December 30, 1983

Dear Pete:

Well here's the material I promised over two weeks ago. There is over 200 pages so that this could indeed be termed 'overkill'. Some of the material I could well have sent you earlier, but since I can't remember what you have, I just sent most of what I've accumulated these past 5 years. As you can tell from the table of contents, I've organized the various letters/experiments/booklets by the date that product was issued. Since much of this material will not be new input data for your human computer, but rather an historical time line reference, ergo the rational for this type of organizational structure.

I hope this info will help fill out your knowledge of some of the origins of our trade/science, and how/when the various ideas/pieces began to shape what we consider now to be the rules and structure of our trade craft.

As you can see, not only a National chronology is presented; but a chronology of the formation of our local committee, and some of it's stated goals/accomplishments.

Of a more practical nature, I've included Carl Wissers' INFO PACK his secretary sends to all apprentice/questioning course certifiers. You will also find most of the material we passed out to the over 35 novice certifiers who attended our 1st Seminar last winter. Hopefully this info plus TC various certifications guides, plus all the info you've gathered from DK BL and BB will assist in at least structuring the Course Certification Guidelines booklet you're working on.

I've also included examples of the Course Map by all four of our local people. We feel its quite important to included 3 basic items on the map. <u>FIRST</u>, Visually readable and accurate depiction of the Start/Finish/Turn points of the Race Course. <u>SECOND</u>, A textual listing of the names of all the Streets/Trails/Paths in sequential order of use. <u>THIRDLY</u>, A textual listing of all Mile/Kilometer marks on the map, measured from a fixed reference point, so that the map becomes an invaluable tool not only for the certification rider and Regional evaluator, but for the race organization itself, to insure this critical information is always available no matter how many personnel changes occur.

I've also included various BL material, some of which I'm sure you probably have.

Enough of this! I'll be sending you my thoughts on various current matters in the near future. Loved your Knight diagram of the Olympic Measurment. It appears that if you drop the highest and lowest reading, the rest of us finish within 15 meters of each other based on the Days Constant. Thats just slightly outside what we usually get locally in multiple measurements of the same course. I believe you have the Oakland material, and TK should be sending you Knight diagrams of the 1982&1983 S.F. Marathon measurements. Adjusting for the Days Constant. 1982 rides showed TB riding the course 19.1Meters tighter than TK. and 8.7 Meters tighter than Ron Grayson (graysons' measurement was never submitted as he had a flat at 12 miles and although we recalculated his constants before and after the flat there was still that small uncertainty). 1983 showed Paul Oerth riding the tightest course again using the adjusted Days Constant, finishing 3.4 Meters infront of TB and 13.4 Meters infront of TK.

This brings up several closing thoughts. Ron Grayson has left our area. He's now at Cornell (so, I believe is Clain Jones) working on his MBA. He is missed, although his paper work was not of TK's caliber, neither is mine, but he was able to ride a course as tight if not tighter than any of us. We now have a new member of our committee, Paul Oerth. Paul's an engineer with the Bechtel Corp. and has the ability, I believe,to mash numbers with the PR BB BL TK crowd. If you could send Paul a newsletter (2455 Union St. #412 San Francisco Ca. 94123) he might be able add some help to the number jockeying that the GANG of FOUR is currently doing.

Please let me know how much it costs you in copying and mailing the newsletter. I think the least we all can do is pick up these charges as long as your willing to do all writing and editorial input. Perhaps you could put Ray Oliu on the list also, He was appointed head of AIMS Course Certification by AS. From correspondence BL and myself have had from him re:(our evaluations of his preliminary draft of Course Certification Guidelines) he seems to approach our subject from more of an engineering standpoint(which he is) than a political one. It would be interesting to see what his feelings on Short Baselines are, especially after examining workups done by PR, BB, BL, and TK. Even if AS doesn't agree, perhaps RO might. At the very least he might offer some constructive criticism. I feel the more scientist practitioners that can be brought into the group the stronger our clout against political decision making. Ray could turn out to be an invaluable member of the group given his position in AIMS and his contacts internationally. The address I have for RO is enclosed on his AIMS stationary just behind this cover letter. He had several other responses on his proposals. Perhaps he could give us his International mailing list of technical people he thinks could/would contribute to our mutual endeavours. I have several addresses of the contributors he lists.

VINCE REGAN
PONY BRITISH MARATHON
424, ST. HELENS RD.
BOLTON, LANCASHIRE
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(telex: c/-NZ-2273)
(phone: 493-369)

ADDITIONAL ADDRESS FOR Ray Oliu

RAY OLIU
BARCELONA MARATHON
JUNQUERES, 16, 9-C
Barcelona-3, Spain
(phone: 301-1230)

Perhaps its wishful thinking, but I think their is a great untapped scientific resourse pool Internationally that would love to get involved in the'State of the Art' info and dialogue your invaluable has offer us in the states. Currently there really is little International dialogue. What little their is, I think has been channeled through AIMS at the NYRRC and has not been sent on to any of our contacts. Perhaps your newsletter could be the seed that could reap some very interesting fruit.

NewsLetter

This is madness,I got to stop for now. I'll be sending thoughts on specific subjects in the near future as will TK. Pete, you deserve a big pat on the back for all your input this past year. Its your kind of energy that stimulates us all even if we don't always answer you.

REGARDS, TB.

1X

Association of International Marathons
AIMS

Barcelona, January 28, 1.983

Dear Colleagues,

A few comments to the rough draft on the procedure for course measurement, sent to you by letter dated Dec.19, 1.982, have now been received. They are not as many as we would like to have. However I am amazed of the interest, effort and good work of those who have cooperated so far. The comments are from :

1 - Bob Leston, PSA-TAC who had received the procedure through Tom Benjamin of San Francisco Marathon.

2 - Tom Benjamin.

3 - Andrew Galloway, Hamilton, New Zeland.

4 - Vince Regan, from Great Britain (ADIDAS British Marathon-Bolton Greater Manchester).

5 - Dennis Kenny, with the Fletcher Marathon, Rotorua, New Zeland.

6 - Gerard Rooijaaklers, from Rotterdam, Holland.

I hope all the AIMS members will be grateful to the good work done by the individuals above. Bob and Tom have surely gone beyond the call of duty with the amount - and quality of information they have contributed to the common cause.

I was hoping to inform you on this project in Tokyo, but as I will not be able to - be there, I decided to keep you up-to-date in writing.

As far as I can see a procedure can be available by the end of the year, to be distributed to all members free of charge. This proceduce -like any technical or scientific work- should be revised, I would say, every 2 years. Thus the important thing is to have one out, soon.

The main factors in course measurement may possibly be summarized as follows :

1 - Type and precision of measuring tools (tapes, electronic devices and counters).

2 - Lenght and precision of measurement of the baseline or calibration distance.

3 - Accuracy in calibrating the vehicle (bycicle or wheel).

4 - The actual measurement of the course. The effect of path selection and - the need to strictly adhere to a very defined one (Shortest Possible Route).

5 - Documentation and certification.

I will try to see that the subject is touched in Tokyo and I will keep you informed in more detaile on the progress of the project.

Sincerely,

Address correspondence to:

RAMON OLIU, Chairman
AIMS Standards Committee
Angli, 5, 3 - 2, BARCELONA-17, SPAIN
Ph.: 203 57 41

CATALUNYA MARATHON - BARCELONA

Jonqueres, 16, 9-C
BARCELONA - 3

Ph.: 301 12 30

Association of International Marathons
AIMS

BARCELONA 2/14/83

DEAR TOM:

SORRY FOR THE DELAY IN SENDING YOU A LITTLE NOTE OF APPRECIATION FOR THE INFORMATION YOU SUPPLIED AIMS ON COURSE MEASUREMENT. YOU AND BOB LETSON MADE A TRULY GREAT CONTRIBUTION TO THE SUBJECT WITH A TREMENDOUS AMOUNT OF DATA, COMMENTS AND ADVISE. WE DO PLAN TO USE IT FOR THE GOOD OF MARATHON RUNNING AND I AM SURE THAT EVERYBODY WILL APPRECIATE THE ASSISTANCE OF EXPERTS ~~TSA~~ LIKE YOURSELVES.

AS I MENTIONED IN THE OFFICIAL LETTER, WE WILL PROBABLY GO AHEAD AND ISSUE AN OFFICIAL METHOD BEFORE THE END OF THE YEAR. I BELIEVE THIS METHOD SHOULD BE REVISED EVERY OTHER YEAR TO MAKE SURE WE KEEP ABREAST OF TECHNOLOGY AND WE ARE ABLE TO ~~DO~~ IMPROVE THE ACCURACY OF OUR WORK. WE PLAN TO GIVE DUE CREDIT TO ALL THOSE WHO HAVE HELPED. WILL KEEP IN TOUCH

SINCERELY

Ry

8K
41:28

Address correspondence to:

RAMON OLIU, Chairman
AIMS Standards Committee
Anglí, 5, 3 - 2, BARCELONA-17, SPAIN
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BARCELONA - 3
Ph.: 301 12 30

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SUPPLIMENTARY LETSON INFO - PROPSED IAAF STANDARDS INFO

M E A S U R I N G   R O A D   R U N N I N G   C O U R S E S

By TED CORBITT
New York Pioneer Club

No. 1

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The author acknowledges and appreciates the special assistance given in this project by John Sterner, Bronx,N.Y. and by John Jewell, Road Runners Club of England.

= =

PROVERBS 20 #10-- "Divers weights, and divers measurers, both of them are alike an abomination to the Lord."

= =

ROAD RUNNERS CLUB, USA Publication No.4 2nd Printing

August 1964, August 1972

For additional copies, order from: Ted Corbitt, 150 W. 225th St., Apt. 8 H Sect.4, New York, New York 10063.

Any profits from the sale of this monograph will be used to promote accurate measurements of road running courses in the USA.

CONTENTS

NOTE: The figures at the end of some sentences, for example 6/ , refers to the number of the source of the information, which can be identified by checking the reference list on pages 28-29.

INTRODUCTION

Man measures speed, strength, and endurance performances for purposes of comparison. These measurements form the basis for establishing new goals in the field of athletics.

The real prizes or rewards for most long distance runners are the times they record at various distances. To make recorded times meaningful, road racing courses should be accurately measured. A.L. Monteverde, who raced from 1881-1936 states that "road courses are in measurement most inaccurate. There is no financial profit derived by such runs and economy rules." Corrective action is urgently needed in the USA. It is unnecessary and unfair to the competitors to call a 9 mile course or a 11 mile course a 10 mile race, as is often done. It would be better to say "approximately 10 miles," if the distance is not known exactly. However, it is possible to obtain exact, meaningful measurements of course lengths.

Road race sponsors can do a great service for the sport by accurately measuring the course of their races. A course need not always be exactly a round numbered distance such as 5, 10, or 30 miles. Except for the marathon (26 miles 385 yards) and specific championship races, road racing courses may be of any convenient distance. The promoter need not change his established course but the course should be accurately measured and the distance called what it is. It has been argued that road race courses have their own personalities, terraine, weather, scenery, and records, which cannot be duplicated elsewhere. Many of these variables also exist in reference to 440 yard tracks, and even in the case of swimming pools, competitors often label a given pool as either fast or slow. Man insists on measuring time (easy to get accurately) and distance (difficult to get accurately) for comparison purposes. Athletes and fans assume that the correct distance of the race course is the advertised distance and they relate timed results not only with past performances on the course but to times made on other courses of the same distance. Another factor was pointed out by John Sterner in 1949 when he stated that, "I think the cause of so many American (marathon) runners doing so well here and then falling down when they run overseas can be traced to the fact that almost all road runs here are run over short courses." This indictment is still true, because the automobile odometer is the most commonly used method of measuring road racing courses in the USA. This method almost invariably leads to short courses.

Observations of numerous racing results suggests that if the course is accurately measured, the course record will fall within a relatively narrow time range. A time very far off of this time range immediately signals that some unusual factor is operating, for instance: unusual weather; short course; etc. Whenever a super-fast time is recorded, the course should be re-checked immediately to confirm the distance. Runners all over the world may be interested in the exactness of the distance and a re-measurement and announcement of the results will settle the question of the distance. Two examples illustrate the point. In 1952, England's Jim Peters raced the "Poly" Marathon in a fantastic 2:20:42.2, raising questions as to the accuracy of the course. Several re-checks found the course to be over the regulation 26 miles 385 yards. The "two-twenty" marathon was here to stay. In 1959, C.Kennedy, Michigan State University, raced over the Inter-collegiate (ICAAAA) 5 mile cross-country course in Van Cortlandt Park, Bronx,N.Y. in 23:51.8. Two teams of student surveyors checked the course and found it short by 490 and 497 yards respectively. 54,45/ The course was lengthened 490 yards.

The problem of course lengths is not new. Arthur Newton has told of his experiences in 1923 and later when he was attempting to break world records in the ultra-long distances in Africa. Measurement methods have not changed much since that time. American officials have lagged behind most countries in getting reasonably accurate road courses, settling for the inaccurate results of quick surveys by automobile odometers.

ROAD RUNNING COURSES

Increasing vehicular traffic adds to the difficulty of selecting road courses. The future will probably see road races largely confined to suburbs, small towns and parklands, and races held in the early hours to avoid traffic.

Upon establishing a race, try to select a permanent course and avoid repeating all the work on a new course each year. A set course allows runners to compare their efforts with previous performances and with runners of other eras on the same course. 41/

Land areas can be divided into three classes: 1) Level: features few or no hills or valleys; 2) Rolling: features hilly country; 3) Mountainous country. These areas may merge into each other or they may be found on one route. 37/ Generally, the race sponsor must use local land areas. In some instances, he will have a choice of setting up an easy (flat) course, or a fast (slightly rolling) course, or a hard (hilly) course. The good, well trained runner can race over any course.

The gradient (grade) of a slope is the rise or fall in a given distance along the level. Gradients are indicated by fractions,e.g. 1/30 means a slope rises 1 foot in a horizontal distance of 30 ft.

There are several types of courses: a CIRCULAR course (e.g. Yonkers Marathon); a POINT-TO-POINT course (e.g. Boston Marathon); a LOOP course of several laps (e.g. Culver City Marathon); an OUT AND HOME or a SWITCH BACK course (e.g. Atlantic City Marathon); and a FIGURE-EIGHT or other figure course (e.g. Van Cortlandt Park cross-country course, or the Hamilton,Ontario, Firestone 25 Kilo run).

If possible, locate the start, finish, dressing room, presentation of prizes, etc. in one area, thus simplifying organization of the race. A course of several laps ("Out and Back" or "Circles") is ideal because it is easier to handle traffic and to man refreshment stations, and it permits spectators to view the race several times. Also, in extreme heat or cold, runners can stop in more favorable spots if necessary, and in those cases where a runner is in trouble from heat exhaustion, he can be watched and pulled out of the race before it is too late. A "figure-eight" or "clover-leaf" shaped course permits the start and finish in the center with the above advantages. 41,53/

Other considerations:

1) Prepare a map of the course and display it in the dressing room or distribute copies of it, possibly reproducing it on the entry form.
2) Measure the course accurately so that it is the advertised length. If possible, mark the course with mile or kilometer points so that they can be seen. This will make it unnecessary for competitors to depend on the inaccurate information often supplied by onlookers.
3) Avoid main roads unless certain of sufficient police protection against traffic.
4) Place easily seen direction signs along the course to guide the runners. Avoid confusing the runners at intersections. Arrows and painted lines (which are not to be crossed, thus heading the runner into the right path) may be used in some instances. These aids are supplemented by having an adequate number of guides on the course.
5) The start or finish, or both, of a road race may be on a track making it easy to add distance to complete the advertised distance.
6) To break up the monotony of the course, use terrain which includes hills and flat areas. However, the land areas in which the event is to be held will determine the nature of the course.
7) At the marathon distance, some thought should be given to standardization of courses to make comparison of times more meaningful. Cerutty recommends that marathons be run on lap courses of 1 to 5 miles, accurately measured; that the course be as level as possible; and that the course be on dirt or grass. He suggests that while classical courses like Boston should stand, all Championship courses should be standardized as outlined above. Thoughtful, business like

planning would lead to more support for long distance running.
8) A course "watch dog" is needed. This could be a two man team who would note changes in the course and see that corrective action is taken to keep the course at the advertised length.
9) Care and attention are essential whatever the method used to measure a course. The measuring team should get a lot of practice, and re-checking courses is a good method.
10) Road Runners Club Associations and other bodies interested in long distance running should combine efforts to persuade race promoters to measure courses accurately.

METHODS THAT HAVE BEEN USED TO MEASURE ROAD RACING COURSES

A variety of methods have been used to measure road courses. These include: steel tape, automobile odometer, measuring wheel, surveyor's chain, etc. Many of the methods which have been used do not permit the accuracy needed for road courses.

Some comments on methods that have been used:
J.Barry (New Jersey): "The only way to measure a course is as I've done by hand. A 100 ft. tape. It's hard and takes quite long to do. But it can be done."

N.Farrell (Canada): "Measure course forward and backward with about five new cars. They should first be checked on a measured course. Go to the Police Department. They have a measured mile strip and also a gadget to check speedometer accuracy."
NOTE: This commonly used method of measurement is too inaccurate for checking road racing courses.

A.L.Monteverde (California): "Road race courses should be surveyed by competent engineers."

J.Jewell: "The recognised method of measuring road races in this country (England) for running and walking races is by surveyor's wheel although in actual fact the promoters of road races use a number of methods."

B.Prentice (Australia): "I find the wheel more accurate than steel tape and chalk marks and much quicker, and to my mind is about as close as you can get." (He used a specially constructed measuring wheel.)

RECOMMENDED METHODS OF MEASURING ROAD RACING COURSES

Ideally promoters of road and cross-country races would have all courses surveyed by competent engineers. This is not always possible or practical. The use of a calibrated bicycle, as used by the Road Time Trials Council in England, is highly recommended for measuring road courses. 21/ The steel tape is the third choice if experienced personnel are available. The surveyor's wheel is another acceptable method. Large scale maps may be used with satisfactory results. The automobile, as ordinarilly used, is not suitable for measuring road courses.

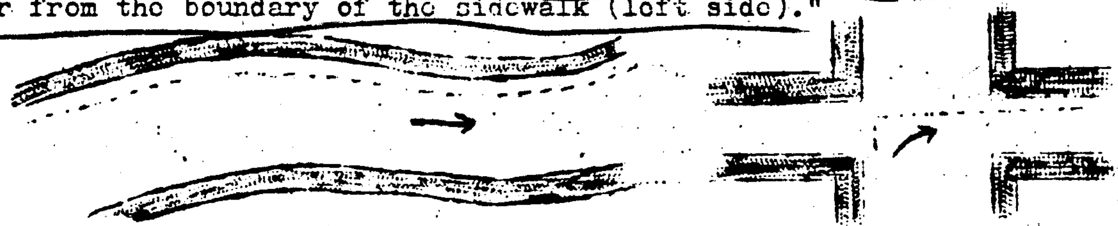
The Amateur Athletic Union of the U.S. Official Track & Field Handbook, in referring to national championship long distance runs, states that "all courses shall be properly marked and measured by measuring wheel or tape." This rule has seldom been observed in the past.

WHERE TO MEASURE A ROAD COURSE

There is a need for uniformity in measuring the path of a road course. Some comments on methods that have been used:
R.Campbell (Massachusetts) : "Cut all turns--here again we know that due to traffic one may not be able to cut the same turns each year. It might be well to measure the course by keeping in the middle of the road."

S.Hamilton: "In Finland, the Government Surveying Office measures the distance running courses in the middle of the road, and the sports people take their verdict as 'it'."

S.Takenaka (Japan): "Measure road course on the roadway off one meter from the boundary of the sidewalk (left side)."



J.Jewell: "Roads are measured here according to IAAF rules, one meter from the curb on the left hand side of the road in Great Britain. There is of course a certain ambiguity in measuring right hand turns, etc. but this is the guiding principle."

P.W. Cerutty (Australia): "The course is measured accurately where the runner will run as is done in track. This cancels out all variations and gives some uniformity for comparison between different countries and efforts."

B.Prentice (Australia): "Usually measure one meter from the kerb, elsewhere as near as possible to where the athletes will run."

RECOMMENDATIONS ON WHERE TO MEASURE ROAD RACING COURSES

The International Amateur Athletic Federation (IAAF) rule requires that road courses be measured one meter (3 ft. 3 inches) from the left hand curb of the road in the running direction. In those countries where traffic rolls on the right hand side of the road the course may be measured on the right side in the running direction. In the interest of uniformity this principle should be applied whenever possible. Otherwise, measure where the runners will run, that is, on the runner's path.

On some roads it will be impossible to measure the course one meter from the curb due to parked vehicles. Here one might measure a distance of a car width plus one meter from the curb, and on extended stretches free of parked cars revert to the one meter from the curb rule.

Jewell reports that measurements made by the Road Time Trials Council method are done on the path followed by the runners when no obstructions exist, with a general regard to the IAAF rule. The runner runs according to the dictates of the circumstances, without running extra distance, and with regard to the traffic and considerations of sportsmanship. Investigation suggests that little distance is saved by the runner taking short cuts, such as crossing to the other side of the road. 21/

ACCURACY

The measurement of road courses is a form of surveying. It is not possible to measure any distance with complete accuracy. The precision of the measurement will depend on the care with which it is made and the instrument used. Regardless of the method used, a certain percentage of error exists due to mistakes (eliminated by checking the work); to systematic errors; and to accidental errors. Aim to keep the errors to a minimum through careful work and by rechecking the measurements. 12,45/

One approach is to check the course measurement by an alternate method. For instance, if the course is measured by a surveyor's wheel, it may be checked by use of a large scale map. Keep dates and records of all measurements including intermediate distances which would be useful in case of road alterations. 21/

Jewell quoted from the Road Times Trial Council report on Course Measuring, the following: "No reliance should be placed on information regarding distances supplied by Local Authorities or by the Police, as such information is often inaccurate and the methods of measuring employed are very rarely to the high standard of accuracy required by the RTTC. Neither should any reliance be placed on milestones as they are generally very inaccurate, and where road alterations have taken place since they were installed, are often many furlongs out of place." 21/

If a distance is measured very accurately several times by the same method, it is usually found that the results vary slightly from one another. The true measure of the distance is taken to be the mean of the different results obtained, that is, the sum of these results divided by their number. This is called the mean value or most probable value. "By the law of probabilities, the chances are even that the error made in using the mean value does not exceed a certain quantity, called its probable error." 6/

Jewell states that Standard Times, including Road Runners Club Standards, are given to the nearest minute, and so "the distance of a road course should at least be correct so as to ensure that the athlete's time to the nearest minute is the correct time to the minute at the particular distance in question, i.e., if his marathon time is 2:20, the error on the course distance should not be such that his real marathon time is not less than 2:19:30 or more than 2:20:30. This means that the error on the course should be less than the distance the athlete covers in half a minute. A much higher degree of accuracy can easily be attained... The greatest error which is permissible for courses of different distances are:

10 miles (record 47:47)	184 yards.
20 miles (1:42)	173 yards.
Marathon (2:15)	171 yards.
London to Brighton (5:26)	143 yards." 21/

Thus the error of measurement at the marathon distance should not exceed 6.5 yards per mile, or error of 0.37%. 21/

MEASURE CONVERSIONS

The yard and the meter are legal measuring standards in the USA. Both systems are used in national championships. The meter, 39.37 inches or 3.28 feet, is often called the "world yard" and it is about 10% more than the yard. The word mile is from the Latin mille, meaning 1000. Since a double pace is 5 feet, one thousand paces is approximately 5000 feet, or about one mile. The American mile is 0.1818 inch longer than the British mile. 28/

The YARD System

1 inch = 0.0833 foot
0.0278 yard
2.54 centimeters
0.0254 meter

1 foot = 12 inches
0.333 yard
0.3048 meter
0.00019 mile

1 yard = 36 inches
3 feet
0.000568 mile
0.9144 meter

The METRIC System

1 meter = 39.37 inches
3.281 feet
1.094 yards
0.001 kilometer

1 kilometer = 3280.84 feet
1000 meters
1093.61 yards
0.6214 mile

1 mile = 63,360 inches
5280 feet
1760 yards
1.609 kilometers

STANDARD DISTANCE

An accurately measured standard distance on a road, preferably straight, is needed to check the accuracy of measuring instruments. Select a level and not heavily travelled road. The distance should be one mile or more. If necessary the distance may be less than one mile. Use a team of at least two men and a calibrated 100 ft. steel tape to measure the distance. The tape is held on the ground under 10 pounds of pull or tension (checked by a spring scale). Mark off reference points on the side of the road with paint, or nails or pegs, etc. Check the measurement several times. Some cities maintain a standard of length with which tapes may be compared. If possible the standard distance should be cross-checked by other personnel. 20,21,26/

Jewell points out that "Secondary Standard Distances" may be set up from the standard distance using the calibrated bicycle method. To do this, record the number of revolutions of the front wheel by a counter as the cycle is ridden over the standard distance. The cycle may then be ridden to or transported to the site of the second standard distance. The number of revolutions between the start and finish of the distance measured is then used to determine the length of the new standard distance by working it out by simple proportion. The same is done when measuring a road course.

Example: If 1700 revolutions = 1 mile, and
If the course measures 1300 revolutions, then

$$\frac{1700 \text{ revs}}{1 \text{ mile}} = \frac{1300 \text{ revs}}{x \text{ miles}}, \text{ then } 1700x = 1300$$

$$x = \frac{1300}{1700} \qquad x = 0.7647 \text{ mile}$$

1760 yards (1 mile)
0.7647 mile (multiply by)
1345.87 yards
length of course.

Note: carry the mileage factor to the 4th decimal place. 58/

COMMONLY USED METHODS OF MEASURING ROAD RACE COURSES

Responsibility for measurement of the road race course falls on the promoter of the race. Generally the method of measurement selected depends upon the precision required, the cost, and other considerations. 11/ A description and evaluation of commonly used methods of measuring road courses will follow. They will be classified into three groups: recommended, questionable, and not recommended.

RECOMMENDED METHODS OF MEASURING ROAD RACE COURSES

I. SURVEYING

Surveying is the art of making relatively large, precise measurements of distance with a maximum of accuracy and with a minimum expenditure of time and labor. 23/ It is concerned with determining the relative location of points on or near the surface of the earth. The principles of plane surveying involve a working knowledge of geometry, trigonometry, physics, astronomy, and theory of probability. Surveying is done by professional surveyors. 11,12/

EQUIPMENT--Surveyors employ the transit and the level and other tools. Surveying instruments are self-calibrating and they can be adjusted to eliminate any errors that tests disclose. 8,23/

METHOD--Surveying involves making measurements of four types of dimensions: horizontal lengths, vertical lengths, horizontal angles, and vertical angles. Horizontal lengths are usually measured with steel tapes, usually graduated in hundredths of a foot. The degree of accuracy of a horizontal measurement is usually expressed as a ratio of the error to the total distance measured. Ordinary measurement with a steel tape gives an accuracy of about 1 part in 3000 (1/3000). 23/

ADVANTAGES--Accuracy is assured.

DISADVANTAGES--Employing a surveyor is expensive. The price may be prohibitive in most cases except on small loop courses. Inquire locally about prices.

PRECAUTIONS--Select a reliable, interested surveyor who possesses sound judgement. 23/

RELIABILITY--The surveyor will provide the most reliable results possible. He will obtain the accuracy needed for road race courses without difficulty. The random errors which occur tend to be either plus or minus and in most cases they cancel each other out by the laws of chance.

II. TAPE MEASUREMENTS OR "CHAINING"

Direct measurement by steel tape is the most commonly used reliable method of determining distances between two points. This method is called taping or "chaining." Links of iron or steel (chains) are seldom used anymore but the term "chaining" is still used to designate measuring with a chain or with tape. 6/

EQUIPMENT--1. Use a calibrated steel tape 100 feet in length. If necessary, a tape 150 feet long may be used. A tape may have a handle at each end or it may have leather thongs or string or hooks at the ends. Check whether the graduation marks begin on a line on the tape or on the handle assembly.

A 100 feet Engineer's or Surveyor's steel tape will cost about $30.00 and up. Band chains or chain tapes, used for route surveys, cost about $20.00 plus about $12.00 for a reel. A general purpose 100 feet steel tape costs about $11.00. 59/

Cloth or woven tapes are not permissible for road course measurements because they are liable to stretch or shrink.

2. Spring balance or spring balance handle, attached to the forward end of the tape to indicate the amount of pull applied to the tape. Its use will improve taping accuracy to 1:3000. It costs about $12.00, reading to 30 lbs. Steel tapes are calibrated to measure correctly when under a certain tension. The tension is held while the measurement is made. This gadget may also be used to counteract the effect of sag when making measurements with an unsupported tape. 59/ Often in practice, the experienced surveyor will use judgement rather than the spring scale.

3. Recording and marking materials.
   a) 4 H pencil and paper or field notebook for notes, etc.
   b) A red pencil to mark the taped distances on the road surface.
   c) Keel or lumber crayon to mark a circle around the red penciled mark or an arrow pointing to the red mark to make it easier for the rear tapeman to find the red mark. 45/ The number of tape lengths may be written on the pavement with keel or chalk.
   d) A hammer and cold chisel to make a permanent mark, for example a + , at specific checkpoints. On some surfaces nails may be driven into the roadway to make a permanent mark. Optional: paint a small circle around the permanent mark.
   e) Plastic flagging tape may be used to temporarily identify landmarks or checkpoint stations. This tape is put on the road surface and may be written on with pencil or ball point pen. A 300 ft. roll of this tape costs about $1.00.

4. Miscellaneous tools:
   a) If part or all of the course is on dirt or on grass, use chaining arrows to mark tape increments. A set of 10 steel arrows cost about $5.00. The lead tapeman starts off with the 10 arrows. He places an arrow at each tape length or increment until he has used them up. The rear tapeman collects the arrows. This serves as a check on errors: the collection of 10 arrows indicates 10 tape lengths.
   b) A tape thermometer to measure the tape temperature if accuracy greater than 1:3000 is sought. 23/ Minimal cost is about $4.50. The thermometer is fastened directly to the tape. Many surveyors do not use temperature corrections except for special jobs. Temperature may introduce an error up to 1:5000. 23/
   c) A plumb-bob is a brass body suspended from a cord. It is used to facilitate measurements with the tape supported at the ends only. Obtain two bobs. Costs range from about $4.50 to $8.50 for the 1 to 1½ lb. sized bob generally used. It is difficult for amateurs to use plumb-bobs because the tape and the bob tend to move during measuring.

NOTE: Minimal equipment for tape measuring a course: 100 ft. steel tape, spring balance, and recording and marking materials. These tools can give the degree of accuracy required for measuring road courses. Use a folding rule or a meter stick for tape alignment.

CARE OF TAPE--Tapes are easily damaged or broken and require care in handling and storage. Before using the tape, examine it for kinks. When the tape is being stored, clean, dry, and grease it lightly with vaseline. Kits for repairing tape are available from the manufacturer for about $34.00.

To unroll tape, one man holds the case and the other man walks away with the free end. The back man signals the lead man to stop before the end is reached, but he is also set to give ground to avoid a sudden jerk on the tape.

To roll up tape, the tape is laid out straight on the ground and the man doing the winding walks toward the free end. Tapes are usually wound up in cases or on rods. They require constant cleaning and oiling to prevent rust. Never put a tape away wet.

