Association of International Marathons and Road Races

AIMS

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AIMS COURSE MEASUREMENT PROCEDURES

1990 EDITION

AIMS ROAD RACE COURSE MEASUREMENT & CERTIFICATION PROCEDURE 1990

Course measurement is of the utmost importance to athletes, race directors and officials alike. The International Association of Marathons and Road Races (AIMS) is proud to provide this booklet which is seen as an important progression in our development. AIMS is determined to raise the standard and quality of road running events throughout the world and I see this publication as an important step in this direction.

Robert M Dalgleish
President
International Association of Marathons & Road Races

Chairman AIMS Technical Committee

With the formation of AIMS in London, 1982, course measurement was recognised as an important criteria of membership.

Our rules of membership require that members' courses be certified by an AIMS/IAAF Approved Measurer.

AIMS has pioneered and developed the AIMS Course Measurement Procedure around the world. It is most pleasing as a further development to present this AIMS Course Measurement Procedure Booklet.

Ted Paulin
Chairman
AIMS Technical Committee

Acknowledgements

This booklet sets out the AIMS Course Measurement Procedure currently used by all AIMS/IAAF Approved Course Measurers.

Thank you to the following people for their contribution to the book:

Peter Riegel	Course Registrar, AIMS Technical Committee, for preparing and collating the material;
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Introduction

The Association of International Marathons and Road Races (AIMS) was formed in London in 1982 as an association of marathons. Road races were included in the late eighties as AIMS continued to develop.

Membership continues to expand as we welcome races from Eastern Bloc countries together with feature road races. Course measurement has always been recognised as a must for all members as a guarantee to competitors that our courses are indeed correct.

The AIMS Measurement Procedure was pioneered and developed in the early eighties and is now recognised around the world. Course measurement in many countries was found to be expensive and sometimes inaccurate. The bicycle measurement system is both reliable, cost efficient and indeed accurate.

This Course Measurement Procedure booklet is the reference book for AIMS measurement.

Equipment

Useful Equipment for Measurers

a **The bicycle** It must be in good condition and comfortable to ride. A touring bike is safer to ride than a racing bike. A three-gear bike will give sufficient traction.

b **A Jones Counter**

c **Steel tape** A 30 m or 50 m steel tape is needed for measuring calibration courses and final course length tuning. A nylon coating will protect the figures and graduations.

d **Spring balance** Needed to ensure that the steel tape is under proper tension. Note: once the measurer has determined the 'feel' of the proper tension, the spring balance may be eliminated and the tension applied using a firm pull at the estimated proper tension.

e **Thermometer** A small thermometer will provide the information so that the steel tape readings can be corrected for temperature if necessary.

f **Pocket calculator** A battery model is more reliable on dark mornings. Make sure that your calculator has the ability to keep adding a figure every time that the = sign is pressed.

g **Notebook, pens etc.** A small notebook will go into a pocket in bad weather, More than one pen/pencil is vital.

h **Crayon or chalk** Useful for making temporary marks on the road.

i **Spray paint** Very useful for marking distances on the road. It can be used with a cardboard template to keep markings neat in appearance.

j **Bicycle tools** As many as are required to keep you on the road and riding safely.

k **Safety equipment** A day-glow harness or jacket is essential. A safety hat is advisable too on busy roads.

l **Masonry nails and hammer** Nails are needed to mark the ends of calibration courses and other important sites on the course.

m **Food and drink** Measurers, like runners, need to keep their blood sugar and fluid levels high. Take a chocolate bar or two and some juice.

AIMS Measurement Procedures

There are two basic measurement procedures used by AIMS. The first is the standard course *layout* procedure. It is used when laying out a new race course. It is designed to be sure that an AIMS course will survive validation by an expert. If followed properly, it will produce a course that is slightly oversized.

The second measurement procedure is *validation*. This procedure is used when a course already exists, and its length is to be checked by an AIMS expert. No short course prevention factor (SCPF) is used in validation. It is the goal of validation to determine, as closely as possible, the true length of a race course.

An extra 1.001 SCPF is built into the layout procedure. Each 'kilometre' used in layout is actually 1001 metres long. Do not confuse layout results with true distances! The validation procedure obtains the best estimate of true course length.

The AIMS procedure has been in use six years. During this time about 100 courses, all involving records, have been checked. Over 90 per cent passed the validation check. In the last two years, only one course has failed. Without the extra safety factor used in layout, at least half of the courses would have failed the test.

Course Layout Procedure

A **calibrated bicycle** is used to lay out a race course. It is necessary to count the number of wheel revolutions very accurately. A **Jones Counter**, named after its inventor, Alan Jones, is used. Mounted to the front wheel of the bicycle, it records 20 counts for each revolution of the wheel. It is available from: NYRRC — 9 East 89th St — New York, NY 10128-0602, USA. Price is $40.00 in USA. Send $45.00 for overseas orders.

The following steps are used in laying out a race course. They will be discussed at greater length elsewhere within this document:

1 **Define the course itself.** Know exactly what is to be measured and run.

2 Lay out a **calibration course.**

3 **Calibrate the bicycle** and calculate a layout constant, including the 1.001 short course prevention factor, SCPF.

4 Lay out a tentative race course.

5 Recalibrate the bicycle and calculate a **Constant for the Day.**

6 Using the **Constant for the Day,** calculate the length of the tentative race course.

7 **Make final adjustments.** Add or subtract the necessary distance to make the course come out right.

8 **Draw a clear course map.** This map is the end result of all the work.

Calibration Courses

The effectiveness of the Jones Counter/Bicycle method of measurement depends entirely on good calibration techniques. Good techniques demand quick access from the race course to the calibration area. Calibrations need to be 'fresh' if they are going to be effective.

The following arrangement would be ideal:

— Pre-measurement calibration within 10 minutes (2 km) from start of measurement of course.

— Mid-way calibration. A section on the course which can be used as a check calibration. Very useful in a full marathon.

— Post-measurement calibration within 10 minutes (2 km) from the finish line.

Remember it is better to have a 400 m calibration course within several minutes bike ride of the start and finish, rather than a 1000 m calibration course 10 km away.

Note: There are three reasons why variations in calibration occur during a measurement session.

1 A mechanical fault with the tyre — slow air leak.

2 A significant change in the temperature during the measurement. This includes the time taken before and after measurement to make the calibrations.

3 If different calibration courses are used, the calibration value may be slightly affected by the difference in road surface texture.

The mechanical fault is a problem that can be mitigated by good equipment — inner tubes, tyres and valves — but punctures do happen to pneumatic tyres. Solid tyres — when available — will also help this problem.

Calibration change due to temperature can be avoided by:

a Making the measurement in the quiet seasons — late spring and autumn and avoiding high summer.

b By measuring on overcast days when the sun doesn't heat up the road surface.

c By measuring at a time of day when the temperature has stabilised. Avoiding a before-and-after sunrise situation will be helpful.

Differences in road surface texture are inescapable, and are an inherent source of measurement error. Do not worry about them, it is wise to avoid very rough surfaces whenever possible.

It is to be expected that the value of the pre-calibration and post-calibration constants will differ. That is why the average is used. It is not perfect, but is generally the most accurate estimate of the true value.

Laying out a calibration course

Use a steel tape to establish a calibration course nearby to the race course. The calibration course must be straight. A minimum length of 500 metres is recommended, but longer is better. A short calibration course nearby is better than a long one far away.

Use pieces of masking tape to stick to the pavement for marking. Put several numbers on the roll before you tear off tape for marking. This will keep you from losing count of the tape lengths. Once you have stuck it down in the approximate position, use a narrow pen to make distance marks on the masking tape. Do not lose count! This is the most common source of error.

