Beijing 2008 Olympic Games

Marathon & Race Walks Measurement Reports

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Official Measurer, Beijing 2008 Olympic Games

COMMENTARY ON OLYMPIC MARATHONS AND RACE WALKS

I travelled to Beijing in July 2008 to measure the Olympic Marathon and Race Walking courses and returned on 12 August in preparation for my role at the Olympic Games as the official course measurer. My measurement reports follow this commentary on my experiences during the Olympic Games.

Pre race

On the morning of 13 August I attended the technical meeting, held at the Athletes' Village. A special component on the road events was held immediately after the main technical meeting, and I was on hand to answer various questions about the course.

At the time of measuring in July, we had no access to the track at the National Stadium as it was covered in preparation for the Opening Ceremony. So my first job on arrival in August was to check the measurements inside the stadium for both the start and finish of the race walks and the finish of the marathon. As indicated in my reports, these measurements proved to be consistent with data provided by BOCOG.

I was able to observe the race walks course as it was being set up on the day prior to competition. My hotel was adjacent to the stadium and the 2km lap for the walks course was on the Olympic Green, immediately outside the stadium. The 2km lap of the walks course was now covered with carpet, which was being used to counter the hard granite surface of the Olympic Green.

I was able to confirm the turn points prior to the carpet being cut at each turn. I also noted that the odd kilometre mark was set up 8m south of pole #10, whereas my reference was 7m south of pole #9. To be sure that it wasn't a mistake in my documentation, I re-measured the course using a measuring wheel and this confirmed that my reference was correct. Omega, who had responsibility for the split times, moved their timing mat and tent but only after confirmation from the competition manager, Mr Shen Chunde.

Checking the marathon course was more difficult as I had to arrange transport through BOCOG and this did not happen until the Saturday afternoon immediately prior to Sunday morning's women's marathon. I had three reasons to see the course again – first, to refresh my memory of the course; second, to check the blue line which had been painted since my July visit; and third to check how each kilometre point was marked.

My memory of the course was fine; BOCOG had done a good job with the blue line and, while not always perfect, it fulfilled its purpose as an excellent guide for runners; but the kilometre points were not clearly marked where they could be seen by runners. When adjusting these points after our measurement, we made paint marks on the kerbs and wrote the distance on the kerb but, other than at the 5km and half way points, nothing formal was painted on the road surface, as we had done in Sydney in 2000. In Sydney we painted very large kilometre marks on the road surface which could be seen from overhead by helicopters and this also made it foolproof in relation to placing signs in the correct positions.

I also observed that tram tracks in Qianmen St, which runners pass immediately before returning to Tiananmen Square at the 10km point, had been filled with concrete, making it not only safer for runners but also confirmed that we made the right decision when measuring to ignore the tram lines and measure the shortest possible route, particularly on the exit from this street which, at the time of measuring, was under construction and fenced from the public.

Race Days – Race Walks
The first road event on the athletics program was the men's 20km race walk at 9am on Saturday 16 August. I was at the Stadium by 7am and checked the start line, which had been measured and marked, as per my instructions, after the previous evening's athletics program.

I then re-aligned traffic cones between the stadium tunnel and the 2km lap to ensure that walkers followed the measured line. Then I walked to each extremity of the 2km lap and checked the turn points. In both cases carpet defined the course, and hundreds of flower pots had been placed inside the loop overnight. Flower pots had been placed at least one metre inside the carpet line (measurement line) so I re-arranged some flower pots 30cm inside the measurement line, as walkers obviously would not stay on the carpet without cones or flower pots to stop them cutting the corners.

Once the course was set up I simply observed the race, first ensuring that the walkers completed three full laps of the stadium before exiting.

The women's 20km race walk was held on 21 August (9am start) and the men's 50km on 22 August (7.30am start). On both occasions I went through the same process – checked the start line, moved cones into place between the tunnel and the 2km lap, and moved flower pots into place at each turn.

Race Days – Marathons
The women's marathon was held on 17 August and the men's marathon on the final day of competition, 24 August. Both started at 7.30am. I observed both races from the Omega timing car. This gave me a good view of the course layout but not such a good view of the runners, as many times they were blocked from view by the photographers' truck and TV vehicles. Nevertheless I was upfront and did see enough to watch the excitement of each race unfold.

Other than in the Olympic Green, I was unable to do a pre race check of the course layout as roads were not closed until approximately 15 minutes prior to the arrival of runners. Kilometre signs were held in place by officials and these did not appear on the course until runners were approaching. Drink stations were placed on the roads after they were closed and so were set up very quickly. So, even if I was to drive the course, say, two hours before the start, there would have been little for me to check.

I checked the Olympic Green at 5am on women's marathon morning, prior to catching a bus to Tiananmen Square for the race start. I had been told that all barricades and cones would be set up by 4am but I was surprised to see crowd control barricades not set up as anticipated and no cones in sight. If runners were to approach the Olympic Green at that time, they would certainly have run a short course.

I phoned Mr Shen Chunde and also spoke to him when I arrived at Tiananmen Square. I drew a diagram of where precisely cones and barricades needed to be placed and he arranged for this to be done prior to the arrival of runners.

I did notice immediately before the start of the women's marathon that the left hand turn out of East Road of Tiananmen Square (at approximately 10.8km) was not coned. The blue line defined the measurement line but this intersection was very wide and runners had to cross several traffic lanes before turning left and going west along East Chang'An St. There was potential for runners to cut a significant distance off the course at this point. I alerted the BOCOG officials (Mr Shen Chunde and Mr Zhang Dongfeng) and they arranged for marshals to stand 30cm inside the blue line as runners turned this corner.

By the time of the men's marathon, I noted that this corner was coned correctly.

During the two races I made the following observations (in no particular order):

- At the women's marathon the official holding the 1km sign stood almost on the blue line and was swamped by women going either side of him.

- Interestingly at the men's marathon I did not spot any sign at 1km, but I may have missed it.
- There was certainly no sign at 2km in the men's marathon but I picked out my reference point and observed that the time was 5.49. I couldn't believe the early pace of a championship marathon and, for a moment, I was concerned about the accuracy of my 2km point!
- Most other kilometre signs were clearly visible and it soon became obvious that the men were running exceptionally fast, unlike the early kilometres in the women's marathon which were at a relatively sedate pace.
- The 5km drink station, inside the Temple of Heaven, was not well placed as it was too close to a left hand turn, with the drinks tables starting almost immediately after the turn and on the right hand side of the course. I mentioned this to the technical delegate after the women's marathon he agreed that it may have been preferable to have the drink station located outside the Temple of Heaven (near the 6km point) but it was not something seen as sufficiently high priority to make a late change for the men's marathon.
- The 7.5km drinking/sponging station was placed on a curve in the road and would have been better placed a short distance further along that same road but this was not a critical factor.
- Around the 18km mark in the women's marathon, our driver obviously forgot that our vehicle had a large timing clock on the roof and tried to drive through a mist station. The mist was not turned on so we didn't get wet but there was plenty of noise when the clock crashed into the overhead pipes of the mist station! There seemed to be no permanent damage and the Omega man on board in our car ensured the clock was still working.
- During the measurement we were at times encouraged by BOCOG staff to take a line other than the shortest possible route, because they would place cones or other devices on the course to make runners take a wider line. Other than in two minor points, we stuck to the SPR as we did not have the confidence that any artificial barriers would be in place on race days. Our decision to almost always stick with the SPR was a good one.
- We did not follow the SPR at the intersection of Zhong Guan Cun South & North Ring Road Bypass (between 26km and 27km). We measured to the end of the centre line in North Ring Road Bypass, rather than the divider fence which we used in most other cases. The blue line on this corner was painted exactly as we measured and on race days barricades ensured runners followed the measured path.
- When measuring we also departed from the shortest possible route at the intersection of Beituchengxi Rd & Beichen Lu Rd (at the 39km point). On the approach to this corner, we measured to the end of the centre line rather than the end of a divider fence. The blue line was not painted as we measured and there were no cones or marshals to ensure that runners followed the measured path. This was not a significant deviation from the measured course but highlighted that we made the right decision in other cases to always measure the SPR.
- On a number of roads, crowd control barricades were placed on the roadway and these barricades almost obscured the blue line in places. This was no real issue but, if doing it again, I would recommend that the blue line be painted another 20cm further out from the kerb to allow room for barricades.
- At the corner of Zhong Guan Cun East Rd & Zhichun Lu Rd (near 34km), the blue line was not painted exactly as we measured (it was long) but runners followed exactly the line that we measured.