To avoid damaging the tape:

1. Steel tapes will stand a direct tension of 80 or more pounds but they will break easily with misuse.
2. When the tape is lying on the ground, keep it extended so that slack is eliminated thus preventing the formation of loops which lead to kinks and breaks.
3. For measurements of less than a full tape length, the tape should be kept on the reel. Reel out as much as you need and reel it in as soon as possible.
4. If the tape is on the ground and is to be moved, drag it from one end only. If the tape is to be raised off the ground, the tapemen (those handling the tape) should lift it simultaneously and keep it in tension. Otherwise the rear tapeman should not touch the tape while it is being moved.
5. Do not let vehicles run over the tape. If this is unavoidable, the tapemen should hold the tape flat and tightly pressed against the road surface. 8,23/

CALIBRATE TAPE--For precision work, the tape should be compared with a tape certified by the National Bureau of Standards. This comparison with a standardized tape or length should be repeated frequently because tapes are easily damaged, leading to incorrect length which leads to errors. Many cities have standards of length which may be used to check a tape.

The National Bureau of Standards, Washington,D.C., will check a steel tape against the official standard, employing any specific pull, temperature and conditions of support to the tape. A fee of $21.00 plus mailing costs for the tape are charged. 11,59/

Systematic errors due to incorrect tape length are eliminated by standardizing the tape and getting a correction per tape length if it is not the exact length.

Systematic errors due to sag, temperature, pull, slope, and habits of placing the mark either inside or outside the true distance, can be allowed for and corrected. Accidental errors are always possible, even with conscientious work, and under normal circumstances the minor errors should balance themselves. Guard against making accidental errors systematic. 2/

ERRORS in chaining are of two classes:

1) Errors due to faulty chaining and to natural conditions:
   - a) Imperfect alignment of tape: tape out of line or not horizontal. If one end of a 100 ft. tape is 1.4 feet higher or lower than the other end the tape will be 0.01 foot shorter. The same displacement to the right or left of the true position will make the tape 0.01 foot shorter. 22/
   - b) Variations in tension of tape: having pull insufficient to compensate for the effects of sag and of the wind.
   - c) Imperfections of observing, including careless plumbing.
   - d) Incorrect length of tape. An old, worn tape will stretch more under tension than a new one. Often, old tapes have been broken and repaired several times and this can lead to errors in length.
   - e) Variations in temperature.
   - f) Sag in tape. 6,11,22/

2) Errors in reading or recording measurements:
   - a) Using the wrong zero point on the tape.
   - b) Reading the wrong foot mark.
   - c) Reading the tape upside down, thus mistaking some figure such as a 6 for a 9 or vice versa.
   - d) Transposing figures in recording, for example: 71.23 instead of 72.13.

f) Mistakes in counting the full tape lengths. 6/

SPECIFIC FORMULI are used to make measurement corrections such as slope correction, temperature correction, tension correction, and correction for sag of the tape, as when measuring over rocky ground for example. 22/ These corrections are generally not used in road course types of measurements.

SAG and PULL--If the ground is rough and the tape cannot be supported evenly along its entire length, it is necessary to apply a correction for the sag of the tape. The formula for sag is as follows:

Let L = Length of the tape in feet.
P = Pull applied in pounds.
W = Weight of tape between supports in pounds.

$$\text{Sag correction in feet} = \frac{L \times W^2}{24 \times P^2}$$

WHERE TO MEASURE--Use the international rule: measure the course 3 feet 3 inches (one meter) from the curb in the running direction. Otherwise measure where the runners will run as is done in track.

<u>METHOD</u>--Form a "taping field party." A minimum of two men are needed to measure a course. If possible, organize a team of up to seven or eight men with one or two cars. Place one man at each end of the tape.

Duties of the taping field party may be divided as follows:

1. Chief--He should have some experience in surveying. He closely supervises the measuring. He might act as the rear tapeman and serve to guide the lead man in getting proper alignment. He might also keep records unless another man is along to record.

2. Lead tapeman--He carries a red pencil and keel to mark tape increments. He uses a meter stick or a folding rule for alignment.

3. Recorder--He marks and describes in notes each ½ mile and mile. It is important to have records of intermediate and check point distances for future reference. 39/ Field notes should be clear and complete giving numerical data, explanatory notes, and sketches made approximately to scale in a notebook. 11/

4. Tension man--If a spring scale is used. Otherwise the lead tapeman handles the spring balance (scale).

5. Assistant--Directs traffic, and assists otherwise. 22,39/

TAPING or Chaining--<u>There are two methods of taping</u>: Surface Chaining and Catenary Chaining.

1. SURFACE CHAINING with a steel tape. Use a 100 ft. tape. Tapes longer than 100 feet are generally not used for measurements along the ground. If possible, a spring balance registering pulls up to 15-30 lbs. is attached to the forward end of the tape. Check to locate the end of the tape and the zero mark.

Lay the tape flat on the road surface. The rear tapeman holds his end of the tape on the line (mark). The rear tapeman directs the lead tapeman for proper alignment. Where it is possible to apply the international rule of measuring one meter from the curb, the lead tapeman uses either a meter stick or a folding rule to obtain the proper alignment. The lead tapeman applies 10 lbs. of tension (pull). To make certain that the tension is not taken up by friction, the lead tapeman might increase the tension to about 20 lbs. and then reduce the pull to 10 lbs. The lead tapeman then marks the tape increment by any of several methods as follows:

> On pavement, mark the spot with a red pencil and circle this with yellow keel or lumber crayon. An alternative is to use either medical tape or special plastic tape on the road surface and make the mark on it with a red pencil or a ball point pen.
>
> On grass or dirt use chaining arrows or pins to mark the spot. Another possibility is to put a tack or nail into the ground.

After marking the tape length the lead tapeman walks forward dragging the tape. The rear tapeman notifies him when to stop. Another possibility is for the rear tapeman to walk forward and take the tape from the lead tapeman and continue on for the next tape length.

In measuring around turns or curves, measure in increments of 5 or 10 feet instead of full tape lengths. 45/

If at the end of the measurement, a less than full tape length increment is needed, the head tapeman should do one of three things to avoid getting the tape messed up:

1. Carry the end of the tape beyond the end point, lay it on the ground and walk back.
2. Reel in the tape the necessary amount.
3. Take in the tape by forming figure-of-eight loops hanging from his hand. This takes practice to master. 23/

Working tape tension--Steel tapes graduated in feet require tensions when supported on a horizontal flat surface at 68°F, as follows: a 100 ft. long tape requires a tension of approximately 10 lbs. A tape over 100 ft. long requires a tension of approximately 20 lbs. The tension required for a tape supported throughout on a flat surface is about the same for any part of the tape as for the full length. 59/

The coefficient of expansion of steel tapes is 0.00000645 per degree Fahrenheit.* Thus a 100 ft. tape will elongate 0.00774 inch for each degree F of tape temperature rise above 68 degrees F. 59

2. CATENARY CHAINING with steel tape. This is a more accurate method than surface chaining but it is more difficult to execute. If the ground is rough or the surface is not cleared of obstacles, this method is recommended. The tape is supported at the two ends by the tapemen. It is necessary to compensate for sag.

The tapeman should face the tape.

1. Each tapeman supports the tape about waist height, the same height above the ground. One man applies tension through a spring balance.

2. The rear tapeman holds a plumb-bob with which he makes certain that the mark on the tape is vertically above the mark on the ground. **

3. The lead tapeman holds his end steady against the tension with one hand. When the rear tapeman signals that everything is ready, the lead tapeman transfers the forward mark on the tape to the ground by means of a plumb-bob held in the other hand. 8/

4. The lead tapeman uses either a meter stick or a hardwood folding rule to get the proper alignment of the tape from the curb: 1 meter.

*The Keuffel & Esser Co., Hoboken, New Jersey, recommends tapes with a thermometer scale as a means of obtaining additional accuracy and uniformity in measuring. This thermometer scale is graduated to correspond to the contraction and expansion of the tape, according to the F thermometer for tapes graduated in feet. It takes the place of the terminal mark of the tape, and the terminal point lies at that mark of the thermometer scale which corresponds to the prevailing tape temperature reading at the time of taking the measurements. 59/

** When a tape is used suspended from the ground, a plumb-bob is used to transfer the ends of the measurement to the ground. The bob is suspended from a cord which hangs over the tape. The plumb-bob is held so that its point is close to the ground, but not touching it; when the tape is taut and properly aligned, the plumb-bob cord is released by the tapeman and the mark is placed where the point of the bob strikes the ground. 6/ It may be necessary to dampen the swing of the plumb-bob by moving the tape up and down slightly, tapping the point of the bob on the mark. 23/ As the bob rests on its point, the tape is released and a mark is made at the point made by the bob.

Working tape tension--The tension required for a steel tape when supported at the ends only depends upon the unsupported length and the cross-sectional area of the tape. A 100 ft. steel tape at 68°F and supported at the ends only requires the following tensions, depending on the type of tape:

3/8 inch Medium	= 20 lbs.	5/16 inch Heavy	= 24 lbs.
1/8 inch Chain	= 19 lbs.	5/16 inch Extra Heavy	= 31 lbs.
1/4 inch Chain	= 27 lbs.	5/16 inch Chain	= 31 lbs.

Recommendations: For measuring a road course, sufficient accuracy is obtained by using the method of surface chaining. Tape temperature correction may be ignored except in extreme weather conditions since the error will fall within allowable limits.

ADVANTAGES--Trained operators can obtain a high degree of measurement with the use of tapes.

DISADVANTAGES--Direct measurement by steel tape is not the most practical means of measuring road courses due to traffic and to the effort and time demanded. However, on short loop courses and courses in park lands these factors are less important. The big disadvantage is the time required, at best about 2 miles an hour. 45

PRECAUTIONS--1. Heat affects the length of the tape.
2. Avoid measuring on windy days.
3. Tapes are liable to become inaccurate with use. Tapes are not provided with any means of adjustment so any inaccuracy found to exist in its length must be noted and added to or deducted from the measurements taken.
4. Steel tapes are only of correct length when they are at a certain tension and temperature, usually 10-15 pounds and 68° F respectively. The tension and temperature at which the tape is of standard length is often stamped on the handle or on a metal tag attached to the handle. 22,30/

RELIABILITY--A steel surveyor's tape is one of the most accurate methods of measurement but it requires skilled use, especially in measuring around turns. 45/ With a calibrated tape, you can expect an accuracy of about 1/1000 or better. If a spring balance is used to maintain the appropriate constant tension and if temperature and slope corrections are carefully observed, an accuracy of between 1/1000 and 1/10,000 may be obtained. 8,12/ The highest accuracy is obtained on flat ground, cleared of obstacles. Precision may be as high as 1/30,000. 11/ Sterner states that a distance measured by tape should not be considered accurate unless at least one member of the party has had some surveying experience. 45/

III CYCLISTS' METHOD (Used by the Road Time Trials Council, England)

The following method of road course measurement described by Jewell is that method developed by racing cyclists in England who compete in Road Time Trials. Due to the fact that times are compared on different courses all over England, a given distance in one area must be the same distance on another course in another section of the country. The cyclist's time trial courses are designed so that there is no advantage in terraine by a given area, and generally, out and home courses are used. This is the same thing that will have to be done in the sport of road racing to make the comparison of road running results, especially the marathon, meaningful on an international basis. 21/

EQUIPMENT--1. A bicycle with good tires and tubes.
2. The bicycle is fitted with a revolution counter. "The revolution counter resembles a normal cyclometer and has a similar method of operation: a striker fitted to the cycle wheel engages a 'star' wheel on the counter attached to the frame or forks. Several types of counters have been tried but only one has proved satisfactory and that is the 5 star type made by Veeder Root Inc., Hartford 2, Connecticut." The counter is a small star wheel revolution counter with gib mounting B-100725.

The Veeder-Root Star Wheel Revolution Counter is sold at $19.40 each in quantities of 1 to 9. However, there is a minimum order of $50.00. The company no longer makes the striker and bracket to mount the meter for operation. A regular bicycle cyclometer may be purchased and it's striker and bracket used to mount the revolution counter on the bicycle. Contact the Road Runners Club of America, or the National AAU Long Distance Running Committee's Sub-Committee on Standards for information on obtaining a counter at costs.

3.Steel tape to make short measurements on the course in special situations, for example to locate a check point mark, or if the course suddenly and briefly changes to rough terrain, etc.
4.Recording materials: pencil and notebook.
5.Road marking materials to establish check point marks. These might include a hammer and cold chisel and paint, and nails in instances where surface material permits their use.

METHOD--"The basic method consists of riding a bicycle fitted with a counter registering the number of revolutions of one of the wheels, over the route to be measured. Immediately before, during or immediately after the measuring, the bicycle is ridden over a known and very accurately measured 'standard distance' and, from the readings obtained, the number of revolutions of the wheel per mile is calculated. This becomes a 'constant' for that particular measuring occasion, and this constant is used to calculate actual distances from the revolution counter readings." 21/

The counter registers the total number of revolutions of the bicycle wheel and does not, as in the case of the cyclometer, convert readings into miles and fractions of a mile.

The biggest task in this method is the measurement of the standard distance. An accurately measured STANDARD DISTANCE must be established.* The start and end of the standard distance should be well defined so that anyone else can recognize and ride over the exact path of the standard course. The exact terminal points can coincide with some permanent and accurately definable points, and where necessary, reference to precise alignment should be made, together with some suitable permanent marking.

A straight road is ideal for the standard distance but not essential. The curb of the road should be permanent and clearly defined so that the measurement can be taken at some fixed distance (for example 3 feet) from it. The measurement is always taken on the same side of the road unless it is dead straight.

In riding over the standard distance to obtain the constant, the measurer should ride exactly in the same manner and in the same position as he will use during the actual course measuring. He should follow the exact line of measurement of the standard distance. Obtain a fresh constant on each separate measuring occasion.

Fractions of a revolution may be calculated from the spokes. The spoke carrying the striker may be marked near the hub and the number of spokes past or short of the counter are counted at the end of the measurement. If the wheel has 32 spokes and the striker is 2 spokes past the counter it is considered 2/32nd revolution or "two spokes." The standard distance should be ridden over at least twice.

Before measuring, the revolution counter should be checked to see that it is fitted and working satisfactorily. The tire of the measuring wheel should be sound and free of suspicion of leakage. "It should be inflated hard but not 'board' hard." 21/ At the starting line, set the bicycle wheel in the zero position, that is with the striker on the point of leaving the star wheel.

*To establish a standard course or distance, use the procedures described in the section on tape measuring. (See pages 7-12)

Other possibilities include: 1) Hiring a surveyor to measure a one mile (or less) standard distance; 2) Asking a local surveyor to volunteer his services for this purpose.

Once a standard is set, use it to calibrate a measuring wheel, bicycle, etc.

The cyclists convert the revolution counter readings to actual distances by the aid of conversion tables but simple arithmetic may be used, as follows: multiply the number of revolutions taken to cover the course (or lap) by the standard distance (in yards) and divide by the average number of revolutions taken to cover the standard distance. The result is in yards, but this can easily be converted into miles and yards. See page 27.

An example of a measurement follows: A 1100 yard standard distance stretch was measured twice and required the following number of revolutions of the bicycle wheel:

496 23/32 and 496 24/32 revolutions.

The number of revolutions needed to cover the road circuit to be measured was 5254 11/32 revolutions.

The bicycle was again ridden over the 1100 yards measured standard distance and 496 25/32 revolutions were required.

Mean constant 496 24/32, equals 496.75revs

Hence length of lap is $\frac{\text{1100 yards} \times \text{5254.34 revs (measured course)}}{\text{496.75 revs (standard distance)}}$ =

11635.2 yards = 6 miles 1075 yards.

OTHER CONSIDERATIONS--If possible measure the course on cool, dull days since a hot sun expands the tire and alters the constant. Do not walk any part of the course. Ride over it as you did on the standard distance course. It is not advisable to measure more than 50 miles on a single occasion. A suitable riding speed is 10 - 12 miles per hour. Take notes of the course measurement including intermediate readings "so that the whole course need not be remeasured if road alterations are made." 21/

Promoters of road races may be able to contact a cycling club for the purpose of having courses measured or checked, after obtaining the special Veeder-Root Star Wheel Revolution Counter.

ADVANTAGES--The Road Time Trials Council Method is a simple, accurate, and rapid method of measuring road running courses. It can be used at a speed five times as fast as a surveyor's wheel.

DISADVANTAGES--None.

PRECAUTIONS--Obtain a fresh constant on each separate measuring occasion. Do not take a short cut in calibrating the bicycle on a standard distance by marking the bicycle wheel with chalk and measuring a few revolutions on the road with a tape.

RELIABILITY--The Cyclists' Method has an accuracy of ± 10 yards in 25 miles. The precision of greater than 1 yard per mile is more than adequate for road race course measurements. A course measured a number of times by this method will reveal similar results.21/

NOTE: The cyclists abandoned measuring wheels 30 years ago in favor of the method described above, because extreme accuracy is required. The RTTC also points out that Surveyor's Chains are generally not accurate enough for measuring road courses. 21/

IV SURVEYOR'S MEASURING WHEEL

The surveyor's measuring wheel is a rubber tired wheel used for giving a rough, rapid measurement of distance on smooth surfaces. The Official AAU Track & Field Handbook states that courses in championship runs shall be measured by measuring wheel or with tape. The surveyor's wheel is not a precision instrument and it is not simple to obtain the accuracy needed for road racing courses. These wheels tend to over value measured distances, that is to produce "short courses." With careful technique the needed accuracy can be obtained with the surveyor's measuring wheel.

EQUIPMENT--Ideally, the wheel should be wide enough to prevent wobble, and the unit should be of sufficient size to give the wheel stability.

1) The following portable measuring wheels are available:
   a) "WHEEL-N-MEASURE METER"
      Records in feet, up to 99,999 ft. Wheel circumference

36 inches. Veeder Root five digit meter can be easily reset to zero. Price $49.50.
Order from--B.G. Reilly Co., P.O. Box 1849, St. Petersburg, Florida; or from the same company at P.O. Box 231, No. Scituate, Rhode Island.
Also from the same company: "TRACKMASTER MEASURING WHEEL," which records up to 99,999 ft. Price $55.00

b) "TRUMETER ROAD MEASURER"
Weight 7 lbs. Rubber tire. Several different calibrations available. Calibrated in either yards or feet and fractions thereof, up to 99,999 ft. Metric system calibrations available. Price $85.00. Order from TRUMETER CO., 38 W. 32nd St., New York 1, New York.

c) "THE WOLVERINE"
Records in feet. Rubber tire. Wheel circumference 36 inches. Order from: Wolverine Sports Supply, 3666 South State St., Ann Arbor, Michigan. Price $49.95.

d) "THE ROLATAPE"
Model 400: Spoke measuring wheel. Price $59.50.
Model 415: Wheel 15 inches in diameter. Neoprene tire. Registers to 100,000 feet, almost 19 miles. Graduated in inches and tenths of a foot. Price $62.50.

Order from: Rolatape Inc., Santa Monica, California; or from: Keuffel & Esser Co., 15 Park Row, N.Y. 38, N.Y.; or from source mentioned in #c above.

2) In addition to the measuring wheel, a steel tape is needed for short measurements in special situations, including the pin-pointing of checkpoint stations.

3) Marking materials: A red pencil and keel to make marks on the road surface. Hammer and chisel to make "cross-cuts," + on the street or sidewalk. Painting a small circle around the cross is optional. Take one or more measurements, by tape, from the "cross-cut" to nearby permanent landmarks. Record in notebook and use the information to relocate the mark.

METHOD--The first step is to calibrate the wheel by walking it over a previously measured standard distance, e.g. a one mile section along a straight road if possible, to check its accuracy. 45/ A correction table may be set up for use in the field. Jewell states that "it appears to be useless to test the accuracy of a surveying wheel on a track partly owing to the nature of the surface and also owing to the difficulty in following any prescribed path accurately round the track." 21/

Apply the average error found in the trials over the measured standard distance to correct the actual wheel readings. This correction will give better measurement results.

To measure the course, set the counter at zero, or start from the existing reading on the counter, depending on the features of the wheel. The axle is placed over the starting line. If the wheel has a striker, position it so that it has just left the counter so that when the counter first registers, the wheel will have made one revolution. As you walk, keep the same distance from the curb, walking straight and at a uniform speed.

~~The wheel should be pushed one meter (3 ft. 3 inches) from the curb in the direction of running.~~ A second choice is to measure along the path to be taken by the runners as is done in track.

Walk over the course at about 2 miles an hour, pushing the wheel by it's handle. If the operator has a partner to record results, it is possible to move a little faster. Better results are obtained by walking the wheel slowly and steadily. Take the counter reading when the axle of the wheel reaches the finish line.

No corrections are needed for air temperature variations. 21/ There is always some slippage due to insufficient friction in operating wheels, the amount depending on the surface being measured. Even with careful operation, wheels slip and light wheels bounce creating inherent errors in this method of measurement. Wheels tend to over-estimate road courses.

1 meter Rule originally 'ruled' & SR [handwritten margin note; partly illegible] ... used from edge of Road Surface throughout course.

The measuring wheel may also be used in conjunction with other methods for comparative measurements, such as when choosing an alternative road or for altering the start or finish of a course.

To set up a correction table for use in the field: Example--The surveyor's wheel is pushed over an accurately measured mile, 5280 feet. The wheel in this case records 5292 feet. To complete the calibration, divide the recorded reading into the actual distance: 5280 ÷ 5292 = 0.9977 which becomes the correction factor. To find the actual footage, multiply the wheel readings by the correction factor, 0.9977. 58/

Reading of wheel in feet	Actual distance feet.
1 - - -	- 0.9977
2	
3	
4	
5	fill in
6	
7	
8	
9	
10 - - -	- 9.9773
20	
30	
40	
50	fill in
60	
70	
80	
90	
100 - - -	- 99.7732
200	
300	fill in
400	
500	
600	
700	
800	
900	
1000 - - -	- 997.732
2000	
3000	
etc.	58/

ADVANTAGES--The surveyor's wheel is one practical method of measuring road racing courses since it can be used by an inexperienced person with a little practice. 45/

DISADVANTAGES--The surveyor's measuring wheel has its limitations: it is not intended for precise surveying. The road must be smooth to use a measuring wheel.

PRECAUTIONS--The light weight, narrow measuring wheels available now, lead to inaccurate measurements in that they tend to over estimate distances. Errors tend to increase as the speed of walking increases much over 2 miles per hour. 21/ Running with the wheel or towing it by car is not recommended.

RELIABILITY--The surveyor's measuring wheel may give measurements correct to 5 yards per mile when pushed slowly and operated carefully. 21/ This degree of accuracy is just sufficient for road course measurements. However, unless operated properly, these wheels produce too large an error for acceptance in road racing.

NOTE: Measuring wheels have been called by such names as Hodometers, Odometers, Perambulators, and Waywisers. Each is a wheel of known circumference, either connected by a train of gears to a counting mechanism or the counter is activated by a striker on the wheel. The distance indicated by a wheel is somewhat greater than the true horizontal distance, but this method of measurement is sufficiently precise for some purposes. Errors are plus and it is not possible to underestimate distances when using these wheels. 11, 12, 21/

V MAP MEASUREMENT

There are several types of maps depicting land areas. The map should contain: statement of scale, title, and the north point. The surveyor takes measurements and observations of land and makes a map to scale. Large scale maps may be used to measure a road course.

EQUIPMENT--Obtain a large scale map of the specific area in which the course is to be laid out. A scale of 1" to 150' is ideal. Smaller scaled maps may be used. The scale of the map is a statement of the relation between a distance measured on the map and the corresponding distance on the ground, for example: 1" = 200' means 1" on the map represents 200' on the ground. Another example: $\frac{1}{63,360}$ means that 1 inch on the map represents 63,360 inches, one mile, on the ground. 12,53/

The U.S. Department of the Interior Geological Survey has made a series of standard topographic maps to cover the U.S. The unit of survey is a quadrangle bounded by parallels of latitude and meridians of longitude. Many areas are published at different scales. Whenever this occurs, the map order should include the map series designation, such as 7½ minute series (published at the scale of either 1:24,000 or 1 inch = 2,000 ft., or 1 inch = ½ mile when published at 1: 31,680), or 15 minute series (scale of 1:62,500 , or 1 inch = approximately 1 mile), or 30 minute series (scale of 1:125,000, or 1 inch= approximately 2 miles). A few special maps are published at other scales as listed in the individual state indexes under special headings. Each quadrangle is designated by the name of a city, town, or prominent natural feature within it, and on the margins of the map are printed the names of adjoining quadrangle maps that have been published.

For information and a free folder describing topographic maps and symbols, write to the Map Information Office, Geological Survey, Washington 25,D.C. Order maps from the same source. In many cities, map stores can supply these maps.

The extent of map coverage is shown on index maps, on which the mapped areas are outlined in black. Write for index to maps of your state. From the index, order the maps you need by the names printed in black and by series designation, for example: Yonkers Quadrangle, 7½ minute series (topographic). Obtain the 7½ minute quadrangles which at 1 inch = 2000 ft. is a larger scale map than the other series. The quadrangle may not contain the whole area that you want so more than one map may be needed. The standard topographic quadrangle map is about 50¢ per copy.

Many libraries have map reference facilities. Use a ruler, or string in checking library maps.

It is usually possible to view or to purchase large scale maps of local streets or roads. Possible sources include: the city or local Bureau of Engineering; or Department of Highways; or the Water and Sewage Dept.; etc. Usually one such department will have the responsibility of surveying streets in each city. Streets must be surveyed before they are built. Theoretically every paved road and street in the USA has been accurately surveyed and mapped to scale. 44/

A screw type adjustable divider is used to scale or measure from the map. A second choice is to measure with a ruler, preferably a metric straight edge ruler. A ruler would be needed in any case to measure right angled turns if a divider is used to measure the course. These supplies may be purchased in stationery stores or stores selling art or drafting supplies.

METHOD--The route for the road racing course is measured with an adjustable divider which is used on the scaled map. A ruler may also be used to measure the distance after checking the scale of the map. 53/ To operate the divider: set the instrument for a ground distance of 20 to 30 feet (if using a large scale map). If a small scaled map is used, set the divider for 1/10th mile or other convenient distance.

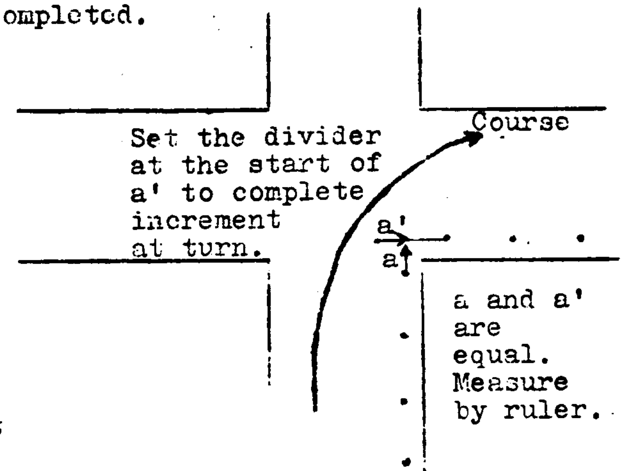
The selected increment is pricked slightly into the map paper for each length. To begin, set the divider legs on the course path with one leg on the starting (or finish) line. Press both legs into the paper. To move forward, pivot on the front leg and turn the back leg forward and puncture the paper with it. Repeat, turning to left and to right alternately. Travel in a straight line along the route.

It is easier to hold the instrument with the thumb and index finger. Avoid holding it by the stem (leg). Mark every mile point or mark certain intersections or check points in pencil as the measurement proceeds. This will give a check on the increments.

One should be able to hit intersections or check points repeatedly on re-checks of the course. Inspect pricks in the paper made by the points of the divider. Recheck the course several times each way.

Errors tend to occur going around a turn, in that you will get a shorter measured distance than the actual distance, tending to produce a long course. This error can be minimized with careful scaling of the path. When measuring right angle turns, it is advisable to use a ruler to permit the use of small increments of measurement until the turn is completed.

Ideally one man should do the mapping, including re-checking his work, and then someone else should check the distance. The course should finally be checked by travelling over the path by any convenient means with the map at hand. An up to date map is no guarantee that there have not been temporary or permanent changes in the road.



After using the divider awhile, recheck its calibration against the scale of the map. 45/

ADVANTAGES--Large scale maps provide the simplest and fastest method available for measuring a road course. A map allows the race organizer to try several different routes on paper. Maps may be used to check measurements by other methods, for example a surveyor's wheel, and as a check against gross accidental errors. 21/

DISADVANTAGES--The measurement of a winding course is not easy and requires the largest scaled map obtainable.

PRECAUTIONS--Obtain an accurate large scale map for good results.

RELIABILITY--Map measurements tend to be made with a greater degree of refinement in city surveying than for land of less value. Scaling a distance from a large scale map gives sufficient exactitude for road racing courses if done properly. 45/ The small errors which occur are not cumulative. Errors using a divider will tend to make a course long rather than short.

This I'd Like To See

Jewell found agreement between map distances and the wheeled distances (Calibrated Cycle Method) very good; the difference between the two averaged 4 yards per mile, and was the same independent of the scale of the map. The accuracy attained depends on the ability to follow the turns of the road by the map measurer (e.g. divider) or other device. Jewell prefers a thin piece of cord to a map measurer (divider). The cord is laid on the map and manipulated around the bends with the fingers. He claims that measurements can be repeated to 0.05 inch. 21/

MEASURING METHODS RECOMMENDED WITH RESERVATIONS

It is strongly suggested that the race promoter select one, or more of the recommended methods of measuring to check his course distance. The methods include: surveying by a professional surveyor, tape measurement, calibrated cycle method, surveyor's measuring wheel, and map measurement. However, if the promoter finds it impossible to use one of these methods, there are three additional possibilities which can be used to measure with sufficient precision for road race courses if certain procedures are followed. These methods are: the "fifth wheel," home made measuring wheel, and the automobile odometer.

I. FIFTH WHEEL

The "fifth wheel" is a small device, usually a special wheel, which is towed behind a car. It may be used to measure either the distance or the speed traveled by an automobile.

EQUIPMENT--Most "fifth wheels" are owned and used by automotive manufacturers and are not likely to be available for the average race promoter. However, the equipment is commercially available. The Tracktest Equipment Co., 27110 Scenic, Franklin, Michigan, sells a "fifth wheel," Model 5101 Trackmeter, for $760.00. 46,49/

The instrument consists of a balanced, rubber tired pneumatic wheel, approximately bicycle size, mounted on a frame. The device may have either a mechanical or an electrical counter connected at the hub. It records in tenths, hundredths, and thousandths of a mile. 26/ It usually connects to an electric speedometer/odometer inside the automobile and records both speed and miles covered.

METHOD--The "fifth wheel" is clamped to the bumper of an automobile so that it can be towed. The wheel must be calibrated against an accurately measured mile. The air pressure in the tire should be maintained at a steady value as indicated by a calibrated tire pressure gauge. 26/

Place the "fifth wheel" so that the center of the hub is directly over the starting point. The counter is then zeroed. Drive at a speed that allows the wheel to be kept firmly on the road surface.

Re-calibrate the "fifth wheel" before each use to include the proper correction factor.

ADVANTAGES--The "fifth wheel" gives rapid measurement of distance.

DISADVANTAGES--The "fifth wheel" is expensive. However, the race promoter might investigate the possibility of borrowing one.

PRECAUTIONS--Calibrate the "fifth wheel" against a measured mile. Drive the automobile with care during all measurements. 46/

RELIABILITY--The "fifth wheel" is not a precision instrument and it possesses the inherent defects of the surveyor's wheel. The accuracy is better than 99% with careful operation. Skilled use of the device will give the precision needed for the measurement of a road running course. 20,46,49/

II. HOME MADE MEASURING WHEEL

It is possible to make a good, reliable measuring wheel but it is suggested that the advice of an engineer be sought before constructing the wheel. 39/

EQUIPMENT--Bob Prentice of Australia constructed a wheel which was accurate and which was adopted for official use in the state of Victoria. In fact he measured the course which was later surveyed and used for the Melbourne Olympic Marathon. He has walked the wheel over most of the road running courses in his state.