Check your steel tape carefully to be sure you know where the zero mark is. Not all tapes are the same.

Pull the steel tape firmly to stretch it tight before marking.

When you have laid out the calibration course, add the appropriate correction for temperature. The reason for this addition is that steel tapes are proper length at 20 C. At colder temperatures they contract, becoming shorter. At warmer temperatures they expand, becoming longer. A short calibration course will lead to a short race course. When you finish, put a nail in the pavement, at each end of the calibration course, for future use.

Correction Factors for Calibration Courses
Correction factors are in centimetres

	Length of Calibration Course, Metres							
	300	400	500	600	700	800	900	1000
DEG C								
35	-5	-7	-9	-10	-12	-14	-16	-17
30	-3	-5	-6	-7	-8	-9	-10	-12
25	-2	-2	-3	-3	-4	-5	-5	-6
20	0	0	0	0	0	0	0	0
15	2	2	3	3	4	5	5	6
10	3	5	6	7	8	9	10	12
5	5	7	9	10	12	14	16	17
0	7	9	12	14	16	19	21	23
-5	9	12	15	17	20	23	26	29
-10	10	14	17	21	24	28	31	35

Example: You lay out a 600 metre calibration course at 10 C. To correct for temperature, add 7 cm to the length before you put down permanent marks. If temperature is 25 C, remove 3 cm before putting down final marks.

Use the bicycle to check that you have not made a major mistake. The counts obtained on the calibration course should be very close to counts you obtain on other calibration courses. If you are riding an unfamiliar bicycle, obtain the count on a single tape length. Use it to check the length of the entire calibration course. The calibration values should be close.

An error at this point in the measurement process will lead to serious consequences later. **Check, check, check!**

Calibrating the bicycle

Obtaining a layout constant

Begin at one end of the calibration course. You will be making four rides — two in each direction. Set the counter to a number you like and record it. Start with the recorded count. Ride to the other end of the calibration course, stop, and record the count again. Lock the wheel with the hand brake, turn the bicycle around and set it down exactly on the mark. Ride back to where you started and record the count again. Repeat the operation.

Now you will be back where you started and will have five recorded numbers. If you do not wish to lock the hand brake each time, you may begin each calibration ride with a fresh number. As an example, using a 400 metre calibration course, Jack and Jill obtain calibration values as follows:

	Jack		Jill	
	Recorded Count	Elapsed Count	Recorded Count	Elapsed Count
Start count	12000		24000	
End first ride:	15703	3703	27668	3668
End second ride:	19407.5	3704.5	31334	3666
End third ride:	23111	3703.5	35002	3668
End fourth ride:	26814	3703	38669	3667
Average counts for 400 metres =		3703.5		3667.25
Counts for 1 kilometre =		9258.75		9168.13
Counts/km with 1.001 SCPF =		9268.01		9177.29
Rough layout constant =		9268		9177

Use rough layout constant for establishing a tentative race course. Exact values will be used in final calculations.

> Once you have obtained a layout constant, lay out the race course. When you are done, return to the calibration course and repeat the calibration procedure to obtain a postcalibration constant, and a **Constant for the Day.** To minimise calibration change, the calibration, measurement and recalibration should be done in as short a time as possible.

Postcalibration:

	Jack		Jill	
	Recorded Count	Elapsed Count	Recorded Count	Elapsed Count
Start count	38000		82000	
End first ride:	41706	3706	85667	3667
End second ride:	45413	3705	89333	3666
End third ride:	49117	3706	92999	3666
End fourth ride:	52822	3705	96666	3667
Average counts for 400 metres =		3705.5		3666.5
Counts for 1 kilometre =		9263.75		9166.25
Counts/km with 1.001 SCPF =		9273.01		9175.42

Constant for the Day — Use the **average** of the precalibration and postcalibration constants	Jack	Jill
	9270.51	9176.35

Installation Instructions for Jones Course Measuring Device

Important: As you sit on your bicycle, in riding position, device is installed on LEFT SIDE of front wheel, between fork and front wheel.

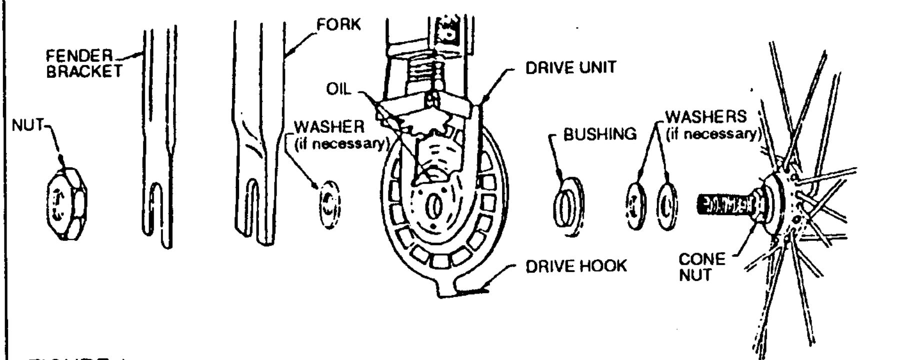


FIGURE 1

Step 1 Turn bicycle upside down and remove front wheel. use a proper size wrench (not pliers) to remove the wheel nuts.

Step 2 Slide washers onto axle to prevent device from touching spokes when placed on axle.

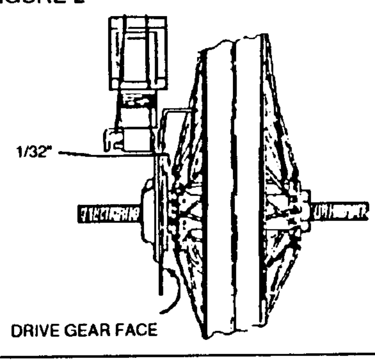
Step 3 Slide unit onto axle and insert drive hook between any two spokes. If clearance between spokes and drive gear face is greater than 1/32" (width of a penny), remove one washer at a time until 1/32" distance between spokes and drive gear is obtained. See Figures 1 and 2.

Step 4 Insert washer between unit and fork if necessary to give clearance and keep device vertical. Place front wheel with device into fork. It may be necessary to spread the fork slightly to make room for the unit.

Step 5 Replace front wheel nuts removed in Step 1 and tighten.

Step 6 Make sure wheel turns freely. If not, it may be necessary to add a washer as shown.

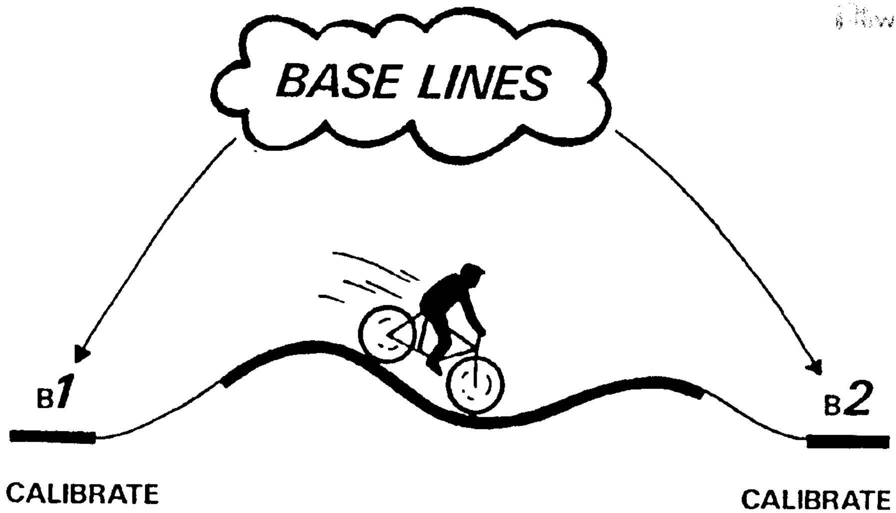
FIGURE 2



NOTES: Attach counter in such a position that the numbers can be seen while riding.