There is always some opportunity for confusion when different languages are involved and this statement may be incorrect but, as a general observation, I think BOCOG may have believed that the painting of a blue line will ensure that runners follow that line at intersections, without realising that cones or barricades are also required to ensure that runners don't cut the corner. Good examples were Tiananmen Square at 10.8km and the Olympic Green at 41km. I can never be sure whether these areas would have been set up correctly without my intervention but it was satisfying being able to contribute to the correct layout. If nothing else, it confirmed that the course measurer is an important official to have on board at events.

On balance, runners followed the measured line and certainly ran at least 42.195km. I was also privileged to witness maybe the greatest marathon run to date – Sammy Wanjiru's 2.06.32 in a summer Olympic Games.

Dave Cundy
Course Measurer, Beijing 2008 Olympic Games

Beijing 2008 Olympic Games

Marathon Measurement Report

APPLICATION FOR CERTIFICATION OF A ROAD COURSE

Name of event: Beijing 2008 Olympic Marathon

Advertised race distance: 42.195km

Race dates: 17 & 24 August 2008

Race director: Shen Chunde

Address: 267 Beishihuanzhonglu, Haidian, Beijing 100083

Phone: +86 10 82275672 **Fax:** +86 10 82275162

Email: shenchunde@beijing2008.cn

Name of measurement team leader: Dave Cundy

Address: PO Box 206, Ettalong Beach NSW 2257 Australia

Phone: +61 2 43427611 **Fax:** +61 2 43427648

Email: cundysm@ozemail.com.au

Location of start: East Rd of Tiananmen Square - leading edge of white line immediately south of the southern pedestrian crossing; gantry to be placed with eastern edge at 7th zebra line from eastern edge of road

Location of turn point: Olympic Green – extremity of turn point is 53.55m north of 9th light pole/tower. Turn has 4m radius.

Location of finish: National Stadium – track finish line

Type of terrain: Flat

Type of course: Point to point

Altitude: Start - 43m Finish - 35m Drop - minus 0.2m/km

Distance between start and finish: 9.2km/Separation = 22% of race distance

SUMMARY OF MEASUREMENTS

Dates of measurement: Calibrated bicycle measurement from start to entrance to stadium track - Thursday night 10 July/Friday morning 11 July 2008.

Note: As the track at the National Stadium was unavailable in July because it was covered in preparation for the Opening Ceremony, the final 537m on the track was measured by steel tape on Thursday 14 August 2008.

How many measurements of the course were made? Five

Names of measurers: Dave Cundy (Grade A), Fran Seton (Grade B), Hugh Jones (Grade A), Norrie Williamson (Grade A), Zhao Pu (trainee – attended measurement seminar in Seoul in June 2008)

How much of the road width is available to runners throughout the length of the road race course?

The full width of the road or, in the case of divided roads, the right hand carriageway is available to runners.

If the route at turns cannot be described as the 'shortest possible route', explain what restrictions will apply, and how these will be enforced?

Other than two left hand turns, where the course will be coned to the end of a divider line, the shortest possible route applies. These exceptions are at the major intersection (left turn) between 16km and 17km and the major intersection (left turn) immediately after 39km. Both are highlighted on the map.

Length of course after any adjustment: At least 42.195km

Difference between longest and shortest measurement: 26.3m

Which measurement was used to establish the final course length and WHY?

The shortest measurement was used to establish the course length, as per usual practice. Hugh Jones had the shortest measurement so I used his data to calculate all kilometre points, the half way split, and the final adjustment to the turnaround point.

OVERVIEW OF THE MEASUREMENT PROCEDURE

The measurement was a basic start to finish measurement with traffic management provided by police. We were also accompanied by a number of BOCOG vehicles.

BOCOG could not identify the turnaround point in the Olympic Green that had been used for the test event in April so we selected a provisional turnaround point (the 9th light pole/tower) and adjusted this location after the measurement to ensure that the course was at least 42.195km.

We were unable to measure on the track at the National Stadium because the track was covered for Opening Ceremony purposes. We accepted BOCOG's track measurement of 537.23 metres was accurate and based all calculations on this fact. Using a steel tape and assisted by ITO Reg Brandis (who also runs a business of surveying athletic tracks), I was able to check the track measurement on 14 August and this confirmed, with a discrepancy of only 8cm, that the distance was indeed 537.23m.

Six bicycle riders participated in the measurement. The local Grade B measurer Mr Hu Xinmin, who was the official measurer for the test event, rode at the front as he was familiar with the route. Dave Cundy, as the official IAAF appointed measurer, followed. Other measurers were Fran Seton, Hugh Jones, Norrie Williamson and Zhao Pu.

All measurers except Mr Hu recorded data at the start and the track side "finish" point, plus reference points near to each kilometre point, plus the half way point. Mr Hu did not record a start or finish count and his data at intermediate points did not match that of other measurers.

We laid out two 300m calibration courses – one on the East Rd at Tiananmen Square, where we pre calibrated, and another on the road between the National Stadium and the Water Cube, where we post calibrated. The Tiananmen Square calibration course started at the marathon start line and we were able to do a calibration check as we rode over this course at the completion of the first loop of the course (approximately 10km), which brings runners back to Tiananmen Square and over the start line.

DETAIL OF THE CALIBRATION COURSE No. 1

1 **Name of event:** Beijing 2008 Olympic Marathon

2 **City/town**: Beijing

3 **Location of calibration course:** Western side of East Rd of Tiananmen Square

4 **Length of calibration course:** 300m

5 **Date measured:** 10 July 2008

6 **Method used to measure calibration course:** 100m steel tape

7 **How many times did you measure the calibration course?** 2

8 **Measurement team leader:** Dave Cundy

9 **Address of team leader:** PO Box 206, Ettalong Beach NSW 2257 Australia

10 **Phone contact of team leader:** +61 2 43427611

11 **Email address of team leader:** cundysm@ozemail.com.au

12 **List names and duties of team members:** Fran Seton, Hugh Jones and Norrie Williamson assisted holding one end of tape, tensioning tape and recording data

13 **Is the calibration course: STRAIGHT?** Yes **PAVED?** Yes

14 **How are the start and finish points marked?** Nails and tape

15 **Are the start and finish points located in the road where a bicycle wheel can touch them, or elsewhere?** Yes

STEEL TAPING DATA SHEET
Calibration Course No. 1

Name of calibration course: East Rd of Tiananmen Square (western side of road)

City: Beijing

Date: 10 July 2008

Start time: 10.30pm **Finish time:** 11.10pm

Pavement temperature: Start 29C Finish 29C Average 29C

Measurements and calculations:

1 First measurement:

3	x	100m	+		=	300.00m
# tape lengths		distance per tape length		partial tape length		measured distance

2 Second measurement:

3	x	100m	+		=	300.00m
# tape lengths		distance per tape length		partial tape length		measured distance

3 Average raw (uncorrected) measurement of course 300.00m

4 Temperature correction. Use the average pavement temperature during measurement. Work out answer to at least seven digits beyond the decimal point.

Correction factor = 1.0000000 + (.0000116 x [Celsius temperature – 20])

Correction factor =

NOTE: For temperatures below 20C, factor is less than one
For temperatures above 20C, factor is greater than one

5 Multiply the temperature correction factor by the average raw measurement of the course (line 3)

1.0001044	x	300.00	=	300.03m
correction factor		avg. raw measurement		corrected measurement

6 If you wish, you may now adjust the course to obtain an even distance, such as one kilometre. This is not necessary as you may choose instead to use an odd-distance calibration course whose endpoints are pre-existing permanent objects in the road to guard against hazards such as repaving. If you adjusted the course, explain why you did it.

