809645		
Marathon course Day 2									
precal - 20 Aug									
	4819	4826	5522	5484.5	5640	5632.5	5686	4810	5577.5
Edwin Flack 500 meters	4818.5	4825.5	5523	5484	5639	5633	5686	4809	5577
	4819.5	4824.5	5523	5484.5	5639.5	5633	5688	4811	5578
	4818.5	4826	5523	5484.5	5639.5	5632	5686	4811	5577
postcal - 20 Aug									
		4821	5527	5474.5		5625	5675	4801	5567.5
Hickson Road 500 meters		4819	5527	5473		5626.5	5675	4798	5566
		4820	5527	5474.5		5625	5675	4799	5566
		4819	5527	5474.5		5623	5675	4799	5565
Counts Obtained									
Red Dot	25000	12800	211000	416000	878900	331556	948832	35760	960720
35	67671	55534	259904	464595.5	928818	381454	999196	78363	1010105
30	115914	103857	315209	519546.5	985273	437867.5	1056147	126537	1065959
25	164165	152189	370488	574478	1041741.5	494282	1113095	174723	1121785
21.0975	201804	189891	413646	617334.5	1085813	538286	1157529	212316	1165351
20	212342	200448	425735	629332.5	1098151	550606	1169966	222849	1177545
15	260460	248856	480919	684095.5	1154480	606885	1226763	270906	1233233
at Lang / Driver ramp	279060	267289	502258	705264.5		628628	1248717		1254757
27 m addon (taped)									
at Lang / Driver ramp -restart measure	279060	267289	502556	705661	1165742	628628	1248717		1255000
10km	308541	296820	536373	739098	1200539	663086	1283820	318893	1289106
Media stop	312556	300844	540979	743668	1205275	667762			
5km Parliament	356784	345158	591713	793981	1257474	719495	1340748	367069	1344909
Hugh Puncture			597962			725868			
4km			602797			730793			
3km			613327			741527			
2km			625033			753456			
1km			636020			764640			
start		393146	646676	848469	1314051	775511	1397287	414895	1400315

Above are data only, and include no calculations except for the computation of individual calibration ride counts

Below are calculations only (By Pete Riegel) and include no data

Name	Hugh	Mike	Dave	Fran	Bob	Norrie	Steven	Peter	Geoff
Aug 19 constant (with SCPF)	9641.632	9656.897	11052.792	10971.085	11338.202	11270.134	11395.885		
Aug 20 constant (with SCPF)		9654.895	11060.800	10969.459		11268.758	11372.862	9619.110	11154.644
Total Finish to Red Dot, meters	2768.9	2768.5	2769.0	2772.2	2765.4	2768.7	2770.6		
Total Red Dot to Start, meters		39421.1	39389.3	39415.7		39424.0	39459.0	39441.8	39414.4
Total course		42189.6	42158.2	42187.9		42192.7	42229.6		

Whole Course Measurements	
Dave	42158.2
Mike	42189.6
Norrie	42192.7
Fran	42187.9
Steven	42229.6

Later Measurements by Hugh & Norrie	
Norrie	42190.6 Calculated by Norrie
Hugh	42198.7 Calculated by Norrie
Hugh	42193.8 Calculated by Hugh

Final course adjustment: 9 Meters added to course

This is only a first cut at analysis, as all data and results have not been examined by all measurers. Contributions are solicited.

As this sheet was being prepared, questions arose concerning some of the group-ride data. More analysis is being done, but is not complete.

SOME OLYMPIC MARATHON MEASUREMENT PHOTOS

from Norrie Williamson & Mike Wickiser

Norrie (L) and Hugh (R) atop Sydney Harbour Bridge. Marathon route may be seen over Hugh's left shoulder. Note safety belts.

Hugh at the beginning of the construction zone.

The group in Park Row. Note the blue line.