Prentice described the construction of his home made wheel as follows:

1) Use an ordinary 28" bicycle wheel. Remove the tire and tube.
2) Construct a steel rim and attach it to the bicycle wheel. The rim is made of steel 1/8" or 3/16" thick and 2" or 2½" wide, for stability. This strip of steel is welded into a circle with an outer circumference of 8 feet ¼ inch. The extra ¼ inch balances almost exactly the amount of wobble when the wheel is used. The rim is rivetted to the wheel. The rivets are counter sunk. Bolts may be substituted for the rivets. Sleeves are attached to make the rim taut.
3) Construct metal forks and a handle and attach this assembly to the wheel. Use steel 1" or 1¼" wide and 3' to 3'6" long. The two pieces of metal are secured by sleeves. The handle is one foot long and is attached to the end of the fork. This aids in the balance of the wheel.
4) A revolution counter with a striker pin is attached to the wheel. Prentice's wheel makes 660 turns (revolutions) to the mile.

Check and recheck the wheel over an accurately tape measured mile, walking at a steady 4 miles an hour, or preferably less, with the wheel in front of the operator.

It is advisable to make tables of the number of revolutions of the wheel needed for one kilometer and for one mile and for fractions of and multiples of these distances. 51/

Some athletic clubs have made their own measuring wheels using a bicycle wheel and revolution counter. The front fork of the bicycle may serve as the handle. 38/ This type of measuring machine would not produce the reliability displayed by the wheel described by Prentice.

METHOD--Calibrate the wheel by walking it over an accurately measured mile. Take the wheel to the course to be measured. Walk over the course with the wheel, concentrating on walking on a straight path. Measure one meter (3 ft. 3 inches) from the curb or on the path the runners will take. One man can cover up to 3 miles an hour. If he has another man to record results, he can cover up to 4 miles an hour on a good road with a wheel of the type made by Prentice.

ADVANTAGES--It is possible to get results of sufficient precision if the wheel is well constructed, stable, calibrated correctly, and operated with care.

DISADVANTAGES--Great care is needed in the construction of a measuring wheel. Otherwise the error in measurement will be too large for acceptance in road running course measurements.

PRECAUTIONS--The wheel must have much more weight and stability than commercial wheels to make it worth constructing. If the steel rim is used, the welder should understand the situation fully.

RELIABILITY--Prentice checked his wheel numerous times and it was never more than 6 to 12 inches off when walked over his accurately measured mile. He feels that his wheel is more accurate for road course measurement than a steel tape and chalk marks and much quicker, and that it is about as accurate as you can get. Generally the reliability of a homemade wheel should be proved--by calibration and comparison with other methods--before acceptance for measuring road courses; otherwise they are not recommended. Accuracy is the goal. 5,20/

VARIATIONS--An odometer is an instrument for measuring distances traveled by a vehicle. Odometers may be attached to wheels of various vehicles. These vehicles are not recommended except for very rough measurements, after calibration on a standard mile course. Road course measurement needs are better met with previously described methods such as tape measurements or the calibrated cyclist's method.

III. AUTOMOBILE ODOMETER

The automobile is the most commonly used method of surveying roads for road races in North America. It is not a recommended method because the distance indicated by the mileage recorder or the odometer is somewhat greater than the true distance covered. 12/ Most American automobile manufacturers have apparently deliberately set both speedometers and odometers optimistically on their automobiles to satisfy the urge for speed and economy in gasoline mileage. This may explain the tendency for imported automobiles to have more accurate odometers than American made automobiles. 45,49/ "The Automobile Manufacturers Association admits that odometers are set to overregister from 1% to 5%. On top of that, tire wear gradually ups a car's odometer reading by about another 1% from what it was when the tires were new." 55/ This means that if you take a measurement directly from the odometer you can generally count on a short road racing course. Occasionally an automobile measurement may lead to a long course due to under-registration by the odometer.

If one must use an automobile to get a rough measurement of a road course, steps should be taken to get the most out of the instrument.

EQUIPMENT--An automobile equipped with an odometer that has been calibrated.
An air-pressure gage and a tire-tread depth gage may also be used.

Materials for record keeping.

If possible, the driver should use an assistant who should also be in the automobile when it it calibrated over a standard distance.

DISCUSSION--The terms odometer and speedometer are commonly used interchangeably. The speedometer is a device which measures speed. The odometer, a part of the "speedometer" assembly, is an instrument which measures distance traveled by the vehicle.

The mileage recorder of an ordinary automobile odometer registers distances to 0.1 mile. Special survey odometers are available reading to 0.01 or 0.001 mile. Both types of recorders must be checked on a reliable certified testing machine. The ordinary odometer may be checked by a reliable speedometer shop, especially if their business consists of fleet automobile and trucking concerns. 49/

Another solution is to operate the automobile for 10 miles between mileage markers on a turn-pike and note the mileage recorded on the odometer in order to determine if it is accurately recording distance. If it is not, then divide 10 miles by the miles recorded on the odometer to arrive at a correction factor. Multiplying this correction factor by an odometer reading will give you reasonably accurate mileage. As an example, if, when you travel a 10 mile turnpike distance your odometer registers 10.4 miles, then divide 10 by 10.4 which equals 0.9615. This figure can be used as a correction factor. Then if you measure a course by your automobile odometer and it records 21.3 miles, you multiply 21.3 by 0.9615 to get a reasonably accurate course distance of 20.48 miles. Any change in tire diameter or tire pressure can change the correction factor. Obtain a new correction factor before each measurement. 47/

Use the same arithmetic whether the odometer is over-registering or under-registering: To determine the <u>correction factor</u>, divide the odometer reading, obtained by driving over the calibration course, into the accurately measured distance of the calibration course. The calibration course should not be less than 5 miles long. Use 10 miles or more if possible. This may be done on an accurately measured loop of one mile (+ or –). 58/

Example: Drive the automobile over the accurately measured 5 mile calibration course. The odometer reading is 5.3 miles. Then the,

True Distance = Odometer Reading (on course being measured) x $\frac{5}{5.3}$ (the correction factor in this case)

True Distance = Odometer Reading x 0.9433 (correction factor)

If the road race course measured 12.8 miles on the odometer, then

True Distance = 12.8 x 0.9433
True Distance = 12.0742 miles
1760 yards(1 mile) x 0.0742 = 130.59
True Course Distance = 12 miles 130 yards

Errors are caused by changes in tire inflation, increased tire pressure caused by temperature increase due to tire friction on the highway, wheel bounce, differential action and other factors. 46/

The National Bureau of Standards investigated the use of odometers recently. Their report of the effects of variables in using an automobile for road measurement follows:

<u>Wet pavements</u>: Slippage of the rear wheels on wet pavement causes larger positive errors than dry road conditions.

<u>Vehicle speed</u>: As the speed is increased from 30 miles per hour to 60 mph the odometer reading tends to decrease on the average by a factor of 0.55% of the distance traveled. High speed driving usually causes a pressure build up in the tires.

<u>Vehicle load</u>: Additional weight in the automobile provided an increase in the odometer reading. It caused an over-registration in the odometer indication.

<u>Vehicle tire pressure</u>: If tires are inflated above the recommended pressure, the odometer reading is decreased. 26/

Make the odometer check immediately before the course is to be tires will make a big difference. For example, if loss of air in the tire permitted a loss of diameter of a half inch (settling of hub 1/4 inch), this would make a difference in circumference of the Diameter multiplied by 3.1416 or in this case 0.5 x 3.1416 = 1.57 inches per revolution of the wheel, and that would make quite a difference in a marathon course. A new tire would have a greater circumference than a well worn tread. Tires of different manufacturers would differ in thickness of treads, etc. 42/

Measure a 1 mile (±) loop calibration course with a calibrated 100 ft. steel tape. Hold the tape under 10 lbs. of tension. Select a little used road as the calibration course. A loop calibration course permits the automobile to be driven a number of laps adding up to 5 or more miles. An alternative is to use official local measure standards. The police department, or some other local agency will have a measured mile strip and also a gadget to check odometer accuracy. 14/ Tire companies may also have an accurately measured mile. To be of use in calibrating an odometer, these short measured courses should be loop courses. Turnpikes and throughways have accurately measured miles along their routes, sometimes at mile intervals along the shoulders in both directions for the entire length of the road. The accuracy of the mileage markers is within 1%. 56/

METHOD--To get the most out of the automobile as an instrument for measuring road courses, use precise and exacting procedures.

Vehicle odometer accuracy can be evaluated precisely by several methods including the "fifth wheel" device, the measured road course, and the simulated road tests using a special device for odometer testing. The first two methods gives the highest degree of precision. 26/

The following steps may be taken:
1. Have the odometer in the automobile calibrated for accuracy by an accredited "speedometer" specialist. 36/ Consumers Union of the US Inc., reports that it is a simple matter to adjust odometers to register nearly accurately. 55/

2. Use an air pressure gage to measure the air pressure in the tires. Adjust the pressure to the level recommended by the tire manufacturer. 26/

3. Standardize the mileage recorder by driving the automobile over an accurately measured distance such as a tape measured loop of a mile or more, or over a 10 mile stretch of a turnpike. 12/ Check the automobile several times. This is done immediately before the course is to be measured. When driving over the accurately measured course to check the odometer, have the same passenger(s) and load in the automobile that you will have during the course measurement.

4. Immediately after step 3, go to the starting line, or the finish line of the course to begin the measurement.
   a) It is easy to make sighting errors when looking at the odometer. Put a small piece of tape or other marker above the odometer to facilitate sighting at the same place and in the same way all the time. 19/
   b) Either set the odometer at zero or jack the automobile up and turn the rear wheel until the odometer is at an even digit or until the indicator is where you want it. 1/
   c) If possible, have one man drive the car and read the instruments, and have a second man make sketches of the course and keep notes and records on the course measurement.
   d) Drive over the course when traffic is light. Drive over the path the runners will take.
   e) The road should be dry at the time of measurement.
   f) McSweeney recommends driving at a speed of 10 to 20 miles per hour. The National Bureau of Standards study indicated that speeds over 30 miles per hour tended to decrease the odometer error. It is suggested that the measurement speed be the same as that used on the calibration course.

5. Finally, correct the distance recorded on the odometer--unless the McSweeney method is being used. The procedure for correction

has been described above under Discussion.

ADVANTAGES--The automobile odometer provides a fast method of getting a rough measurement of a road course.

DISADVANTAGES--Consumers Union of U.S. Inc., engineers have found that automobile odometers almost always over-register. The average odometer error is 3½ per cent. 55/ A study in 1963 by the National Bureau of Standards, Washington, D.C., indicated that the average odometer in automobiles provides an over-registration error of more than 3 per cent under standard test conditions. 26/ New automobiles are equally faulty in this respect. Direct reading from the odometer is unacceptable for road course measurement unless the McSweeney calibrated method is used. 21/

PRECAUTIONS--If an automobile must be used to measure a road racing course, have the odometer calibrated for accuracy by an accredited "speedometer" specialist. Then follow the procedure described above under Method.

RELIABILITY--Automobiles, motorcycles, scooter bikes, etc. are not reliable means of measuring distances. 39/ The odometer tends to provide greater over-registration errors for city roads than for highway conditions. 26/ Tests indicate that wet pavements and added vehicle loads tend to increase the odometer error, while increased vehicle speed and increased tire pressures tend to decrease the error. 26/ Errors in measurement range from about 3% to 10%, or more, in excess of the actual distance covered by the automobile. The road running course will be "short" by the error of the odometer. This points out the fallacy in measuring a course with several different automobiles and taking the average as the course distance. 20,45/

Conclusion: Taking a reading directly from the automobile odometer is not acceptable for measurement of road running courses. However, by calibrating the automobile and paying attention to correct procedures, it is possible to get acceptable measurement results. The automobile odometer has such a bad reputation that any measurements made with it will remain suspect and the race organizer would be wise to spend his energy measuring his course with one of the methods listed under acceptable measuring methods such as "chaining" (tape measure), or the "calibrated cycle method."

THE McSWEENEY METHOD

The McSweeney method takes the ordinary odometer (mileage indicator) and produces suitable results in road course measurements by calibrating the automobile. Jewell has described McSweeney's method as follows: Calibrate the car mileage recorder on a standard mile before use. This is similar to the method used by the Road Time Trials Council (calibrated cycle method) which uses an accurate calibration of a pneumatic tire before use in measuring distance.

McSweeney adjusts the tire pressure so that the readings of the mileage recorder are correct; whereas with the cyclists' method it is only necessary to blow up the tire hard and to determine the number of revolutions covered in a mile. The rest is simple arithmetic.

McSweeney recommends a maximum speed of 20 miles per hour on a smooth road, otherwise 10 mph. To calibrate the automobile, drive to the measured mile. Check the pressure in the tires to see that they are always the same as on previous occasions. McSweeney has an accurately measured one mile loop. He drives around the one mile loop 5 times and if the mileage recorder comes up to the mile exactly at the same spot everytime around, he goes to the course to be measured and does the job. If necessary he adjusts the tire pressure until he gets a correct recording. When he changes tires, he experiments again until he gets the one mile lap accurate again on the mileage recorder. 21/

MEASURING METHODS WHICH HAVE BEEN USED BUT WHICH ARE UNRELIABLE

The following methods are NOT RECOMMENDED.

I. BICYCLE AND CYCLOMETER

A bicycle may be used for very rough road surveying.

EQUIPMENT--A bicycle and a cyclometer made for the wheel diameter of the bicycle. The diameter of the wheel must be at the specific value for the set revolutions of the cyclometer to record an accurate mile. The usual cyclometer, designed for a 28" wheel, requires 720 revolutions of the bicycle wheel to record one mile. It is attached to the axle of the front wheel of the bicycle. A cyclometer may be obtained which registers distance in miles and tenths of a mile. The air pressure in the tires and the weight of the rider play roles in the effective diameter of the wheel. 29,40/

METHOD--First determine the error of the bicycle by riding it over an accurately measured strip of road of at least one mile, preferably more, and comparing its true mileage with that registered on the cyclometer. The tires should be pumped up hard. 18,29/ Calibrate the bicycle before each measuring job.

After riding over the calibration course, a correction factor can be determined by dividing the cyclometer reading into the standard distance. Then after riding over the course to be measured:

$$\text{True Distance} = \text{the Cyclometer Reading} \times \frac{\text{Standard Distance}}{\text{Standard Distance Reading}}$$

58/

ADVANTAGES--The bicycle is a rapid, rough means of measuring distances.

DISADVANTAGES--The ordinary cyclometer registers only eights or tenths of a mile and is too coarse for road course surveying.

PRECAUTIONS--The road surface is a factor in the accuracy of the results. The cyclometer is designed for a 28" wheel. However, with a rider on board the tire deflation may reduce the effective diameter of the wheel to 27.8" , for example, and the cyclometer would record 1.019 miles for each mile ridden. 57/ The bicycle should be ridden over the calibration course.

RELIABILITY--The cyclometer is not a precision instrument. At best it will record with an error of about 1%. This is in excess of the allowable error for reasonably accurate road course measurements. On poor roads the cyclometer measurements may be as much as 5% in excess of the actual distance travelled. 40,57/

II. WALKING OR PACING

Walking or pacing was formerly widely used in measuring land. It is a rapid means of making a rough survey of distances. 12/

EQUIPMENT--Material to keep records and to make a rough map, i.e., paper and pencil. Optional: a tally register, which is operated by hand to count the paces or strides. A register may be obtained which registers to either 999 (price about $4.75) or 9,999 (price about $6.25) and it may be set back to zero. 59/

METHOD--Wiklund suggests the following procedure: Three or four runners are trained to walk over the course. Each man determines his average walking pace per mile by counting the number of steps in a lap on a 440 yard track. Check this at least four times to get a good average. If the course to be measured is hilly, measure off a 220 yard or 440 yard section on a hill with a steel tape and walk it both ways several times to get the number of steps needed for hill walking. Practice walking this measured hill strip as well as on a 440 yard track. Generally more steps will be needed to cover a given distance going up hill. After standardizing the pace (stride), the survey is started.

Each man walks over the course and keeps a written record of the number of quarter miles paced off. These men should walk over the route as a runner would run, cutting corners, straightening out curves and any other legal maneuvers taken by runners to save steps. 52/ A road race should be laid out and run on the road, but selected sidewalks, etc. may be made officially a part of the course.

A US Army Engineer Field Manual states that the length of a man's pace at a natural walk is about 30 inches but varies somewhat above and below this figure. Each man determines his own pace length by walking several times over a known distance. Avoid taking un-natural strides. Knowing the length of a pace or step, the measurement of a distance consists of counting steps, and keeping a tally. 13/

ADVANTAGES--This simple method requires very little skill. It does require attention to details and some practice.

DISADVANTAGES--The normal pace length decreases on slopes and with fatigue.

PRECAUTIONS--Maintain the same stride length. Practice pacing over an accurately measured distance.

RELIABILITY--At best, pacing on level ground can give correctness to 3%. 13/ It is possible to get a precision of 1/100 with much experience. The method is far from accurate enough to be acceptable for measuring road race courses.

VARIATION--A very rough estimate of distance can be made by observing the interval of time recorded by watch, needed to travel by walking or riding from point to point. The tendency to either over-estimate or to under-estimate the rate of travel makes this method unsuitable for road course measurement. 8,18/

III. PEDOMETER AND PASSOMETER

The Pedometer and Passometer are instruments resembling a watch. If one of these mechanical registers is not available, a tally register may be substituted.

EQUIPMENT--A pedometer has a pointer which indicates miles on a dial. It has an adjusting screw which gives the erroneous idea that the instrument might be adjusted to the individual's step length, a factor needed to convert paces into miles or fractions thereof.

A passometer confines itself to counting the number of steps taken. The operator makes his own calculations of distance covered. The instrument is delicate. The operator must avoid making jarring steps since they are capable of causing the oscillating hammer to rebound thus recording an extra pace (step), that is, one step can cause two steps to be recorded unless care is taken. 15/

METHOD--The operator should standardize his pace or step length by walking over a known distance on level ground and on uneven and sloping ground. 12/ Some surveyors use the 3 feet pace to estimate distances but a 2½ feet pace is recommended because it is a little less than the natural step and because 40 such paces equals 100 feet. Each two paces or double step is called a stride. Thus a 2½ feet pace means a 5 feet stride or about 1000 strides per mile. The walker's pacing must be regular. These instruments are not useful in mountainous country. On moderate slopes up to about 10° , fairly good results may still be obtained by stepping out up hill and by maintaining a steady stride length on downgrades. 15/

The pedometer or passometer (or paceometer) is tested over a measured distance. The passometer is used to count the number of steps in the measured distance and the pace (step) length is determined from this information. 8/

The pedometer is attached to a point near the center of the body. The jolt at each step causes a pointer to turn in one direction. The pointer is worked through a train of wheels operated by a pendulum which falls at each step, and is returned to its original position by a spring. The pointer movement is read on the dial, which is usually graduated in fractions of a mile. The pointer can be returned to zero when the reading has been taken. 8/

ADVANTAGES--The pedometer or the passometer may be used at a rate of 3 to 4 miles an hour. 15/

DISADVANTAGES--These interpolating instruments are not intended for precise surveying.

RELIABILITY--The pedometer and the passometer will generally give an error of 2% to 3% with careful use. They are not practical for measuring road race courses. 11,12,15/

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MISCELLANEOUS

THE SURVEYOR'S CHAIN--The surveyor's chain or Gunter's chain (66' long, of 100 links at 7.92 inches each in length) is seldom used today. Originally the term "chaining" referred to this method of measurement. Today "chaining" refers to measuring with a steel tape. The surveyor's chain is durable, takes rough handling, is easily repaired or adjusted, and requires minimal care in maintenance. 8/ The surveyor's chain is not as accurate as a steel tape. Reliability is increased by comparing the chain with a standard measure before each use. 30/ Correct use of a chain will give an accuracy of between 1/500 and 1/1000. 8/

ROPE--Rope has been used for rough measurement of rugged terrain or forest paths with numerous obstacles. Rope is not suitable for measuring road running courses because it varies in length depending on its age, the weather, and the amount of stretch or tension applied. 8, 53/

MOBILE DISTANCE RECORDER--Jewell has described a specially built measurer in which the various sources of error in the surveying wheel have been overcome. It consists of two wheels mounted in a frame which is towed behind a car. A measuring wheel is mounted between the two running wheels and it is retracted when not in use. The number of revolutions it turns is recorded by a counter.

The measuring wheel has a pneumatic tire. It is calibrated before use and is checked afterwards. "A thin chalk line is made across the tire of the measuring wheel and the car driven very slowly forward so that as the wheel rotates a chalk mark is left on the road. The car proceeds until 10 revs of the measuring wheel have been completed and the distance between the first and the tenth mark is measured with a steel tape to one eighth of an inch. Hence the distance covered by one rev., or, if considered more convenient the number of revolutions per mile, is calculated." 21/ The accuracy is ± 1 yard per mile. The gadget has stability and weight and the measuring wheel is spring loaded onto the road so that bouncing and wobbling are eliminated. This leads to a high degree of accuracy. 21/

MATHEMATICS IN ROAD COURSE MEASUREMENT 58/

* Systematic errors due to incorrect tape length are eliminated by standardizing the tape and getting a correction per tape length if it is not the exact length.

Question--If a 100 ft. tape is incorrect the chances are that it will be short. Say it is 0.1 ft. short for 100 ft. length, you would add that increment per 100 ft. measurement. But what happens if you tape a partial tape length, for example 13.6 ft. for the same tape error ?

Answer--Use a correction factor, in this case minus 0.001 which is found by dividing the tape shortage by the tape length $\frac{0.1}{100}$

Multiply this correction factor, −0.001, by the total measurement, and then add this figure to your total measurement.

Example: 13.6 x (−0.001) = −0.0136

$$\begin{array}{rl} 13.6 & \text{measurement} \\ +\ 0.0136 & \\ \hline 13.6136 & \text{ft.= actual length.} \end{array}$$

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* A statement that two ratios (fractions) are equal is called a proportion. Any two equal ratios may be used to form a proportion. The Rule of Proportion: In any proportion the cross products are equal. We can find any one of the four terms of a proportion when the other three are given. Example, (cross multiply) $\frac{4}{40} = \frac{7}{n}$, 4 x n = 7 x 40, 4n = 280 , n = $\frac{280}{4}$, n = 70

*In the calibrated cyclist's method of measurement, the rider rides over a measured (standard) distance to obtain a constant. The distance is measured in revolutions and fractions of a revolution. The number of spokes past or short of the counter are counted at the end of the measurement. If the wheel has 32 spokes and the striker is 2 spokes past the counter it is considered 2/32nd revolutions. The revolution counter readings are converted to actual distances by the aid of conversion tables or by the use of arithmetic (proportion).

Example of a measurement: a 1100 yard standard distance was measured twice and required 496 23/32 and 496 24/32 revolutions of the cycle wheel.

The number of revolutions needed to cover a road course was 5254 11/32 revs. The cycle was again ridden over the 1100 yards standard distance and 496 25/32 revs were required.

Mean constant 496 24/32, equals 496.75 revs.
Hence length of course is $\frac{1100 \text{ yards} \times 5254.34 \text{ revs}}{496.75 \text{ revs}}$ = 11635.2 yards

Course length = 6 miles 1075 yards.

Question--How would you set up a conversion table ?

By arithmetic, 1 revolution = 2.2144 yards. Found by dividing the number of revolutions needed to cover the standard course on the bicycle into the standard distance, $\frac{1100 \text{yards}}{496.75 \text{revs}}$ = 2.2144 yards

No. of Revolutions	Distance traveled, yards
1	2.2144
2	
3	
4	
5	fill in
6	
7	
8	
9	
10	22.144
20	
30	fill in
40	
50	
60	
70	
80	
90	
100	221.440
200	
300	
400	
500	1107.200
600	
700	
800	
900	
1000	2214.400

1 spoke = 0.0692 yards. Found by dividing the total number of spokes into the value for one revolution

Spokes	Distance in yards.
1	0.0692
2	
3	
4	
5	fill in
6	
7	
-	
-	
-	
-	
-	
-	
-	
30	
31	
32	2.2144

After finding the values for 1 revolution and 1 spoke, multiply these by the revolutions and the spokes to get the distances measured. These could be either in yards or miles, etc. With these, other multiples of the same can be quickly interpolated.

NOTE: For revision purposes, please send all corrections and suggestions for improvement of this monograph to: Ted Corbitt, 5240 Broadway, New York 63, New York, USA

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Bob's Letter From Ted putting him on NSC 1974

No. 2

2

THEODORE CORBITT, R.P.T.

Apt. 8H Sect. 4

150 W. 225 ST. NEW YORK, NEW YORK 10463

Tel. 212-LO 2-7393

6 November 74

Dear Mr.Letson,

Thanks for the information about the Balboa Park terraine.

I am writing this time to invite you to join the Sub-Committee on Standards, of the National AAU Long Distance and Road Running Committee. Mr.Bill Hargus has previously suggested that I do so. I like your thoroughness and interest in this generally thankless but necessary task.

There are other areas besides certifying courses and this is where you would be, for now. It would mean working with other members to produce something in the standards area. And if there are other areas in which you have a specific or special interest, that would be good. I have two things in mind now but will mention them only if you have the time to serve--and that is not always easy, I know.

Yours,

Ted Corbitt

Ted Corbitt
Chairman AAU Standards Committee

This letter typifies Ted's style of inquiry: big questions (3)

8 June 75 No.3

Apt.8H Sect.4,150 W.225 St.,NY,NY 10463

Dear Robert Letson,

Hope you are well.

Three items:

1)Bill Hargus refers to a "recent recheck showed it (Mission Bay Marathon Course) to be hundreds of feet too long..." Am I correct in assuming that he is referring to your measuring team's effort which found the course 1650 ft too long? (the 1973 MBM was 1650 ft long. RAL)

2)If possible, please write up details of your two counter measuring technique, including sources of materials, and send it to me. Some of our members feel strongly that courses should be measured twice, but this is not always possible and the two counter set up is a nice compromise and the total price for someone owning a bike is still cheaper than buying a measuring wheel.

3)Send name of your second counter or better yet, names, prices and sources of all counters that you have used and indicate which wheel the specific counter is used on. One Committee member is in the process of writing an article on road course measurements and he wants to know sources and prices of counters for recommendations in this Runner's World article.

4)Would you like to work with one or two of us on Standards related to timing events? If so let me know.

Thanks.

Yours, Corbitt

Ted Corbitt

No. 4 a road calibration course is needed. The selected road should be one mile long,

for best calibration results. However, if it is impossible to find such a strip, any lesser distance will serve, but not less than 1/2 mile in length. In the latter instance, if possible, als lay out a one-kilometer length. It should be carefully measured at least twice with a good steel tape. Take the average of the two or more measurements as the distance. Measure it with a team 3 or more men, at least one of whom has had experience in taping with a steel tape. Inspect the first and if it has kinks, splices or evidence of repairs, do not use it unless it has been certi and you have the "corrected" length. Identify the correct start (zero) and end points of the tap In taping, the tape should be stretched strongly, e.g. 10 lbs. pull, and the increments should be carefully marked. Avoid measuring in extreme temperatures, as these affect the accuracy of the t Take the average of the several measurements and permanently mark the start and finish with nails chiselled cross-cuts (if concrete), and paint. If a city "measured mile" is available and suitab it may be used after re-measuring it.

Measure all courses along the path the runner will be expected to take, including all short cuts, and use the IAAF rule of measuring one meter (3 ft, 3 inches) from the curb or parked vehic or obstacles, in the running direction. Note that runners will generally take short cuts at ever opportunity. Road races should be on the roads, but a course may be laid down on lightly-used si walks or other paths when necessary. It is usually a good idea to run facing or against traffic. seeking the shortest path, and when running on roads with many turns, runners will often run on e side of the road. Measure where they will run. In a heavy traffic situation the course may be l out on one side only and the runners directed to run only on that side.

Consideration should be given, at least in the marathon and in the metric championships, to ting up checkpoint timing stations in kilometers, e.g. 5-kilometer increments. A kilometer = 0.62137 mile.

Since the RRCA and the AAU are both now keeping national road course records, the Standards mittee has upgraded its standards, after much thought. Now, a course must be measured at least twice, with the average of the measurements taken as the course distance. This will help to insu more standard distances throughout the country and will further reduce errors in measurements. T goal is to make the course the exact distance listed. A road course may further be cross-checked using large-scale maps or by re-measuring the course by a second method. A course measured by st tape may be cross-checked, preferably by use of the calibrated bicycle method, or by the calibrat measuring wheel method.

The automobile odometer, relied on in the past to lay out road race courses, is not acceptab for course measurements, since it generally produces a short course by 3 to 10% or more. The rec mended method for measuring a road course is the Calibrated Bicycle Method. However, when proper used, acceptable results can be gotten with the Calibrated Measuring Wheel method. Measuring wit steel tape or chaining is an excellent method, when done by experienced personnel. Large scale m may be used to lay out a course, before measuring with one of the above acceptable methods, or as cross-check in addition to two measurements.

SURVEYING. This is done by professional surveyors or civil engineers. We need the surface of th course measured, and it is usually measured with a steel tape. Ordinary measurement with a steel tape gives an accuracy of about 1 part in 3,000. If the cost of hiring a surveyor is too much, t one of the following methods may be selected. If a surveyor is used, he must first be informed o exactly what is needed to produce a properly measured race course. If he doesn't know what is st dard practice, his measurement may have to be rejected.

CALIBRATED BICYCLE METHOD

In this popular method, road race courses are measured by fitting a bicycle with a special m anical wheel-revolution counter. It counts revolutions and fractions of a revolution of the whee The counting assembly may be a star wheel revolution counter, or a lever or a gear-actuated count Another possibility is a resettable automobile trip odometer combined with a bicycle cable/gear, suring in odometer and fractions of a wheel circumference units.

This method was developed by the road racing cyclists in England. It has been adopted by th Road Runners Club of England, the RRC of America and the AAU of the USA. It permits the measure of a road course at about 10 miles an hour, with an accuracy within one yard per mile.

EQUIPMENT NEEDED

1. A bicycle with good tires and tubes.
2. The bicycle is fitted with an available wheel revolution counter. Contact the Chairman of the Standards Committee of the NAAU Long Distance Running Committee, or the President of the RRCA, for details of availability and cost of a revolution counter assembly. Carry a wrench and screwdriver.
3. Steel tape to make short measurements on the course in special situations, e.g. stretches of dirt and grass, or to locate checkpoint or reference marks in relation to fixed landmarks, such as start and finish lines.
4. Pencil and notebook to record figures and results. Record and date everything done.
5. Marking materials to establish checkpoint marks: hammer, cold chisel, paint, nails, adhesive or masking tape, red pencil.
6. A steel-taped road calibration course, one mile long. If necessary, the distance may be 880 or 1100 yards (one kilometer rounded off), minimum. It must be measured at least twice and a thorough check made of the number of tape lengths or increments used. Do not measure on windy days or in extreme temperatures. The tape expands in hot weather and shrinks in cold.

METHOD

1. Attach the revolution counter or odometer/bicycle cable-gear, as directed in the installation instructions. The following, for a star-wheel assembly, will serve as a guide. It is attached on the right side of the front wheel.

a. Attach and adjust the counter on the axle and put the striker on a spoke so that the striker turns the counter blade or lever. Test the adjustment by turning the wheel. The adjustment is a delicate one and care is needed. Recheck this before each measurement.

b. Paint or mark the spoke carrying the striker so that it can be easily seen. Or, use the tire valve as a guide by having the spoke next to it as the zero or starting point on the ground under the axle, as the spoke holding the striker has just left the counter blade or lever arm. This also provides a means of counting the spokes to determine a fraction of a revolution.

c. The tire should be inflated hard, but not too hard or the wheel will bounce unduly. It should be free of suspicion of leakage. If used, tire air pressure gauges should not be used except immediately after pumping the tire up.