The counter is not designed for continual use in wet weather. If bike is to be used a great deal for other than measuring, it is recommended that the counter be removed and only mounted while measuring courses.

Calibrated Bicycle Method



1 Create base line(s) with steel tape or electronic meter
2 Bicycle B1 (4 times)
3 Bicycle race course } Same Day
4 Bicycle B2 (4 times) }
5 Calculate length
6 Adjust course as required

Define the course

This is the most important step in measuring a race course. Before you can measure something, you must know what to measure. You will probably have a rough route in mind, and you will know the streets that the runners will follow. Before you measure, decide how much of those streets will be available to the runners. Will they have the entire road, from curb to curb? Will they be kept to the right- or left-hand side? Are there any places where the course crosses a grass or gravel area?

If runners are expected to stay to one side of the road, this may cause uncertainty in measuring corners. The precise route around each restricted corner must be defined by barriers on race day. It is up to the measurer to locate those barriers exactly.

The result of your work will be a map that shows the entire race course. The map should be good enough to allow a perfect stranger, using the map alone, to measure exactly where you did. If your course has many restrictions, they must all appear clearly on the map. The map may be hard to draw and hard to understand.

Do it the easy way

The easiest way to define a course is to say that the runners will have the full use of the entire road, from curb to curb, or from curb to solid median divider, if one exists. This leaves the measurer with no doubt as to where to measure. On race day, the director may put up some barriers for safety, but this will only lengthen the course slightly.

If you lay out a course with many restrictions and barriers, it may come up short if the race organisation omits or misplaces the barriers. If a record time is involved, a short course can be extremely embarrassing to the race organisation and the measurer.

Shortest Possible Route (SPR) — Follow the Stretched String

Once you have defined the limits of the course, you are ready to measure. Your measured path must be the **shortest possible route** within the limits of the course boundaries. Imagine how a stretched string would follow the course. Follow that imaginary string when you measure. Runners may swing wide on corners, but you should not attempt to measure what you think they will do. The exact SPR is the proper route to follow.

Measuring the SPR means hugging the **inside** edges of curves. The measured path officially lies **30 centimetres** from the curb or other solid boundaries of the running surface. Attempt to maintain this distance on curves and corners. On stretches **between** curves, the SPR takes the shortest possible **straight** path. It zigzags from one edge of the road to the other, whenever necessary, to minimise the distance.

Laying out a race course

Once you have calibrated the bicycle, you will have determined a **layout constant**. Use this constant to lay out the race course.

Go to one end of the course. Either end will do — as long as you follow the proper line, direction of measurement does not matter. Look at your Jones Counter. Rotate the wheel until the counter reaches a value you would like to use as a starting count.

Calculate how many counts it will take to cover the various split points you wish to lay down on the course. Add these to the starting count. When you have finished calculating you will have listed the proper count for each split point.

Ride along the course, stopping at the precalculated counts. Make a mark on the road at each place you stop. Record the location of the mark for later documentation. When you reach the end, you will have established a tentative race course.

Although only one measurement is required by AIMS, a second measurement serves as a check against mistakes. The second rider should stop at the **same** points laid down by the first rider. He does not need to calculate his own split points, although this does serve as a check. Exact agreement is **not** to be expected. **Do not shift the marks** at this point when you see disagreement. Read the counter and leave the mark alone until it is time for final adjustments.

Recalibrate the bicycles, and determine the Constant for the Day. Use this constant to calculate the official length of the tentative course.

Finally, add or subtract distance as required to make the course come out to the proper length.

If you decide to do two or more course measurements, you may repeat your ride, or another rider may accompany you. Each rider must use a bicycle that has been calibrated and ridden by himself.

See the example of layout of a marathon course for how the numbers will look.

The example shows how two measurers might lay out a course. A single measurer may do the job by riding the course twice. Remember that each measuring occasion must be preceded and followed by four calibration rides. If the course is not a long one, you may be able to calibrate, ride the course twice, and recalibrate. Since a flat tyre will destroy your calibration, it is wise to recalibrate frequently to protect previous work.

Layout of a marathon course (42.195 km)

Jack's Layout Constant = 9268 Counts/km	
1 km =	9268 counts
5 km =	46340 counts
2.195 km =	20343 counts

Jill's Layout Constant = 9177 Counts/km	
1 km =	9177 counts
5 km =	45885 counts
2.195 km =	20144 counts

Course Layout — Jack lays down the marks. Jill stops at Jack's marks.

	Jack		Jill	
Point	Counter Reading	Interval Counts	Counter Reading	Interval Counts
Start	17000	0	43000	0
1 km	26268	9268	52178	9178
5 km	63340	37072	88873	36695
10 km	1)09680	46340	1)34734	45861
15 km	1)56020	46340	1)80614	45880
20 km	2)02360	46340	2)26504	45890
25 km	2)48700	46340	2)72367	45863
30 km	2)95040	46340	3)18237	45870
35 km	3)41380	46340	3)64125	45888
40 km	3)87720	46340	4)09982	45857
42.195 km	4)08063	20343	4)30103	20121
Total counts =		391063		387103

Check for agreement between measurements:

Jack's distance = 391063/9268 = 42.1950 km
Jill's distance = 387103/9177 = 42.1819 km

Difference = 13.1 metres

NOTE: These are *not* final values. Do not adjust any marks at this time!

Jack and Jill now recalibrate their bikes. When they are done, they get the following *Constants for the Day*:

Jack: 9270.51 counts per kilometre
Jill: 9176.35 counts per kilometre

Remember: The Constant for the Day is the *average* of precal and postcal

Now they *calculate their official measured distances*:

Jack: 391063/9270.51 = 42.1835 km — *Official value*, since it is *lower*.
Jill: 387103/9176.35 = 42.1849 km

Length of course before final adjustment = 42183.5 metres
Desired length of course = 42195.0 metres
Final Adjustment: (42195-42183.5) = add 11.5 metres to course

Course Check by an Expert

AIMS race courses may be checked at some time by an expert measurer. This may be done immediately preceding the race to be sure the course is correct. If the course is incorrect he will fix the deficiency in accordance with AIMS layout procedure. The same measurer will then observe the race to be sure it followed the proper measured path. He will also obtain times for the leading runners to check against official results. In this way, if a record is set, there will be evidence of credibility.

If a record is set on an AIMS course that has not been checked before the race, an expert (called a **validator**) will be sent to check the course. If the course is found short, the record will be disallowed.

The validator will use the following procedure:

1 Review existing course maps and consult with the race director and witnesses to the race. Videotapes of the race may be viewed. This is done to determine the exact course that was used. If the exact course cannot be determined, the process will end and the record will be disallowed.

2 Once the proper course is known, the validator will establish a calibration course and calibrate his bicycle. He will ride the race course and obtain a measurement of its length. He will then recalibrate his bicycle.

3 He will use the **average** of the pre-measurement calibration and the post-measurement calibration to determine a constant. No 1.001 SCPF will be added. The constant may be adjusted to account for unusual conditions, if strong justification for doing so exists. Otherwise the average will be used.

4 He will divide the counts obtained on the race course by the calibration constant. This will yield a measured length for the course.

5 If the measured length is less than the nominal length of the course, the record will be disallowed.

6 If the measured length shows the course to be at least as long as it is supposed to be, and if evidence of proper timing can be obtained, the record may then be considered as valid.