Approaching Sydney Harbour Bridge

On Anzac Bridge

At the Hickson calibration course

COURSE DETAILS - THE 2000 SYDNEY OLYMPIC MARATHON

- Start on Miller Street, outside North Sydney Oval (33 metres north of Carlow Street)
- Continue south (downhill) to Pacific Highway
- Half left onto Pacific Highway to roadway entrance for Sydney Harbour Bridge
- Enter lanes one, two, three, and four of roadway on the bridge, transitioning to lanes seven and eight. The moveable median at the toll plaza on the south side of the Bridge is worth noting - it could account for different interpretations of the SPR
- Cross Sydney Harbour (Routes 2, 40)
- Angle left onto Cahill Expressway
- Exit Cahill Expressway onto Bridge Street and then onto Macquarie Street
- Left (south) onto Macquarie Street
- Pass New South Wales Parliament House (~5 kilometers)
- At Queens Square, where Macquarie Street ends, half left onto Prince Albert Road to College Street
- Half right onto College Street, passing Hyde Park, to Whitlam Square
- Half left onto Oxford Street to Taylor Square
- Half right onto Flinders Street, which crosses South DowlingStreet and then becomes Anzac Parade
- Continue south on Anzac Parade to Lang Road
- Left onto Lang Road and into Centennial Park, encircling the Park's central expanse for ~3.8 kilometers(~10 kilometers is near the Federation Pavilion) and returning to Anzac Parade along Old Grand Drive, transitioning to Lang Road near Driver Avenue.
- Left onto Anzac Parade, continuing past the University of New South Wales into suburban Kingsford
- Continue south to turnaround point at Broadbent Street just north of Avoca Street intersection in suburban Kingsford
- Return northward on Anzac Parade to Flinders Street (~23 kilometers)
- Half right onto Flinders Street to Taylor Square
- Half left onto Oxford Street to Liverpool Street
- Left onto Liverpool Street, passing the south side of Hyde Park, to Elizabeth Street
- Right onto Elizabeth Street alongside west side of Hyde Park to Bathurst Street
- Left onto Bathurst Street (~25 kilometers) and proceed west to Anzac Bridge in suburban Pyrmont
- After the bridge crossing, follow City West Link Road in suburban Lilyfield to Dobroyd Parade in suburban Haberfield
- Continue on Dobroyd Parade to Ramsay Road
- Right on Ramsay Road (~ 32 kilometers) to Fairlight Street in suburban Five Dock
- Left onto Fairlight Street, crossing Great North Road and continuing as Queens Road past Williams Street (~35 kilometers)
- Queens Road becomes Gipps Street in suburban Canada Bay
- Continue on Gipps Street to Sydney Street in suburban Concord
- Left onto Sydney Street to its end at Concord Road
- Cross Concord Road onto the exit ramp off the M4 Motorway in suburban Strathfield
- Continue along eastbound lanes of the M4, entering Sydney Olympic Park via bus tunnel ("mouse hole") in suburban Homebush Bay
- Proceed on Olympic Boulevard around southeast and southwest sides of Olympic stadium to the marathon tunnel on the west side
- Through the stadium tunnel onto the stadium track near the 100 meters sprint start
- Within the stadium the top bend is run in lane 5 as far as the 800m break point.
- Continue to the finish line, then run one additional lap around to end at the standard finish line for running events

The above course description appeared in *The Olympic Marathon - The History and Drama of Sport's Most Challenging Event* by David E. Martin and Roger W. H. Gwyn (Human Kinetics, 2000). Some corrections were kindly provided by Dave Cundy and Hugh Jones.

Measurement of the Olympic Marathon course, Montreal, 1976

by R. R. Wallingford

Ron Wallingtord was the Race Director of the Montreal Olympic marathon and is now Technical Coordinator of the Canadian Track & Field Association. The "bicycle method" of course measurement described in the article is the official CTFA method for measuring road courses. Further information on road course certification can be obtained from'the CTFA National Office. 355 River Road. Vanier. Ont. KIL SC1. (Note: This address is out of date)

Due to the very late completion of the ramps leading down to the stadium (June 26th, 1976), the final measurements of the Montreal Olympic marathon course were only taken after this date. However, the course had been measured by a professional survey crew in March 1976, using blueprints for calculating the connecting ramp distances with the main road course measurements. Since the telephone company needed to know the location of the 5 km points in order to plan installation of telephones used to relay en route information back to the stadium, a survey crew was hired by COJO (the Olympic organizing committee) to do this job.