Final (adjusted) length of calibration course 300m

7 **South end point:** Same line as start of marathon

8 **North end point:** 6.38m < 4th pole from East Chang'an St (pole on eastern side of road)

DETAIL OF THE CALIBRATION COURSE No. 2

2 **Name of event:** Beijing 2008 Olympic Marathon

2 **City/town**: Beijing

3 **Location of calibration course:** Eastern side of Tianchen East Rd

4 **Length of calibration course:** 300m

5 **Date measured:** 10 July 2008

6 **Method used to measure calibration course:** 100m steel tape

7 **How many times did you measure the calibration course?** 2

8 **Measurement team leader:** Dave Cundy

9 **Address of team leader:** PO Box 206, Ettalong Beach NSW 2257 Australia

10 **Phone contact of team leader:** +61 2 43427611

11 **Email address of team leader:** cundysm@ozemail.com.au

12 **List names and duties of team members:** Fran Seton, Hugh Jones and Norrie Williamson assisted holding one end of tape, tensioning tape and recording data

13 **Is the calibration course: STRAIGHT?** Yes **PAVED?** Yes

14 **How are the start and finish points marked?** Nails and tape

16 **Are the start and finish points located in the road where a bicycle wheel can touch them, or elsewhere?** Yes

STEEL TAPING DATA SHEET
Calibration Course No. 2

Name of calibration course: Tianchen Donglu

City/town and State: Beijing

Date: 10 July 2008

Start time: 11.10am **Finish time:** 11.40pm

Pavement temperature: Start 29C Finish 29C Average 29C

Measurements and calculations:

1 First measurement:

3	x	100m	+		=	300.00m
# tape lengths		distance per tape length		partial tape length		measured distance

2 Second measurement:

3	x	100m	+		=	300.00m
# tape lengths		distance per tape length		partial tape length		measured distance

3 Average raw (uncorrected) measurement of course 300.00m

4 Temperature correction. Use the average pavement temperature during measurement. Work out answer to at least seven digits beyond the decimal point.

Correction factor = 1.0000000 + (.0000116 x [Celsius temperature – 20])

Correction factor =

NOTE: For temperatures below 20C, factor is less than one
For temperatures above 20C, factor is greater than one

5 Multiply the temperature correction factor by the average raw measurement of the course (line 3)

1.0001044	x	300.00	=	300.03m
correction factor		avg. raw measurement		corrected measurement

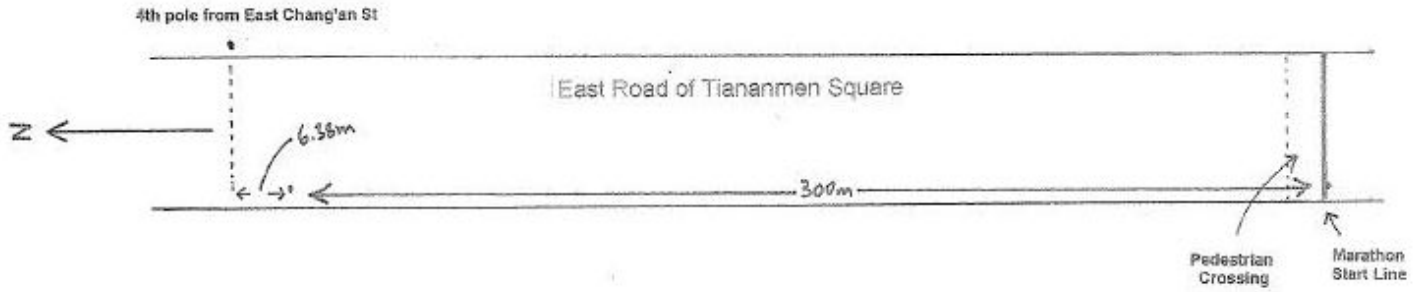
6 If you wish, you may now adjust the course to obtain an even distance, such as one kilometre. This is not necessary as you may choose instead to use an odd-distance calibration course whose endpoints are pre-existing permanent objects in the road to guard against hazards such as repaving. If you adjusted the course, explain why you did it.

Final (adjusted) length of calibration course 300m

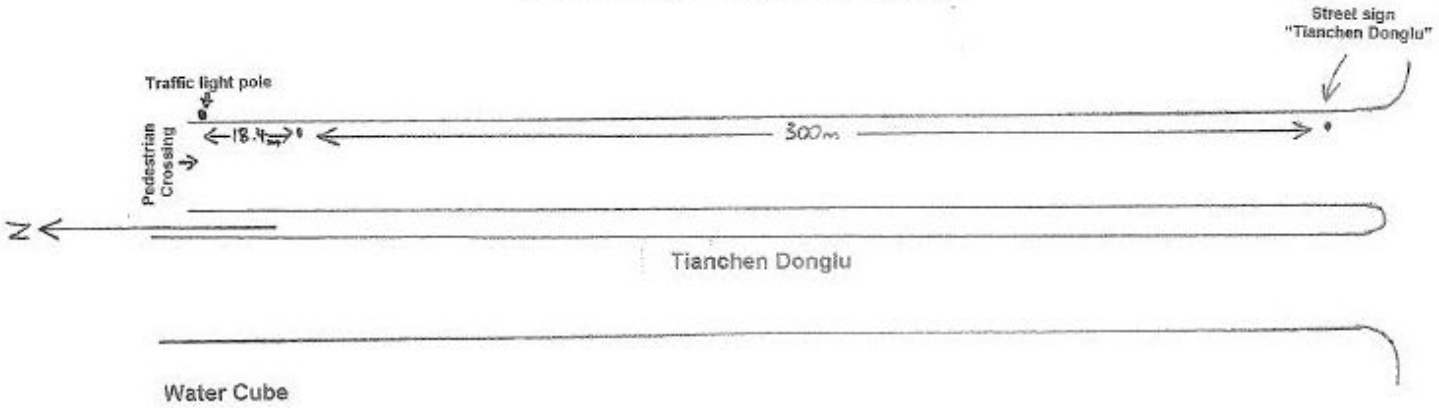
7 **South end point:** At street sign “Tianchen Donglu”

8 **North end point:** 18.4m < traffic light (centre of pole); 9.5m from pole #T00058 in centre median of road

Calibration Course No. 1



Calibration Course No. 2



BICYCLE CALIBRATION & COURSE MEASUREMENT DATA SHEET

	Dave		Hugh		Norrie		Fran		Peter	
Pre calibration	Time 11.20pm	Temp 28C								
Start	3200		46000		8464		733100		36230	
End ride 1	6221	3021	49502	3502	11984	3520	736551	3451	39714	3484
End ride 2	9243	3022	53004	3502	15503.5	3519.5	740004	3453	43199	3485
End ride 3	12262	3019	56506	3502	19023.5	3520	743455	3451	46684	3485
End ride 4	15283	3021	60008	3502	22543	3519.5	746906	3451	50168	3484
WC (A)		**10079.23583**		**11685.00667**		**11744.2325**		**11516.505**		**11626.615**
At 10km										
Check 1	20368		80986		144431		866454			
Check 2	23389	3021	84489	3503	147951	3520	869907	3453		
WC (B)		**10080.07**		**11688.34333**		**11745.06667**		**11521.51**		
Post calibration	Time 7.10am	Temp 27C								
Start	41000		53000		517937		232750		540364	
End ride 1	44020	3020	56502	3502	521458	3521	236202	3452	543850	3486
End ride 2	47038	3018	60004	3502	524978	3520	239653	3451	547334	3484
End ride 3	50059	3021	63505.5	3501.5	528498.5	3520.5	243104	3451	550820	3486
End ride 4	53079	3020	67007.5	3502	532019.5	3521	246556	3452	554305	3485
FC		**10075.89917**		**11684.58958**		**11747.15208**		**11516.505**		**11629.118**
Daily constant		**10077.5675**		**11684.79813**		**11745.69229**		**11516.505**		**11627.866**
Measurement	Time: 11.55pm	Temp: 28C								
Start	16000		60000		22787		747150		50213	
1	26247	1016.8	71878	1016.5	34727	1016.5	758860	1016.8	61823	998.5
2	36062	1990.8	83255	1990.2	46165	1990.3	770079	1991.0	73319	1987.1
3	46255	3002.2	95086	3002.7	58055	3002.6	781739	3003.4	85103	3000.6
4	56341	4003.0	106783	4003.7	69815	4003.9	793275	4005.1	96753	4002.5
5	66277	4989.0	118288	4988.4	81382	4988.6	804633	4991.4	108228	4989.3
6	76484	6001.8	130109	6000.0	93263	6000.2	816295	6004.0	119976	5999.6
7	86634	7009.0	141877	7007.1	105095	7007.5	827893	7011.1	131713	7009.0
8	96751	8012.9	153607	8011.0	116890	8011.7	839460	8015.5	143389	8013.2
9	106559	8986.2	164981	8984.4	128334	8986.0	850672	8989.0	154714	8987.1
10	116882	10010.6	176943	10008.1	140365	10010.3	862468	10013.3	166599	10009.2
11	126990	11013.6	188656	11010.5	152145	11013.2	874022	11016.5	178270	11012.9
12	137080	12014.8	200358	12012.0	163905	12014.4			189914	12014.3
13	147283	13027.3	212187	13024.4	175797	13026.9	897219	13030.8	201684	13026.6
14	156932	13984.7	223375	13981.8	187046	13984.6	908251	13988.7	212821	13984.3
15	167172	15000.8	235246	14997.8	198988	15001.3	919980	15007.2	224641	15000.9