The Course Map

It makes no sense to measure something unless you document what you measured. If you do not do this properly, you will be the only person who can say where the course is supposed to go, or where it begins and ends. Paint on the pavement is not enough. The map should be good enough so that the race director could re-establish the course even if the roads were repaved.

Drawing a good course map is just as important as measuring the course properly. The purpose of the map is to provide all information that race officials need to properly use the course as it was laid out.

The map must clearly show the course route, showing all the streets and roads it uses. Include any necessary words to make the route totally clear. Good maps are usually **not** drawn to scale. Portions may be enlarged or distorted to show details, such as when a course begins or ends in a stadium.

The map must precisely describe the positions of the start, finish and any turn-around points, using taped distances from nearby permanent landmarks. These descriptions must be clear enough to enable a complete stranger to accurately **re-locate** the points, even after the road has been resurfaced, and all the markings you made on the road have disappeared.

If you laid out the course so that runners have use of the entire road, the map will be simple to draw. It will also be easy for the race director to set up the course properly on race day.

If the route is anywhere restricted (ie the whole road not available), the map must show exactly how the runners are to be guided onto the proper path. Your descriptions of all required barriers must be just as precise as for a start, finish, or turn-around.

If you are not sure whether your map is adequate, give it to another person. Ask them to locate the race route and locations of points. If they cannot do it, without your help, your map is not good enough. Improve it until a stranger can follow the route.

Appendix A

SUPPLEMENTARY TIPS

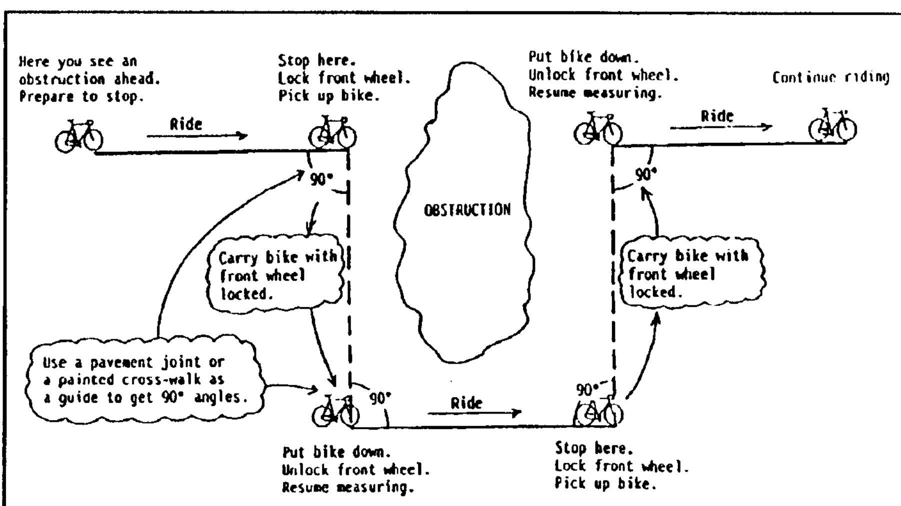
Avoiding Road Hazards

Always try to stay on the proper measuring line. Occasionally there will be a road hazard, or pothole, in your path. Try to think ahead. If you see a pothole in your path, begin to drift sideways so as to just clear the hazard. Do not wait until you are at the pothole. In this way the measurement will not be greatly affected. Alternatively, use an **offset manoeuver** (see diagram) to get around the obstacle.

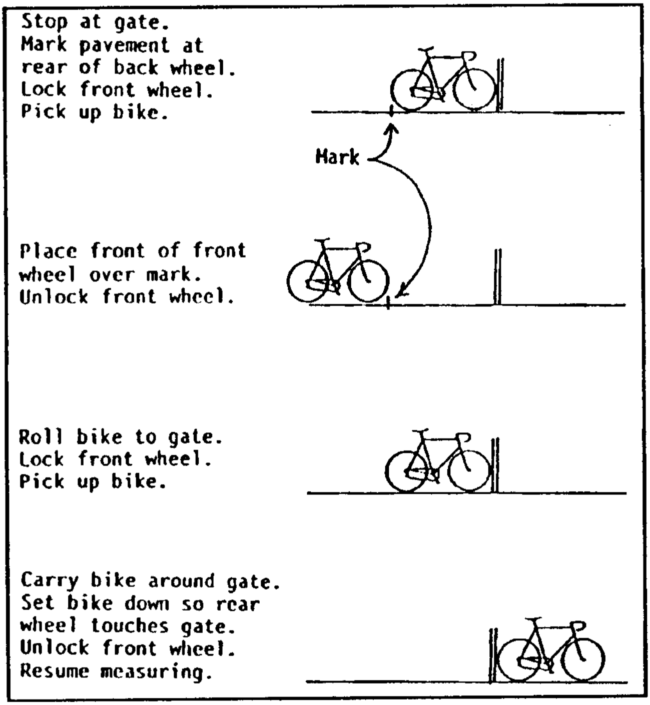
Getting Around a Parked Car or Obstacle

If the obstacle is on a long, straight portion of the course, simply make a gradual sideways movement to clear it, as with an ordinary road hazard or pothole. If the car is parked on an outside bend, ride to the rear bumper. Lock your wheel and move the bike sideways until you have clear space ahead. Roll forward until clear of the car. Lock the wheel and again move sideways back to the proper line. Resume measuring. See diagram for **offset** manoeuver.

OFFSET MANOEUVER



Measuring Past a Gate or Barrier



Record Temperatures During Measurement

A record of temperatures during the measurement can be important. Occasionally something strange may happen during a measurement. When it does, knowledge of measurement conditions can sometimes resolve the problem. Therefore, record the temperatures. If the road is dry, record this. If it is raining or the road is wet, record it. These minor things may help you later.

A Final Note:

The most important figure of the whole measurement is the last one! Most measurers start with a 'round' number on their Jones counter, and there is nearly no danger of noting down a wrong figure at the starting line. But at the other end of the course a reading error can be made very easily (e.g. 58967 instead of 58697), and it is nearly impossible to reconstruct it exactly afterwards. It is highly recommended to let at least two persons read the final figures independently.

Counter Backlash

Look at your Jones counter as you roll the bike back and forth a few centimetres each way. You will see that the counter does not move until the backlash is taken up. This can affect calibration accuracy. Good procedure is: always take a count when the bike has just finished rolling *forward*. If you roll past a mark, roll back until the bike is 10-20 cm behind the mark. Roll it gently forward again, stopping exactly at the mark. Then read the counter.

When calibrating, you wish to start on an exact count. Roll the bike forward until you see the number you want. Lock the wheel with the hand brake (or your hand). Pick up the bike, with the wheel still locked, and place it directly on the starting mark. This will eliminate backlash. With practice this will become natural to you.

Measuring Across Off-Road Surfaces

Short stretches of grass or dirt may be measured with the bike. If an extensive portion (more than 5 per cent) of the course lies on an irregular surface, measure these portions with a steel tape, or lay down a calibration course on the off-road surface, calibrate the bike, and use the bike to measure.

Badly-Defined Road Edges

The course is theoretically defined as lying 30 cm from curbs or road edges. Occasionally you will find that the edge of the road is worn or in poor condition. You may find an occasional drain grating in your path. In cases like these, use your best judgment of the shortest path available to the runners.

Walking the Bicycle

Your bicycle is calibrated for your weight in a riding position upon it.