The survey crew followed the basic international (IAAF) rules of staying one metre from the curb in the running direction and taking the shortest distance between two points, on curved roads. A steel tape was used for all curved areas and a distomat measuring instrument was used to record the straight lines The distomat measures the time taken for a beam of light to be reflected from the measuring point to its source and thus measures "air" distance and not the undulations of the pavement. In several instances, snow had to be shovelled out of the way to accomplish this feat. It took the survey crew three weeks to complete the task.

The crew inserted nails in the asphalt as bench marks along the course in several places and appropriately identified these points for us in drawings for future reference. Unfortunately, one-third of these nails were occluded by the fresh paving of a third of the course in preparation for the race before we could use them. The few points we did locate served as a double check for us when carrying out the actual measures.

The writer as Marathon Race Director, along with Norm Patenaude, an experienced marathon runner, and Canadian distance runner Peter Quance formed the nucleus of a team which set up the official measurement.

Cursory exploratory measurements took place using the calibrated bicycle method, verifying the basic surveyed course except for the stadium ramp These preliminary experiences convinced us of the importance of having an experienced rider (Norm Patenaude) and a first rate bike after out initial bad experiences We found that we had to do all our measurements at night and under police protection. The reasons were that the air in the tires expanded if we started in the morning and proceeded during the heat of the day, thus causing the bicycle to lose its original calibration. In addition, the traffic was too formidable to attempt to go against it during the day, especially while charting the shortest distance across curved roads.

Our first task was to get the surveyors to measure the standard kilometre on a flat straight section of the course. This was measured with a distomat and then three times by steel tape under the supervision of a land surveyor. The steel tape measures were 5 13/16" (14.6 cm), 2 1/8"' (5.4 cm), and 2 1/2" (6.35 cm) short of the distomat measures in a kilometre. The distomat evidently loses this much in the undulations of the pavement and so is not too reliable for standardizing a kilometre or measuring a course.

Using the mean of the steel tape measures, we proceeded to calibrate the bicycle late in the evening and continued through to daylight the next morning. A Jones Counter, which records 20 counts per revolution of the bicycle wheel, was employed. Norm Patenaude rode over the kilometre course three times to calibrate, recording 9359, 9358 and 9357 counts. We then pegged 9358 counts as being the equivalent of 1 kilometre. We started in the stadium at the point the surveyors calculated to be the start and proceeded with the measurement. Each kilometre was duly marked on the pavement with a spray can, and notes taken as to its location. After measuring the course, we rode over the kilometre distance twice more to check the calibration of our bicycle. Our recalibration on the kilometre course was dead on, being 9358.5 and 9357.5 counts.

Our first result had a discrepancy of 81.8m with the surveyors' result. The surveying crew on rechecking their

figures found a discrepancy of approximately 50 m due to a blueprint change from the original design, leaving their measure and ours about 30m different. I would suspect a distomat distance to be approximately 30m too long if used exclusively due to the lack of "credit" for undulations of the pavement .

Using our earlier measure as a basis for starting, we carried out the second official verification measure. Calibration of the bicycle before course measurement gave readings of 9334, 9334.5, and 9335 counts. We considered 9335 to be the official kilometre count. Our verification measure was never more than 3 metres different from the first one at any of the 5 km points and in fact ended up with an incredible 8 count difference in 393,890 total counts for the course. The 6 counts verified the earlier measure by within 0.86m. Our recalibration was again dead on, being 9335, 9334 and 9335 for three rides taken over the earlier calibrated kilometre.

We were in touch with Ted Corbitt of New York who graciously advised us as we proceeded with our measurements, and thus ensured more reliability. We feel that since the bicycle did not lose its calibration and that all the intermediate check points were consistent, we had an extremely accurate course

Other sidelights on the race organization

Because of the numerous intersections (more than 400 on the course), we insisted on the painting of a 4" (10 cm) blue line. This was very difficult as the blue was distinct for only so long when painted on busy city streets. With several patch-up jobs and good cooperation from the five municipalities through which the race passed, the lines were ready by race day.