16	177072	15983.2	246729	15980.5	210533	15984.2	931272	15987.7	236063	15983.2
17	187276	16995.8	258557	16992.8	222429	16997.0	942938	17000.6	247837	16995.7
18	197349	17995.3	270245	17993.0	234180	17997.5	954463	18001.4	259468	17996.0
19	207641	19016.6	282181	19014.5	246179	19019.1	966228	19023.0	271337	19016.7
20	217663	20011.1	293804	20009.2	257867	20014.1	977682	20017.5	282909	20011.9
21	227539	20991.1	305247	20988.6	269384	20994.7	988977	20998.3	294306	20992.1
half	228556	21092.0	306426	21089.5	270571	21095.7	990134	21098.8	295479	21092.9
22	237657	21995.1	316976	21992.3	281179	21998.9	1000542	22002.5	305983	21996.3
23	247875	23009.0	328811	23005.2	293089	23012.9	1012214	23016.0	317774	23010.3
24	257938	24007.6	340478	24003.7	304817	24011.4	1023714	24014.6	329381	24008.5
25	267945	25000.6	352080	24996.6	316482	25004.5	1035180	25010.2	340917	25000.6
26	278074	26005.7	363820	26001.3	328291	26009.9	1046760	26015.7	352611	26006.3
27	288491	27039.4	375887	27034.0	340422	27042.7	1058666	27049.5	364626	27039.6
28	298103	27993.2	387027	27987.4	351626	27996.6	1069645	28002.9	375716	27993.4
29	308183	28993.4	398694	28985.9	363368	28996.2	1081167	29003.3	387338	28992.9
30	318340	30001.3			375200	30003.6	1092772	30011.0	399056	30000.6
31	328200	30979.7	421887	30970.8	386693	30982.1	1104036	30989.1	410433	30979.0
32	338494	32001.2	433813	31991.4	398686	32003.1	1115800	32010.6	422307	32000.2
33	348414	32985.5	445306	32975.0	410244	32987.2	1127138	32995.1	433753	32984.6
34	358683	34004.5	457202	33993.1	422205	34005.5	1138875	34014.2	445602	34003.6
35	368840	35012.4	468969	35000.1	434037	35012.8	1150485	35022.3	457326	35011.8
36	378849	36005.6	480569	35992.8	445701	36005.9	1161924	36015.6	468871	36004.7
37	388788	36991.9	492081	36978.0	457277	36991.4	1173278	37001.5	480336	36990.7
38	398447	37950.3	503270	37935.6	468529	37949.4	1184314	37959.8	491476	37948.8
39	409114	39008.8	515636	38993.9	480963	39008.0	1196501	39018.0	503786	39007.4
40	419500	40039.4	527667	40023.5	493067	40038.5	1208368	40048.4	515764	40037.5
41	429700	41051.6	539490	41035.4	504951	41050.3	1220017	41059.9		
Finish	434843	41561.9	545447	41545.2	510944.5	41560.6	1225908	41571.5	533488	41561.8
	Time: 7.00am	Temp: 27C								
Final calculations										
Add radius of turn point		13.51		13.51		13.51		13.51		13.51
Add distance on track		537.23		537.23		537.23		537.23		537.23
TOTAL DISTANCE		42112.7		42095.9		42111.3		42122.2		42112.5
Short by		82.3		99.1		83.7		72.8		82.5
Final adjustment			**Add 49.55m at turn point**							

Beijing 2008 Olympic Marathon Street by Street Course Description

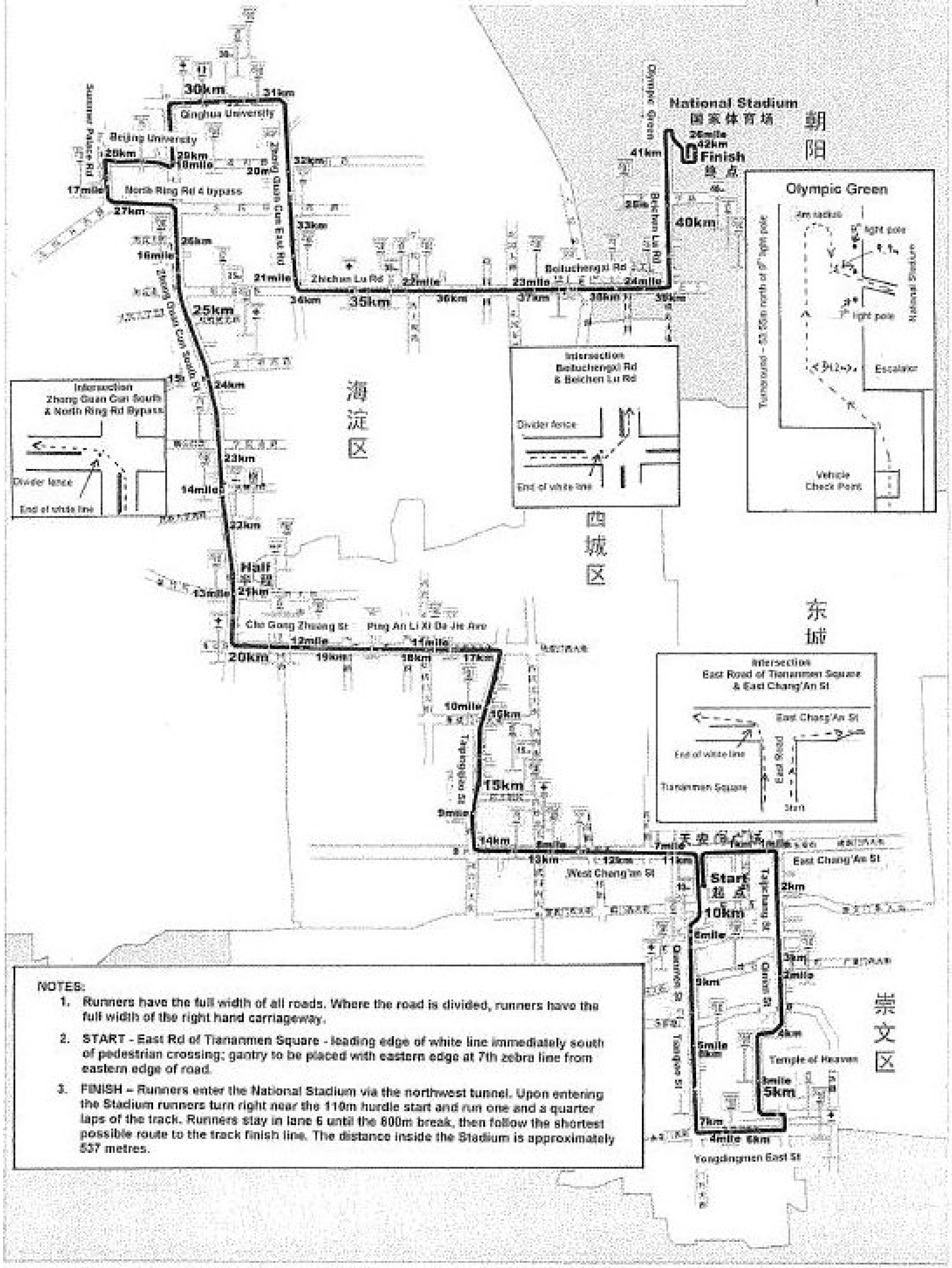
- Start East Road of Tiananmen Square and proceed north (full width of road)
- Turn right into East Chang'an St and proceed east (east bound carriageway)
- Turn right into Taijichang St and proceed south (full width of road)
- Continue into Qinian St (full width of road)
- Continue through the north gate of the Temple of Heaven (full width of road)
- Exit from south gate of Temple of Heaven (full width of road)
- Turn right into Yongdingmen East St and proceed west (full width of road)
- Turn right into Yongdingmen Inside St and proceed north (full width of road)
- Continue into Tianqiao St (northbound carriageway)
- Continue into Qianmen St (full width of road)
- Turn right Zhengyangmen Jianlou gate tower (full width of road)
- Proceed into East Rd of Tiananmen Square and proceed north (full width of road)
- Cross the start line
- Turn left into West Chang'an St and proceed west (westbound carriageway)
- Continue into West Chang'an St (westbound carriageway)
- Continue into Fuxingmen Inner St (westbound carriageway)
- Turn right into Taipingqiao St and proceed north (northbound carriageway)
- Continue into Zhao Deng Yu Rd (northbound carriageway)
- Turn left into Ping An Li Xi Da Jie Ave and proceed west (westbound carriageway)
- Continue into Che Gong Zhuang St (westbound carriageway)
- Turn right into Capital Gymnasium South Rd and proceed north (northbound carriageway)
- Continue into Zhong Guan Cun South St (northbound carriageway)
- Turn left into North Ring Rd 4 bypass and proceed west (westbound carriageway)
- Turn right at Haidian Bridge and proceed north along Summer Palace Rd (full width of road)
- Turn right at southwest gate of Beijing University and proceed east (full width of road)
- Exit Beijing University and turn left into Zhong Guan Cun North St and proceed north (northbound carriageway)
- Turn right into west gate of Qinghua University and proceed east (full width of road)
- Turn right at Qinghua Universtity Main Bldg and proceed south (full width of path)
- Exit southeast gate of Qinghua University and continue south on Zhong Guan Cun East Rd (southbound carriageway)
- Turn left into Zhichun Lu Rd and proceed east (eastbound carriageway)
- Continue into Beituchengxi Rd (eastbound carriageway)
- Turn left into Beichen Lu Rd (northbound carriageway)
- Continue into Olympic Green
- Go past entrance to Stadium tunnel
- Clockwise u-turn 53.55m after pole #9
- Return to Stadium tunnel
- Continue onto track for final 537metes, following lane 6 until the 800m break point, then shortest route to track finish line