2. Ride the bicycle a few minutes and check the counter operation again.
3. Immediately before and immediately after measuring the race course, the bicycle is ridden over the accurately measured road calibration course (standard distance) of not less than ½ mile, preferably one mile long. From the readings obtained, the number of revolutions, and fraction of a revolution, of the bicycle wheel per mile is calculated. Take 4 rides before and 2 rides over the calibration course after the course measurement. This provides the "constant" for that particular measuring occasion, and it is used to calculate actual distances from the revolution counter readings.

a. At the starting line of the calibration course, on the roadway, put the axle of the front bicycle wheel over the line and set the counter at the "zero" position, that is, with the striker on the point of leaving the star wheel, or just past the activating lever or cam of the counter.

b. Write down the meter reading (there are no fractions of a revolution on the starting line readings), or reset the meter to zero when possible.

c. Ride over the calibration course at least 4 times to obtain the constant.

(1) The same cyclist should ride over the calibration course and the race course. Each rider has his own riding pattern.

(2) Ride exactly the same way and with the same weight and equipment on the bicycle as will be used during the actual race course measurement.

(3) At the end of the calibration course, stop the bicycle so that the axle is over the end line. Count the number of spokes of the striker past the counter, or spokes past the zero point of the wheel, and record this along with the number of revolutions on the meter. Subtract the starting figure from the finish figure. The result is the revolutions for that trial. Fractions of a revolution are calculated from the wheel spokes. For instance, if the wheel has 32 spokes and the striker is two spokes past the counter, it is 2/32nds of a revolution or "two spokes." In recording the result, give the number of revolutions from the meter and the spokes, e.g. 1671 8/32 revolutions. Convert the fraction (spokes) to a decimal figure by dividing--in this case 32 into 8--e.g. 8/32 = 0.25 revolution, or 1671.25 revolutions. Carry the decimal to two places.

(4) Ride over the calibration course at least 4 times and record the results. If you get a cluster of readings around a certain figure and one or more readings vary significantly from the general trend, e.g. by ½ revolution or more, discard the offbeat recording in calculating the "constant."

(5) Add the results of each ride and divide by the number of rides. The result is the working constant for measuring the racing course--once you determine the number of revolutions for one mile. The constant is good for that day only.

(6) Always recalibrate the bicycle after the race course measurement. Take two rides over the calibration course and average the result with the pre-course measurement constant, for the final constant. The two results should be very close.

(7) Obtain a new constant on each occasion that a course is measured.
Notes: (a) The road should be dry for the calibration and course measurement, and all must be done on the same day. (b) Avoid the hottest part of the day in measuring. (c) Ride the bicycle all the way over the course. (d) Avoid extreme weather conditions and do not measure on very windy days. (e) Measure where the runners will run. (f) Check the measurement by an alternate method when possible; or, measure the course a second time on another day, if possible.

4. Ride the bicycle over the race course and record the number of revolutions needed to cover the course. Or, ride a predetermined number of revolutions needed to lay out a specific distance. Keep records of intermediate distances so that the whole course need not be remeasured if road alterations are made or if the course must be shortened or lengthened to bring it to a specific length.

5. Convert the total number of revolutions of the bicycle wheel into miles. Use one of the following methods:

a. Conversion tables. Figure the value for one revolution on the basis of the "constant" for that occasion. Then make a table of revolutions and values for 1 through 10 revolutions. Then tabulate in multiples of 10 through 100, and in multiples of 100 through 1,000, and finally in multiples of 1,000 through 10,000 revolutions.

b. (The preferred method) Simple arithmetic as follows: multiply the calibration course distance (may be figured in feet or yards) by the number of revolutions needed to cover the course (or lap) and divide the result by the constant (the average number of revolutions taken to cover the calibration course). The result will be in yards or feet, depending on which unit was used for the calibration course distance. Convert it to miles and yards or into kilometers as needed.

c. If measuring a specific distance, figure out the number of revolutions needed to cover one mile. If the calibration course is one mile, you will have it directly from the average number of revolutions needed to cover the mile. Figure out the value for one revolution. Then compute the total number of revolutions and fractions of a revolution (to the number of spokes) needed to make up the specified course distance.

An example, using arithmetic (proportion) to convert the revolution counter readings to actual distance, will now be given. A 1,100-yard road calibration course was ridden over twice and required 496 23/32 and 496 24/32 revolutions of the bicycle wheel. A road course was ridden over, and it took 5,254 11/32 revolutions to cover the racing course. The bicycle was again ridden over the 1,100-yard calibration course, and 496 25/32 revolutions were required. Adding the three constants (two before and one after the measurement of the race course) and dividing by 3 gives a "mean constant" of 496 24/32 revolutions, which equals 496.75 revolutions. So the race distance was:

$$\frac{\text{1,100 yards x 5,254.34 revolutions (the measured course)}}{\text{496.75 revolutions (mean constant)}}$$

= 11,635.2 yards.

Then 11,635.2 yards divided by 1,760 yards (1 mile) = 6 miles 1,075 yards, or 6.61 miles.

Formuli:

(1) $\frac{\text{Standard distance (calibration course) x revolutions on race course}}{\text{Constant}}$ = Dist. of race course.

(2) One revolution = yards (or feet) = $\frac{\text{Standard distance (calib. course)}}{\text{Constant}}$

(3) One spoke, in yards, = $\frac{\text{Value for one revolution}}{\text{Number of spokes}}$

Details on the availability, prices, and additional information on suitable revolution counters and the special automobile odometer/bicycle cable assembly may be obtained from the Chairman of the AAU Standards Committee. His address may be obtained either through the President of the RRCA or the NAAU, 3400 W. 86th Street, Indianapolis, IN 46268. The "Jones Counter" system is the counter most often sold and used at this time. It currently (Feb., 1978) costs $12.00 and is available from Clain Jones (or Dr. Alan Jones), 3717 Wildwood Drive, Endwell, NY 13760. Instead of dealing with revolutions and spokes directly, this counter records 20 counts per revolution of the bicycle wheel, and you deal only with these counts.

CALIBRATED SURVEYOR'S MEASURING WHEEL

The surveyor's measuring wheel is a rubber-tired wheel used for obtaining a rough measurement of distance on smooth, paved roads. It is less useful on dirt or grassy surfaces (both of which should be measured by steel tape). The measuring wheel is not a precision instrument, and it will usually produce a "short course." To keep the error within allowable limits, the wheel must be calibrated over a tape-measured road course ½ mile or more long, and it must be walked over the courses at about two miles an hour.

EQUIPMENT NEEDED

1. The wheel. A number of wheels are available. Choose one which records up to 100,000 ft. For sources, see the section on "Race Equipment" in this handbook.
2. A steel tape to make short measurements in special situations, including dirt or grass stretches on the course, or in pinpointing checkpoint stations to permanent landmarks for future reference.
3. Marking materials: a red pencil and keel to make marks on the road surface (adhesive or masking tape may also be used for temporary markers); hammer and chisel to make "cross-cuts" (+) on the street or sidewalk. Painting a circle or lines around the cross-cut or using nails, if the surface is suitable, is helpful. Take one or more measurements by tape from the mark to nearby permanent landmarks. Record all such information in a notebook, date it, and use it to relocate the mark, etc.

METHOD

1. The first step is to calibrate the wheel by walking it over a road calibration course of not less than ½ mile, and preferably 1 mile long, which has been previously measured at least twice with a steel tape. Before each measuring job, walk the wheel over the calibration course at about 2 miles an hour, keeping the same distance from the curb all the way, and record the number of feet on the meter. Take several readings each time at first. Later, two such trips over the calibration course will confirm that the wheel is functioning normally.
2. Find the correction factor. Divide the recorded average meter reading for the calibration course into the actual tape-measured distance (also in feet). Carry the figures to 4 decimal places. Example: 5,280 ft. (taped road calibration course) divided by 5,290 ft. (recorded on the wheel pushed over the same course) equals 0.9977, which becomes the correction factor. Thus every foot recorded on this wheel is worth 0.9977 ft. (instead of 1.0000 ft.). In time, this factor may change slightly.
3. A correction table may be set up for use during the race-course measurement. List the value for one foot, e.g. 0.9977 ft., two feet and so on up to 10 ft.; then 10 ft., 20 ft., etc. to 100 ft.; then in increments of 100 ft.; then in increments of 1,000 ft. up to 100,000 ft. Use the table to plot a road course measurement using the wheel.
4. Instead of using a correction table, you may find the actual footage of the course by multiplying the wheel reading for the entire course (which has been walked over with the wheel at about 2 miles an hour) by the "correction factor." This serves to "correct" the wheel reading, giving a more accurate result. Adjustments in the course length may then be made with the wheel, again using the correction factor, or made with a steel tape if necessary.
5. An alternative to setting up a correction table or to using the correction factor is to walk the wheel over the calibration course several times. Average the meter readings, and use the figure directly. For instance, if a mile calibration course of 5,280 ft. gives a wheel reading of 5,288 ft., let 5,288 ft. on the wheel equal one mile on the ground as the race course is measured.

To measure the course:

a. Place the axle of the measuring wheel over the starting line (or finish line if measuring backwards) which is marked on the road.

b. Check the meter and write down the reading, or reset to zero if possible.

c. Start walking the wheel over the course at about 2 miles per hour.

d. Keep the same distance from the curb (3 ft., 3 inches, or a car width plus one meter, if cars are parked along the side), and walk over the approximate path the runner will be expected to take, including all shortcuts.

e. Record readings from the wheel at some intersections and at mile or kilometer points, and keep for future reference.

f. Make checkpoint and intersection marks on the road or sidewalk and, once these marks are final, mark them permanently (chiselled cross-cuts on sidewalks or concrete; nails on asphalt or macadam; paint, stakes, etc. depending on the surface). Tape-measure the distance of the checkpoint mark from some permanent landmark (e.g. manhole cover; telephone pole--and check to see if it has a number on it; corner of building; etc.).

g. Take a reading when the axle of the measuring wheel reaches the finish line.

h. Check your results using a "correction table," or "correct" the wheel reading by multiplying it by the "correction factor" (see nos. 3 and 4, above). Or, if using the method described in no. 5 above, recheck the figures.

i. When certain that the distance is correct, permanently mark the start and finish lines of the race course and keep records so that the exact points may be relocated.

NOTE: Do not run with the wheel or tow it by a vehicle. To do so introduces errors. Walk the wheel at around 2 miles an hour to produce acceptable results. Measure the race course twice. Keep a written record, dated, of everything you do.

TAPE MEASUREMENT OR "CHAINING"

Direct measurement by steel tape is the most commonly used reliable method of determining distance between two points.

EQUIPMENT NEEDED

1. A calibrated steel tape 100 ft or longer in length. Obtain a steel tape made for this purpose. It should not be broken or spliced, unless it has been re-certified and the "corrected" distance known for your use. The whole measurement job hinges on the use of an accurate steel tape and its proper use.
2. Spring balance, attached to the forward end of the tape to indicate the tension or pull on the tape (used to increase the accuracy).
3. Recording or marking materials: field notebook, pencil, red pencil or keel to mark points on the road, a hammer and chisel, and plastic tape.

TAPE HANDLING

To unroll the tape, one man holds the case and the other man walks away with the free end. To roll up the tape, it is laid out straight on the ground and the man doing the winding walks toward the free end. For measurements of less than a full tape length, the tape should be kept on the reel. Reel out as much as is needed and reel it in as soon as possible. If the tape is on the ground and is to be moved, drag it from one end only. If the tape is to be raised off the ground, the tapemen should lift it simultaneously and keep it stretched out. Otherwise the rear tapeman should not touch the tape while it is being moved. Do not let vehicles run over the tape. The tape should be compared with a certified tape. Many cities have standards of length which may be used to check a tape.

In surface chaining, tapes longer than 100 ft. are generally not used for measurements along the ground. Lay the tape flat on the road surface. The rear tapeman holds his end of the tape on the line and directs the lead tapeman for proper alignment. The lead tapeman applies 10 lbs. of tension (pull), and then marks the tape increment. On grass or dirt, chaining arrows or pins are used to mark the spot. In measuring around turns or curves, measure in increments of 5 or 10 feet instead of full tape lengths. Cross-check the measurement by another method.

Errors in chaining are of two classes: errors due to faulty chaining and to natural conditions, errors in reading or recording measurements. Measure where the runners will run, allowing one meter from curb or obstacles.

Tapes are easily damaged. Use care in handling. Before using it, check it for kinks. When it is being stored, clean, dry and grease it lightly with vaseline.

PERSONNEL

A minimum of two men is needed to measure a course, but generally a minimum of three men should make up the "taping party." If possible, organize a team of up to 7 or 8 men with one or two cars. Place one man at each end of the tape. Duties of the taping field party may be divided as follows:
1. Chief. He should have had some experience in surveying. He supervises the measuring. He might act as the rear tapeman and serve to guide the lead man in getting proper alignment. He might also keep records unless another man is along to record.
2. Lead tapeman. He carries a red pencil and keel to mark tape increments. He uses a meter stick or a folding rule for alignment.
3. Recorder. He marks and describes in notes each ½ mile and mile. Field notes should be clear and complete, giving numerical data, explanatory notes, and sketches, made approximately to scale in a notebook.
4. Tension Man. If a spring scale is used to indicate the stretch force on the tape, a special man may do this. Otherwise the lead tapeman handles the spring balance (scale).
5. Assistant. Directs traffic and assists otherwise.

LARGE SCALE MAPS

Large scale maps may be used to lay out a road course, or to cross check a course measured by the Calibrated Bicycle Method or by the Calibrated Measuring Wheel Method. The map should contain: statement of scale, title, and the north point. Obtain a large scale map of the specific area in which the course is to be laid out. A scale of 1 inch on the map to 150 ft. on the ground is ideal. The U.S. Dept. of the Interior, Geological Survey, makes standard topographic maps covering most of the U.S. For information and for maps, write to the Map Information Office, Geological Survey, National Center, Reston, VA 22092 (for locations east of the Mississippi River) or to U.S. Geological Survey, Branch of Distribution, Box 25286 Denver Federal Center, Denver, CO 80225 (for locations west

This letter exemplifies Ted's generosity, by sharing a hard-earned fee. (4)

NO. 5

20 May 78

Apt. 8H Sect. 4
150 W. 225 St.
New York, N.Y. 10463

Note on Ted's 1978 Course Cert. GuidLines

To: Robert Letson, San Diego, CA
Tom Osler, Glassboro, NJ
David A. Senechalle, Austin TX

Re: Expenses for AAU Standards Committee Mailings

See my Copy belived to have Come from this Article.

Gentlemen,

I wrote an 11 page contribution on COURSE MEASUREMENT for the new book edited by Joe Henderson, The COMPLETE MARATHONER published by Runner's World. They also used something I had written some years back. As you may know, they do not pay a lot but I received $150.59 for the Course Measurement chapter. I am splitting this four ways and each of you are received a check for $37.64.

This is to help in your expenses for the AAU/RRC Standards Committee work. Some of you have served longer than others and the amount spent has not been the same. This is just to help and not meant as a total reimbursement.

Again I want to thank all of your for your generous contributions towards the work of the Standards Committee. I know how busy you all are and on behalf of the rest of the runners in the country, thanks for taking time out to make your contributions.

Yours,

Ted Corbitt
Chairman AAU Standards Committee

No. 6

From
Joe Henderson
'THE COMPLETE MARATHONER'
1978

39

Course Measurement

Driving a car over the route won't do. Runners expect precision

Ted Corbitt

The United States long-distance running course certification program was started in 1964, first by the Road Runners Club of America (RRCA) and months later by the Amateur Athletic Union of the US. Originally, the AAU was concerned with requiring accurate courses for its national championship long-distance events. In 1966, the RRCA and the AAU, via the Sub-Committee on Standards of the National AAU Long Distance and Road Running Committee, agreed that the AAU Standards Committee would take over all course certification. The RRCA has continued to keep a list of certified courses in this country, in cooperation with the AAU Standards Committee.

To certify a marathon course, the course must be measured accurately, using an acceptable measuring technique such as "chaining," the use of a steel tape, the "calibrated bicycle method" or the "calibrated measuring wheel method." The recommended method of measuring is the calibrated bicycle method, which will be described later.

COURSE PLANNING

The International Amateur Athletic Federation defines the marathon race as being 42,195 meters, or 26 miles, 385 yards. The course should be on paved highways, but it may be on paved bike paths, on pedestrian walkways, on closed roads in parklands, on city or country roads with limited traffic, where the roads can be closed during the race or where traffic can be controlled by the police.

There are numerous marathon course configurations. Some generally-used course layouts include:

1. "Point-to-point" Course (e.g., Hopkinton-to-Boston Marathon and the Fiesta Bowl Marathon, Scottsdale, Ariz.).

2. "Big loop" Course (e.g., Yonkers Marathon, wherein the start and finish are near each other.).
3. "Out-and-back" Course (e.g., Culver City Marathon and the San Francisco Marathon.
4. "Out and Back, with a Loop " (e.g., Holyoke Marathon and Observer Marathon, Charlotte, N.C.).
5. "Lap course" (e.g., Atlantic City—out and back three times: Detroit Marathon, Belle Isle, five laps).
6. "Figure-of-eight loop" (e.g., Atlantic Avon Marathon and Land-O-Lakes Marathon, Minneapolis, Minn.).
7. "Out-and-back in two directions" (e.g., Rotary Shamrock Marathon, Virginia Beach, Va.).

Generally, the race promoter should plan to use the most favorable course in his area, in terms of safety, ease of staying on the course and so forth. Sometimes, the location of the sponsor or of dressing facilities dictates the site of the course, especially as to the start and finish points. Some courses have been set up out of town for special effects, such as to race at higher altitude, or to take advantage of parklands which are relatively free of vehicular traffic and air pollutants.

In striving for personal best times and to qualify for the US marathon tryouts for the Pan-American Games and the Olympic Games marathon teams, runners want some courses which will help them make fast times. The hardest courses are the hilly ones, with the emphasis on hill climbing. These courses are easier to run in cold weather, and they are harder and "slower" in hot weather. The easy courses are the more or less flat ones. It is possible to make fast times on such courses, provided other factors are favorable. The fastest courses are those that are gently rolling, featuring mild to moderate hill climbing, interspersed with many long gentle to moderately steep downhill sections. There are courses of various mixtures of these types of layouts. Most courses are capable of producing fast times with fit, determined runners, striving under favorable running conditions. (The Boston Marathon course, for instance, is moderately hard, and features a lot of hill climbing, rewarded with many long down sweeps, which helps fit, courageous runners to generate fast times.)

It is claimed that "following winds" don't actually push the runner along, but they reduce the air resistance which impedes his moving ahead. Courses with prevailing winds which create tailwinds will generally produce faster times. Headwinds cause slower times. These factors may be considered in laying out a marathon course, especially where weather patterns are consistent.

Running over a scenic course can add to the runner's enjoyment of the challenge and can stimulate him to tolerate a harder effort over the course. While selecting a scenic route should take a second place to course safety, frequently the two factors merge, with planning.

Safety usually refers to the absence of danger from automobile traffic and air borne pollutants. Hostile neighborhoods and poor footing may be problems occasionally. Weather also is a common safety factor; snow and ice are sometimes ignored but such footing is a big danger to older competitors, and hilly courses under these conditions are a danger to all runners. Shady lanes for summer races make such racing safer.

The race promoter should select a course that the runners can stay on without getting lost while racing. With plenty of police protection, almost any route can be used. If police protection is likely to be nonexistent or skimpy, the selected course should present the minimum number of encounters with traffic. Ideally, the course would be cleared of traffic, or perhaps one lane would be closed to traffic. Some of the mass-participation races effectively close entire roads to traffic as the runners take up every bit of free road space. Traffic-free loops of 5-6 miles inside parks are good racing sites, except for the marathons with extra large fields where the slower runners get lapped, complicating the lap-recording job.

Once the course is selected, the promoter should check with the police departments concerned along the route and make certain that the race will be permitted as planned. Police have in some cases demanded changes in race routes as late as the day of a race. Route problems should be resolved before the final selection and measurement of the race course.

The race promoter must monitor the marathon course with people and with signs to keep the runners on course. If personnel are to turn the runners onto new roads, they should be in place before the race starts, especially at turns as well as at forked roads where a decision must be made by the runners as to which way to run. Guide signs are useful, although there have been cases in which they have been removed or replaced to lead runners off-course.

Many races have been spoiled after the gun went off by having the lead runners or others run off course. In some cases, police escorts have led runners down wrong roads. The sponsor should make certain that lead vehicles actually know the course route. When runners go off-course, all releases of race results should mention this fact. Such incidents usually result when the courses are too complicated, winding, or leave apparent main roads without adequate guidance or signaling to the runners. Such courses need a lot of people on duty to keep the runners on the measured route.

A few marathon sponsors have, at some expense, followed the lead of the Munich and the Montreal Olympic marathon courses and painted blue lines on the road to point the way. These painted lines are solid at points but mostly broken lines, as at the New York Marathon's point-to-point loop and at the Ocean State Marathon with its three lap course. Painted signs on the road and other use of paint can also aid in keeping runners on-course, if permission can be gotten from the police department to put them down.

Courses which serve well for less than 200 runners, give or take a hundred, can suddenly become obsolete as racing sites when the entry lists explode to upwards of 1000 starters. The start area and the first few miles of the Boston Marathon course used in the 1970s is a good example of an obsolete racing start. Courses which use sidewalks, bikeways or similar small paths become unmanageable when several hundred starters show up to race.

Race starts on stadium tracks also become impractical with several hundred starters, since running even a half-mile on the track could result in the runners in the back of the pack getting lapped. It then becomes more sensible to start the race outside of the stadium and, if desired, to have the race finish on the stadium track. Also, loop courses of more than three repeated laps for a marathon present problems with slower runners getting lapped, complicating lap recording, especially in those races with no qualifying entry times. In some cases, race sites have been changed for established races to meet the demands of larger fields. Others should be changed, or perhaps the sponsors should break some of these races into several separate races to make racing fairer for all of the runners.

There are marathon fans who will travel around to see marathon "shootouts" among the stars. The circular, out-and-back and figure-of-eight loop courses favor spectators to varying degrees. Spectator welfare is often considered in laying out courses. Fans have resorted to walking or jogging around loop courses during races, and to riding such vehicles as bicycle, automobiles, buses, subways and even helicopters to scoot from place to place to watch a marathon battle unfold.

PREPARING TO MEASURE

A prospective marathon course may be roughly and quickly surveyed by automobile to check out possible routes. The course may be more closely inspected by walking over it, or preferably running over it. It may also be checked or plotted out on large-scale maps from local sources—for instance, maps with a scale of one inch on the map to 150 feet on the ground, or US Department of Interior Geological

Survey topographic maps of the area, purchased from a map store. Measure the proposed route by scaling of the road with an adjustable divider, with a ruler or a string calibrated on the map's scale.

Course measuring should not be done in extreme weather conditions such as rain, snow, windy days or very hot weather. Measuring should not be done when a wide variation in the temperature of the atmosphere will develop during the measurement.

The names of all streets and roads making up the marathon course should be written up and kept for reference. A map should be made of the course. A profile of the terrain may also be made by referring to maps of the area.

The race course must be measured at least twice, using proper, acceptable procedures. A written report of what was done, when and how the course was measured, must be sent to the AAU Standards Committee for review. This committee studies the report and determines if the measurement techniques are acceptable, and if the course appears to have been measured with "reasonable accuracy." If all is correct, the course is added to the list of certified courses being kept by the RRCA. If the measurement is not acceptable, the race promoter is informed of this fact, with suggestions as to the needed corrective actions.

Re-certification of marathon courses has become common. Many road changes still occur. Each promoter of annual races should arrange for an inspection of the course before race day each year, to determine that the measured route is still intact. If road changes have been made, the course must be brought back to the 26-mile, 385-yard (42-kilometer, 195-meter) distance, and the results of the alterations sent to the AAU Standards Committee for study and re-certification of the course. For information on road course measurements or course certification, contact the AAU Standards Committee, through the AAU of the US national office, or the RRC of America. It is wise to study acceptable procedures before measuring a race course so as to avoid wasted efforts. Professional measurers also need to know the special needs of road course measuring before measuring a race course.

The standard mile: It is necessary to lay out a road calibration course with a good steel tape, in order to calibrate a bicycle wheel or a surveyor's measuring wheel. Accuracy of the calibration course is essential to get course accuracy. This standard length should be one mile for best results, but it may be one kilometer or one-half mile as the minimum length. Select a straight, level, paved, lightly-traveled road for the road calibration course. It should be carefully measured at least twice, if an experienced measuring crew does the job; if they lack much experience, the calibration course should be measured four times. The average of these measurements is used as the calibration distance, and the start and finish lines are permanently marked (drive nails in asphalt/macadam surfaces, or chisel cross-cuts in concrete, and use paint to identify lines/points).

Tape-measuring equipment needed to lay out a road calibration course includes: a calibrated *steel tape*, preferably 100 feet long. Inspect the tape for splices, kinks or evidence of repairs. Such a tape shouldn't be used unless it has been re-calibrated and the "corrected" length known for use. The exact starting and ending points of the tape should be located. A *spring balance* (or by a spring scale from a hardware store) is attached to the forward end of the tape. Also, have a *notebook* and 4H *pencil* to record everything that is done; a *red pencil* to mark distances on the road, and *keel or lumber crayon* to mark a circle around the red penciled mark to make it easier for the rear tapeman to find the red mark (the number of tape-length increments may be written on the road), or *chaining pins* may be used to mark the red line by laying them on the road mark; and a *hammer*, cold *chisel, nails* and *paint* to put permanent marks at the start and finish of the calibration course.

A minimum of two persons, at least one of whom has experience, can lay out a road calibration course, but it is best to get at least three persons to form the measuring team. The chief of the measuring party should have had experience and should supervise the measurement. He might act as the *rear-tape* man and serve to keep the *lead tapeman* in proper alignment as they travel over the calibration course, and he may keep written records unless another person is on hand to do it. The lead tapeman carries a red pencil to mark tape increments on the road. He handles the spring balance or scale with which the tape is stretched for a 10-pound pull with a 100-foot tape. A *recorder* writes notes of tape increments, and so forth (the rear tapeman may do this if no recorder is on hand). He may also assist the lead tapeman by marking tape lengths. If there is another person to serve as an *assistant*, he can direct traffic and assist in other ways.

An electronic distance meter or measurer may be used to lay out a road calibration course on a level, straight, paved road. The accuracy of the electronic distance meter is greater than that for measurements with a steel tape.

Running tracks are not acceptable for calibrating either a measuring wheel or a bicycle fitted with a special counter.

CALIBRATED BICYCLE METHOD

It is difficult to accurately measure road race courses, but the easiest and most practical means of measuring a road course accurately is to use the calibrated bicycle method of measuring. It permits measuring at about 10-12 miles an hour. A bicycle fitted with a special counter is calibrated and then ridden over the route to be measured.

A road calibration course must be measured with a steel tape before measuring the race course with the bicycle. Instructions on setting up a calibration course have been described previously.

Equipment: (1) bicycle, with good tires, pumped up but not too hard; (2) bicycle counter: there are several counter systems in use, none of which can be purchased in stores; contact the AAU Standards Committee for information on acceptable counters which are available; (3) marking materials: hammer, chisel, nails, paint to mark the roads at checkpoints, etc., and for field notes: notebook, pen/pencil; (4) steel tape: to fix the start/finish and checkpoint marks to permanent landmarks; marks put on the road often get wiped out due to road repairs or to re-paving of roads.

Method: Before calibrating the bicycle, ride it several miles to warm it up. Then ride over the road calibration course at least four times, recording the counter readings (e.g., "counts," or "revolutions and spokes," or "odometer and wheel units," depending on the counter used). The readings are averaged and this result is taken as the "constant," with which the race course is then measured. The bicycle is then either carried or ridden to the race course site.

The bicycle is ridden over the race course. The front-wheel axle is placed on the starting line, and the bicycle is ridden along the path the runners will take, including all possible shortcuts. The latter is especially important in measuring around turns. Unless barriers will be set up to channel runners onto a specific path, the shortest route lies about one meter from curbs or painted boundary lines, fences, vehicles and so forth.

Meter readings should be taken and recorded periodically at intersections. Checkpoints or intermediate distances, preferably in metric increments of 1-5- kilometer intervals, should be set up along the course. The latter should be identified (by tape measurements), with nearby permanent landmarks for future reference and marked. These marks can be useful if part of the course must be re-measured due to road changes or if the start/finish points must be changed later on.

After the bicycle has been ridden from the starting line to the finish line (or vice versa), it is recalibrated by riding it over the calibration course again at least twice. These figures are averaged. Next, the original constant from the calibration rides is averaged with the post-course-measuring calibration rides average for the final "constant" for the day. The latter is used to compute the distance of the measured course. In most instances, no adjustment of the race course is needed. However, the arithmetic should be done. Modest adjustments will need to be made at the start or finish line, when there is a sizeable change in atmosphere temperature between the original calibration rides and in completing the course measurement.

The race course must be measured a second time to confirm the distance. The remeasurement may be done the same day or on another day. Or, two bicycles, each fitted with a special counter, may be ridden over the course at the same time. The results should be very close. The average of the two measurements is taken as the race course distance.

The calibration of the bicycle, the course measurement and re-calibration of the bicycle must be done the same day, for each measuring occasion. The person who calibrates the bicycle should do all of the riding, including the race-course measurement and the recalibration of the bicycle.

CALIBRATED MEASURING WHEEL METHOD

The measuring wheel is inferior to the calibrated bicycle method as a measuring tool. It is slower and less accurate for measuring distances on paved surfaces. It is not the precision instrument that the advertisements suggest. However, it is possible to get acceptable results with careful use of a measuring wheel. Otherwise, measuring wheels tend to produce short course, but a given wheel could produce a long course, or the result could be close to accurate, depending on the wheel and how it is used. Select a wheel that has a circumference of about 36 inches or a diameter of about 15 inches.

Equipment: Measuring wheel; steel tape; marking materials: hammer, chisel, nails, paint; notebook, pen/pencil.

If a partner can be taken along as the wheel is walked over the race course, he can serve as a recorder and helper. A steel tape and marking materials will be needed in special situations—e.g., to pin-point checkpoint stations and start/finish marks to nearby permanent landmarks. Any unpaved sections of the course should be measured twice with the steel tape, and cross checked with the wheel. If an unpaved course is to be measured with a wheel, the wheel should be calibrated on a special calibration course measured on the same type of surface, is possible. Ideally, such surfaces should be measured with a steel tape.

Method: To measure a race course, the measuring wheel is calibrated by walking it at about two miles an hour over a road calibration three or four times, averaging the meter readings and comparing this to the known ground distance of the road calibration course, which has been previously established with a steel tape. The latter has been described previously. The average number of feet per mile as found by the calibration walks over the road calibration course may be used directly to measure the race course, or a "correction factor" may be used.

For example, if the measuring wheel has been pushed over a one-mile road calibration course several times and produced an average reading of 5290 feet for the taped 5280 feet, then divide the wheel recorded readings into the actual ground distance: 5280 ÷ 5290 = 0.9981 which becomes the "correction factor." To use the latter, the wheel reading for the race course, obtained by slowly walking the wheel over the course, is multiplied by the correction factor to get the actual (corrected) measured distance of the race course.