Although the course had several turns it was as flat as was practical for a race being held in a congested city. The relatively cool day with comforting rain allowed the quality field to perform up to expectations. The electrical vehicles used by TV personnel also allowed closer proximity to athletes without affecting the runners. We had a TV dress rehearsal one week before with several athletes who had a tour of the course. This helped us get a preliminary feel for the actual event. As a result, TV coverage of the actual race was excellent.

Our major problem was relaying times from the early kilometre points. Even our well-trained specialized time place recorders had trouble at the 5 km point where the first 34 runners went by in three seconds. Unfortunately the runners rounded a bend just before this point which added to the difficulty. Other minor problems were also encountered. Due to internal problems in COJO, black on red numbers were substituted for the black on light blue originally ordered. These were not as distinct on an overcast day as they should have been. Also, the overhead helicopters involved with the live TV coverage unfortunately drowned out the voices of the officials at the checkpoints who were reading athletes' numbers into tape recorders for use in monitoring places.

One electric vehicle had a person to identify numbers on the run and call them to a recorder. This would have proven satisfactory if the electric vehicle doing this task had not had mechanical trouble.

By having triple checks in most instances the few unexpected problems did not appreciably affect the total result. The lay-out for refreshments seemed quite good although not having the expected heat we could not test the system accordingly. Essentially, every athlete had a potential drink opposite his number at each refreshment station, with ten numbers per table.

As a final point, I would suggest that the bell be rung (at least for the leaders) when they have one lap to go in the stadium. I believe this would tend to dramatize the last lap, and reinforce earlier instructions on distance remaining in the stadium.

This article was published by *Canadian Track & Field Association*. It was sent to Pete Riegel in 1982 by Bob Baumel, and appeared in *Measurement News #2, December 1982*. The above was scanned from the original. The Editor assumes responsibility for any errors.

Note that the above, written decades ago, contains descriptions of procedures that are no longer standard practice. A discussion of these differences may be found on the RRTC web site at **www.rrtc.net**

LAST MONTH'S PUZZLE ANSWERS

The Puzzle:
All those jokes about times being taken with the school alarm clock, or the local sundial, seem pretty tame compared to this one.

The Stockholm Olympic Marathon was on a STRICT out-and-back course from the stadium track through Stocksund and Tureberg to the turnaround at Sollentuna. The OR states that "Stocksund [was] about 3 miles (circa 5 kilometres) from the start, and ... Tureberg, 9 miles (15 kilometres) from the Stadium." It also says that the race began at 1:48 pm, and I've collected all the useful split times (pm!) and finish times (elapsed!):

	Stocksund	Tureberg	Sollentuna	Tureberg	Stocksund	Finish
1st	2:17:26	2:42:32	3:01:15	3:22:41	4:02:20	2:36:54.8
2nd	2:17:26	2:42:32	3:00:40*	3:22:40*	4:02:20*	2:37:52
6th	2:18:10	2:44:03		3:26:10		2:43:24.9
13th	2:17:26	2:44:28		3:29:40		2:51:06.6
21st	2:17:39	2:43:10	3:02:30	3:26:24		3:01:39.2

For the record, those are indeed the places they finished, and the asterisks just indicate who was leading, so ignore them too. Also, until the IAAF set the distance at 42.195 km in 1921, a typical Scandinavian marathon was 40.2 km, but again this is no big deal. If necessary redefine them so the course IS 40.2 km, as long as the turn, at Sollentuna, is indeed half way, 20.1 km!
Puzzle: How is this mess reconciled? (When did it really start?!)

Puzzle by Malcolm Heyworth

ANSWERS

From Brian Smith: One may need better statistical tools than I have to approximate the starting time .... but ... if we focus on first and second place winners (wasn't the winner in 1912 a South African ? as I once was... Can't find my record book) for whom we have the most data it is obvious that they ran a faster "out" than "return". This could have been due to uphill on the return but more likely fatigue, but it is of no matter.

Tureberg to Sollentuna was about 14.4% faster than Solentura to Tureberg ..... and Stocksund to Tureberg was about 58% faster than Tureberg to Stocksund.