Beijing 2008 Olympic Marathon Reference Points

		KEY: < = before; > = after; ~ = approximately; RH = right hand; LH = left hand
Km point	**Street**	**Reference**
Start	East Rd of Tiananmen Square	Leading edge of white line immediately south of the southern pedestrian crossing; gantry to be placed with eastern edge at 7th zebra line from eastern edge of road
1	East Chang'an St	16.5m < last light pole < intersection Zhengyilu Rd; adjacent phone box
2	Taijichang St	9.8m > pole #022 (74); ~ 15m < intersection; ~ 8m < blue sign. Opposite Ao Hua Lian store.
3	Qinian St	2.7m < pole #T10022; ~ 75m < intersection
4	Temple of Heaven (TOH)	3.7m < red lantern on RH side of road < first RH turn inside TOH
5	Temple of Heaven (TOH)	11.6m > phone box on LH side of road; just south of "Sanzuomen" gates inside TOH, opening to wide courtyard area
6	Yongdingmen East St	Adjacent pole #25
7	Yongdingmen Inside St	7.1m < pole #T60020
8	Tianqiao St	11m < unnumbered pole adjacent old trees monument @ Beijing Museum of Natural History; ~ 15m < phone box
9	Tianqiao/Qianmen St	15.6m > traffic light in middle of intersection < new tourism city street
10	Approach to East Rd of Tiananmen Square	8.1m < white line at major intersection < East Rd of Tiananmen Square; adjacent Old Beijing Train Station
11	West Chang'an St/Tiananmen Square North	10.5m < light pole > Chairman Mao's portrait @ Forbidden City
12	West Chang'an St	12m < first light pole > gates at front of Xing Hua building
13	West Chang'an St	24.4m < pole #10001; near west side of intersection; opposite building with curved end on LHS of road
14	Taipingqiao St	18.2m > pole #T20004; ~ 120m > RH turn into Taipingqiao St
15	Taipingqiao St	2.2m > pole #20019; near blue sign with 3 LH arrows, 4 straight ahead arrows, one RH arrow
16	Zhao Deng Yu Rd	19.5m > pole #T20042; > where road narrows into two lanes; opposite shop with blue sign over door
17	Ping An Li Xi Da Jie Ave	7.2m > pole #W10017; just through intersection; opposite "SHARP"
18	Che Gong Zhuang St	7m > pole #T10007; just > intersection with sign "PKU Hospital--->"
19	Che Gong Zhuang St	14.5m < pole #T10032; 200m < overhead bridge
20	Che Gong Zhuang St	9.2m < pole #T10010; < blue sign CHEGONGZHUANG - left, right, straight ahead

21	Zhong Guan Cun South Rd	11.4m > north side of underpass; north side of intersection
half	Zhong Guan Cun South Rd	8m > unnumbered pole (2nd pole > intersection); ~30m < blue sign "PKU Stomatology Hospital"
22	Zhong Guan Cun South Rd	7.7m > midpoint of overhead bridge; before "16-19" painted in yellow on road; > Hu Bei Plaza Hotel
23	Zhong Guan Cun South Rd	5.2m < pole in middle of pedestrian crossing with light; "Baihua" on LH side coming into intersection
24	Zhong Guan Cun South Rd	3.7m < unnumbered pole; 10m before blue sign - one left lane, 3 straight ahead lines; 200m < overhead bridge "Sitong Bridge" < 3rd Ring Road
25	Zhong Guan Cun South Rd	3.4m > unnumbered pole with blue sign - straight/right into slipway; ~30m before sign "Haidian Hospital"
26	Zhong Guan Cun South Rd	1.3m < pole #36 (very faint) off RH side of road; > overhead pedestrian bridge; adjacent China Everbright Bank; shopping centre, market
27	North Ring Rd 4 Bypass	1m > unnumbered pole (2nd pole < PKU Gymnasium sign)
28	Beijing University	12.6m > unnumbered pole immediately < small bridge just inside southwest gate of university
29	Zhong Guan Cun North Rd	14.1m > unnumbered pole (2nd pole in street > exiting university)
30	Qinghua University	6.9m > first light pole > bridge just inside west gate of university
31	Qinghua University	4m < pole BM16; adjacent History Museum
32	Zhong Guan Cun East Rd	8.6m > pole #T10003; ~ 400m > exit from university, adjacent building #9 on RH side
33	Zhong Guan Cun East Rd	25m > pole #T10026; ~ 70m > Ring Rd 4W overpass; adjacent Chinese Accident Bldg #55
34	Zhichun Lu Rd	6.9m > unnumbered pole (2nd pole > LH turn into Zhichun Lu Rd); opposite Customs Bldg with blue glass at front and clock on top
35	Zhichun Lu Rd	0.1m < unnumbered pole; opposite sports store painted blue with Adidas & Reebok signs
36	Zhichun Lu Rd	7.2m > unnumbered pole (2nd pole < intersection); opposite pink apartments; > sign on LH side of road, when looking back sign reads Zhichun Rd; ~ 100m < traffic lights; ~ 15m > orange phone booth on RH side
37	Beituchengxi Rd	22m > white line < intersection; McDonalds in street on RH side; Peony Hotel on LH corner
38	Beituchengxi Rd	64.4m > white line < intersection and Jiande Bridge; km mark adjacent eastern end of Jiande Bridge
39	Beituchengxi Rd	6.1m > pole #T20001 < LH turn into Beichen Lu Rd (Olympic Blvd)
40	Beichen Lu Rd	23.5m < pole #T20005
41	Olympic Green	35.4m < pole #7