A change in your riding position — leaning forward, standing on the pedals — will alter the weight on the front wheel and hence change the wheel profile and calibration figure. Consistency of riding position during calibrations and measurement is essential. Getting off the bike will produce even greater changes in the wheel profile, so it should be avoided wherever possible.

Flat Tyres and Loss of Pressure — Calibrate Frequently

If you get a flat front tyre, and have not yet obtained a post-measurement calibration, your measurement is void. You must start over. For this reason it is a good idea to recalibrate as frequently as possible. This protects the previous measurement. If you get a flat *rear* tyre, you may fix it and resume measuring. The rear tyre has no effect on the calibration of the front tyre.

Never use a tyre gauge between calibrations. Each use of a tyre gauge lets a bit of air out of the tyre. This changes its calibration. A calibrated wheel should never be repaired, inflated, or have any air released until a recalibration value is obtained.

Changing temperatures will affect your calibration. If a large temperature change is expected, it is wise to recalibrate as frequently as possible. This will keep your measurements accurate.

Appendix B

Examples of Course Maps

The following are four course maps, showing different ways they may be drawn.

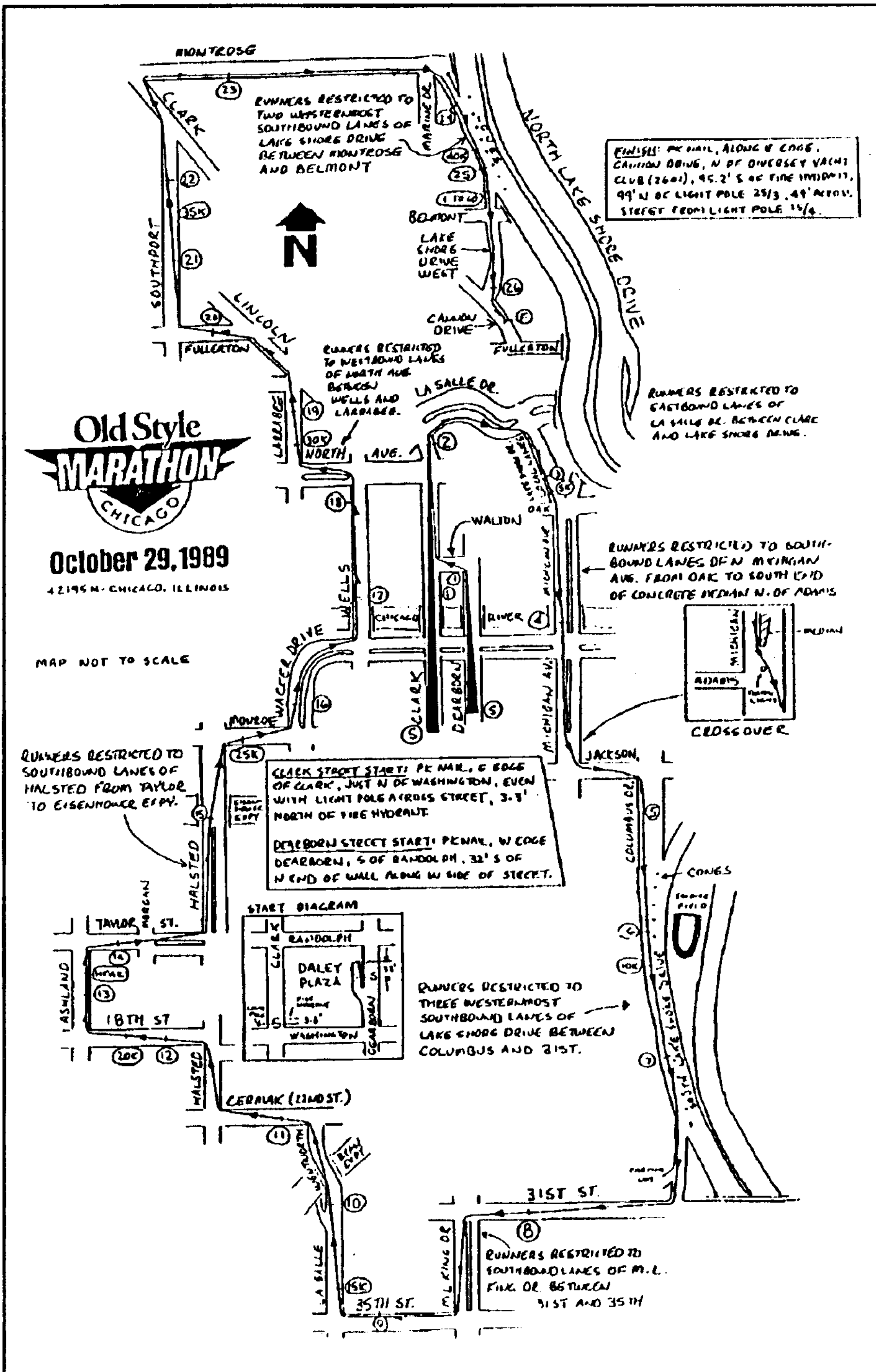
Old Style (Chicago) Marathon — This map shows the full width of the roads and the location of the measured path within the roadway.

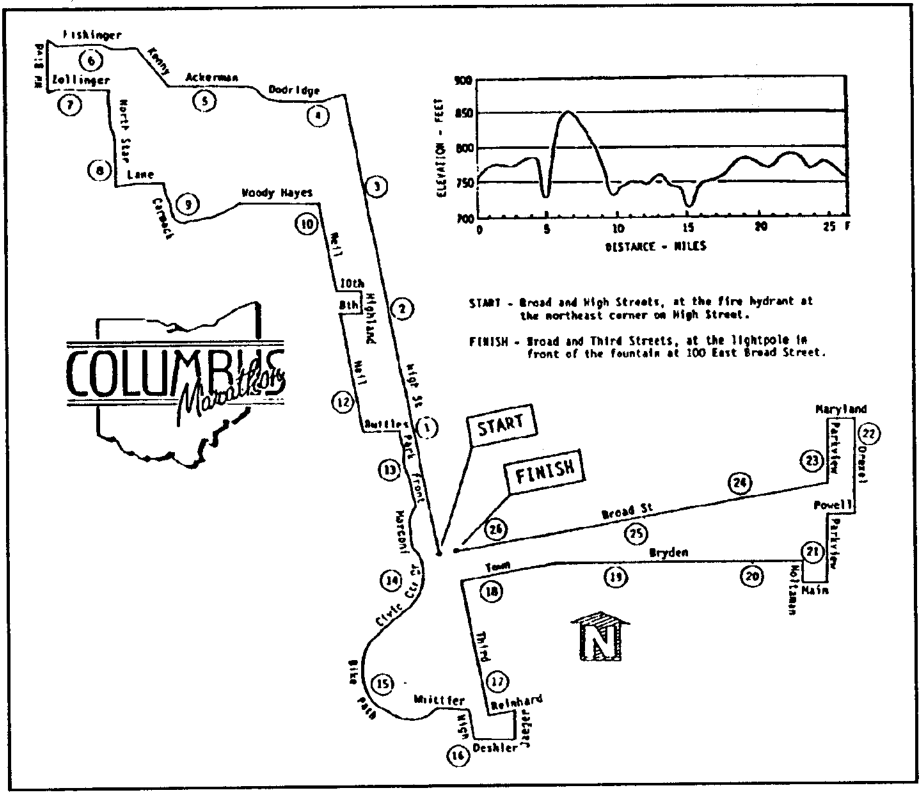
Columbus Marathon — This is a single-line type of map. Notes on the measured route amplify the line drawing as required. This type of map may be used when runners have the full use of the roads everywhere on the course. This is noted on the map.

Carnaval Miami 8K — This is an example of a map which shows a lot of care by the measurer. Note that details of the measured path are clear and easy to follow.