But Stocksund to Tureberg is about twice as long as Tureberg to Sollentuna. To pro rate the speed differences sugests the second half was covered about 43.5% slower than the first ..... WOW .... that would have meant a blistering 64:30 for the first half .... it could have been down hill ..... if these guesses and approximations are anywhere near the mark that would mean a starting time of ... 1:56:45 pm

From Bernie Conway: Here is my guess as to what happened in the pre 1921 Stockholm Olympic Marathon. I believe that the observer in Stocksund wrote the initial time down as 2:07:26 and then misread it as 2:17:26. The observer then just wrote the seconds down for the remaining runners as they were closely packed. My reasoning is that this would result in a 3.5 minute per km pace, which is close to the pace for other sections of the race.

Secondly, I believe the actual start was at 1:50 not 1:48. This would again give a pace closer to 3.5 min/km.

My question is "What happened in the section from Sollentuna back to Tureberg"? The pace indicates 4.5 min/km. Was the turnaround actually a turnaround a large block of approximately 860 m circumference in Sollentuna? Did the timer only time the runners as they entered the town and not when they exited?

From: Malcolm Heyworth: "so the race really started at 1:48:28 pm by the Stocksund clock!"

From Pete Riegel: Dear Malcolm, I'm boggled by your analysis (ed note: it was massive and complicated). I assume the above is your conclusion for the starting time. I find it implausible because that makes the outgoing first split 28:58, and the return over the same distance 23:03, and this at a time when they were dying. I'd expect a faster first split.

It could be that the first half was downhill and the second uphill, or with hills placed cunningly to confuse things. From the puzzle as stated it's impossible to tell. Also, I saw no reason to assume any error in the timing. My method did not make any assumptions about split distances, but I did use an assumption that the course was probably a bit short, as I didn't want a first half that was a WR for the half-marathon.

I used only the data for the race leader and ignored the rest.

After looking at the data a couple of ways I have come to the conclusion that justification exists for a range of answers. The field died badly in the second half, and after some diddling I conclude that the start time was 1:55. Final answer. My method was mainly cut-and-try until I got what, to me, was most plausible. (Note: I sent my answer to Malcolm before receiving his)

Can you summarize your methodology in ten lines or less? If not, I'll do my own summarizing, as your explanation is too complex and lengthy to be useful to many.

As I said, I await the contributions of others.

Let's see what you have. If it's to be published in Measurement News, I hope it is short and snappy, and not a huge long analysis of data which, in my view, has no one correct interpretation. Too bad the answer isn't known. It will be interesting to see what others may think.

Best regards, Pete

From Malcolm Heyworth: Dear Pete:

"I'd expect a faster first split." Speaking of records, try comparing the times between Stocksund and Tureberg each way too! Perhaps you'll change your mind when you say, "I saw no reason to assume any error in the timing."

If you think the 1:12:40 split at the half (20.1 k, so NOT a half marathon by today's standards) was good, the split in the next OM (again strict out-and-back) is given as 1:13:10 and ONE of those runners finished in 2:32:35.8 for a new "WB" when the course length is given as 42.75 k for anyone stupid enough to believe it, but, as I've said, it was Antwerp! Nurmi won the 10 k in 31:45.8, which IS credible!

As for hills, the course description in the section titled A Flat Course Suggests Fast Times says: "With its minor grade changes... ."

If you want it in ten lines or less you better do it yourself. That'll at least give me an out.

From: Ray Thompson: Looking for a simple solution, I propose that the race did start at 1:48 PM (?late 1:45 scheduled start), and that the initial 5k splits at Stocksund were (somehow) all recorded as 10 minutes too long. All other times are OK as noted. The consequences of this proposal are "reasonable," but not as "smooth" as some may desire. In particular, the second half split for the winner is 10 minutes slower than the first (? headwind, fatigue, strategy), and the final 5k split seems rather slow. Last 5k times indicate considerabl;e slowing, but winner had been pressed by 2nd place finisher until almost the end; perhaps everyone faded.

Summary of answers:

Brian Smith	1:56:45	
Pete Riegel	1:55	
Bernie Conway	1:50	Brian and and Pete did not consider that there might be error in the recorded
Ray Thompson	1:48	times taken at Stocksund. Bernie and Ray agreed with Malcolm - a timing error
Malcolm Heyworth	1:48:28	occurred there.