Beijing 2008 Olympic Marathon Course

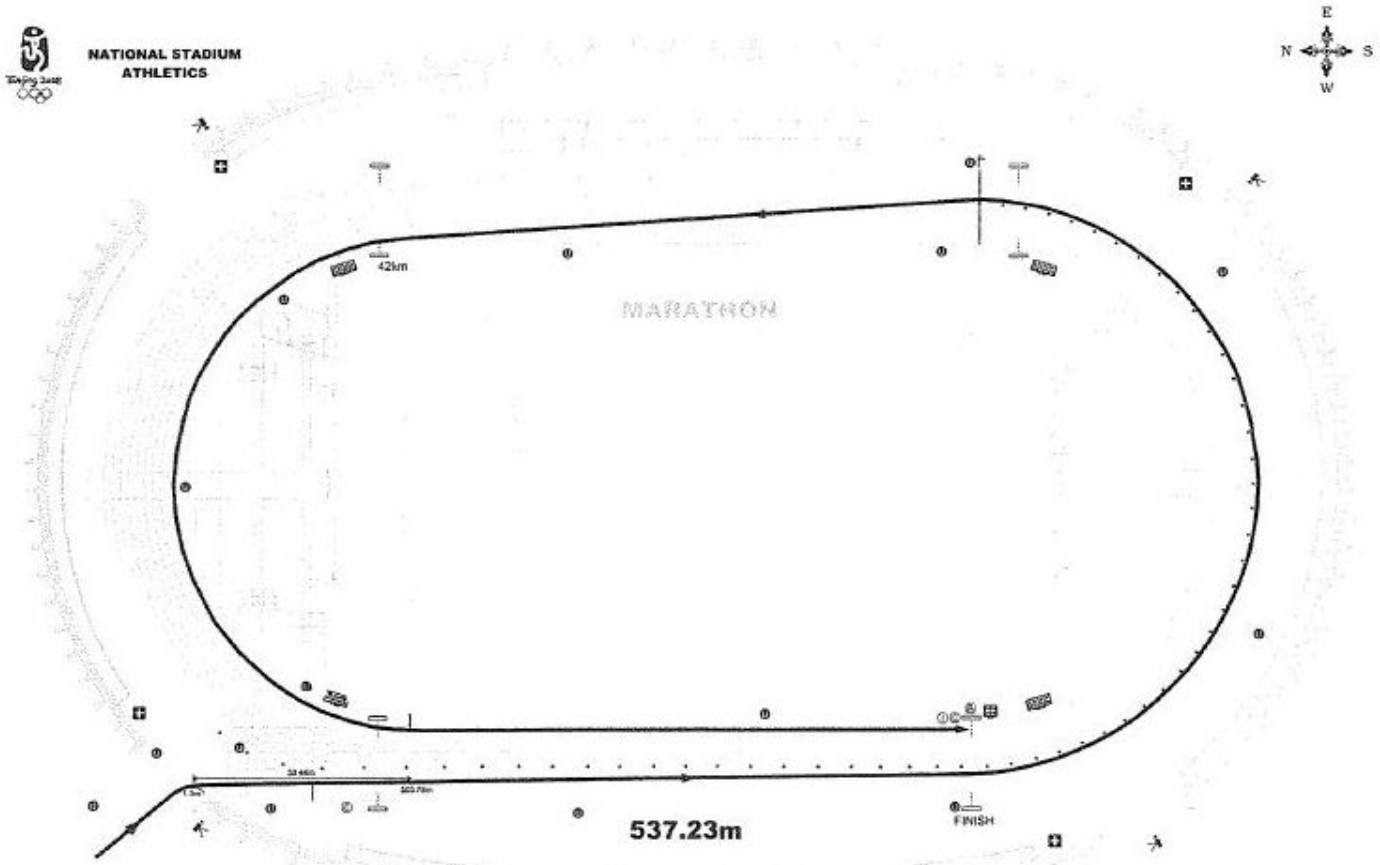


NOTES:

1. Runners have the full width of all roads. Where the road is divided, runners have the full width of the right hand carriageway.
2. START - East Rd of Tiananmen Square - leading edge of white line immediately south of pedestrian crossing; gantry to be placed with eastern edge at 7th zebra line from eastern edge of road.
3. FINISH – Runners enter the National Stadium via the northwest tunnel. Upon entering the Stadium runners turn right near the 110m hurdle start and run one and a quarter laps of the track. Runners stay in lane 6 until the 800m break, then follow the shortest possible route to the track finish line. The distance inside the Stadium is approximately 537 metres.

Marathon Finish

NATIONAL STADIUM
ATHLETICS



INTERNATIONAL MEASUREMENT CERTIFICATE

Name of race : *Beijing 2008 Olympic Marathon* **Distance :** *42.195km*

Location : *Beijing* **Country :** *CHN*

Type of course : *Point to point* **Date of race :** *17&24/07/08* **Date of measurement :** *11/07/2008*

Elevation change : *Minus 0.2* **m/km, Separation :** *22* **% of race distance**

Measurer's name : *Dave Cundy* **IAAF / AIMS Grade :** *A* **Country :** *AUS*

Certificate number : *CHN2008/023*

Date registered *16/07/2008* International Measurement Administrator *Dave Cundy* Signed :

This is to certify that the length of the above road race has been established by an expert employing the method of a bicycle calibrated with a Jones counter. It remains valid for five years so long as the course is no way changed from that defined in the full measurement report submitted by the expert measurer named above. Any modification of the course, however minimal, will nullify this certificate and will require a new official measurement to be undertaken.

Beijing 2008 Olympic Games

Race Walks Measurement Report

APPLICATION FOR CERTIFICATION OF A ROAD COURSE

Name of event: Beijing 2008 Olympic Race Walks

Advertised race distances: 20km & 50km

Race dates: 16, 21 & 22 August 2008

Race director: Shen Chunde

Address: 267 Beishihuanzhonglu, Haidian, Beijing 100083

Phone: +86 10 82275672 **Fax:** +86 10 82275162

Email: shenchunde@beijing2008.cn

Name of measurement team leader: Dave Cundy

Address: PO Box 206, Ettalong Beach NSW 2257 Australia

Phone: +61 2 43427611 **Fax:** +61 2 43427648

Email: cundysm@ozemail.com.au

Location of start: National Stadium – 15.25m before 1500m start

Location of finish: National Stadium – track finish line

Type of terrain: Flat

Type of course: Lap

Altitude (in metres above sea level): Start 35m Finish 35m No drop

Distance, in a straight line, between start and finish: Negligible ~ 75m – no separation

SUMMARY OF MEASUREMENTS

Date of measurement: Saturday 12 July & Thursday 14 August 2008

How many measurements of the course were made? Full course measured once by steel tape and the 2km lap was checked by 4 measurers using calibrated bicycles

Names of measurers: Dave Cundy (Grade A), Fran Seton (Grade B), Hugh Jones (Grade A), Norrie Williamson (Grade A), Hi Xinmin (Grade B), Zhao Pu (trainee – attended seminar in Seoul June 2008)

How much of the road width is available to race walkers throughout the length of the walks course?

The full width of the course defined by barricades, carpet and flower pots. Walkers have use of the full width of the course.

If the route at turns cannot be described as the 'shortest possible route', explain what restrictions will apply, and how these will be enforced?

Shortest possible route applies.

Length of course after any adjustment: At least 20km/50km

Difference between longest and shortest measurement: Not applicable

Which measurement was used to establish the final course length and WHY?

The course as initially laid out by steel tape was used. Checks by calibrated bicycle confirmed that this course was at least the advertised distance.

OVERVIEW OF THE MEASUREMENT PROCEDURE

The race walks course comprises five sections:

1. a Stadium section at the start
2. a link from the Stadium to a 2km lap in the Olympic Green
3. a number of 2km laps
4. a link back to the Stadium
5. a Stadium finish.

We did not have access to the National Stadium (the Field of Play was covered for the Opening Ceremony rehearsals) at the time of the July measurement so I accepted the data provided by BOCOG at that time, and did a final check of the Stadium component on 14 August. It was only at this time that I was able to establish the precise start line.