New York City Marathon — This map also shows full width of the roads and the location of measured path within the roading.

Note that all maps have an exact description of the location of the start and the finish of the course.


Old Style MARATHON CHICAGO
October 29, 1989
MAP NOT TO SCALE
N
MONTROSE
CLARK
SOUTHPORT
LINCOLN
FULLERTON
MARINE DR.
NORTH LAKE SHORE DRIVE
BELMONT
LAKE SHORE DRIVE WEST
CANNON DRIVE
LA SALLE DR.
LARRABEE
NORTH AVE.
WELLS
WALTON
MICHIGAN AVE.
RIVER
CHICAGO
WACKER DRIVE
MONROE
CLARK
DEARBORN
JACKSON
HALSTED
TAYLOR ST.
MORGAN
ASHLAND
18TH ST
CERMAK (22ND ST.)
WENTWORTH
LA SALLE
35TH ST.
M. L. KING DR.
31ST ST.
COLUMBUS DR.
LAKE SHORE DRIVE
CONES
RUNNERS RESTRICTED TO TWO WESTERNMOST SOUTHBOUND LANES OF LAKE SHORE DRIVE BETWEEN MONTROSE AND BELMONT
RUNNERS RESTRICTED TO WESTBOUND LANES OF NORTH AVE. BETWEEN WELLS AND LARRABEE.
RUNNERS RESTRICTED TO EASTBOUND LANES OF LA SALLE DR. BETWEEN CLARK AND LAKE SHORE DRIVE.
RUNNERS RESTRICTED TO SOUTHBOUND LANES OF N. MICHIGAN AVE. FROM OAK TO SOUTH END OF CONCRETE MEDIAN N. OF ADAMS
RUNNERS RESTRICTED TO SOUTHBOUND LANES OF HALSTED FROM TAYLOR TO EISENHOWER EXPY.
CLARK STREET START: PK NAIL, E EDGE OF CLARK, JUST N OF WASHINGTON, EVEN WITH LIGHT POLE ACROSS STREET, 3.3' NORTH OF FIRE HYDRANT.
DEARBORN STREET START: PK NAIL, W EDGE DEARBORN, S OF RANDOLPH, 32' S OF N END OF WALL ALONG W SIDE OF STREET.
START DIAGRAM
RANDOLPH
DALEY PLAZA
WASHINGTON
CROSSOVER
ADAMS
MEDIAN
RUNNERS RESTRICTED TO THREE WESTERNMOST SOUTHBOUND LANES OF LAKE SHORE DRIVE BETWEEN COLUMBUS AND 31ST.
RUNNERS RESTRICTED TO SOUTHBOUND LANES OF M. L. KING DR. BETWEEN 31ST AND 35TH



Notes on the Measured Route

The course was measured entirely *on the pavement* of the roads and paths described in this map. At corners and turns, the measured path is one foot from the curb or edge. Leaving turns, the course takes the shortest possible route to the next turn, without regard to direction of vehicular traffic.

There is a curved shortcut which allows vehicles to make a right turn onto Fishinger from Northwest Blvd. The course passes through this shortcut.

Runners may be directed to either side of the centre divider on Woody Hayes. Both routes are legal, although runners must sooner or later move right to turn onto Neil Avenue.

When runners turn right onto Neil, they will immediately encounter Ohio State University sidewalks. Proceed straight ahead, rejoining Neil Avenue in a few hundred feet when the sidewalk ends.

As Civic Center Dr begins to turn left at Rich St, runners should get onto the sidewalk and follow it along the riverfront to the bike path. They emerge from the bikepath onto Whittier St. This short stretch of sidewalk, and the sidewalk on Neil Ave in the University, are the only places on the course where runners may use sidewalks.

OFFICIAL ROUTE OF

CARNAVAL MIAMI 8K

MIAMI, FLORIDA

START - ON BISCAYNE BLVD. 107 FT. 5 IN. W OF THE CHALLENGER MONUMENT.

MILE ① - ON BRICKELL AVE. 57 FT. 10 IN. N OF TRAFFIC SIGNAL POLE ON W SIDE OF ROAD (N END OF BRIDGE) AT THE INTERSECTION OF SE 4 ST. (BY THE DUPONT PLAZA)

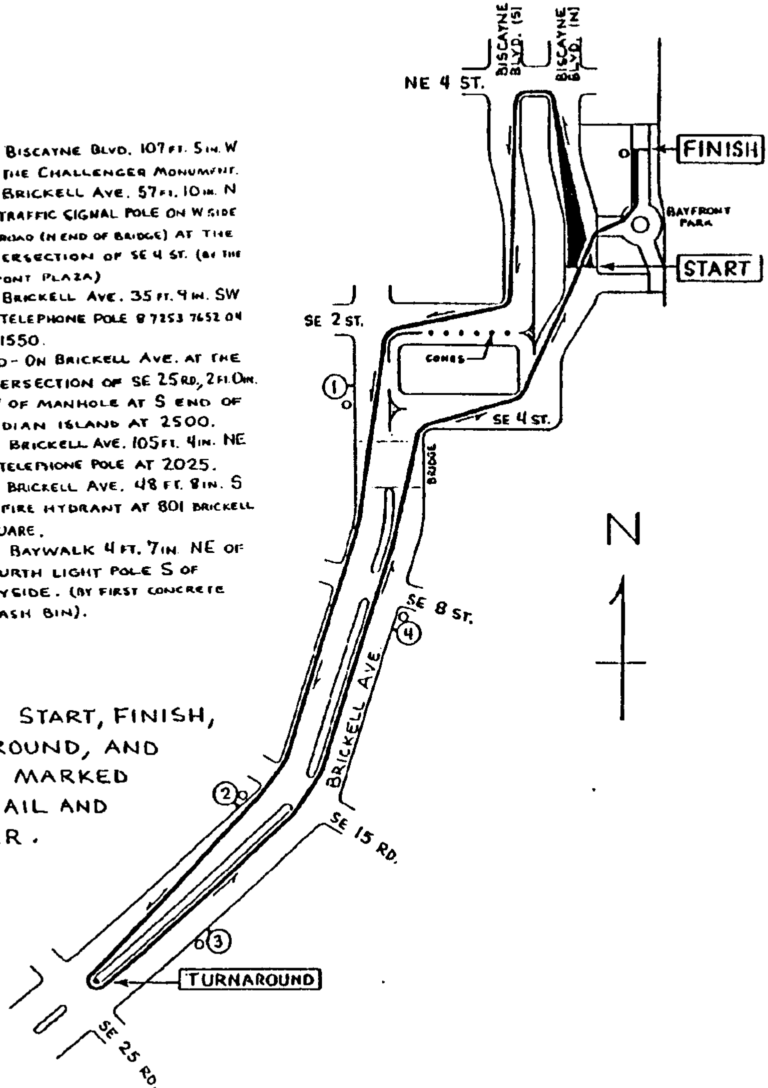
MILE ② - ON BRICKELL AVE. 35 FT. 9 IN. SW OF TELEPHONE POLE 8 7253 7652 ON AT 1550.

TURNAROUND - ON BRICKELL AVE. AT THE INTERSECTION OF SE 25 RD., 2 FT. 0 IN. SW OF MANHOLE AT S END OF MEDIAN ISLAND AT 2500.