TEMPERATURE CORRECTION

I received the following calibration course information from a measurer:

Two 1000 foot measurements were taken. They differed by ½ inch. Temperature was 52F. No temperature correction was made.

I asked the measurer to clarify, and received the following message:

The second cal course measurement was short of 1000' by 1/2 inch, therefore 999.96'.

I replied: Does this mean the second measurement of 1000 feet terminated 1/2 inch before the first? If so, the second measurement of the same distance was 1000.04 feet . Please explain. Can you see why I am puzzled?

I received this reply: *We started our measurement of the cal course at the point by the water tower, call this starting point A measuring south 1000' marking a temporary point B at the terminus. From point B we measured north back to point A. The distance was 1000.04'. I set the permanent point B at that distance, 1000.04'. I'm sorry about this confusion. Does this clear it up?*

It cleared it up in my mind. Later I reflected that I might have been overly strict, and wrote: "I did not mean to be brusque with you about the calibration course, and in my haste I neglected to give you a lesson." Here was the lesson:

1) You lay out 1000 feet, putting a mark at the starting point and a nail at the far end, as you will be doing your adjusting at the starting point when you return from your second measurement.

2) You are now at the far end. In your mind you are now a surveyor who has just discovered an ancient calibration course. You have no idea how long it is SUPPOSED to be. You want to find how long it IS, so you take a measurement. It turns out to be 1000.04 feet long.

3) You measure the temperature - it's 52 F.

4) The average of the two measurements is 1000.02 feet.

5) You use the formula on the Steel Taping Data Sheet:

Correction Factor = 1.0000000+(.00000645x{Temp(F)-68})

or, CF = 1.0000000+(.00000645x(52-68))
or, CF = 1+(.00000645x(-16))
or, CF = 1+(-.0001032)
or, CF = 1-.0001032
or, CF = .9998968

Now, Correction Factor x Average Raw Measurement = Corrected Measurement

or, .9998968x1000.02 = 999.917 feet. This is the final measured length of the calibration course. If you want, you can lengthen it by .08 feet to make it an even 1000 feet, and drive the final nail.

Pete

COURSE MEASUREMENT EXERCISE IN FRANCE

On May 21, 2000, a measurement exercise was held in the area of Le Pouliguen-Guérande, on three separate circuits. Organized by Michel Provost and Jean-François Delasalle, the exercise included 33 of France's measurement officials.

Boucle de la Mer

Boucle de Intermarché

Boucle de Lidl

Results of the measurement exercises may be seen at right.

	La Mer	Intermarche	Lidl
Measurers	29	32	28
Average, m	1718.09	984.14	1418.89
High, m	1719.75	986.10	1420.40
Low, m	1716.86	980.26	1417.13
Std Deviation, m	0.76	1.20	0.72
Std Deviation, m/km	0.44	1.22	0.51

Summary of Measurements

In addition to the measurements of the three loops, Jean-François threw in a rather sticky exercise, which readers will see as our MN Puzzle of the Month.

By Jean-François' reckoning, 11 of the measurers got it right. 14 others were very close. Seven either had no result or had an improper one.

I don't know how much time the people had to solve the puzzle, but your Editor thinks he would have had a hard time with it.