With the exception of the radii at each end of the 2km lap, we used a steel tape to measure all remaining parts of the course. The distance at each end of the lap was calculated mathematically, using a radius of 4.3m. Calibrated bicycles were used to check the distance of the 2km lap.

As the 2km lap is entirely on paving stones, the actual route that walkers follow is to be covered by carpet. This will be cut to fit the course and will assist in defining the course. The carpet will be 4m wide with an 8m gap between the northbound and southbound lanes.

COURSE MEASUREMENT DATA SHEET
Details of steel taping of the course

For the July measurement, BOCOG advised the following measurements for the Field of Play (FOP):

- Start to Point E (exit point where the FOP meets the Stadium tunnel) = 1378.2m
- Point C (where Stadium tunnel meets the FOP) to Finish = 117.8m

On 14 August ITO Reg Brandis assisted me to check these distances, using a steel tape. We confirmed the distance from Point C to the finish line and measured and calculated the precise start line.

Stage 1 – 12 July 2008
The first stage of the measurement process was to measure, using a 100m steel tape:

- from the exit point where the FOP meets the Stadium tunnel (Point E) to the entrance point to the 2km lap (Point H)
- from the exit point from the 2km lap (Point I) to the point where Stadium tunnel meets the FOP (Point C).

The taped distances were:

- Point E to Point H = 283.4
- Point I to Point C = 251.2m

Stage 2 – 12 July 2008
The second stage of the measurement process was to measure the 2km lap. The 2km lap is entirely within the Olympic Green and comprises large paving blocks. These are laid out in a pattern that allows perfect alignment across the course. The paving blocks are also 1m in length and 0.5m in width so this provides another good basic check of distance.

As the course was perfectly geometrical and comprised a surface very different to a normal road surface, all measurers agreed that measuring with a steel tape, then checking by calibrated bicycle, was the best method to measure this particular course.

The 2km lap runs north/south and neither the southern or northern turn points that had been used for the April test event were documented. We ascertained the turn positions as follows:

1. ***Southern turn*** - started at Point I (the exit point from the 2km lap) and measured to the south so that the distance to the extremity of the southern turnaround point is 250m. This involved measuring 243.25m to the start of the turnaround point, which had a radius of 4m (4.3m for the walking line). The location of extremity of the southern turn point is 2.3m south of pole #4.
2. ***Northern turn*** - started at Point I and measured to the north so that the distance to the extremity of the northern turnaround point is 750m. This involved measuring 743.25m to the start of the turnaround point, which had a radius of 4m (4.3m for the walking line). To be consistent with a calibrated bicycle measurement, we added a short course prevention factor into this measurement so we actually measured 744.25m. Before setting the northern turnaround point, we adjusted for the expansion of the steel tape. The temperature was 35C so we took 17cm off the measured distance, then established and defined the

turnaround point The location of the extremity of the northern turn is 15.42m north of pole #16 (2nd pole south of Datun Lu Rd).

During stage 2 we also ascertained the odd and even kilometre points. To calculate the odd kilometre point, we worked backwards from the finish line:

- Finish to Point C = 117.8m
- Point C to point I = 251.2m
- Point I to start of southern turn = 243.25m
- Radius of southern turn = 13.5m
- End of southern turn to odd kilometre = (1000 – 13.5 – 243.25 – 251.2 – 117.8) = 374.25m.

That point is 131m north of Point I (Point I is on the northbound side of the course and the odd kilometre point is on the southbound side of the course but the nature of the paving stones made it a simply job to align these marks). The precise location of the odd kilometre mark is 7m south of pole #9.

To locate the even kilometre mark, we calculated the distance from the odd kilometre mark, as follows:

- Odd kilometre to extremity of southern turn = 381m (southbound)
- Extremity of southern turn to point adjacent the off kilometre point = 381m (northbound)

A further 238m was required to be measured in a northerly direction to locate the even kilometre mark. The precise location of the even kilometre mark is the southern edge of the green hedge, immediately south of Guojiatiyuchang North Rd, or 14m north of pole #12.

Stage 3 – 12 July 2008

The third stage of the measurement process was to check the 2km lap by calibrated bicycle. Four measurers checked the course – Dave Cundy, Hugh Jones, Norrie Williamson and Hu Xinmin.

For the calibration course we used a 300m section of the 2km lap course which we had just laid out. This provided the perfect calibration course as it was actually part of the walks course, incorporating the precise “paving stone” surface. No adjustment was made for temperature on this part of the course so the calibration course, when adjusted for temperature, was 300.05m.

The bicycle checks verified that the 2km lap was at least that distance. Incorporating the short course prevention factor, I measured the course at 1999.4m. Hugh Jones measured the distance to be 2000.4m, Norrie Williamson 1999.2m and Hu Xinmin 1999.8m.

My data and calculations are included with this report.

Stage 4 – 12 July & 14 August 2008

The fourth stage of the measurement process was to determine the start line on the track and check the distance from the end of the tunnel to the finish line. We calculated the former as follows:

- Start to Point E (exit point where the Field of Play meets the Stadium tunnel) = 1378.2m (based on BOCOG data)
- Point E to Point H (entrance point to 2km lap) = 283.4
- Point H to Point J (even kilometre) = 302m

This distance is 1963.6m. The start line therefore must move back 36.4m from the start estimated by BOCOG. We calculated this to be approximately 14.8m before the 1500m start, with walkers completing three full laps, plus one half lap before exiting the Stadium. The full distance within the Field of Play must be 1414.6m, so three laps + 214.6m.

On 14 August I was assisted by ITO Reg Brandis to check measurements within the stadium. Using a steel tape we confirmed that the distance from end of the tunnel to the finish line was 117.8m, as previously advised by BOCOG.

We then measured from the tunnel back to the start line. Making this distance 214.6m gave us a start line 15.25m before the 1500m start, reasonably close to our estimate that the start would be 14.8m before the 1500m start.

DETAIL OF THE CALIBRATION COURSE

3 **Name of event:** Beijing 2008 Olympic Marathon

2 **City/town**: Beijing

3 **Location of calibration course:** Olympic Green

4 **Length of calibration course:** 300m

5 **Date measured:** 12 July 2008

6 **Method used to measure calibration course:** 100m steel tape

7 **How many times did you measure the calibration course?** 1

8 **Measurement team leader:** Dave Cundy

9 **Address of team leader:** PO Box 206, Ettalong Beach NSW 2257 Australia

10 **Phone contact of team leader:** +61 2 43427611

11 **Email address of team leader:** cundysm@ozemail.com.au

12 **List names and duties of team members:** Fran Seton, Hugh Jones and Norrie Williamson assisted holding one end of tape, tensioning tape and recording data

13 **Is the calibration course: STRAIGHT?** Yes **PAVED?** Yes

14 **How are the start and finish points marked?** Tape

17 **Are the start and finish points located in the road where a bicycle wheel can touch them, or elsewhere?** Yes

STEEL TAPING DATA SHEET

Name of calibration course: Olympic Green

City: Beijing

Date: 12 July 2008

Start time: 2.00pm **Finish time:** 2.15pm

Pavement temperature: Start 35C Finish 35C Average 35C

Measurements and calculations:

3 First measurement:

3	x	100m	+		=	300.00m
# tape lengths		distance per tape length		partial tape length		measured distance

4 Second measurement:

	x		+		=	
# tape lengths		distance per tape length		partial tape length		measured distance

3 Average raw (uncorrected) measurement of course 300.00m

4 Temperature correction. Use the average pavement temperature during measurement. Work out answer to at least seven digits beyond the decimal point.

Correction factor = 1.0000000 + (.0000116 x [Celsius temperature – 20])

Correction factor =

NOTE: For temperatures below 20C, factor is less than one
For temperatures above 20C, factor is greater than one

9 Multiply the temperature correction factor by the average raw measurement of the course (line 3)

1.0001044	x	300.00	=	300.05m
correction factor		avg. raw measurement		corrected measurement

10 If you wish, you may now adjust the course to obtain an even distance, such as one kilometre. This is not necessary as you may choose instead to use an odd-distance calibration course whose endpoints are pre-existing permanent objects in the road to guard against hazards such as repaving. If you adjusted the course, explain why you did it.