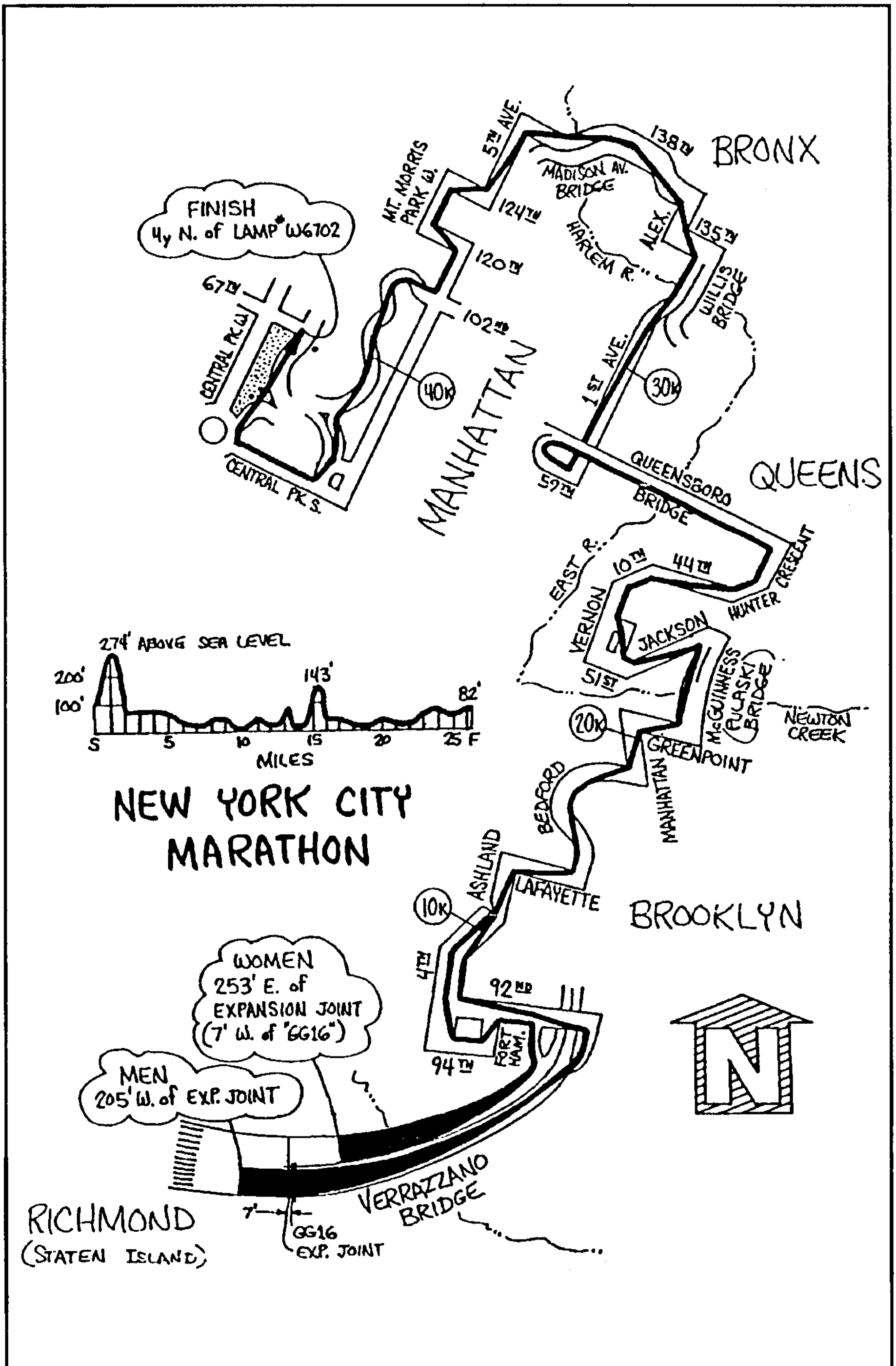
MILE ③ - ON BRICKELL AVE. 105 FT. 4 IN. NE OF TELEPHONE POLE AT 2025.

MILE ④ - ON BRICKELL AVE. 48 FT. 8 IN. S OF FIRE HYDRANT AT 801 BRICKELL SQUARE.

FINISH - ON BAYWALK 4 FT. 7 IN. NE OF FOURTH LIGHT POLE S OF BAYSIDE. (BY FIRST CONCRETE TRASH BIN).



NOTE: START, FINISH, TURNAROUND, AND SPLITS MARKED WITH NAIL AND WASHER.


BRONX
138TH
5TH AVE.
MT. MORRIS PARK W.
MADISON AV. BRIDGE
124TH
ALEX.
135TH
HARLEM R.
120TH
WILLIS BRIDGE
FINISH
4y N. of LAMP# W6702
67TH
102ND
CENTRAL PK. W.
40K
MANHATTAN
1ST AVE.
30K
CENTRAL PK. S.
59TH
QUEENSBORO BRIDGE
QUEENS
EAST R.
10TH
44TH
HUNTER CRESCENT
VERNON
JACKSON
51ST
McGUINNESS
PULASKI BRIDGE
NEWTON CREEK
274' ABOVE SEA LEVEL
200'
100'
143'
82'
S
5
10
15
20
25 F
MILES
20K
GREENPOINT
MANHATTAN
BEDFORD
NEW YORK CITY MARATHON
ASHLAND
LAFAYETTE
BROOKLYN
10K
4TH
WOMEN
253' E. of EXPANSION JOINT
(7' W. of "GG16")
92ND
94TH
FORT HAM.
MEN
205' W. of EXP. JOINT
VERRAZZANO BRIDGE
RICHMOND
(STATEN ISLAND)
7'
GG16
EXP. JOINT

Appendix C – Course Measurement

Data sheets
(for information only)

Application for Certification of a Road Race

Details of Calibration Data Sheet

Bicycle Calibration Data Sheet

Course Measurement Data Sheet

AIMS Measurers Certificate

AIMS Race Observers Certificate

Road Race Certification Document

Association of International Marathons and Road Races

AIMS

SPONSORED BY asics

APPLICATION FOR CERTIFICATION OF A ROAD COURSE

① NAME OF COURSE ______________________________

② ADVERTISED RACE DISTANCE ______________________________

③ LOCATION OF START ______________________________

LOCATION OF FINISH (IF DIFFERENT) ______________________________

④ MEASURING TEAM LEADER ______________________________

NAME ______________________ TELEPHONE(   ) ______________

ADDRESS ______________________ FACSIMILE(   ) ______________

⑤ RACE DIRECTOR (IF COURSE IS MEASURED FOR SPECIFIC EVENT) ______________________________

NAME ______________________ TELEPHONE(   ) ______________

ADDRESS ______________________ FACSIMILE(   ) ______________

⑥ DATE ______________________________

⑦ A clear map of the course, showing start and finish points and any turnarounds or changes in direction must accompany this application.

⑧ TYPE OF TERRAIN FLAT ☐ ROLLING ☐ HILLY ☐

⑨ ALTITUDE (IN METRES ABOVE SEA LEVEL)

START ________ HIGHEST ________ LOWEST ________ FINISH ________

⑩ TYPE OF COURSE OUT & BACK ☐ POINT TO POINT ☐ LOOP COURSE ☐ OTHER ☐

Chairman Technical Committee, Ted Paulin,
Melbourne Marathon Inc., Olympic Park, Swan Street, Melbourne 3002, Victoria, Australia.
Phone (03) 429 5105, Fax (03) 428 5336

DETAIL OF CALIBRATION COURSE

① NAME OF EVENT ______________________

② NAME OF CALIBRATION COURSE ______________________

③ LENGTH OF CALIBRATION COURSE ______________________

④ CITY AND SITE ______________________

⑤ DATE(S) MEASURED ______________________

⑥ METHOD USED TO MEASURE CALIBRATION COURSE ______________________

⑦ HOW MANY TIMES WAS CALIBRATION COURSE MEASURED ______________________

⑧ HOW ARE START AND FINISH POINTS MARKED ______________________

⑨ MEASURING TEAM LEADER ______________________

NAME ______________________ TELEPHONE(   ) ______________________

ADDRESS ______________________ FACSIMILE(   ) ______________________

____

OFFICIAL AIMS/IAAF COURSE MEASURER.