Avoid jogging with the wheel or towing it with a vehicle, as this produces inaccurate results. It must be walked at less than three miles an hour. Place the axle of the measuring wheel over the starting line and walk the wheel over the race course, generally keeping one meter from the curb or from parked vehicles, lines, fences and so forth, going in the running direction. A second guide is to measure where the runners will run, including all shortcuts. Runners tend to take all shortcuts possible, and this should be considered in laying out the course. In measuring around turns, measure where the runners will run.

Wheel meter readings should be taken at various intersections, and intermediate or checkpoint distances (preferably in meters) may be marked en route. A final counter reading is taken as the wheel reaches the proposed finish line. The course must be measured a second time. The average of the two measurements is taken as the course distance. Then permanently mark the start and finish points. Finally, walk the wheel over the calibration course once to determine that it is functioning properly as compared to pre-course measurement calibration figures.

CHAINING

Chaining or measuring with a steel tape will give the most accurate measurement for road courses, provided experienced personnel is available. (The inexperienced measuring team will get a more accurate course measurement by using the calibrated bicycle method of measuring.) A marathon promoter might be able to get the services of a surveyor who also runs and who might donate his time to such a measurement; otherwise, it might be relatively expensive. The surveyor must be thoroughly informed by the promoter as to the standards of measurement needed for race courses. The race course must be measured twice for certification consideration. The course might be measured with a steel tape, and the second measurement to confirm the distance might be done by the calibrated bicycle method.

If professional help is not available, the race promoter should find at least one person who has had experience measuring distances with a steel tape, to be part of a three (or more)-person measuring team.

It is a good idea to make a rough survey of the route by automobile, or to lay out the course by means of large scale maps.

Equipment: (1) calibrated steel tape, 100 feet long, free kinks, splices or repairs; other lengths may be used; (2) spring balance or a spring scale, registering up to 15-30 pounds, attached to the front end of the tape; (3) marking and note-making materials: a hammer and chisel to mark points on concrete, nails to mark asphalt paved roads, and paint or make visible lines or circles; adhesive tape, masking tape or a flagging tape may be used to make marks; a red pencil to mark taped increments on the road surface, and keel or lumber crayon to mark a circle around the red penciled mark, or use chaining arrows to point to the tape increment marks; and a notebook and pencils or ball point pens; a tape thermometer may or may not be used to make temperature corrections for the tape.

Steel tapes should be handled with care, and they should be protected from vehicles. When the tape is lying on the ground, it should be kept straight. For measurements less than a full tape length, reel out as much tape as needed, and keep the rest on the reel. When the tape is on the ground, it should be moved by dragging it from the front end only. If the tape is raised off the ground, the tapemen should lift it up together and keep it stretched out. The tape should be cleaned and greased lightly with Vaseline before storing it. Steel tapes can be calibrated by the National Bureau of Standards, Washington, D.C.

Method: Measure the race course one meter from curbs, marking lines and so forth in the running direction, generally along the path that the runners will take, including all shortcuts, and using care in measuring around turns to measure where the runners are likely to run.

A measuring team should include a minimum of two persons to tape measure a race course. The taping team should have 3-7 persons, plus the use of an automobile to travel with the group. One person will be at each end of the tape, and specific duties will be assigned to each member of the party, for example:

1. Chief: Supervises the measurement. He may serve as the rear tapeman and he might keep records. He helps to keep the lead tapeman in proper alignment.
2. Lead tapeman: Carries a red pencil (and possibly keel) to mark tape increment lines spots on the road. He keeps the measurement aligned properly, and he operates the spring balance attached to his end of the steel tape.
3. Recorder: Keeps notes and figures for the measurement and makes sketches of the route.
4. Tension man: Handles the spring balance (relieving the lead tapeman of this job).
5. Assistant: Assists the measuring party and controls traffic.

To measure the course, locate the zero and end points of the steel tape. Lay the tape flat on the road surface. The rear tapeman holds his end of the tape on the starting line, while the lead tapeman applies 10 pounds of pull/stretch on the tape and then marks the spot with a red pencil or equivalent. The rear tapeman has a difficult job keeping his end of the tape fixed furing the 10-pound stretch by the lead tapeman, and this is a key to accuracy. Chaining arrows may be used to mark the spot on paved roads as a supplement to the red mark, and they are a must if taping on dirt or grass. The rear tapeman helps to keep the lead tapeman in alignment on the course. After marking the tape length, the lead tapeman drags the tape forward for the next increment, and the rear tapeman carries his end which may have the reel attached. To measure around turns or curves, the course should be measured in tape increments of 5-10 feet instead of full tape lengths. At the end of the measurement or at the end of a section, the lead tapeman may carry the end of the tape past the end point, lay it on the ground and walk back to mark the point, or the tape may be reeled in to make the measurement.

The taping team should be alert to the dangers of measuring in traffic. It is helpful to have a person on hand to control traffic. Measurements should not be done in extreme weather conditions which affect the length of the tape, and measurements should not be done on very windy days. The race course must be measured twice and the average of the measurements taken as the distance.

No. 7

COMMITTEE REPORT: The Sub-Committee on Standards 1978

Committee Members: Ted Corbitt, Chairman, Apt.8H Sect.4, 150 W.225 St., N.Y.,N.Y. 10463; 2)Dr David Costill, Muncie, Indiana; 3)Dr Tom Osler, Glassboro, N.J.; 4)Bob Letson, San Diego, Calif.; 5)Dr David Senechalle, Austin, Texas. Consultants: John C. Jewell (RRC of England) Wokingham, England; Dr Alan Jones, Endwell, N.Y.; Dr Ben Buckner, Columbus, Ohio; and Aldo Scandurra, Greenlawn, N.Y.

REPORT: In the first ten months of 1978, the Sub-Committee on Standards certified a record 127 road race courses, including 56 marathon courses (some of these being re-certifications). A number of new marathon races are in the planning stages and a number of other marathon courses are in the process of being certified. There has been a sharp increase in 10 kilometers road courses also.

The book, THE COMPLETE BOOK OF RUNNING, by James F. Fixx, mentioned some of the work of the Standards Committee, and this stimulated a lot of new interest in measuring courses, and scores of runners, including a number of women, have sought instructions for how to measure racing courses. Inquiries from several foreign countries have also come as a result of Fixx's book.

To further facilitate collection of measurement data, our questionnaires are again being updated. Generally, the new standard of requiring two measurements of racing courses for certification purposes has worked reasonably well and has upgraded measurement accuracy.

Conferees who have certified race courses which have been altered due to course obsolescence or to other reasons, are urged to get them re-certified by the Standards Committee. If certified courses have been abandoned, let the Standards Committee know this.

Again we urge successful bidders for National Championships to have the involved race promoters take the initiative and contact the Standards Committee about their plans to measure their courses. Courses should be certified by the Standards Committee at least 60 days before the championship race and before the entry blank is submitted to the National AAU Long Distance Running Committee for approval.

Submitted by:

Ted Corbitt
Chairman Standards Committee
Oct. 30, 1978

TO BOB LETSON: Thanks again for your valuable help Ted Corbitt

CERTIFICATION DOCUMENTS

announcement (1) of establishing the San Diego Certification Committee

NO. 8

SAN

March 11, 1979

D

Bob Day, PSA-AAU Long Distance Running Chmn.
3740 Sports Arena Blvd.
San Diego, CA 92110

Committee

Dear Bob,

The explosion of new race courses in San Diego, and the backlog of paperwork assumed by Ted Corbitt who selflessly donates his time to review all national AAU certifications, has caused me to initiate a new policy that is designed to ease Ted Corbitt's workload and increase our responsiveness to local needs. The new policy is a method whereby local courses may obtain PSA-AAU certification. The rules are:

1. PSA-AAU certification standards will be identical to those defined by the National AAU Standards Committee. If, at a later date, national certification is requested, this can be accomplished by mailing Ted Corbitt a copy of the PSA-AAU certification report.

2. The National AAU Application for Certification form will be submitted to the PSA-AAU Certification Chairman for review and approval. Review will be impartial, based only upon evidence of accurate measurement for a safe, approved running route.

3. Notification of certification will be mailed to the race director on PSA-AAU stationery, signed by the PSA-AAU certification chairman, with a map of the course on the reverse side. The certified distance and accuracy will be stated in the letter, and a PSA-AAU certification number will be composed as follows:

   e.g. 7905 =the 5th certification for 1979.
   7905N =the "N" is added if National.

4. All National AAU Certified Courses will automatically be added to the list of PSA-AAU certified courses.

5. Courses that have been altered physically (the running route is impossible to run) will be deleted from the list and the race director informed of this deletion.

6. Certification records will be maintained by the PSA-AAU certification chairman and will be available for inspection at any time. A complete list of current PSA-AAU certified courses should be published each year, and made available on request.

Corbitt's reply

31 March 79   Apt.8H Sect.4, 150 W.225 St., NY, NY 10463

Dear Bob Letson,

I have read your letteron the PSA-AAU Certification process.

Yes indeed, there has been an explosion of course measurement activity around the country.

Your measurement/certification procedures are ok. Since the local coures will be certifiable in terms of the AAU/RRC standards, I suggest that they all be included in the national list. Presumably age group or other records might be setin any of these events. The National Running Data Bank gets an abstract of information on all certified courses (they keep the "list" for the RRCA).

I have been trying to get an idea from Ken Young as to what else he needs from the AAU Standards Committeeto complete his picture. Here is what I send him now and this is what I have in a loosleaf notebook for each certified course (a carbon copy goes to Ken Young)--the information submitted is kept in boxes or bags:

Distance
Name of Race
City,State where held
Person to contact (could be measurer or race director)
His address
Sponsor
Terraine
Course configuration, e.g. Out and Back, etc.
Actual distance
How measured or measuring instrument
When measured
If at high altitude, altitude
Certification date.

If you can certify the course (PSA-AAU), keep the original information, but send a one page report of the above, I will put it on the national list and forward a copy to Ken Young. The report would indicate that you have the original information.

The Standards Committee is supposed to be involved in some other areas of racing welfare of runners and we have at times, but most of the effort has gone into course measurements. We have to get going in some other areas. I have a committment from one of our local runner/officials to do something about timing races and organizing finish line activities. I will check with current Standards Committee members asto what they can do or want to do to get these things underway. Yours, Ted Corbitt Ted Corbitt further reply from Ted

14 April 79

Apt.8H Sect.4
150 W.225 St.
NY,NY 10463

(PSA-AAU certification notification for Bonne Bell 7908N)

Dear Mr Letson,

The format is excellent. I do need one other piece of information: the date or dates course is measured. This is part of the records we have been keeping and sending to Ken Young: the National Running Data Center in Colorado.

Thanks for your views on using two counters on a bike for course measurements. I wrote to all members of the committee and to three consultants, including Dr Jones. Your reply and one from Engineer Aldo Scandurra who worked with us back in 1964 here in NY City to develop our measuring program and who was National AAU Long Distance Running Committee Chairman to appoint me to the Standards Committee in 1965. He feels that two ceparate measurements should be done. He too uses two counters on his bike. I have no quarrel with this view and I've followed the two separate measurements in all courses I've measured.

Yours, Ted Corbitt

Sample certificate

Pacific Southwest Association Inc.
Amateur Athletic Union of the United States

San Diego and Imperial Counties, California
1135 Garnet St.
San Diego, California 92109
(714) 275-1292

MEMBERS

United States Olympic Association
International Amateur Federation of Track and Field, Men and Women; Boxing, Gymnastics, Swimming, Men and Women; Wrestling; Bob Sleighing, Handball and WeightLifting.

Certification

DISTANCE: 10,000 METERS

NAME OF RACE COURSE: EL CAJON 10 KM

CITY: EL CAJON STATE: CA

RACE DIRECTOR: JOHN S. MEYER

ADDRESS: 9001 GROSSMONT BLVD., LA MESA, CA 92041

PHONE: 469-5023 462-9225

SPONSOR: EL CAJON KIWANIS

TERRAINE: paved 98% dirt 2% grass ______

flat rolling (hilly) mountainous uphill downhill

ACTUAL DISTANCE: 10,000 METERS

HOW MEASURED: instrument: JONES COUNTER

method: CALIBRATED BICYCLE METHOD

number of measurements: 2 ON 6 SEPT 80

difference between measurements: 7 YARDS

ALTITUDE: 500 - 800 FEET PSA-AAU cert. # 8036

The following signatures certify that the race course described above has been measured accurately and that a map of the course and a record of all measurements have been filed with the PSA-AAU Certification Committee:

Robert A. Letson — *October 1, 1980*

Chairman, PSA-AAU Certification Committee — date
4369 Hamilton St. #4; San Diego, CA 92104

______ — ______

Chairman, National AAU Standards Committee — date
Apt. 8H Sect. 4; 150 W. 225 St.; NY, NY 10463

START - 56 yards west of east side of yellow shack

1 MILE - 81 yards north of 1823 Granite Hills Dr. mailbox

2 MILE - 56 yards west of utility pole opposite 1955 Dehesa Ave.

3 MILE - 31 yards south of 650 Colinas Mira mailbox

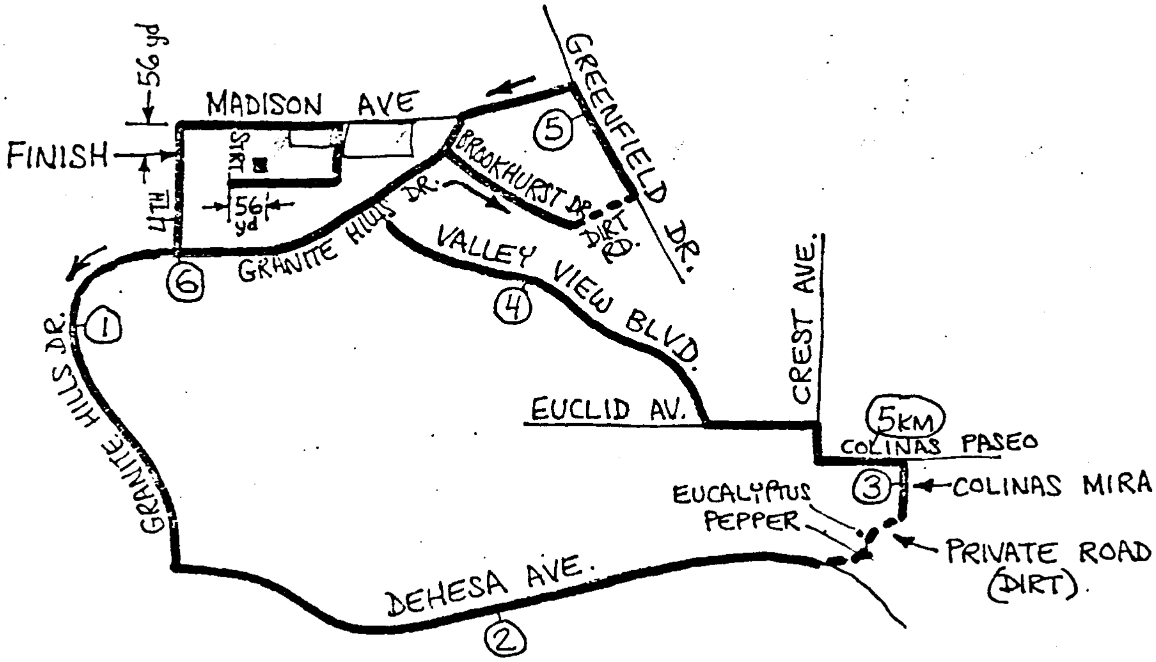
5 KM - 31 yards east of 2448 Colinas Paseo driveway

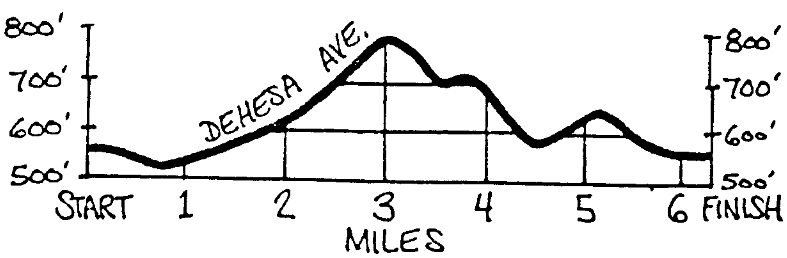
4 MILE - 28 yards south of 2nd oleander bush at 1980 Valley View Dr.

5 MILE - 49 yards south of "SCHOOL 25 MPH" sign

6 MILE - corner of Granite Hills Drive and 4th Ave.

FINISH - 56 yards south of Madison Ave.
north side of parking lot.





EL CAJON 10 KM

(SAMPLE)

I

APPLICATION FOR CERTIFICATION OF ACCURACY

Name of course: NAVAL STATION-BROADWAY PIER 10 KM Date: MARCH 2, 1980
City and state: SAN DIEGO, CA
Sponsor: 32ND STREET NAVAL STATION, SPECIAL SERVICES
What type of measuring methods were used?
(Bicycle Method?) Walking Wheel? Steel Tape? Electronic Meter?
Describe each measuring device (make, model, dimensions, etc.):
JONES COUNTER 20/REV
Who was responsible for measuring the course?
Name: BOB LETSON Address: 4369 HAMILTON ST. #4, SAN DIEGO, CA 92104
Who will be responsible for locating the start/finish points, marking the course, measuring future changes, and reporting future changes to the National Standards Committee:
Name: BOB STOPP Address: SPECIAL SERVICES
CODE 10 BOX 15
NAVAL STATION
SAN DIEGO, CA 92136

DESCRIPTION OF THE COURSE

1. What is the advertised length of the race course: 10,000 METERS
2. Is the course (flat) rolling, hilly, very hilly, up or down? Submit an elevation profile if possible.
3. How much of the course is paved? 100% grass? dirt?
4. Describe exactly where the START, FINISH, and TURNAROUND points are located with reference to unique permanent landmarks. Draw maps/diagrams if necessary.
START — ON McCANDLESS BLVD, 7 YARDS SE OF VESTA ST. (4 YDS NW OF WHITE DOT)
FINISH — ON CENTRAL WALKWAY BY WARF, 35 YARDS S. OF BROADWAY PIER, AT 3RD LAMPOST S. OF BROADWAY PIER
5. List the names of all streets/trails from start to finish, indicating all left/right turns and which side/half of each road is used.
ATTACHED
6. Submit a complete, detailed map of the course with all names, showing all dirt/grass stretches, and including a north arrow.
ATTACHED

COMPARISONS WITH A KNOWN STANDARD DISTANCE. Certification requires two comparisons of each measuring device with a known standard distance. If steel tape is used, the standard must have been measured with utmost accuracy by other survey tapes. If a wheel is used, the standard must have been certified via steel tape or electronic meter and must be at least 880 yards long on a straight, flat, paved surface.

7. Describe the known standard distance:
Name: MISSION BAY ROAD CALIBRATION COURSE
Location: MISSION BAY, SAN DIEGO, CA
Length: 1 MILE ± .06 FOOT
How measured: ELECTRONIC METER + STEEL TAPE
Certified? YES

> If the known standard distance is not certified, apply now by answering all appropriate questions on another APPLICATION FOR CERTIFICATION OF ACCURACY for the known standard distance.

8. Describe how each measuring device was compared with the known standard distance. List the date, time, and raw data for each comparison.

LETSON MARCH 2, 1980 70°F DRY SEMI-CLOUDY

8AM	BEGIN	43000	> 7602	15205/MILE	15202/MILE
	1/2 MILE	50602	> 7603		
	MILE	58205			
NOON	BEGIN	65000	> 7599	15199/MILE	
	1/2 MILE	72599	> 7600		
	MILE	80199			

IJ

9. If steel tape or walking wheel was compared, what is the average correction factor?

10. If the bicycle method was used, what were the average digits/mile
for the first measurement:
for the second measurement: } 15202/MILE

COURSE MEASUREMENTS. Certification requires two measurements of the road course. If the bicycle method is used, the known standard distance and the race course must be ridden all during the same day by the same person for each measurement.

11. Was the measuring route identical to the shortest route most likely to be run by the winner of the race? YES
12. Were all left/right turns measured to within one yard of the inside edge of curve? YES If not, explain.

14. If part of the race course is on dirt or grass, how were these nonpaved stretches measured?

15. If steel tape was used, answer the following questions:
   a. How many people were in the survey party?
      What were their specific duties?

   b. How was the tape tension maintained during measuring?

   c. How was the tape increments count maintained?

   d. How were the curves measured?

16. If the bicycle method was used, answer the following questions:
   a. Was the bicycle ridden over the known standard distance and over the race course all during the same day by the same person for each measuring occasion? YES
   b. Was the known standard distance compared before and after measuring the race course? YES If not, explain.

17. List the date, time, and raw data for each measurement of the road course.

LETSON MARCH 2, 1980 9-11 AM

BASED UPON 8AM CONSTANT

FINISH	60000	3RD LAMPOST S. OF BROADWAY PIER
5 KM	07240	65 YARDS E. OF 28TH ST.
1 MILE	39275	8 YARDS NW OF MANHOLE, 50 YDS NW OF DIVISION ST.
START	54480	11 YARDS SE OF VESTA ST.
START	70000	11 YARDS SE. OF VESTA ST.
1 MILE	85205	SAME
5 KM	17240	6 YARDS SE. OF PREVIOUS 5KM (AVG = 3 YDS SE)
FINISH	64480	5 YARDS S. OF 3RD LAMPOST (AVG = 2½ YDS SE)

AVERAGE CONSTANT = 8AM CONSTANT − 3 COUNTS (−2 YARDS/10 KM)

18. Describe any adjustments (calculations, measurements) made to create an exact distance:
START, 1 MILE RELOCATED 4 YARDS TO ACCOMODATE AVERAGES
5 KM RELOCATED 2 YARDS "
19. What is the average corrected distance of the road course?
10,000 METERS
20. What is the difference between all of the measurements?
5 YARDS

RETURN THIS FORM WITH ALL QUESTIONS ANSWERED TO THE REGIONAL CERTIFIER IN YOUR AREA:

CT, ME, MA, NH, NY, RI, VT - Allan Steinfeld; Box 881, FDR Sta; NY, NY 10022

IL, IN, MI, NJ, OH, PA, WI - David Katz; Box 822; Port Washington, NY 11050

DE, DC, MD, VA, WV - A. J. Vander Waal; 75 E Wayne Av 310; Silver Springs, MD 20901

AZ and southern CA - Bob Letson; 4369 Hamilton St #4; San Diego, CA 92104

all others - Ted Corbitt; Apt. 8H Sect. 4; 150 W 225 St; NY, NY 10463

Personal Letter & Ted's 1980 - Report

NO. 9

THE ATHLETICS CONGRESS LONG DISTANCE RUNNING AND ROAD RUNNING COMMITTEE
COMMITTEE REPORT: Sub-Committee on Standards

COMMITTEE MEMBERS: Ted Corbitt, Chairman, 150W.225St.,#4,8H,NY,NY 10463
Dr.Ben Buckner, Ohio State U., 1958, Neil Ave., Columbus, Ohio 43314
Dr.David Costill, Human Performance Lab., Ball State U., Muncie, Ind.
Robert Letson, 4369 Hamilton St.,#4, San Diego, Calif., 92104
Dr.Tom Osler, 233 Pomona Ave., Glassboro, N.J. 08028
Dr.David Senechalle, 4803 Balcones Drive., Austin, Texas 78731
Allan Steinfeld, 424 W.119th St., Apt.45, NY,NY 10027
David Katz, Box 822, Port Washington, N.Y. 11050

Consultants: Aldo Scandurra, 22 Monett Place, Greenlawn, N.Y. 11740; Dr.Allan Jones, 3717 Wildwood Drive, Endwell, N.Y. 13760; and John Jewell, RRC of England, 296 Barkham Road, Wokingham, Berkshire, England.

The Sub-Committee on Standards Spent most of 1980 working on COURSE CERTIFICATIONS. The 10,000 meters road race is currently the most frequently organized new race in the USA.

The Committee is looking into the effects of an aiding wind on running performances. It is testing the accuracy of measuring wheels when pushed at various speeds. Standards are being developed for certifying tracks, mainly for 24 Hour Track Runs, which are increasing

There were 280 courses, including 83 marathons (21 re-certifications) certified through October of 1980. Committeeman Robert Letson of San Diego, introduced the Calibrated Bicycle Method of Measuring Road Courses into Mexico this year.

The Committee is studying proposed changes in some of the measuring standards, submitted by Ken Young, National Running Data Center. All standards will be reviewed in consultation with the Road Runners Club of England's Standards Committee to promote international co-operation on standards.

The question of decentralization of the course certification phase of the Standards Committee has been raised again. The Committee proposes that each TAC Association, in a two year target, establish a long distance race course measuring committee--to measure some courses, to evaluate and certify as accurate local course measurements, on road, cross-country, and outdoor and indoor tracks--to be supervised by Regional Chairmen.

The Standards Committee would supervise the program, serve as consultants and instructors to Regional and Local measuring officials, certify Nat'l Championship Courses, and work on other standards duties. (See Appendix to report for additional details of proposal.)

Report submitted by Theodore Corbitt, 11/10/80

Ted Corbitt

thoughts and plans for decentralization (6)

21 Dec 80

A

Dear R. Letson,

Thanks for the report on the Miami track measurement. I was very curious as to how you would rate the one person measurement.

Enclosed is the Standards Committee report for 1980. I've only attended one Nat'l Convention (AAU), seeing no reason to attend to read a one page report. However, I would have attended this year, in the light of the proposal to decentralize course certification. But earlier in the year I had agreed to accept an invitation to attend/participate in the Race Directors Convention in Honolulu, Hawaii Dec. 3, 4, 5. I talked on short and long running courses and participated in a workshop on the same subject. The TAC Convention was the same week. I haven't heard what happened on the Committee report.

Ken Young was on the same program (as was John D. "Jock" Semple of the Boston Marathon Committee) at Honolulu. He suggest that we decentralize

12/21/80

whether the TAC's National Long Distance Running Committee approves or not. He has suggested previously that our sub-committee should change its name to Nat'l Standards Committee, presumably to appease anti-AAU, anti-establishment types.

I don't anticipate a negative reaction from our parent Committee since the chairman had asked in a letter what I thot of having two Standards Committees, an eastern and a western groups.

This was not the first suggestion of change. I think that if it is going to be done it should be done right — that is as local as you can get, with initial close supervision by regional, experienced consultants (if we get an OK I will ask current Standards Committee members to take on this job, or recruit others).

I don't believe that we will get local volunteers in each AAU/TAC Association, but we can try. I stayed in this to make sure that the program survived. In 1964–1965, there weren't many around willing to get involved. That is not the case today. Getting some of these enthusiasts to commit themselves for several years may not be easy but a decentralized program can be made to work at this time.

I started the RRC of America Newsletter (now called FOOTNOTES, and still a

(3) 12-21-80

quarterly) and when it losts its editor in 1965 or so it was almost 10 years before that newsletter was again published on a sustained, regular basis. The measurement program could have gone the same route.

The climate is such today that there may be enough volunteers to meet our needs. If not, do you think it practical to pay nominal fees for the service?

I'll contact you again on this subject,

Yours

Ted Corbitt

Ted Corbitt's "1980" Report

APPENDIX: Sub-Committee on Standards Report 11/10/80

GOAL: To decentralize the process of certifying of accurately measured long distance running courses--road, cross-country, and indoor and outdoor tracks--by the TAC's National LDRRCommittee, through its sub-committee on standards.

PROPOSAL: That each TAC Association LDRRCommittee establish a Long Distance Course Certification Committee, to encourage or promote accurate measuring of long distance road courses, and to certify those courses found, upon evaluation, to have been measured accurately.

I. Each TAC LDRRC establish A Long Distance Running Course Measurement and Certification Committee.

- Chairman
- Committee members
  - Volunteer surveyor
  - Trained course measurers
  - Course measurement evaluators

DUTIES

ok 1. Measure selected courses.

OK+ 2. Cross-check selected course measurements in own or neighboring area per request.

3. Determine if course has been measured accurately (is certifiable).
4. Locally certified courses submitted to Regional Certification Chairman for approval, during first two years of local committee's existence.
5. Contact consultants as needed.

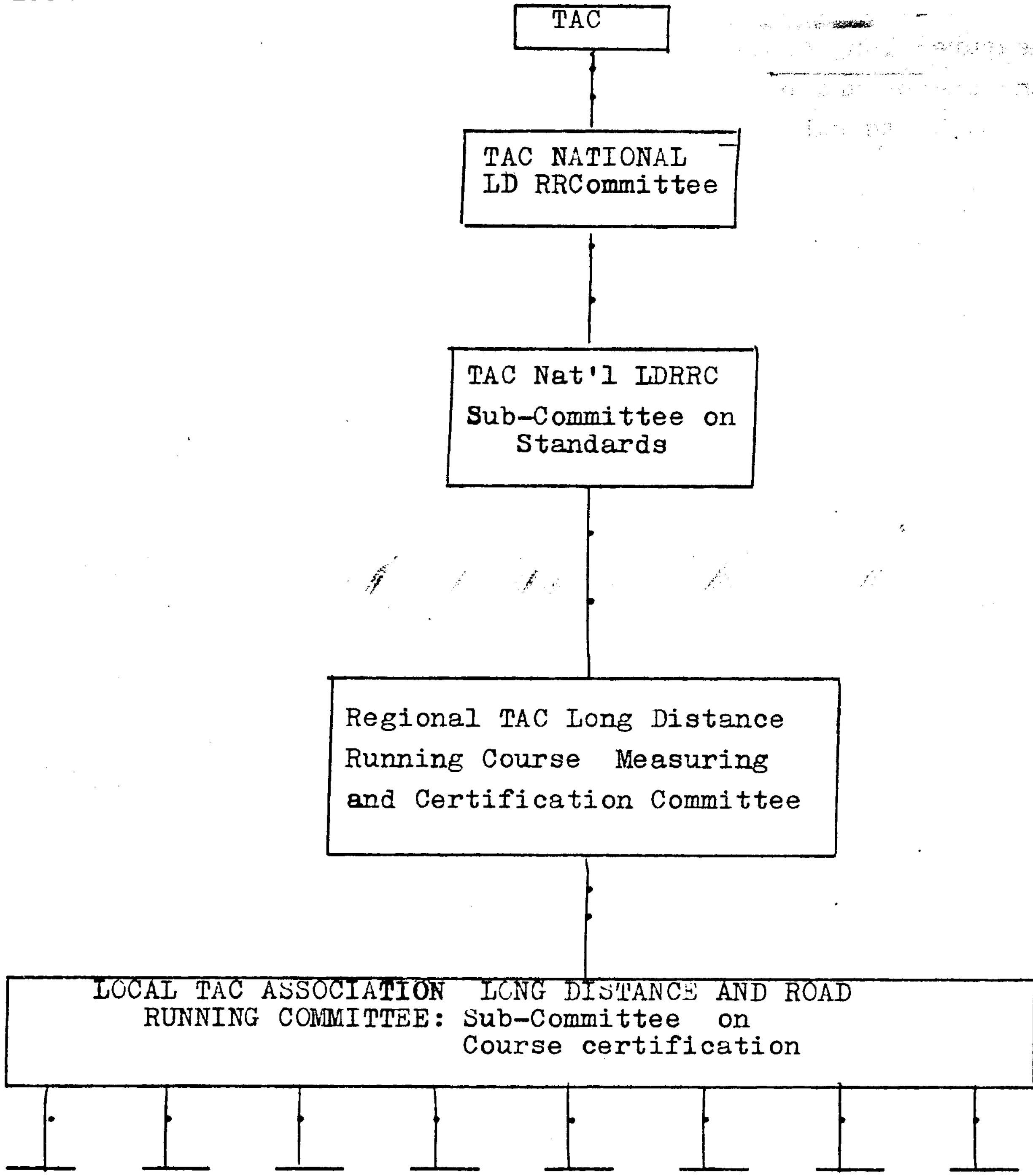
II. Set up Regional Course Certification Committees

- Chairman
- Members

DUTIES

1. Advise and supervise local TAC Course Certification Committees.
2. During first two years check all locally certified course paper work, as a learning/teaching tool. Option: cross-check some measurements.
3. Serve as consultants for local certification committees.