Final (adjusted) length of calibration course 300.05m

BICYCLE CALIBRATION DATA SHEET

Name of event: Beijing 2008 Olympic Race Walks

Date of measurement Saturday 12 July

Name of measurer: Dave Cundy

Length of calibration course: 300.05m

PRE-CALIBRATION - ride the calibration course four times, recording data as follows:

Ride	Start count	Finish count	Difference
1	68900	71918	3018
2	71918	74934	3016
3	74934	77951	3017
4	77951	80968	3017

Time of day: 3.30pm Temperature: 35C

WORKING CONSTANT = number of counts in one kilometre, calculated from the pre-measurement average count, and multiplied by 1.001 – the 'short course prevention factor'

Pre-measurement average count = 3017

Counts per km = pre-measurement average count x 1000/length of calibration course in metres

Working Constant = counts per km x 1.001 = 10065.04582

POST-CALIBRATION - ride the calibration course four times, recording data as follows:

Ride	Start count	Finish count	Difference
1	2000	5016	3016
2	5016	8032	3016
3	8032	11048	3016
4	11048	14064	3016

Time of day: 3.55pm Temperature: 35C

FINISH CONSTANT = number of counts in one kilometre, calculated from the post-measurement average count, and multiplied by 1.001 – the 'short course prevention factor'

Post-measurement average count = 3016

Counts per km = post-measurement average count x 1000/length of calibration course in metres

Finish Constant = counts per km x 1.001 = 10061.7097

CONSTANT FOR THE DAY = 10063.37776

COURSE MEASUREMENT DATA SHEET

Name of event: Beijing 2008 Olympic Race Walks

Name of measurer: Dave Cundy

Date of measurement: Saturday 12 July 2008

Start time: 3.35pm **Temperature:** 35C

Finish time: 3.55pm **Temperature:** 35C

Constant for the Day: 10063.37776 counts/km

MEASUREMENT DATA

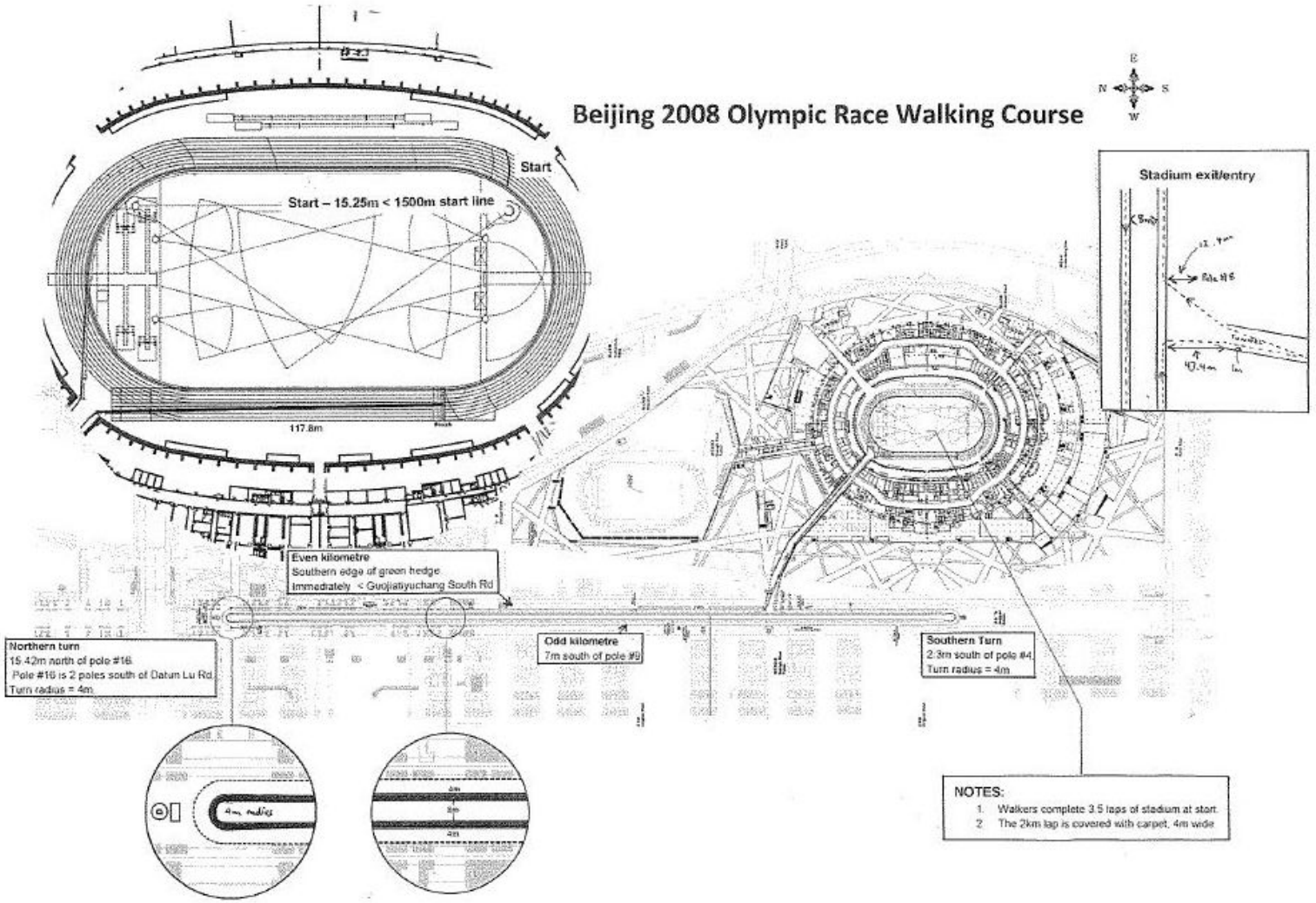
Measured point	Counter reading	Cumulative counts	Cumulative distance in metres	Adjustment in metres
One lap				
Start point	80970			
Finish point	101092	20122	1999.45	
Distance in straight line				
End of southern turn	87583			
Start of northern turn	97508	9925	986.25	
Distance between even and odd km				
Even km	101403			
Odd km	91355	10048	998.5	

Desired length of course: 2000m

Length of course as measured: 1999.45m

Note any adjustments made to the course after measurement: No adjustment necessary to the overall length as this calculation includes a short course prevention factor. The odd kilometre point was moved 1m south as the impact of adding the SCPF when taping effectively added 2m between the even and odd kilometre and nothing between the odd and even kilometre.

Beijing 2008 Olympic Race Walking Course



INTERNATIONAL MEASUREMENT CERTIFICATE

Name of race : *Beijing 2008 Olympic 50km Race Walks* **Distance :** *50km*

Location : *Beijing* **Country :** *CHN*

Type of course : *Lap* **Date of race :** *22/07/2008* **Date of measurement :** *12/07/2008*

Elevation change : *0* **m/km, Separation :** *0* **% of race distance**

Measurer's name : *Dave Cundy* **IAAF / AIMS Grade :** *A* **Country :** *AUS*

Certificate number : *CHN2008/025*

Date registered *16/07/2008* International Measurement Administrator *Dave Cundy* Signed :

This is to certify that the length of the above road race has been established by an expert employing the method of a bicycle calibrated with a Jones counter. It remains valid for five years so long as the course is no way changed from that defined in the full measurement report submitted by the expert measurer named above. Any modification of the course, however minimal, will nullify this certificate and will require a new official measurement to be undertaken.

INTERNATIONAL MEASUREMENT CERTIFICATE

Name of race : *Beijing 2008 Olympic 20km Race Walks* **Distance :** *20km*

Location : *Beijing* **Country :** *CHN*

Type of course : *Lap* **Date of race :** *16&21/07/08* **Date of measurement :** *12/07/2008*

Elevation change : *0* **m/km, Separation :** *0* **% of race distance**

Measurer's name : *Dave Cundy* **IAAF / AIMS Grade :** *A* **Country :** *AUS*

Certificate number : *CHN2008/024*

Date registered *16/07/2008* International Measurement Administrator *Dave Cundy* Signed :

This is to certify that the length of the above road race has been established by an expert employing the method of a bicycle calibrated with a Jones counter. It remains valid for five years so long as the course is no way changed from that defined in the full measurement report submitted by the expert measurer named above. Any modification of the course, however minimal, will nullify this certificate and will require a new official measurement to be undertaken.