Chairman Technical Committee, Ted Paulin,
Melbourne Marathon Inc., Olympic Park, Swan Street, Melbourne 3002, Victoria, Australia.
Phone (03) 429 5105, Fax (03) 428 5336

BICYCLE CALIBRATION DATA SHEET

NAME OF EVENT

NAME OF MEASURER

DATE OF MEASUREMENT

① Ride the Calibration Course 4 times, recording data as follows;

RIDE	START COUNT	FINISH COUNT	DIFFERENCE
1			
2			
3			
4			

PRE-MEASUREMENT AVERAGE COUNT	
TIME OF DAY	
TEMPERATURE	

NB. Calibration rides interrupted by traffic, pedestrians etc. should be discarded and a further ride follow.

LENGTH OF CALIBRATION COURSE

Working Constant = Number of counts in one kilometre or one mile, calculated from Pre-measurement average count, and multiplied by 1.001 "safety factor". Working Constant = ☐ x 1.001 = ☐

② Now measure the course, including all intermediate distances, if required, using the working constant. Enter the data on the "Course Measurement Data Sheet".

③ Recalibrate the bicycle by riding the calibration course 4 times, recording data as follows;

RIDE	START COUNT	FINISH COUNT	DIFFERENCE
1			
2			
3			
4			

POST-MEASUREMENT AVERAGE COUNT	
TIME OF DAY	
TEMPERATURE	

Finish Constant = Number of counts in one kilometre or one mile, calculated from Post Measurement average count and multiplied by 1.001 "safety factor". Finish Constant = ☐ x 1.001 = ☐

Constant for the Day = Average of both Working Constant and FinishConstant.

CONSTANT FOR THE DAY = ☐ Conversion Factor: 1 mile = 1.609344 kilometres.

Chairman Technical Committee, Ted Paulin,
Melbourne Marathon Inc., Olympic Park, Swan Street, Melbourne 3002, Victoria, Australia.
Phone (03) 429 5105, Fax (03) 428 5336

Association of International Marathons and Road Races

AIMS

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COURSE MEASUREMENT DATA SHEET

NAME OF EVENT ______________________________

NAME OF MEASURER ______________________________

DATE ______________ START TIME ______________ TEMPERATURE ______________

FINISH TIME ______________ TEMPERATURE ______________

CONSTANT FOR THE DAY ______________ COUNTS/km ______________ COUNTS/metre ______________

MEASUREMENT DATA

MEASURED POINT	RECORDED COUNT	COUNT ELAPSED SINCE PREVIOUS POINT	INTERVAL LENGTH METRES	CUMULATIVE LENGTH METRES

DESIRED LENGTH OF COURSE ______________ LENGTH OF COURSE AS MEASURED ______________

NOTE ANY ADJUSTMENTS MADE TO THE COURSE AFTER MEASUREMENT:

Chairman Technical Committee, Ted Paulin,
Melbourne Marathon Inc., Olympic Park, Swan Street, Melbourne 3002, Victoria, Australia.
Phone (03) 429 5105, Fax (03) 428 5336

Association of International Marathons and Road Races

AIMS

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AIMS Measurers Certificate

Race Name____

City______________________Country______________________

Was measured in accordance with AIMS measurement procedure the course was found to

be not less than _____ Kilometres

AIMS Measurer____

Date____

Mr Ted Paulin Chairman AIMS Technical Committee
Olympic Park, Swan St Melbourne 3002 Australia Tele 61 03 429 5105 Fax 61 03 428 5336

Association of International Marathons and Road Races

AIMS

SPONSORED BY asics

AIMS Race Observation Certificate

Race Name____

City______________________Country______________________

Was run on the exact course measured and

Certified By____

AIMS Observer____

Date____

Mr Ted Paulin Chairman AIMS Technical Committee
Olympic Park, Swan St Melbourne 3002 Australia Tele 61 03 429 5105 Fax 61 03 428 5336

Association of International Marathons and Road Races

AIMS

SPONSORED BY asics

Road Race Certification Document

Race:____

Location:________________ City________________ Country________________

Type of Terrain: flat ☐ rolling ☐ hilly ☐

Altitude (in metres above sea level) Start________ Highest________ Lowest________ Finish________

Name____
Local Race Measurer

Address____

City____________________ Country____________________

Phone____________________ Date____________________

Measuring Method: Bicycle ☐ Surveyor Wheel ☐ Steel Tape ☐

It is hereby certified that
the course described above and defined by the attached map has been approved for AIMS certification
by the observer noted below. The course measurement complies with all IAAF/AIMS rules.
If this course is changed in any way from the above approved route, it invalidates the Certification.
The course must then be recertified.

AIMS Observer____________________ Date________ ____________________

As authorized by Ted Paulin Chairman AIMS Technical Committee

Appendix D

METRIC-IMPERIAL CONVERSIONS

If the imperial measurement is required, the relevant conversion material is listed for your information. The easiest such definition to remember is that of the inch:

one inch = 2.54 centimetres **exactly**

From this one can derive the equivalents of other units of length, e.g.,

one foot = 12 x 2.54 cm = 30.48 cm = 0.3048 metres

one yard = 3 x 30.48 cm = 91.44 cm = 0.9144 metres

one mile = 5280 x 0.3048 metres = 1.609344 kilometres

If both mile and kilometre distances must be marked when laying out a race course, the conversion is most easily done in the **working constant**:

(a) Determine the working constant in counts/mile or counts/kilometre.
(b) Divide the constant in counts per mile by 1.609344 to obtain the constant in counts per kilometre.
(c) Multiply the constant in counts per kilometre by 1.609344 to obtain the constant in counts per mile.

CONVERSION TABLE FOR STANDARD DISTANCES

The following table shows how kilometre and mile distances are related but is not intended for routine measuring. It is easier to do the conversion **once** in your measuring constant, as above, than do repeated conversions for each split. The table does show, for example, that 10 kilometres is not exactly 6.2 miles. Courses measured to exactly 6.2 miles **will not** be certified as 10 kilometres!

1 km =	0.62137119	miles	1 mile =	1.609344	km*
5 km =	3.1068560	miles	5 miles =	8.04672	km
8 km =	4.9709695	miles	10 miles =	16.09344	km
10 km =	6.2137119	miles	20 miles =	32.18688	km
12 km =	7.4564543	miles	30 miles =	48.28032	km
15 km =	9.3205679	miles	40 miles =	64.37376	km
20 km =	12.427424	miles	50 miles =	80.4672	km
25 km =	15.534280	miles	100 miles =	160.9344	km
30 km =	18.641136	miles			
50 km =	31.068560	miles			
60 km =	37.282272	miles			
100 km =	62.137119	miles			
150 km =	93.205679	miles			
200 km =	124.27424	miles			

half marathon	=	21.0975 km**	=	13.10938 miles
marathon	=	42.195 km**	=	26.21876 miles

* Imperial to metric conversions are **exact**.
** The marathon is **defined** as 42.195 km **exactly**.

CONVERSIONS FOR STEEL-TAPING

1 foot	=	0.3048 metres (**exact**)
1 kilometre	=	3280.84 feet
degrees Celsius (°C)	=	[degrees Fahrenheit (°F) — 32] divided by 1.8