III.



IV.TRAINING TO BE COURSE MEASUREMENT EVALUATORS

1. Regional or National Workshop
   Week-end
   or Long week-end
2. Written materials
3. Cassette tapes

Note: This is Ted's model, a hopeful plan to set up each local area, and still maintain coordination

Jones Bike Counter info.

No. 10 ①

3717 Wildwood Drive
Endwell, NY 13760
September 14, 1981

Mr. Bob Letson
4369 Hamilton Street, #4
San Diego, CA 92104

Dear Bob,

Clain and I sure enjoyed your newsy letter. That is some story about the invention of the Frisbee.

I'm afraid if we keep corresponding like this, neither of us will get anything else done.

I'll try to look up Bruce McClean. I just did. There's no listing in the phone book and I just called information and they have nothing. Am I spelling it right?

I guess I never told you how I invented the counter. It was written up in Running Times a few years ago but that was before they went national. It was still a regional magazine. I ran cross-country in high school and college (Penn State) and was always interested in measurements. I laid off running for ten years . (I graduated in 1958 from Penn State with a degree in Engineering Science and stayed around for a year to get a M.S. in Engineering Mechanics. I then went to Purdue in 1959 and got a Ph. D. in late 1963 in Engineering Sciences. My thesis was on the theory of wave propagation in optical fibers.) In 1968 I started running again after reading Cooper's Aerobics. In 1970 I ran a local "20 kilometer" race and ran an unbelievable time. I checked the course with my car (after calibrating it on an Interstate highway.) I found it to be about 11.4 miles. As it happened, this was the last year for the race since the priest who had run it was retiring. A couple of us decided to pick it up and also to form a running club, The Triple Cities Runners Club, which I have been president (read dictator) of ever since. We found a new course and I read an article in Runner's World about measuring courses. A friend of mine gave me an elapsed time meter that had been salvaged from an old IBM machine. It was made by Veeder Root and is just like the ones Clain uses now but it was metal and die cast. I still have it. It says on the end, "The Veeder M'F'G. CO., HARTFORD, CONN., U.S.A., PATENTED OCT. 22, 1895, AUG 15, 1911" I got the counter but didn't know what to do with it. I stopped by a local bicycle shop and the owner had a box full of odometer gears. It seems people buy new odometer/speedometers when they break but the gear is still okay. I found one that looked like it would work. I then put the gear on the bike and wired the counter to the fork so that the squared off end stuck in the gear. This was in 1971. I measured the course (3 times before I made Ted happy) and forgot about it. In 1972 Ted asked me for details on the device I had used. I went back to the bike shop to find out how to order gears. The owner just said it came from Japan. That was no help. I then started looking at odometer/speedometers in stores. I finally found a Stewart Warner and the directions had replacement part numbers. Just what I needed. I bought one for Clain's bike. He was 8 then. I wrote to Stewart Warner and they gave me the addresses of a few distributors in upstate New York. I wrote to one in Syracuse and ordered the part. I think it took a couple of months to get. The counter was tougher. I looked up Veeder-Root in the Thomas Directory and wrote to them. They gave me a catalog and the name of a local distributor. The catalog had a counter that looked just like the old one. It cost about $6.00 ($3.98 in quantities over 100) so I ordered one. However, Veeder-Root will not handle orders under $50.00. I told them to wait until other Veeder-Root orders came in. They even called me once to see if I still wanted it. After about three months I got the counter. At this point I realized that the counter should not be wired to the fork but should be an integral part of the gear. That's when I came up with the present wiring arrangement. I thought I was done. I made an engineering drawing of the entire thing, included instructions for making it, and sent it off to Ted. He said he could not expect his user's to be able to saw, file, and wire. Wouldn't I make 30 to hold him over until he got someone to manufacture the star wheel counter. (At least I think this was what he was referring to.) He said he would buy 15 of them. At this point I asked Clain if he wanted to help. I didn't want to get involved. At first Clain only cut off the gear and I did the rest. He made $1.00 per counter and I made nothing. They cost $8.25. Remember? Then Clain began filing off the counter shaft and eventually did the wiring. He also took over all the paper work. My only involvment is picking up the counters at the distributor. At first I had to advance Clain money but he shortly became self-sufficient.

Never in our wildest dreams did we imagine Clain selling the quantity he does. He has learned a lot from it.

One of the possible things to do with the business when Clain graduates is to sell it. Would you be interested? It's a lot of work without great rewards. It's a great business for a kid. I'm not sure Clain is serious so just regard this as a query of interest.

I take it you're not married since I don't see how a wife could put up with all you do for running.

I wrote to Ken Young this evening asking about what you said about people sending floppy disks to him with race results. I suggested, it could even be done over phone lines. Then there wouldn't be the problem of incompatable disks.

Our running club has been scoring meets with an IBM 5110 computer since 1977. I would like to get an IBM Personal Computer and do it on that. However, it is a lot of money.

Since you seem interested, I'll fill you in on what I do at IBM. You can skip this part if you find it boring.

I joined IBM in November 1963 in the Mathematical Sciences Department. I worked for several years on the IBM Blood Cell Separator. This work led to the development of the IBM Blood Cell Processor. The BCP is used to wash glycerol from thawed, frozen blood. It is also used to wash plasma from blood to reduce chance of hepatitis and transfusion reactions. I have three patents on the machine and I was the person who developed the concept. I've installed BCS's in Mayo Clinic; Rome, Italy; Barcelona, Spain; and Dublin, Ireland.

During my early years I reviewed three books on fiber optics for the Journal of the Optical Society of America.

After leaving the blood work I worked in motion control using microprocessors. They were very new at the time. I learned to program 6800's, Fairchild F8's, MOS 6502's. I wrote assemblers for these plus Intel 8080, Intel 8048, and DEC PDP-8 (!), all in APL. Another fellow and I am author's of IBM's APL GRAPHPAK. GRAPHPAK is now included as an integral part of APL and produces plots on color tubes and other devices.

I'll include a copy of results from one of our running club's recent informal meets. We do all the record keeping on a 5100. The Explorers help with this but I wrote the programs. For scoring the big meets, the program was written by a kid who is 17 now but started on it when he was 12 and had a working version the first year which we used.

You know about Clain but I should mention my other two. Kendra is a junior at Lehigh University in Bethlehem, PA in Industrial Engineering. Adele is a high school junior (president of her class). We adopted her from Korea when she was two. My long suffering wife is a nursery school teacher. She has taught nursery school since 1970 (I think) and is now co-director of the school. Tonight she is giving a talk to the parents telling them what the school hopes to accomplish this year.

I didn't mean this letter to be an autobiography or a brag sheet but I'll leave that for you to judge.

I sure hope I get to San Diego some day and can meet you in person. By the way, do you still run? I just hear about the course measurments. My best times are: 37:30 for 10K, 1:19:30 for 20K, 57:15 for 15K, 3:18 for Marathon (ugh). I have never trained properly for a marathon.
Boston

Alan

Enclosed is the Riegel device. You can have it, I'll get a new one. Would be interesting to compare his with yours. His is based on log-log plots. He wrote a big article on it in a journal. I'll try to find a reprint

Alan L. Jones
3717 Wildwood Drive
Endwell, New York 13760

May 26, 1978

Dear Bob,

Thanks for your order of 10 counters. When your order arrived Clain had a back-log of about 30 orders. He has had a heck of a time getting the bicycle odometer gears from Stewart-Warner. They have lost his order twice and only ship after a couple of calls from our distributor. He has now sold over 500 counters since starting in 1973. He really enjoys the business but gets depressed when he gets behind on orders because he likes to respond quickly to orders. He has sold 173 so far in 1978!

He really appreciates your letters of endorsement. In all the years we have been doing this I have only certified two courses--a 20K and a 15K. How many have you done? It looks like I'll do at least two more this summer due to the running revolution. Everyone wants to hold a race.

Clain's gotten some nice publicity. Running Times magazine (Eastern US) ran a short article with a picture about his business. Also, the local paper ran a nice piece on him with a couple of pictures.

Thanks for the copy of your report to Ted Corbitt. That will help me in preparing for my next measuring.certification application.

I was out to San Jose and San Fransisco in March but haven't been to Southern Calif. for a long time. If I do I'd like to look you up.

9 Yours in running.

Alan

P.S. I ran the Boston Marathon this year for the first time since 1973. My brother came in from Boulder, Colo. and we ran together the whole way--3:18:45.

(2) (4) (5)

3717 Wildwood Drive
Endwell, NY 13760
September 6, 1981

Mr. Bob Letson
San Diego Certification Committee
4369 Hamilton Street, #4
San Diego, CA 92104

Dear Bob,

Thank you very much for the copy of "Certified Road Race Courses, San Diego County, California". It is a beautiful piece of work. Also, thanks for the Letson Pace Mates.

You had mentioned some time ago to Clain about an investment that hadn't panned out. I assume you mean this device. I think you did a really good job. I have a Riegel device which is also good but yours has the advantage of a method to compute the time per mile for any distance. Do you have a background in mathematics which allowed you to produce the Pace Mate?

Clain is over the 1900 mark in counter sales. They keep coming in at the rate of 400 per year. This has been the rate ever since Jim Fixx's book hit the market. (Fixx will be running in a local race this coming weekend. They are having him come to talk at the dinner the night before.) Clain is caught up for the first time this year (except for an order of 100 from the Canadian Track and Field Association). He had a terrible time in the spring when the company that makes the gears went on strike. Then when the strike was over they seemed to show no interest in filling our order. We just got over 200 more gears from them and have ordered 500 more. If that comes in Clain should be set for quite awhile. However, Clain will be (probably) leaving for college a year from now. He hasn't decided what to do with the business. In weaker moments I think about carrying it for him during the winter months. We'll see what happens. He has been doing this for eight years now. He recently looked back at his early orders and found you ordered your first counter on December 2, 1973 (which was Clain's number #22) and then ordered five more on December 22, 1973. His very first one was sold to Ted Corbitt on October 1, 1973.

You have commented several times about the increasing cost of the device. However, it has exactly tracked the cost of living since the $10.00 price in early 1974. Also, his costs have gone up at about the same rate. Therefore, when figured in constant dollars, his profit has been constant.

6

After the next 100 are sold, Clain will convert to a six digit counter. This is after a lot of urging from Ted. Clain delayed on selling this due to the price hike but by going to larger orders of parts to get a better price break, he thinks he will be able to sell the new one at the old price of $17.00 for awhile. However, due to the higher cost of the counter, I am afraid a price hike will come sooner than it would have otherwise. I am sure you will be glad to see a six digit counter.

If you don't mind a personal question, what do you do for a living? For your information, I am a senior engineer at IBM in computer graphics. Clain is trying to decide what he will take in college. He is leaning toward statistics right now.

Thanks again for the report and the Pace Mates. I think every area of the country needs a "Bob Letson".

Sincerely,

Alan L. Jones

Alan Jones

KEN YOUNG'S PROPOSED CERTIFICATION STANDARDS (1 page) and my reply (7 pages)

1981? E

2A

NO. 11

AUTHOR: KEN YOUNG:

PROPOSED CHANGES IN COURSE CERTIFICATION STANDARDS

1. The average of the two (or more) measurements can not be less than the advertised distance. For example, a 10 km course cannot measure 9.999 km and qualify for records at 10 km.

2. The standard deviation of the mean measurement cannot exceed 0.04% of the advertised distance. For example, the allowable error in the measurement for a marathon would be 18.5 yds. Suppose the following measurements were made:

A	46,145 yds	
B	46,195 yds	error is 25 yd (take another measurement)
C	46,175 yds	error is 14.5 yds (acceptable)

For a marathon to qualify on the basis of only two measurements, the measurements could not differ by more than 37 yds, otherwise a third measurement would be required. A 10 km course could qualify if the difference between the two measurements were less than 8 meters.

3. Courses must be measured along the straight-line distance that a runner could follow and remain on the pavement (or within the curbs). (circled, marked "?")

4. Courses may not be measured more than 50 cm from the curb when the course follows an inside curve (curb or edge of pavement has a smaller radius of curvature than the course).

5. Course must not have more than 115° of total curvature per kilometer if it is measured 50 cm from the inside curve.

The error is $2\pi\Delta r$ where Δr is the radial distance between the one foot from the curb (or eight inches without curb) allowed for track measurements and where the course measurement is taken (50 cm).

Currently, Δr = 100 - 30 cm = 70 cm with an error of 4.4 meters in 360° of curvature

Proposed, Δr = 50 - 30 cm = 20 cm with an error of 1.25 meters in 360° of curvature

To keep this source of error (which is biased) to the same 0.04% limit, only 115° of curvature can be allowed per kilometer.

A two loop, 10 km course has 720° of curvature (with no concavities) or 72°/km (acceptable)

6. Courses with greater total curvature than 115° per kilometer must be measured in accordance with track guidelines (one foot from a curb or eight inches from an uncurbed curve).

NOTE: Currently certified courses measured 100 cm from the curve are within the error limits if the total curvature does not exceed 33° per kilometer.

The above was sent to us by Ken Young. I would like to have your evaluation, comments or counter-proposals. We will review all of our standards later.

Thanks

Ted Corbitt

ANALYSIS OF KEN YOUNG'S PROPOSALS

1. THIS INVOLVES 3 ASPECTS OF RACES: THE COURSE, THE EVENT, AND THE RECORDS.

   COURSE: I AGREE THAT THE OFFICIAL CERTIFIED LENGTH OF A RACE COURSE SHOULD BE THE AVERAGE OF AT LEAST TWO "GOOD" MEASUREMENTS.

   EVENT: THE NATIONAL AC STANDARDS COMMITTEE CURRENTLY DOES NOT CERTIFY EVENTS. NEVERTHELESS, I AGREE THAT THE "ADVERTISED LENGTH" SHOULD BE THE OFFICIAL CERTIFIED LENGTH. CERTIFICATION OF EVENTS OPENS UP A NEW PANDORA'S BOX OF PROBLEMS.

   RECORDS: I AM IN FAVOR OF MAINTAINING TWO CATEGORIES OF RECORDS:

   "STANDARD" PERFORMANCES ON COURSES WHOSE CERTIFIED LENGTH IS EQUAL TO OR LONGER THAN THE STANDARD DISTANCE.

   "ESTIMATED" PERFORMANCES ON NON-STANDARD COURSES WHOSE OFFICIAL CERTIFIED LENGTH IS LONGER THAN (99 %) OF THE STANDARD DISTANCE. THIS HAS TREMENDOUS VALUE, FOR IT RESCUES FROM OBLIVION PERFORMANCES THAT WOULD OTHERWISE BE "DISQUALIFIED", AND IT DOES NOT INTERFERE WITH "STANDARD PERFORMANCES". ESTIMATES SHOULD BE BASED UPON AVERAGE SPEED.

   May be even 95% ~~(99%)~~ if PACE PREDICTION factors are used (eg. MIN/MILE = SEC./¼ MILE)

2. KEN'S RECOMMENDED TOLERANCE ($\pm.04\% \cong \pm 2$ FT/MILE = 4 FEET/MILE TOTAL) IS ACHIEVABLE, BUT IS OFTEN EXCEEDED. A MORE LIVEABLE LIMIT MIGHT BE ±1 YARD/MILE = 2 YARDS/MILE TOTAL. I WOULD ADD THAT THE MEASUREMENT THAT SHOULD BE REJECTED IS THE ONE THAT WOULD CREATE A SHORT COURSE (FOR EXAMPLE IF A = 46,145 YD AND B = 46,195 YD FOR A SPECIFIC COURSE, B SHOULD BE REJECTED).

   CAUTION: EMPHASIS ON TOLERANCE INSURES CONSISTENCY, BUT DOES NOT INSURE ACCURACY. I'VE WITNESSED CONSISTENT "CERTIFIABLE" MEASUREMENTS THAT WERE INACCURATE BY 100 YARDS / 10 KM — UNSTEADY BICYCLISTS RIDE SINGLE FILE, OR MEASURE ON RIGHT SIDE ONLY INSTEAD OF SHORTEST ROUTE

2C

3. "REMAIN ON PAVEMENT"? "WITHIN THE CURBS"? I'VE SEEN RACES WHERE RUNNERS GO ON DIRT/GRASS AND JUMP ON/OFF CURBS. A BETTER WORDING MIGHT BE TO MEASURE "THE SHORTEST ROUTE THAT CAN BE TAKEN WITHIN THE RUNNABLE LIMITS OF THE COURSE". THE TRICK IS TO DEFINE THE "RUNNABLE LIMITS" (SEE APENDIX A).

4. "50 CM MAXIMUM" SEEMS LIKE A GOOD RECOMMENDED GUIDELINE.

5. & 6. THIS REFINEMENT COULD BE SIMPLIFIED BY REQUIRING ALL COURSES TO BE MEASURED 12-INCHES-FROM-CURB OR 8-INCHES-FROM-LINE.
UNFORTUNATELY, MOST ROAD COURSES ARE NOT AS WELL DEFINED AS A TRACK. OFTEN THE EDGE OF RUNNING ROUTE IS INDISTINCT, OR CHOICES ARE POSSIBLE SUCH AS JUMPING ONTO A SIDEWALK OR ACROSS GRASS OR AROUND A TREE FOR A TURN. A MORE FLEXIBLE COMPREHENSIVE RULE WOULD BE TO "MEASURE THE SHORTEST ROUTE THAT CAN BE RUN BY THE WINNER OF THE RACE".

WA

GENERAL COMMENT

I believe that most people would prefer a simple standard. For example, a "golden rule" could be

MEASURE THE SHORTEST ROUTE THAT CAN BE RUN BY THE WINNER OF THE RACE.

and

BE AS ACCURATE AS POSSIBLE. DO NOT MAKE ANY APPROXIMATIONS.

Robert A. Letson
4369 HAMILTON ST. #4
SAN DIEGO, CA 92104
NOV. 4, 1980

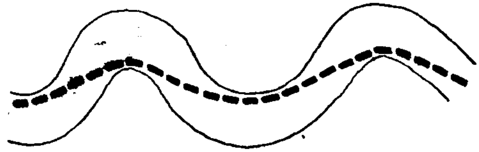
2D

APPENDIX A

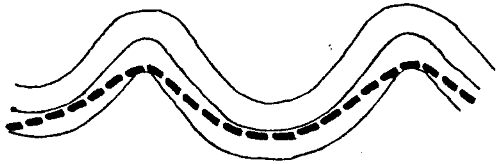
THE KEY TO ACCURACY IS TO DEFINE EXACTLY WHERE THE RUNNING ROUTE LIES WITHIN THE LEFT-HAND AND RIGHT-HAND LIMITS OF THE RUNNABLE SURFACE.

THE FIRST STEP IS TO DEFINE THE LEFT-HAND AND RIGHT-HAND LIMITS OF THE COURSE. THE NEXT STEP IS TO DEFINE THE SHORTEST RUNNING ROUTE WITHIN THESE LIMITS.

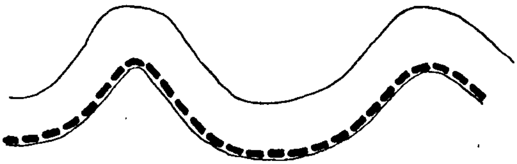
EXAMPLES: "ENTIRE ROAD"



"RIGHT HALF"



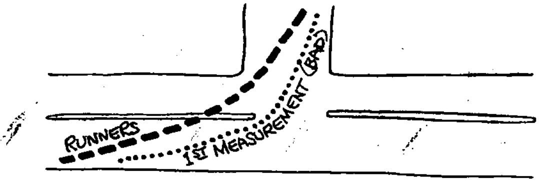
"RIGHT SIDE"



25Km

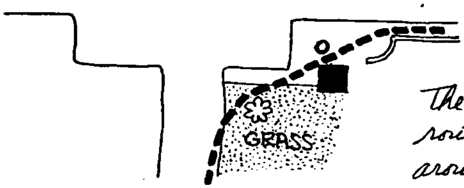
The best courses use "entire road." If part of road is used, runners should be disqualified if they run into the prohibited part of the road — this should be done only if heavy vehicle traffic prevents use of entire road. Traffic cones should be used to define the running lane for "RIGHT/LEFT SIDE".

Sometimes runners jump curbs. For example, in the Heart of San Diego Marathon and 10 Km, this occurs: **2E**



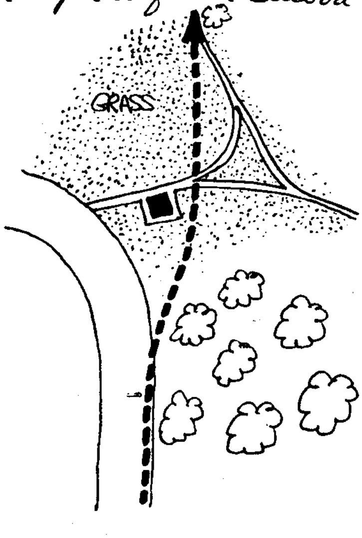
The course was measured avoiding the center island (.......)
The runners jump over the center island (- - - - -)
The course was therefore remeasured where the runners run; a saving of almost 15 yards.

Sometimes runners go "cross country" over grass, dirt, around trees and obstacles. For example, the Balboa Park 8 mile does this:



The measured/running route is accross grass around a tree onto sidewalk.

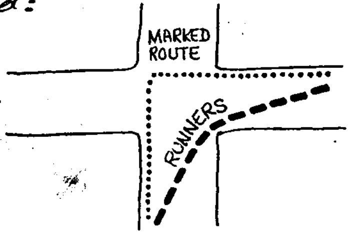
Another example is for the Balboa Park 10 Km which does this:



The measured/running route is the shortest route across grass. This route is marked with coathangers and bed sheets (straighten coathanger, cut in two, form a loop, tie a strip of white cloth to the loop, stick into grass)

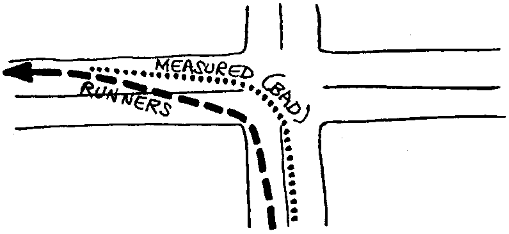
2F

Turns create problems. In the 1974 Santa Monica Marathon this occured:



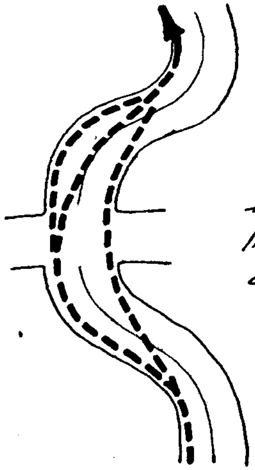
Traffic is blocked anyway, so this should have been measured and marked where the runners ran along the shortest route.

Another example is for the America's Finest City Half Marathon



The race director insisted that the runners would stay on the "right half" only, but instead they took the shortest route, saving 10 yards. The shortest route should have been measured.

Another difficult turn is in the Mission Bay Marathon (1981):

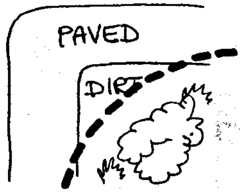


This is a moderately busy street. Runners take various routes. It is dangerous and not recommended to take the shortest route. About half of the runners keep to left side. Most of the rest move towards the center line, and half of these are confronted with automoble traffic. This course was measured along the middle route.

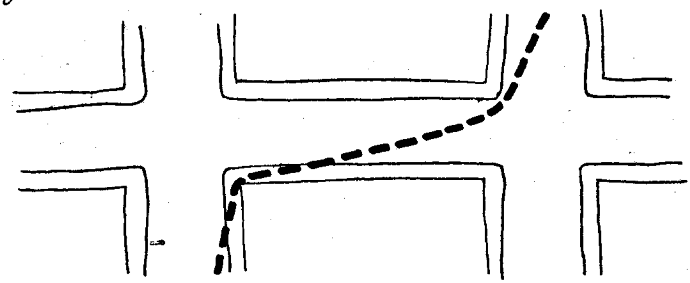
The best solution is to cone a running lane on the left side and measure this.

Sometimes the sides of the road are undefined. For example, the Fiesta Island 10 Km has a paved road with firm dirt shoulders that some runners prefer to run on:

Selecting the exact running/measuring route is a matter of judgement. My judgement has usually been to stay on the pavement, but close to the edge next to dirt for turns. If there was an obvious short cut on dirt, this would be measured and documented.



In the Los Alamitos Marathon there are many left and right turns (about 90) with city streets that have runnable sidewalks. Opportunistic runners may save 3 yards or so per turn by using the sidewalk. However, it is tiring jumping on/off curbs, or running on sidewalks that have driveway dips. My judgement was to measure half of the turns on sidewalk and the other half on street.



2H

APPENDIX B

CERTIFICATION OF RACES

This is currently not done. If this were to be attempted, the needs would be:

1. DISQUALIFY RUNNERS WHO DEPART FROM THE MARKED COURSE TO REDUCE THE DISTANCE.
2. VERIFY THE EXACT RUNNING ROUTE. A MAP OF THE ACTUAL ROUTE TAKEN SHOULD BE DRAWN.
3. COMPARE THE ACTUAL RUNNING ROUTE WITH THE CERTIFIED ROUTE, LIST ALL DISCREPANCIES. ~~IF THE ACTUAL RUNNING ROUTE IS NOT CERTIFIED, AND IF CERTIFICATION & RECORDS ARE DESIRED, THEN~~ THE ACTUAL ROUTE MUST BE MEASURED & REPORTED for CERTIFICATION.
4. VERIFY THE ACCURACY OF CLOCKS USED TO TIME THE EVENT.
5. VERIFY THE SUCCESSFUL ACCOUNTING OF FINISHER'S IDENTITY/PLACE/TIME.
6. RECEIVE AND VERIFY PRINTED RESULTS.
7. A COPY OF THE "CERTIFICATION" OF THE COURSE SHOULD BE SUBMITTED WITH RACE RESULTS TO WHOEVER IS IN CHARGE OF MAINTAINING OFFICIAL RECORDS (KEN YOUNG?)

It would be wise to have local records committees maintain their own records consistent with national standards. Summaries of local records could be submitted for national records.

Probably the best way to administer this is via "SANCTION" which can be rewritten as a contract with questionaire & signatures required for the above items, and instructions on how to submit for local & national records.

If you think this is a good idea, let me know & I'll try to institute it on a trial basis in San Diego. Bob Letson

NO. 12

COMPUTER SCIENCES CORPORATION

APPLIED TECHNOLOGY DIVISION (714) 225-8401
4045 HANCOCK STREET · SAN DIEGO, CALIFORNIA 92110

17 September 1981

Tom Benjamin
P. O. Box 8715
San Francisco, CA 94128

RE: Certification

Dear Tom,

It's good to hear that the Bay Area is trying to get organized, which is not easy to do in such a large metropolitan area.

The only logical method is to have several local certifiers. I know from experience that this is a job that is not necessarily "appointed", as much as it is "assumed". Anyone with artistic ability, patience, love for the sport, can do it simply by just beginning to do it, as I did. It certainly does help if a local club/group selects an individual (I was initially appointed by Bill Gookin to certify the club's courses) because this creates a feeling of support. But this is not necessary. I would encourage anyone to try. And this also means being creative. Which means that old ways/standards can be questioned/tested/ignored/revised to suit local needs. The only National Standards are to be as accurate as possible, and communicate.

The most useful guarantee for accurate courses is to:

1. Create many convenient certified 880 yard calibration courses,
2. Sell many Jones counters,
3. Give recognition (e.g. certificates) to people who do a good job.

I'm afraid I may have given you too much information in the enclosed files. I hope this does not overwhelm you. If it does, you have my permission to throw it all in the trash can. Nevertheless, it represents many years of study and experience. This has been my labor of love, a memorial to Frank Townsend and Bill Hargus who died in 1975. The certifications in San Diego are my monument to their memory, hopefully a living one. And it is also a monument to the honesty and heroic drive of a humble man who spends most of his time rehabilitating handicapped children, Ted Corbitt.

Respectfully,

Bob Letson

Robert A. Letson
4369 Hamilton St. #4
San Diego, CA 92104

No. 13

TOTAL RACE SYSTEMS
P.O.BOX 8715
SAN FRANCISCO, CA. 94128

Oct. 30, 1981

Dear Nancy:

Enclosed you'll find a packet of information I gave everyone at the T.A.C.-R.R.C.A. course certification meeting at my place Oct. 15. This material is primarily from Bob Letson in San Diego. He is one of the four Regional Certification Chairman working with Ted Corbitt.

Hopefully it will give you and anyone else in your area insight into the reasons and history of the present National Course Certification program under Ted Corbitt. It will also give you an idea of what Bob Letson's approach is in San Diego.

In our meeting of Oct. 15, we broke the greater bay area down into eight districts or zones (hopefully with more added as time goes on). Each Regional District or Zone would be manned by someone from that area who has shown interest and/or expertise in course certification according to the guidelines laid down by Ted Corbitt and the National Standards Committee.

The preliminary format looks like this.

ZONE A.) Santa Rosa and Sonoma County, Mike McGuire of the Empire Running Club.

ZONE B.) Marin County, Kees Tuinzing and Jeff Blaine of the Tamalpa Running Club.

ZONE C.) San Francisco County, myself, Tom Benjamin of the Pamakid and Dolphin South End Running Clubs.

ZONE D.) San Mateo County, Sheldon Gersh who is now co-ordinating our first steps in this Regional set-up through his position as the current LDR-TAC Course Certification Chairman. (Sheldon should be sending you something in the mail)

ZONE E.) Santa Clara County and San Jose, Ron Grayson and Tom Knight of the West Valley Track Club.

ZONE F.) Southern Alameda County(everything south of Oakland),Pete Shandera of the Sunrise Track Club.

ZONE G.) Northern Alameda County, Oakland north including the Richmond and El Cerrito areas-- Carl Wisser and John Notch of the Lake Merrit Joggers and Striders and Nor Cal Seniors.

ZONE H.) The rest of Contra Costa County-- Nancy Lewis race director of the Devil MOUNTAIN Race.

TOTAL RACE SYSTEMS
P.O.BOX 8715
SAN FRANCISCO, CA. 94128

Each Zone Chairman is asked to compile or copy, the course map and all pertinent course certification information(ie. exact start and finish race route etc.) of each Nationally Certified Race Course in his or her area (see enclosed list-- complete thru Sept 1, 1981 from information gathered from the N.R.D.C. newsletter). You can use Bob Letson's format as a guide in compiling this information. This format can be found on the last two pages of part D of your handout. Hopefully, after several months each Regional Zone Rep. will have all of his/her local information completed and turned in to Sheldon Gersh of myself for publication in a Greater Bay Area Course Certification Guide. It is hoped also, that the Regional Reps. will make their knowledge and expertise available to interested parties in their regions.

If we can make this general structure work, in possibly a year or so, we will be able to demonstate to Ted Corbitt and the National Standards Committee our competancy in course certification. With this demonstrated success, I think, we have a good chance of having Ted and the National Standards Committee grant a local Bay Area individual or committee, the power to accept, evaluate, and grant a National Certification for local race courses. Once we establish a strong local program of course certification, as they have in San Diego, Isee this as a real possibilty.

Please direct any questions concerning the enclosed material, the ideas and objectives of the Regional Committee, or anything else, to Sheldon or myself.