	Boucle de La mer	Boucle de Intermarché	Boucle de base du circuit Lidl
Alt Patricia	1718.30	985.09	1418.86
Bonato Gérard	1718.04	984.10	1418.75
Bouillon Alain	1717.22	984.33	1419.50
Brard Gérard	1719.62	985.20	1419.55
Calenge J.Pierre	1719.09	983.48	1417.13
Callais Marcel		980.26	1418.64
Corgier Roland	1718.60	984.10	
Cosquer Thierry	1717.23	983.98	1418.84
Debrion René		985.43	1420.40
Delasalle J.François	1717.44	983.72	1418.23
Delerue Christian	1718.80	983.99	1418.47
Ducasse J.Pierre	1718.00	980.77	1418.09
Father Alain	1718.09	984.81	1419.04
Gougat Michel	1718.20	983.76	1419.91
Grall J.Marie	1717.81	984.00	1419.01
Hamard Julien	1716.86	983.97	1418.70
Ingueneau J.Paul	1717.70	986.10	1419.51
Julien Bernard	1718.32	984.07	
Marechal Isabelle	1718.30	984.73	1419.42
Mercier Jean	1719.71	984.82	1419.30
Mongin Hervé	1718.60	983.90	1418.75
Morel Maurice	1719.75	985.70	1419.22
Mourretas Pierre	1718.01	984.32	1418.03
Picotin Christian	1717.22	984.39	1419.16
Préault Pascal	1718.12	984.36	1419.39
Pretat Raymond	1717.43	983.41	1418.27
Provost Michel	1718.07	985.12	
Segura Antoine	1717.55	983.66	
Servais Fernand		985.98	1420.14
Tudoce J.Louis	1717.64	983.18	1418.62
Vaillant Claude	1717.65	983.71	1418.03
Voiriot André	1717.38	984.07	1418.08
Moyenne	1718.09	984.14	1418.89

PUZZLE OF THE MONTH

At Jean-François Delasalle's "Boucle de Lidl" loop at the Le Pouliguen-Guérande Seminar, attendees were asked to solve a version of the problem shown below. The course is a proposed 10 km. The start is fixed at point B. The finish is fixed at point F, which is located within the entrance drive to a supermarket.

Measurement data were obtained as shown in the captions of Figures 1 and 2. All distances are in meters.

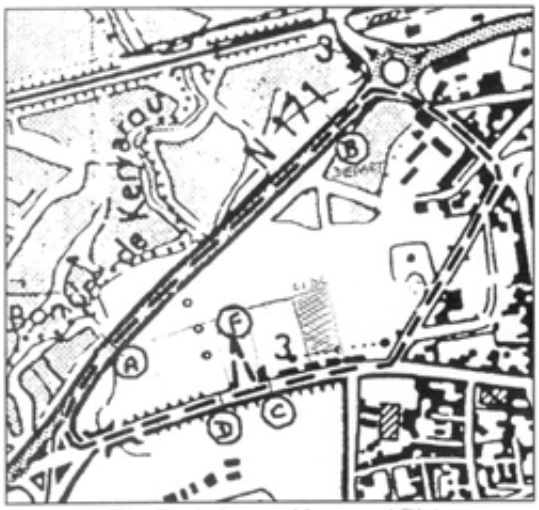


Figure 1 - The Basic Loop - Measured Distances

A	
B	349.70
C	719.49
D	26.54
A	322.50

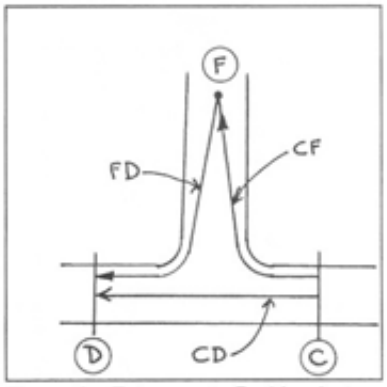


Figure 2 - Entrance to Parking Lot Measured Distances

C	
F	79.63
D	82.11

A 10 km course is desired. The running route is:

Start at Point B
Run clockwise around the loop to Point C
Complete 6 laps from C to C
Run from C to the finish at F.

In order to get the extra distance needed, a turn-around will be placed in the driveway. It is curbed and has a radius of 1.5 meters. Ignore the width of the driveway. Runners will pass around this turnaround on each of their 6 laps.

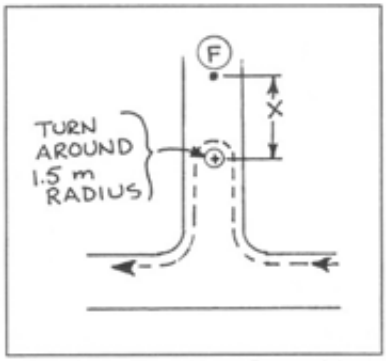


Figure 3 - The Puzzle - For a 10 km course, what should be the offset X from point F?

What is the needed offset from point F to the center of the turn-around, and in which direction from F does it lie? Assume north is upward in Figure 3.