Thanks for your interest,

Tom Benjamin
P.O. BOX 8715
San Francisco, Ca.
94128

TABLE OF CONTENTS

Tom Benjamin
P.O. BOX 8715
San Francisco, Ca.
94128

TOM BENJAMIN
TOTAL RACE SYSTEMS
P.O.BOX 8715
SAN FRANCISCO, CA. 94128
415-221-2195-h

CONTACTS FOR BAY AREA COURSE CERTIFICATION PERSONEL

1. Pete Shandera- 7849 Greenly Dr. Oakland,Ca. 94605-415-845-5200-w, 636-0981-H
2. Carl Wisser- 2608 Ninth St. Berkely,Ca. 94710-415-549-3687-H
3. Len Wallach- 1060 Continentals Way#104 Belmont,Ca. 94002- 415-593-2788-H
4. Sheldon Gersh- 316 N. El Camino Real#112 San Mateo,Ca. 94401-415-342-7041-H
5. Ron Grayson- 49 Showers Dr.#479 Mtn. View,Ca. 94040-415-941-6399-H/493-4411-B ext.5507
6. Tom Knight- 724 Arastradero Rd.#107 Palo Alto,Ca. 94306- 415-856-3349-H/ 854-3300-ext. 2065-B
7. Mike McGuire- 3605 Aaron Dr. Santa Rosa,Ca. 95404- 707-542-6687-H
8. Kees Tuinzing- 627 Gallerita Way San Raphael, Ca. 94903- 415-479-3839-b 472-7917-h
9. Royal Mason- 2630 45th Ave. San Francisco,Ca. 94116- 415-564-5102-H
10. John Notch- 230 Marlow Dr. Oakland, Ca. 94605- 415-562-2210-H
11. Scott Thomason- 110 Lenox Way San Francisco,Ca. 94127- 415-564-4771-H 681-6616-H
12. Tom Benjamin- P.O. Box 8715 San Francisco,Ca. 94128-415-221-2195-H 877-1231-B M/T/W
13. Bob Letson- 4369 Hamilton St. #4 San Diego,Ca. 92104- 714-298-0924-H 225-8401-ext 253-B
14. Ted Corbitt- 150 W. 225th St. Apt. 8h Sect. 4 N.Y.,N.Y. 10463-212-562-7393-H
15. Ken Young- P.O. Box 42888 Tucson, Az. 85733- 602-626-3188-H also c/o Atmospheric Physics Dept. Univ. of Arizona 602-626-1211-w
16. Bob Martin- P.O. Box 42888 Tucson,Az. 85733- 602-323-2223-Oct-May also Trail West P.O.BOX 60 Buena Vista,Co. 303-395-2536-June-Sept. Zip81211
17. Alan and Clain Jones- 3717 Wildwood Dr. Endwell, N.Y. 13760-607-754-2339-H
18. Joe Oakes-518 Outlook Dr. Los Altos,Ca. 94022- 415-9415530-H
19. Jack Leydig- P.O. Box1551 San Mateo, CA. 94401- 415-341-3119-Eves.
20. Nancy Lewis- 50 Corwin Dr. Alamo, Ca. 94507- 415-837-8030 or 837-9187

Jan 16, 82

Dear Tom,

this is to confirm that I am willing to process any application for certification from the Bay area — in fact, from anywhere. I will simply treat it as if it were a local San Diego course (except that I am unable to measure it personally).

I will do this regardless of any concensus or political opinions in Bay area. This service is strictly "complimentary".

If there is some feeling/agreement about using a unique letter-head for the certificate (e.g. "Pacific Association" instead of "Pacific Southwest Assoc. San Diego") I will comply with your wishes. In this respect you will retain control of the letterhead format.

And if someone in Bay area is designated to fulfill the role of review/certification, I will give all data I have to the person of your choice.

I would appreciate $5 per application, to help defray costs for xeroxing, postage, etc.

Best wishes,

Bob Letson

P.S. The only S.F. courses I now have records on are (1) "Paul Masson Marathon" and (2) "Challenge Cup 50".

1982 Seminar

NO. 14

DATE: February 16, 1982

FROM: Carl Wisser
2608 Ninth Street
Berkeley, CA 94710
(415) 549-3687

TO: Bay Area Nine Counties Race Course Certifiers
(See enclosed list)

RE: Organizational Meeting & Certification Seminar
Saturday, March 20th, 9AM to 3 PM
7700 Edgewater Drive, Oakland, CA
(See map)

ENCLOSURES: Certifiers List
Location Map
Sample Course Certification

The enclosed list, complete with addresses and phone numbers was compiled with the help of Tom Knight and Tom Benjamin. The list is made up primarily of people who we know have certified at least one race course nationally in the past two years and have shown an interest in upgrading the race certification standards in our area.

In an effort to move this notion forward, we have organized a "Race Course Certifiers Day" seminar and organizational meeting.

Our get together is specifically designed to bring together this group for the purpose of meeting one another, sharing information, reviewing certification methods, techniques and problems, and the setting up of our organization (complete with chairman, logo (letter-head) mailing address and modus operandi). The members of which will be instrumental in the "official"*certification of race courses.

Tom Knight and Tom Benjamin will be leading the seminar and we will be also joined for the day by Bob Letson.

Bob Letson, who resides in San Diego, is the official National Certifier for the southwest region and has agreed to extend his territory to include our area. (Northern California) Bob sets very high standards in his course work and as a National Certifier**. His approval is tantamount to Ted Corbitt's approval. Bob is expecting to get a lot of help from our group and is delighted with the seminar.

We will be measuring a calibrated mile with an electronic device as well as doing some tape work. We will be measuring a very irregular loop course of a mile or so in length against a "known" measurement. We will then move indoors, to write up our results and hold discussions regarding all aspects of the certification process. Afterwhich, we will have a short meeting (given that we have the strength) regarding our organizational set up.

Please bring the following:
- -Bicycle and Jones counter+ or other measuring device
- -Note books and pencils

* P.A. L.D.R. T.A.C.
** On the board of the National Standards Committee under Ted Corbitt
\+ Tom Benjamin has extra counters

TO: Bay Area Nine Counties Race Course Certifiers
FROM: Carl Wisser

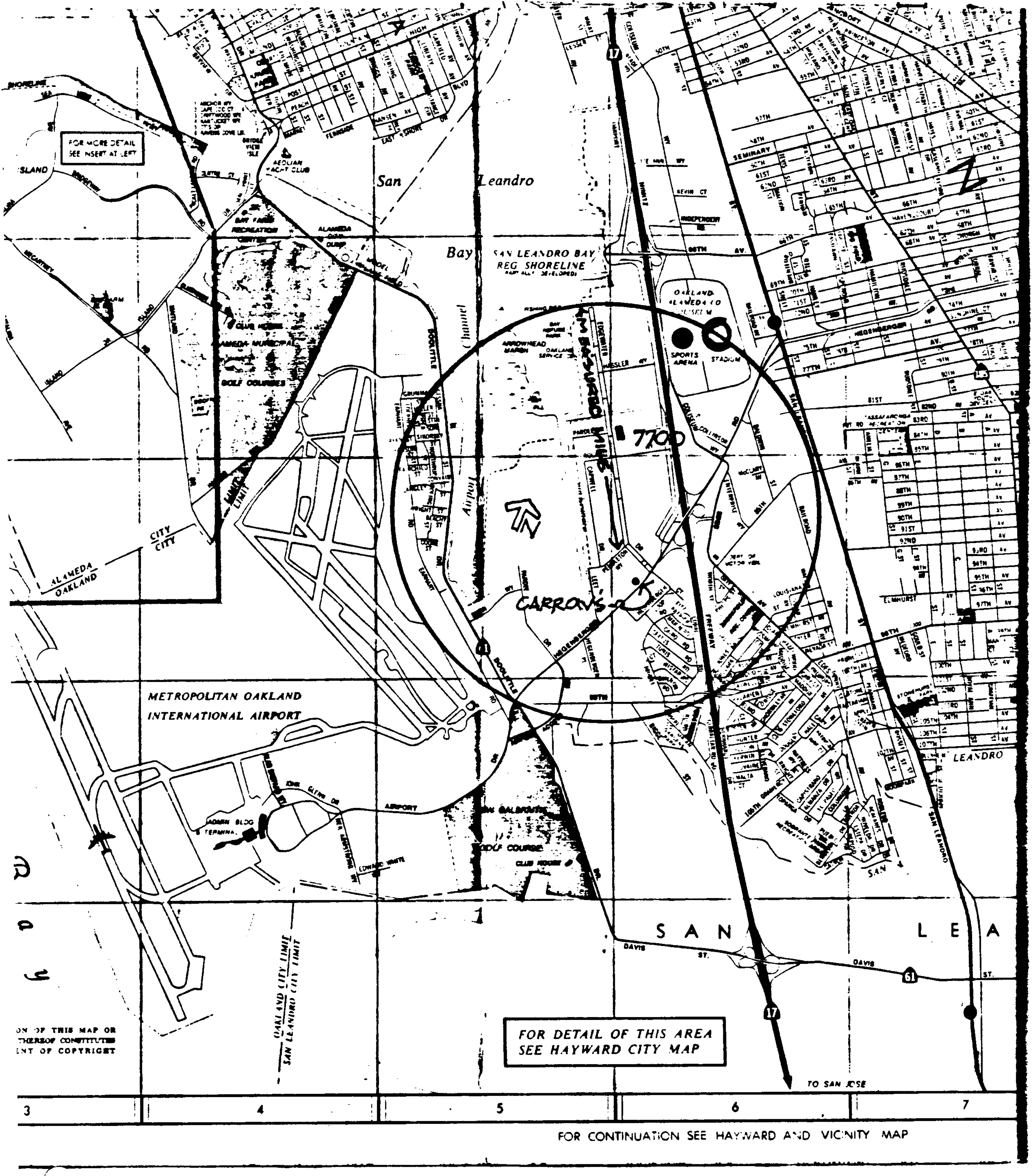
February 16, 1982
Page 2

There are restaurants in the area and Bob Letson and I will be having breakfast at Carrow's (see map) at 8:00AM for those who can join us.

This is a very exciting event and I look forward to seeing you all there. Please let me know as soon as you can if you will be attending. By the way, if you can't attend and you want to send someone else or you have someone in addition in mind who you think would benefit the group, please be very selective (our initial criteria is that the person has certified a course nationally during the past two years), and forward his or her name with your response.

Regards,

Carl



FOR MORE DETAIL SEE INSERT AT LEFT
San Leandro Bay
SAN LEANDRO BAY REG SHORELINE
AEOLIAN YACHT CLUB
BAY FARM RECREATION CENTER
ALAMEDA MUNICIPAL GOLF COURSES
ALAMEDA / OAKLAND
CITY / CITY
Airport Channel
OAKLAND ALAMEDA CO COLISEUM
SPORTS ARENA
STADIUM
7700
CARROWS
METROPOLITAN OAKLAND INTERNATIONAL AIRPORT
ADMIN BLDG
TERMINAL
JOHN GLENN DR
EDWARD WHITE
GOLF COURSE
CLUB HOUSE
OAKLAND CITY LIMIT / SAN LEANDRO CITY LIMIT
SAN LEA
DAVIS ST.
LEANDRO
FOR DETAIL OF THIS AREA SEE HAYWARD CITY MAP
TO SAN JOSE
3
4
5
6
7
FOR CONTINUATION SEE HAYWARD AND VICINITY MAP

San Francisco Marathon

March 14, 1982

NO. 15 (CHRISS)

Dear Alvin:

Enclosed are correspondence collected over the past 6 months on the progression of events in the Bay Area, regarding changing and upgrading our course certification program.

Section A. Includes correspondence I've received concerning problems in the Bay Area Course Certification Program, and possible solutions as outlined by National Standards Committee member Bob Letson of San Diego.

Section B. Includes a letter sent out to all known Bay Area and Northern California course certifiers, concerning a planned Course Certification Seminar to be held this March 20, 1982. The purpose of this seminar will be to aquaint all potential course certifiers with the most up to date information on the techniques of our trade,.We will use information provided from National Standards Committee member, Bob letson, local surveyor Hans Haselbach, and information gather by myself, Tom Knight, and Carl Wisser. At this meeting, we plan to elect a new PA-LDR-TAC course certification chairman and a course certification Executive Board. I intend to place Carl Wissers' name in nomination for the chairmanship. Carl has shown a great deal of enthusiasm for this task as evidenced by his coordinating this seminar. Unlike several other qualified people, Carl has indicated he has the time to devote to this task and is interested in taking it on. We also hope the guidelines set up at this seminar will provide a much more useful and organized course certification program for the Northern California area.

Section C. Includes Ted Corbitts' ideas on diversification of course certification power down to a more local level approach.

Section D. Includes an example of the map, statistics, and certificate issued by Bob Letson in San Diego. A compilation of all such approved race courses is published in phamplet form once a year in San Diego for use by the local running community. It also serves as an inducement to all San Diego race directors to get their races certified and included in the next years book. This is something I would like to see happen in our area through the office of our local Course Certification Chairman.

To capsulize-- Our needs locally are as follows :

1. The need of a local Course Certification Chairman. He would have the power to issue a provisional certificate of accuracy for a prospective race course. This would greatly increase the communications problems we've experienced locally in recent years. It would also facilitate accurate records on a local level. This has been missing in most cases leaving large gaps in our knowledge on the exact perameters of existing race courses. In many cases, the person who originally certified the course is no longer known. Therefore keeping

local records of all certified courses is a very real practical necessity.

2. This individual would need funding to carry out his duties. Money for copying and mailing of these proposals to both the National Office and back to the race certifier, as well as, copies for the local office files. Money for rental of an EDM electronic measuring device whose main use would be setting up of as many calibrated ½ mile, 1 mile, and 1kilometer courses as possible to insure standardization and accuracy for all local course certifiers. A surveying concern in the Bay Area has agreed to rent their electronic meter for a minimum fee of $40.00 dollars a day. Because of the relative speed of measuring with this device, a number of calibrated miles could be set up in just a single days use. It probably would not entail more than 2-3 uses per year to set up all the calibrated miles we would need in the Greater Bay Area. To insure proper service, to the running community, the local certification chairman should probably be compensated somehow. If he is to do a proper job, a great number of hours of work are needed. Funding can perhaps come from part of the TAC dues paid by the local runner for his TAC card each year, or a course certification fee could be applied to every application he receives fpr approval. For instance, a $10.00 processing charge, applied to every application for a certified race course. Having Nationally Certified 14 race courses to date, I think this fee is more than fair considering the amount of time and expertisethat should be applied to each proposal.

3. Coupled with the duties of processing course certification applications, I feel it is imperative that a local record be kept of the course map indicating as exactly as possible where the Start/Finish and intermediate mile/kilometer marks are locatedon that particular course. This would help alleviate any questions locally, when that particular race course is to be used in future years by other groups. Hopefully this information would be published once a year in phamplet form. National Standards Committee member Bob Letson does this in San Diego. (See enclosed example Section D.)

4. Finally I feel a bi-yearly seminar on the current principals and techniques of Course Certification should be offered by the local TAC Course Certification Chairman to anyone interested in the running community. This would help to demystify the procedures of course certification and encourage more races and race directors to accuratley measure their courses according to national TAC guidlines.

If these four suggestions are implemented on the local level, it will be of significant service to the local Running Community and to the National TAC as well. With the TAC supplying this service locally, the benefits obtained by the local Running Community from this service should be worth the price of a TAC Card alone. If I could get your thoughts on the funding aspect of this proposal, as well as any other thoughts about the decentralizing of the power to issue provisional certificates for accuracy on proposals for course certification submitted to the local chairman,.

I feel now is the time we start looking at updating the National as well as, the Regional structure for Course Certification. A more systematic set of guidelines is needed to help in the implimentation of new Regional Course Certification Committees such as ours in the Greater Bay Area. We would love to see a booklet issued by the National Standards Committee. A booklet not only informing the local certifiers of current techniques and standards for course certification, but also setting up procedures for decentralizing the authority for course certification to a more workable and useful local level.

Regards,

Thomas R. Benjamin
Course Coordinator, S.F. Marathon
80 Stonestown Mall, Suite 115
San Francisco, Ca. 94132
415-681-2322-B, 415-221-2195-H

The Athletics Congress of the USA

National Governing Body for Athletics in the United States

Pacific Association
Board of Athletics

NO. 16

Published Just After 1982 Conference / Seminar

MAR. [redacted] 1982

TRUTH IN RUNNING

It is an undeniable right (and need) of most runners to know that the distances they race are reasonably accurate so that each can assess conditioning by comparing running times against standard racing distances. No victory is as hollow as a P.R. gained on a short course!

This right, carried to its fullest development, is the basis for the establishment of the National Standards Committee under Ted Corbitt which oversees the accurate measurement and certification of all nationally certified roadrace courses; this right is also the force behind the National Running Data Center in Tucson, Arizona under the direction of Ken Young. The Data Center collects and keeps all road racing age group records in the United States. Records are recognized only on nationally certified courses.

To aid in this process, locally, there is now a seven member certification committee located in the greater bay area. Sponsored in part by the TAC, the committee is recognized by Ted Corbitt and processes its course accuracy applications by checking and certifying applications on a local level and sending them on for a final check and certification on a national level by Ted Corbitt and the National Standards Committee. Notification of courses which have been so certified is sent on to the National Running Data Center.

The Greater Bay Area Certification Committee has three main functions: 1. Course Measurement by providing "How to do it" packets for those who want to do their own course measurement and by providing a course measurement service for a modest fee. 2. Record Keeping by being able to make available to any runner all currently certified local race courses as well as providing year to year course route information to local race directors. 3. Education by publishing articles in local publications and holding course measurement seminars twice a year. Note: The committee will hold its next seminar early next year, date and location to be announced. The seminar will cover such topics as course measurement theory, course measurement mathematics and actual hands on course measurement (bring a 10 speed bike). The seminar is open to anyone interested in gaining skills and knowledge in this area.

For more information regarding our work, please contact our office in Berkeley at 549-3688 or write The PA-TAC Certification Committee, 2608 Ninth Street, Berkeley, CA 94710.

The following is the list of certifiers:

Tom Benjamin, P.O. Box 8715, San Francisco, CA 94128
Ron Grayson, 2510 Greer Road, Palo Alto, CA 94303
Dick Hughes, 3462 Laurel Avenue, Oakland, CA 94602
*Carl Wisser, 2608 Ninth Street, Berkeley, CA 94710
John Mansoor, 10513 Fair Oaks Blvd., Apt. J, Fair Oaks, CA 95628
Tom Knight, 724 Arastradero Road #107, Palo Alto, CA 94306
Pete Shandera, 40 Sante Fe, Pt. Richmond, CA 94801

In the future we will be publishing lists of local certified courses.
*Chairman

31 July 82 No. 17

Committee OK
From Ted.

Apt.8H Sect.4
150 W.225 St.
New York, New York 10463

To: Carl E. Wisser
PA/TAC/LDR Certification Committee
2608 Ninth St.
Berkeley, California 94710

Re: Measurement and Certification of the Alameda Run for the Parks Course

Dear Mr. Wisser,

Congratulations to you and our Course Certification Committee. Bob Letson wrote to me previously, stating that your Committee was functioning well and ready to certify courses.

I am returning the copy of the Certification statement. Letson has been following this format for several years. He sends a copy of the form as you sent it and I keep this and he includes a one page certificate and map, etc. on back which he sends to race director.

After cross-checking Bob Letson several years, I now just record from the certificate and send the main one back to him and keep the one like you send, after signing them. However, I will be checking your applications as I record them for a time.

Send a stamped, self addressed envelope for a reply when you write. Our Committee has no budget.

Your certificate says the course was measured 2/26/82, a typo which you want to correct.

I'll be in touch.

Yours, Ted Corbitt

Ted Corbitt
Chairman TAC Standards Committee.

PS: This course is now on the national list of certified courses.

San Francisco Marathon

August 30, 1982

NO. 18

Dear Ted,

Just a note of information on our measurement team involved in the calibration courses enclosed as well as a number of others you will be receiving shortly. The EDM ND 250 was handled at both ends by the Haselbach brothers, Hans and Erik. They own the Haselbach Surveying Instrument Co. of Burlingame, Ca. and train professional surveyor's in the techniques for handling the latest EDM and surveying equipment. I feel confident that we could have not received more competient help in our calibration course measurements. While Tom Knight and myself have been present and helped with 14-880 yd, 2-mile, and 10-one kilometer course measurments, the Haselbach's Captained each end of our team on every measurement insuring the greatest accuracy possible. For this reason I feel totally confident with our results.

Just a commmnt on Allen Steinfeld's letter in the Runner Magazine. After reading the letter I ran a test with my Relatape 415 measuring wheel on the Andersen Dr. ½ mile. This ½ mile is perfectly flat and traffic free on weekends, it also has a yellow line running precisely between both ends of the ½ mile nail and flasher disk points we laid down, my results are as follows

No.	Direction	Readingat EDM ½ Mile	Aug 22,1982
1.	N.W.	2,638' exactly	
2.	S.E.	2,639' 10''	
3.	N.W.	2,639' 6''	
4.	S.E.	2,639' 7''	
5.	N.W.	2,639' 4''	
6.	S.E.	2,639' 6''	
7.	N.W.	2,639' exactly	
8.	S.E.	2,639' 11''	

NOTE: The temperature was constant at 75 degrees on a completely clear and dry day with a E-SE wind of less than 5 mph. The wheel was pushed at a normal walking pace.

CONCLUSIONS: The wheel proved more accurate than I remembered in less extensive trials 3 years ago. HOwever, If you throw out the first measurement as an aberation you still have an eleven inch variation in an 880 yd course which doesn't match the accuracy I've experienced with my Jones Counters.

I feel the Relatape 415's accuracy can meet National Standards

(SEE PAGE TWO)

CONDUCTED BY PAMAKID RUNNERS

P O Box 27385 (415) 681-2322 · Ofc San Francisco, California 94127

However, I will still use my Jones Counter to get the most accurate reading possible in measuring a course primarily on the roads.

While the difference in accuracy between the two devices might seem like nit-picking to some-- I feel it behooves us to try to be as accurate as possible. Consequently, as I have both measuring instruments, I will continue to use the Jones Counter for my basic course measurement, and use my Relatape 415 to measure the distance of selected reference points to my major course marks (ie. Start, Finish, Mile, and Kilometer marks).

While my feelings about the general accuracy of my measuring wheel have been calmed, the whole question about the practicality of using the wheel to certify urban road courses, I feel, still leaves alot of room for doubt.

As anyone who has had to Nationally Certify a road course in an urban environment can testify; to cut the tangents with auto traffic competing for the same space, can be quite distracting and unnerving at best, and really quite dangerous at worst. when your cutting the tangent on an "s" curve for example, you want to make that "B" line as quickly as possible to avoid the oncoming auto traffic. In this example, the speed with which you can cut the tangent is of primary importance. From my own experience, I can concentrate on the line I'm cutting to a much more accurate degree on my bike as opposed to the much slower measuring wheel, and as our course certification committee in northern california has discovered; a number of courses in our area thought to be Nationally Certified for accuracy are indeed short because the certifier did not cut the tangents as tightly as he should. In fact, there are certain tangents on the S.F. Marathon course that can only be measured with the greater speed provided with the bike. The wheel could only approach the accuracy of my bike if the roads in question were completly closed to traffic by the police. While this is possible in some cases, I feel most course certifiers won't usually have that option. Therefore, because of the importance of concentration on the shortest line route, I can't see how someones concentration on his objective won't be more adversely influenced by the greater time and hazard he places himself using the wheel vis-a-vis the bike method. I know both myself and all five members of the Northern California course certification committee have had similiar reservations about the wheel when a Jones Counter is available.

I would like to hear your thoughts and impressions on your experiences over the years on using both these instruments on an urban road course with a number of tangents to be cut properly.

WARMEST REGARDS, TOM BENJAMIN-PA-TAC ASSOCIATION CERTIFIER

Tom Benjamin

CONDUCTED BY PAMAKID RUNNERS

P.O. Box 27385 (415) 681-2322 - Ofc. San Francisco, California 94127

The Athletics Congress of the USA

11/15/82

PA LDR CERTIFICATION COMMITTEE
2608 Ninth Street, Berkeley, CA 94710 (415) 549-3688

Dear Ted:

Enclosed is my application for Certification for the Fulton St. 880 yd./1 km. Course. As you know the Fulton St. 880/1km has been previously Certified by Steel Tape. However, this measurement was done only for the South side of the street. For convenience and for traffic safety, as well as a double check against our Steel Tapping-- we used the Nikon edm meter on both the North and South sides of the street. It might be of interestto note that the original 880 yd mark on Fulton using the Steel Tape was 2.5 inches short of the EDM Meter reading of 2,640.02 feet.

While I'm on the subject of calibrated 880 yd. courses, I believe Carl Wisser has advised you of my findings regarding the Rodd-Lake St. 880 yd. Course we recently submitted for Certification.

Just out of curiosity, I decided to check all three of the San Francisco EDM Meter Courses and compare them. Here are my results.

RIDE	COURSE NAME	RESULTS	AVG.
A.) - - -	Fulton St. 880 - -	1st. ride heading West 7,590 2nd. ride heading East 7,586	x2=15,176
B.)- - -	Rodd-Lake St. 880 - -	1st. ride heading West 7,298 2nd. ride heading East 7,298	x2= 14,596
C.)- - -	Presidio 880 - - -	1st. ride heading West 7,588 2nd. ride heading East 7,588	x2= 15,176

NOTE: The Rodd-Lake St. 880 was 290 counts shorter than the avg. of the other two. Using 15,176 as my constant- The Rodd-Lake St. 880 is actually short by 100.86 feet.

Apparently our surveyor, Hans Haselbach programed his meter for 2,540 feet equalling 880 yds. I can't confirm this since I was at the other end of the measurement team at the time, however, on one other occasion when I was at the Meter end of the team, Hans programed 2,540 feetby mistake-but caught himself immediately.

I immediately informed Tom Knight of my findings and he and Ron Grayson rechecked all the EDM Courses in the South Bay against a known standard distance. They all checked out perfectly.

The Athletics Congress of the USA

PA LDR CERTIFICATION COMMITTEE
2608 Ninth Street, Berkeley, CA 94710 (415) 549-3688

I think this episode shows once again the falibility of even the most diligent Certifying Team. This is why we have instituted a triple check on all our Calibrated Course Certifications:

STEP ONE: Calibrate a bike over a known standard distance and then use it to put down your preliminary marks as a yardstick for the EDM Meter team.

STEP TWO: Shoot the Course with the EDM Meter-- double checking the distance programed for your 880/1km measurement and making sure there is no significant difference from your calibrated bike marks.

STEP THREE: Go back and recalibrate your bike on a different known distance and re-ride all the measurements made by the EDM Meter.

This brings to mind a rule that we normally use in Certification, but forgot to apply in the Rodd-Lake St. 880. "Never assume your measurements and calculations are correct no matter how exacting you've been. Always, if possible, crosscheck your figures by one or better still two other methods".

FINALLY A SUPPLEMENT TO MY FINDINGS USING THE WHEEL VS. THE BIKE OVER A CALIBRATED $\frac{1}{2}$ MILE.

BIKE Ride No./Direction		Results	WHEEL Ride No./Direction		Results
1. ---	NW -----	7,549	1. ---	NW -----	2,638' Exact[illegible]
2. ---	SE -----	7,548.5	2. ---	SE -----	2,639' 10''
3. ---	NW -----	7,550	3. ---	NW -----	2,639' 6''
4. ---	SE -----	7,548.5	4. ---	SE -----	2,639' 7''
5. ---	NW -----	7,549.5	5. ---	NW -----	2,639' 4''
6. ---	SE -----	7,549.5	6. ---	SE -----	2,639' 6''
7. ---	NW -----	7,548	7. ---	NW -----	2,639' Exact
8. ---	SE -----	7,549	8. ---	SE -----	2,639' 11''
AVERAGE		7,549.0 Counts	AVERAGE		2,639' 4''
Distance between Longest & Shortest Measurements		2 Counts	Distance between Longest & Shortest Measurements		23 Inches
or		8.39'' Inches.			

NOTE: Again, the temperature and weather conditions were constant and very similar for both the Wheel and Bike Calibrations.
Both were done on the Anderson 880 yd. which has been Certified with both Steel Tape and Electronic EDM Meter. Note the much greater fluctuation with the Wheel, but the avg. for 8 measurements is still only 8'' short of an exact 880 yds.

The Athletics Congress of the USA

PA LDR CERTIFICATION COMMITTEE
2608 Ninth Street, Berkeley, CA 94710 (415) 549-3688

IN CONCLUSION: Thanks to Tom Knight and his handy calculator, the Standard Deviation was plotted for both the Wheel and the bike. Because of the large difference between the first Wheel measurement and the other seven, He also plotted the standard deviation for both the Wheel and Bike dropping the lowest measurement from both as an aberration. The two sets of figures follow.

BIKE: TOTAL MEASUREMENTS INCLUDED	AVERAGE COUNTS 7,549	Standard Deviation ± 0.7 Cou[nts] or Standard Deviation ± 2.8 Inch[es]
WHEEL: TOTAL MEASUREMENTS INCLUDED	AVERAGE FEET 2,639'4''	STANDARD DEVIATION ± 7.3 Inches
BIKE: 7 BEST MEASUREMENTS	AVERAGE COUNTS 7,549.1	Standard Dev. ± 0.59 Counts or Standard Dev. ± 2.5 Inches
WhEEL: 7 BEST MEASUREMENTS	AVERAGE FEET 2,639'6.3''	Standard Deviation ± 3.6 Inches

If you use all eight measurements for both instruments the Bike & Jones counter are 2.6 times more accurate, but if you drop the low count for each instrument as an aberration: you find a very close correlation between the two instruments, with the Bike only slightly more accurate.

Thanks for your support for our Committee, We've made substantial progress especially in setting up new Calibrated 880/1km Courses as well as checking many of the major Race Courses on the West Coast for Accuracy. Now that this basic work is nearing completion we are devoting more time to gettin[g] the methods and practical benefits of Course Certification out to the general Northern California Running Public via THE SCEDULE a monthly publication mailed free to over 14,000 Runners and Race Organizers. The PA/LDR Course Certification Committee has been given one page each month to use as it sees fit. We plan to not only give the Running Public information on where they can go to receive information on Nationally Certified Courses in our area, but to give them a location (Carl Wisser's Offices) where any and all their questions on Course Certification and Nationally Certified courses can be answered. In the coming months we are planning a Course Certification Seminar in which any aspiring certifier can learn the accepted standards

The Athletics Congress of the USA

PA LDR CERTIFICATION COMMITTEE
2608 Ninth Street, Berkeley, CA 94710 (415) 549-3688

of the TAC/RRCA NATIONAL STANDARDS COMMITTEE and then be tested both in the field and in the classroom on the information we've imparted. We have found in our investigations of inaccurately measured courses, that ignorance of the accepted National Standards is the primary culprit. We sincerely hope that through our monthly news column in THE SCEDULE, and our course certification seminars, to correct the situation. We would like to see the day when we didn't have to spend the time we do, rechecking Inaccurately measured courses and can devote the most of our time to many other neglected areas of Course Certification.

Warmest Regards,

TOM BENJAMIN-PA/TAC ASSOCIATION CERTIFIER

cc: TOM KNIGHT
BOB LETSON
CARL WISSER
KEN YOUNG

17 September 82   Apt.8H Sect.4, 150 W. 225 St., NY,NY 10463

To: Tom Benjamin
P.O. Box 8715
San Francisco, Calif. 94128

Re: Use of Surveyor's Measuring Wheels in Race Course Measurement

Dear Mr. Benjamin,

In reply to your letter on the use of the measuring wheel for laying race courses, the Standards Committee discourages the use of these wheels. However, we do still accept results of such measurments, provided the measurements are done following our guidelines.

In general, most members of the Standards Committee view the results of wheel measurements with suspicion. More often than not, users spend a lot of time measuring without finding out how we want the wheel to be used, and we can't use or accept their work. There has been more detected cheating and dishonesty from those using this method than any of the other two acceptable methods (use of steel tape and the calibrated bicycle method). Many novices figure that to be acceptable the results should exactly match and that is what they report, figuring that rounding off a few inches or a few feet doesn't matter.

In practice the wheels tend to produce short courses, but a wheel of the same model and manufacturer may produce a long course. By walking the wheel at less than three miles an hour, and by calibrating the wheel before using it, it is possible to get acceptable results. With the new IAAF rules, the results may be less acceptable. A number of courses were measured by wheel in Atlanta, Georgia. Then a man used the calibrated bicycle method to remeasure them and while there were no very close matches, the results were as close as the differences between two bicycle measurements.

I started looking into all methods of measurement in 1958 and this led to my recommending that the Road Runners Club of America form a Standards Committee. They and the AAU both formed Standards Committees and (that was 1964) by 1966 the Road Runners Club terminated their certification program and the AAU became the sole certifying agent. (The AAU had some "muscle" or leverage to get the then relectant Race Directors to measure their courses accurately or even to report how they had measured their courses. We got no cooperation from the big three marathons: Culver City/Western Hemisphere Marathon, Yonkers Marathon --annual site of national marathon championship for many years, and the Boston Marathon. Outsiders measured all three to get them certified. The only one to become controversial was Culver City which curiously had been measured by a measuring wheel--a member of the Standards Committee and his wife spent two days measuring it and reportedly found it long. The Race Director disputed this. Ultimately we never found out who was correct as the course changed a bit.)

A walking club in England gave up the measuring wheel in the 1930s because of unacceptable results. Users in Australia, England, Canada and New Zealand were disenchanted with this measuring instrument. I did not find out if all had calibrated the wheels and still found them unacceptable. I wrote to anyone in the world for whom I could get an address and who spoke English. No contact spoke favoably for the wheels. However, the IAAF recommended its use. And indeed with very caseful usage one could just get acceptable results. This may no longer be true with the IAAF rule now saying that the race course cannot be less than the stated distance.

I have not read Alan Steinfeld's letter on the wheel in RUNNER MAGAZINE. Your quick study of wheel results are typical of good results. Many results are very ragged. Some results are "too good" to be true, as some novices think that to be acceptable an exact match of lengths are needed and they will report that they taped a half mile road calibration course at 2640 feet each time and that the wheel recorded 2640 feet each time. Most members of theStandards Committee dislike dealing with these results, others do not have such negative feelings towards the wheel results.

Have you checked the Burlingame, California Calibration Mile (I believe that this is the calibration course that Jack Leydig used) which was used to lay out a number of certified courses in that neck of the country?

You mentioned the danger from traffic in walking the wheel. The time needed is one of the arguments that we have used to persuade measurers to abandon the wheel. The danger thing exists in all of the measurements. The practice has been to remeasure the NY MARATHON Course each year and it is done on a Sunday morning in August. The section going over the Queensboro Bridge connecting Manhattan and Queens has a one lane side road with cars coming down into Queens while the cylists are pedalling uphill and not much clearance. That is a nightmare for an amateur cyclist. One of two methods used for the 1976 Montreal Olympic Games marathon course was the calibrated Bicycle Method and they were out around 3 or 4 AM and I believe that they had a police escort as a means of beating the traffic and for some safety.

I think that course measurers who can get a motorized police escort-automobile or motorcycle, or any official car or a vehicle with overhead flashing lights to alert motorists, should get this help. Your point of the extra tough position for those walking wheels is correct. We still get applications of people who tow wheels in vehicles and they are even less likely to permit the instrument to traverse the shortest route.

We need to do more studies of the wheel as to accuracy, and at various speeds. Perhaps a wheel with apneumatic tire and with more weight to keep the wheel plastered to the road would produce an accuracy comparable to the bicycle. The slow measuring pace would still be a negative. Two years ago a middle aged man attempted to measure a course with a bicycle but he couldn't ride in a staight line and had to use a wheel. A very hilly course may need to be measured by wheel, or get a fit racing cylist to measure.

Yours,

Ted Corbitt

Ted Corbitt

cc: Carl Wisser; and R.A.L.

JACK'S ATHLETIC SUPPLY
P. O. Box 459
San Carlos, CA 94070
415/595-2249

NO. 19

Nov. 13, 1982

11/29/82 - Mr. Jones indicated he had sold interest in his counters to the NYRRC. Can you send me 2 units "COD", or call me if you give me a wholesale discount on a larger number of units and I'll probably order more. Thanks!

Sincerely, Jack Jack Leydig

C. Jones
3717 Wildwood Dr.
Endwell, NY 13760

Dear Mr. Jones:

We are interested in selling your bicycle calibration device (Jones Counter) to meet directors and other interested individuals in Northern California (and elsewhere). We are in the business of supplying road races and organizations with various supplies (see enclosed flier) and would like to add your valuable device to our list of items. I realize that your markup (profit) is probably not great, but perhaps you could give us a small discount for wholesale purchase? If not on a single unit, drop-shipped, then at least perhaps after an initial investment of say 10-15 units? Please write or call me at your earliest convenience so that we may discuss this further. I'm not aware of the current price of your device, but I'd like to have you send me two immediately (I'll be happy to pay COD...I hope company check is ok or let me know by phone the exact amount if you need "cash only" or Money Order).

Hope that I can push your fine device on individuals who are interested in making sure of the accuracy of their training courses. I advertise a lot in California Track & Running News (I'm scheduling editor there also so have contactwith most of the race directors in the state as well as Nevada) and would put in an ad in an upcoming issue as soon as I know what kind ofprice you could give us. Thanks very much.

Sincerely,

Jack

Jack Leydig

PS - I think it's cheaper to send the counters by 1st class mail, rather than UPS, but if you'd rather send it UPS (easier for you), that's fine...my street address for UPS delivery is: 125 Dale Av., San carlos, CA 94070.

New York Road Runners Club

International Running Center
9 East 89th Street
New York, NY 10028
(212) 860-4455

Mailing Address:
P.O. Box 881, FDR Station
New York, NY 10150

6 December 1982

Jack Leydig
JACK'S ATHLETIC SUPPLY
Box 459
San Carlos, California 94070

Dear Mr. Leydig:

Thank you for your inquiry of 29 November.

The NYRRC purchased the JONES DEVICE business from Clain Jones just before he went away to college. These items are priced at $20 each, and they are sold at cost. The JONES DEVICE is not mass produced, and we are not set up to produce large quantities of them - in fact, they are produced in no regular fashion, but as time permits.

The club prefers to retain exclusive distribution of the JONES DEVICE to assure that will be used by individuals and organizations following the prescribed measuring and calibrating techniques. The JONES DEVICE is not a measuring device per se, but a counter that must be calibrated upon each measuring occasion. Calibration courses are few and far between, and establishing them is a very exacting procedure that should not be attempted by someone without experience .

I am flattered that you wanted to "push" this item in your business, but at this juncture I'll say thanks, but no thanks.

I have enclosed a bit of information on the JONES DEVICE and suggest that anyone in your area interested in road course measuring or setting out a calibration course contact:

Carl Wisser,
Chairman
PA/TAC Standards Committee
2608 Ninth Street
Berkeley, California 94710

CARL — I PASS THIS ALONG FOR YOUR INFO. COPY OF HIS INQUIRY IS ATTATCHED. REGARDS, Bill

Sincerely,

Bill Noel,
Executive Director

12-7-82

Hi Tom!

This is probably old news to you. I'm still in favor of 400m calib course (where 800m is unavailable), and am trying to see if there can be some way to officially acknowledge outstanding performances such as Nick Rose 27:44/9950 m.

Merry Xmas! - Bob Letson

New York Ro

International Running Center
9 East 89th Street
New York, NY 10028
(212) 860-4455

Robert A. Letson
4369 Hamilton Street #4
San Diego, CA 92104

Dear Bob:

Thank you for the letter concerning Tolerances and Salazar's World Record. There have not been rumors of last year's course being 108 yards short.

Last year's course was measured in Central Park in the recreation lane. We were forced to use this lane by the Parks Department so that the blue line would not adversely affect automobile traffic patterns. Unfortunately, the crowds were so large in the park that Alberto was forced to run down the center of the roadway. By running down the center of the roads in Central Park he actually ran 7 yards longer than the way the park was measured.

In order to avoid that situation in 1982 and to be sure that when the crowds thinned out runners did not run tangent-to-tangent and possibly cut off 40-50 yards within the park, we received permission from the Parks Department to measure the course differently.

We measured the park from tangent-to-tangent (the prudent runner's path) and painted the blue line down the middle of the roadway. We notified the runners that the blue line was only a guideline and that they could run the prudent runner's path.

We cut some tighter corners on the course and added 26 yards, 1 for each mile. Adding the shortened distances in the park, the tight corners plus the 1 yard per mile, that distance is 108 yards. Therefore, if the crowd permitted the runners to run the shortest distance possible, the runners would run 26 miles 385 yards + 26 yards.

So much for the New York City Marathon course.

New York Road Runners Club

International Running Center
9 East 89th Street
New York, NY 10028
(212) 860-4455

Mailing Address
P.O Box 881, FDR Station
New York, NY 1015C

NO. 20

I would reccommend that the certified base line be at least 800 meters. I believe people who are measuring courses (especially neophytes) require a longer length to calibrate their wheels.

As for the tolerances and the IAAF . . . .
The IAAF game plan as of 1983 is to require all International Competitions (Road Races) to obtain an IAAF permit (sanction). In order to receive the permit the race organizers will have to meet certain standards. Among these will be criteria associated with the methods of timing and recording; aid stations; course supervision and especially course measurement and certification. The tolerance proposed is ± 1/1000. I happen to agree with their stringent tolerance. They are concerned with high caliber competition. It is only right that these races meet the toughest standards.

It is important that all race directors, no matter how small their race, have their courses measured properly. The message must be transmitted to the directors emphasizing the importance of every runner receiving their correct time and finishing place and competency at the correct distance. To do less would violate the trust that a runner places in a race director.

In order to encourage properly measured courses, I would reccommend a lesser standard of ± 1/500. For those events that wish to follow a more stringent standard, the standard should be ± 1/1000.

It is important that the average runner understand the relationship between distance and time. The average runner is responsible for the growth of our sport. To say that a 2:08:45 and a 2:08:50 are equivalent would only confuse the runners and the press, even more, the times of the average runner would need to be adjusted. Once you begin using an equivalent system it will have to be adjusted for wind, elevation, number of turns, etc. Who will make these judgements? Are we, you or others to develop a mathematical model for the various parimeters? I don't believe it is in the best interest of the sport.

I agree with your proposed rules except the section on Standard Records.

I hope this has not added to the continuing good work needed to be done on measuring courses and keeping it simple in order to encourage all races to be measured properly. I applaud your efforts.

Respectfully,

Allan Steinfeld

Allan Steinfeld

P.S.

Please excuse the delay in answering your letter. We've all been averaging 10-16 hour work days preparing for the TAC National Cross Country Championships at the Meadowlands.

A.S.

AS:mp

RE: Certification conference

12-22-82

Dear Tom, **NO. 21**

Some thoughts for an agenda:

1. News from Alan Steinfeld
2. News from Ken Young
3. News from each certifier
4. Discuss problems & solutions
   - personalities
   - resolving deficiencies with an applicant
   - measuring busy streets
   - map drawing
   - formats (certificate, handout)

(if the weather is good)

5. Contest: test how accurate each person can measure a curvy & challenging course via calibrated bicycle. The actual length* of the course should be kept secret, with results mailed (or announced after everyone is finished). If each person measures at least twice, then two variables can be measured:
   a. consistency
   b. accuracy

   Two sets of grades, with accuracy being the most important

Pete Letson
San Diego

* measured via electronic meter & steel tape (SUPER ACCURATE) 12" from curb (same as tracks) on turns.

NO. 22

San Francisco Marathon

December 29, 1982

Ken Young
National Running Data Center
P.O. Box 42888
Tucson, Az. 85733

Dear Ken:

Enclosed is a copy of the proposed standards for the set up and Certification of an AIMS member Marathon.

I'll be sending Ray Oliu, the Author, a detailed analysis. Just some comments on several sections in his text, which I feel must be looked at more closely and changed/strengthened for the final draft.

SECTION 5.a.
I'm glad to see he is taking pains to be as exact as possible with the basic unit of measurement for a Road Race Course "The Calibrated 1KM/1MILE/880YD. Distances". I would suggest, however, that rather than four separate steel tapings; that the current U.S. Standard of two tapings within acceptable error would suffice. Those results should then be cross checked by EDM Meter. This would give the safest and most accurate result, and still be less time consuming.

SECTION 5.b.
This could be confusing to novice certifiers. They might interpert this to mean the bike is calibrated only twice before your measurement ride. A notation should be inserted in this section advising "That you never should tamper with the tire pressure once the bike is calibrated".

Again, it should be clearly indicated that at least 4 rides are needed to calibrate your bike before your measurement ride; even more if you are not getting acceptable correlation between your calibration rides. It's recommended to ride your bike at least a mile on a warmup before starting to calibrate, and at least 2 rides at the end of your course measurement for re-calibration. Then you average these two figures (The pre-measure calibration average and the post-measure calibration average) this will give you your days constant.

SECTION 6.a.
This statement should leave no room for misinterpretation. Unless certain streets will only be partially closed to traffic; THE SHORTEST POSSIBLE ROUTE (SPR) the runner will be able to legally run on race day must be the measured line. I can't emphasize this point to strongly.

CONDUCTED BY PAMAKID RUNNERS
P.O. Box 27385 (415) 681-2322 - Ofc. San Francisco, California 94127

SECTION 6.a. cont.
The Pacific Association Course Certification Committee of TAC, has found that misinterpretation and lack of knowledge of this concept to be by far the leading culprit in the many short courses we've measured to date. Not only has it's quantatative effect been significant, but more importantly is it's qualatative effect on each short course. We have found, that by far the most gross errors in a Road Race Courses' accuracy, are made through less than rigid adherence and lack of knowledge of this concept. It is at the heart of the problem of almost every short course we have come across.

The certifiers must be made to understand that the course has to be measured this way inspite of the inconvenience/legalities/danger it places the certifier. This is the reason that Police/Vehicle Protection, Safety Vests and Helmet, and an early starting time for measuring; are essential to measuring safely and accurately in an urban environment.

Also note that the 1 meter from the curb rule indicated, should be changed to conform more closely with current NSC and TAC Track requirements. 12" from curbed roadway edge, and 8" from the edge of uncurbed roadways.

SECTION 6.b.
Again this section must leave no doubt that the certifier must measure the SPR legally able to be run on race day. We must dump potentially ambiguous phrases when describing this concept (ie. "Shortest Probable Route","Shortest Route Avg. Runner is Likely to Take", "Prudent Runners Path" etc. It must be spelled out in the most unambiguous phrase possible (SPR). To belabor a point; in our course verifications, it's not been the calibrated 1km/880YD course or the inexperience of the certifier nearly as much as the lack of strict adherence to the SPR concept that has produced the most prodigious errors.

SECTION 6.c.
Again the SPR concept be clearly articulated in this section, as well as the replacement of the 1 meter from the curb concept.

SECTION 6.f.
The technical advisor's background should be broadened to include anyone with a demonstrated competence through practical experience in course certification. There can be no substitute for experience. Just being an Engineer or Scientist does not necessarily lead to the most accurately measured course. I think Tom Knight and Bob Letson would both agree on this point. The mathematical expertise required to certify a course is easily learned when taught in clear simple format by any reasonably intelligent individual. The

SECTION 6.f. cont.
members of the National Standards Committee (NSC), however, should have a Scientists' or Engineers grasp for figures/formulas, as they are the people who have to carry on a more detailed dialogue in updating and redefining course certification procedures.

SECTION 7.a.
Again it would be faster and more accurate with two measurements with steel tape cross checked with an EDM Electronic Meter, or two EDM measurements cross checked by 1 steel taping.

SECTION 8. TABLE 4.
Added to these 4 causes for error, must be the current major culprit, less than strict adherence to the SPR concept. This section should be fleshed out, by indicating that any and all areas that can be cut by a runner, which are not part of the race route, must be barracaded and monitored to prevent cutting.

THE MAP
Much more than a simple map should be included. Just as a certifier must write up his findings as documentation for future use as reference material to answer possible questions on his particular course, and as an evaluation tool to be used by the various authorities in his particular Course Certification Organization; so it is with the map. It should be of sufficient detail so that the evaluator can determine, with a reasonable degree of accuracy, how it was measured and run, How the Tangents were cut, where monitors and barracades were used to insure runners could not cheat, etc. This would give the course evaluator a much more detailed feel for the course in question. In the case of the S.F. Marathon a 91 page Course Atlas was produced which broke the entire course down into 2 and 3 block segements on a scale of 1"=100'. This scale was much more useful in determining how the course was measured, run, and monitored. While this might be somewhat more elaborate than is needed for the average race. The competative prestige, size, and intricate technical necessities of staging an International Marathon demand a similar type document by the Marathon and it's various committee's. As well as supplying in different and greater detail, information an evaluator of that particular course should have, to make the best evaluation possible, but it can also be used as a technical tool for Medical, Aid Station, Course Control, Split Timing, and all the various logistical agencies that need to mesh if the race is to come off properly.

IN CONCLUSION
I'm relieved to hear that the AIMS Standards Committee is setting up its own structure. Hopefully this will indeed spur the IAAF to make some decisions, so that our sport can have a semblence

CONDUCTED BY PAMAKID RUNNERS

P.O. Box 27385 (415) 681-2322 - Ofc. San Francisco, California 94127

IN CONCLUSION cont.
of International uniformity, and accuracy.

While not an expert on International Course Certification progress; with the exception of John Jewell and now Ray Oliu, I'm not aware of much activity on the U.S. scale of accuracy, Internationally.

It would be my hope that the standards eventually drawn up for the AIMS Standards Committee Members, the IAAF, and the U.S.NSC be as uniform as possible. Hence it is vital that the experience and knowledge gained by the NSC and its members throughtout this country be evaluated thoroughly by any new Standards Committee for their proposed guidelines. If the AIMS group and the IAAF fail to devise guidelines which are not at least as strict (and practical) as the current NSC Standards were in for real trouble.

Now, seems to be the time, to standardize a set of comphrehensive course certification guidelines. Rather than starting from scratch, it seems to me, the current NSC guidelines should be used as the basic structure, With modifications made on the structure only where a proven need for change exists. This would enable the AIMS group to proceed almost immediately in implimentation, and put the pressure on the IAAF to do likewise. To try to devise a whole new set of guidelines when a proven set already exists, seems counter-productive and potentially more time consuming than necessary.

Hopefully from all this, a common approach can be reached, and a potentially chaotic area of our sport can be uniformily standard-ized to the much greater benefit of us all.

Regards,

Tom Benjamin
Course Coordinator S.F. Marathon
Member PA-TAC Standards Committee
P.O. BOX 8715
San Francisco, Ca. 94128

cc:Scott Thomason
Tom Knight
Bob Letson

No. 23

TAC STANDARDS COMMITTEE--NEW MEASUREMENT STANDARDS/RULES

1.COURSE MEASURING PATH:Study course by map and otherwise. Determine how much of road will be available to the runners: all, half, or one lane. Decide if there are local laws or police restrictions which define where runners will be allowed to race, such as with traffic or against traffic or at will.

MEASURE THE SHORTEST PATH possible on the race course, including all short cuts.

2.The old one meter rule is dead. Measure 12 inches from curbs, or 8 inches from edge of curbless roads or lines, where applicable.

3.The IAAF now says that a course cannot be less than the stated distance. It may be longer, e.g. 50 meters for the 42,195 meters marathon.

ADD AN EXTRA 1/1000th of race course distance to the standard length. This extra distance may be added en route, for instance measuring each kilometer one meter long, or each mile a bit long, or add extra distance at the start or finish, or turn around point.

4.All courses should be measured at least twice. Use the longer measurement. The two measurements should be reasonably close. If a 10,000 meters course measurements differ by more than 8 meters, or if marathon course measurements differ by more than 37 yards, take a third measurement.

5.In writing a report (application) of the course measurement, state the exact length of the course, plus the added distance, for instance: 26 miles 385 yards, plus 50 meters. You will still use 26 miles 385 yards on entry blanks and in press releases.

6.If an open American record, or a "world's best" time is made in a road race, it must be confirmed that the correct, measured course was the one raced, and an independent measurement of the race course will be made. If the course is found to be short of the stated distance, no record will be allowed.

====== ====== ===== ===== ====== ====== ======

ADDITIONAL POINTS: The Race Director , or someone delegated to make decisions as to course route, and the start and finish points, should be on hand during the course measurement.

Someone who has run the course and who knows the shortest path taken by the runners should guide the course measurer; or should operate the measuring device.

Measure the course when the traffic is light. In dangerous situations, try to get a police escort, or a municipal vehicle with flashing lights on the roof, to be driven along to alert motorists and so protect the course measurers.

Safety of the runners, traffic problems, safety of course measurers, and other practical factors help to determine the course route and configuration.

After measuring a race course, verify the actual running route taken by the runners during the following race(s). Compare the actual route run, with the measured or certified route. In case of discrepancies, measure the actual running route, including all noted short cuts, and get the course re-certified.

Ted Corbitt, Chairman TAC Standards Committee, 1/13/83

No. 24 Feb. 1983 Seminar

PA/TAC/LDR
CERTIFICATION COMMITTEE
2608 Ninth Street
Berkeley, California 94710

PA-TAC CERTIFICATION COMMITTEE COURSE MEASUREMENT SEMINAR & CLINIC

On the morning of Saturday, February 19th at precisely 8:15 this first of its kind seminar was convened in Oakland, California with no less than thirty-six participants from all corners of the Greater Bay Area complete with bikes and calculators. Five committee members acted as instructors.

The all day, somewhat disorganized but definitely enthusiastic clinic was conducted in three stages: A morning discussion on the philospphy and procedure of course measurement; a "hands on" measurement of a nearby two mile course with bikes and Jones Counters (a very precise measuring device); and the day ended with a session covering the mathematics of course measurement and certification.

As part of the course measurement excercise each of the riders determined how "tightly" they rode the course by how closely their two mile mark matched an "official" two mile mark. (The idea is to ride the shortest possible legal route.)

A great deal was learned by all and not the least was learned by the Committee itself in its first seminar.

We wish to give special thanks to Cherie Swenson of the Oakland Marathon for making the meeting room and her office available for our clinics use.

Carl Wisser, Chairman

PA - TAC

COURSE MEASUREMENT SEMINAR

The GREATER BAY AREA CERTIFICATION COMMITTEE will hold it's first of two seminars this year on Course Measurement and Certification.

FEBRUARY 19, 1983
at 8:00 a.m. Sharp!!
770 Edgewater Drive,(near airport)
Oakland, California

This seminar will be a "Hands on Experience". We will cover all facets of course measurement for certification. If possible, bring a 10 speed bike, pocket calculator and notebook. Lunch will be available at the snack bar at a near by fitness center.

Please R.S.V.P. to Carl Wisser at (415) 549-3688.

PA-TAC

THE ACCEPTED CURRENT METHOD FOR MEASUREMENT OF ROAD RACE COURSES-1983

Adapted from an article written in the January 1983 issue of the National Running Data Center News Letter (NRDC), by David Katz, a member of the National Standards Committee (NSC); the recognized authority for Road Race Measurements Standards by the governing bodies of the RRCA and TAC in the United States.

CALIBRATED BICYCLE METHOD

The calibrated bicycle incorporates a small counter known as the Clain Jones Assembly (available only through the New York RRC, PO BOX 881 FDR Station, N.Y., N.Y. 10050, attention: Bill Noel. Price is $20.00 postpaid). This device is mounted on the front axle of the bicycle (see blue hand-out). The counter counts fractions of revolutions of the bicycle wheel and reads from 00000-99999. The technique for using this device is as follows:

BEFORE MEASURING -To Calibrate your bike before your measurement ride. This known as your RIDING CONSTANT .

1. Check your tires for proper pressure.
2. Ride your bike at least a mile to stabilize the temperature and pressure. The same person who calibrates the bike must also measure the course.
3. Line up the axle of the front wheel of the bike with the exact starting point of the Calibration course. Note the starting count (reading) of the Jones Counter. (you can spin the bike wheel so the counter reads an even number if you wish).
4. Ride the Calibration course at the same speed you plan to measure the race course.
5. Try to ride as straight a line between the two calibration points as possible. If you have to deviate from this line because of auto traffic or other obsticles on the calibration course,the ride should be thrown out and done over. The accuracy of your calibration rides must be as exact as possible.
6. Stop the bike at the exact end of the calibration course, lining up the front axle with the end mark on the ground. Note the counts on the Jones Counter.
7. Repeat the riding of the Calibration course at least three more times for a total of at least four rides.
8. To get your calibration count simply subtract your finishing count from your starting count on each calibration ride.

   FOR EXAMPLE:

finishing count	42681	
starting count	35000	
total counts	7681	over an 880yd/½ mile course.

9. After the four trials (rides), calculate the average of the four.

   FOR EXAMPLE:

trial #1	7681 counts
trial #2	7678 counts
trial #3	7682 counts
trial #4	7679 counts
total	30720 counts,or 7680 per trial for ½ mile, or 15,360 per mile.

BEFORE MEASURING - CONT.

15,360 counts equals 1 mile for this particular measurement ride and is known as your RIDING CONSTANT.

*10. The Standards Committee requests that all courses be measured with a short course prevention factor of 0.1%, i.e., lengthening the course by 0.1%. This margin should be calculated and added to your Riding Constant.

EE NOTE A.

FOR EXAMPLE:

riding constant	15360 counts/mile
0.1% to be added	x.001
	15.36 counts/mile
rounded off to	15 counts/mile
then	
riding constant	15360 counts/mile
the added 0.1%	+15 counts/mile
new riding constant is	15375 counts/mile

THE BIKE IS NOW CALIBRATED AND THE RACE COURSE CAN BE MEASURED.

AFTER MEASURING - The recalibration of your bike, known as the RECALIBRATION CONSTANT .

1. On the same day as the calibration and actual measuring, the bike must be recalibrated over the calibration course. This procedure should be carried out immediately after you have finished measuring the course. This recalibration number or constant must be compared with your riding constant used to measure the course. You must recalibrate your bike on the calibration course at least twice, average those two figures which will give you your recalibration figure.

FOR EXAMPLE:

trial #1	7683 counts
trial #2	7685 counts
	15368 counts, or avg. of 7684 per trial for ½ mile, or 15368 counts per mile.

AFTER RECALIBRATING - Average your Riding Constant and Recalibration Constant, which will give you your------ CONSTANT FOR THE DAY.

FOR EXAMPLE :

1.

Riding Constant(less 0.1%)	15360 counts per mile
Recalibration Constant	15368 counts per mile
Total	30728 divided by two equals 15364 counts per mile which is your Constant for Day.

2. Therefore your Riding Constant(15360) was 4 counts per mile shorter than your Constant for the Day(15364). A cumulative correction of 4 counts/mile must be added to each mile. For example: the 1st mile must be retracked 4 counts from the original mile mark. The 2nd mile must be moved ahead 4+4 or 8 counts from the original 2 mile mark, etc. Also remember to multiply this 4 count per mile figure times your total course length, to determine your total course adjustment factor.

NOW MEASURING THE COURSE ITSELF

The race course can be mapped out first using aerial photo's, large scale maps, or even a car odometer. Note: most car odometers will produce a short course by 2 to 5%. Methods other than the calibrated bike or measuring wheel should only be used to obtain an approximate measurement of the course and ARE NOT ACCEPTABLE FOR CERTIFICATION. This includes an EDM Meter when used to measure anything other than a straight calibration course.

Perform all calculations including desired mile/kilometer points and start and finish points prior to measuring the course. Use

6.21371 miles = 10 kilometers as your standard for all for all metric calculations. Please keep a written copy of all your calculations and turn in these field notes with your application. It is also advised that you do all calculations twice to guard against errors.

It is advisable to ride your course as if you were certifying it. Ride at least once before you actually ride for certification. This will enable you to accurately determine your start and finish points before your actual rides for certification. This SET UP ride can save you alot of headaches later on if done as precisely as possible.

Measure the course with two riders if possible. This will give you your two rides of the course while giving you both a double check on your calculations and measuring technique. Sometimes it is not always possible to ride with someone else. Remember, if you do the two course measurement rides they should both be done on the same day. If for any reason you can't ride the course twice on the same day, you MUST CALIBRATE and RECALIBRATE your bike for each days ride.

Proceed to measure the course following the SHORTEST POSSIBLE ROUTE (SPR) the runner will legally be able to take without being disqualified. Ted Corbitt says, "give the runners a chance to cut a corner and they'll take it, therefore this is how you should measure." Try to use the whole roadway whenever possible, this will help to eliminate otherwise needed coning and barracading of the unused portion of the roadway. Care must also be taken at corners on a course. If not properly barracaded and monitored, many runners will cut the course short by cutting the corner. Again it is helpful to first ride or run the the course to get a better understanding of the turns, corners, and terrain; before you get on your bike for your preliminary measurement.

Careful note taking is essential in all aspects of measuring. Many measurers use a standard spiral pocket notebook. This type of book prevents the measurer from losing pages. Detailed landmark, as well as calibration information should be included for all measured points.

The National Standards Committee requires a minimum of two measurements for certification. If two measurements are made, the measurement producing the longer adjusted course should be used. If more than two measurements are used you should still use the longest measurement which you are able to confirm as being accurately done.

MEASURING THE COURSE ITSELF - cont.

Since the set of measurements that will be used as the course measurement is not known until all measurements have been completed and the likelihood of slight adjustments (4 counts per mile in our example)being required following the set of recalibration trials, initial paint marks on the roads should be minimized to simple coded lines or letters. Once the final determinations have been made, a combination of landmark notations, painted mileage markers, and masonary nails hammered into the pavement should serve as your final permanent marks for the start/finish mile/kilometer points.

Once all measuring has been completed, a detailed report and certification questionaire including all calculations, fieldnotes and maps must be submitted to the nationally designated certifier in your area (for northern and central ca. Carl Wisser PA-TAC Office 2608 Ninth St., Berkeley Ca. 94710. Phone 415-549-3687). These individuals will review the report and correspond with the measurer if there are errors or questions. The regional certifier will then forward the report to Ted Corbitt for final approval. Ted Corbitt is the only individual in the United States authorized by the TAC and RRCA to award certification to a race course that appears to him " to be measured with reasonable accuracy". Ted will return a certificate to the regional certification chairman,with his signature stating the course is Nationally Certified. Only in this way may a course be added to the list of Nationally Certified Courses kept by the record keeping organ--The National Running Data Center, run by Ken and Jennifer Young in Tucson, Az.

NOTE A.

In 1981, a validation program was started by the National Running Data Center (NRDC) to verify the accuracy of race courses where American records were established. For a performance to stand as a record, the course must be remeasured and the findings not be short of the measured and certified race route by more than the following short tolerances:

1. Races held prior to Apr 1981-they can be short by 0.5%
2. Races held from 1 Apr 1981 thru 31 Dec 1983--no more than 0.2%
3. Races held from 1 Jan 1984 thru 31 Dec 1984--0.1%
4. Races held on or after 1 Jan 1985-no short tolerance allowed.

These tolerances apply only to the findings of an independent measurer, assigned to validate performances for a particular race by the NRDC and Ken Young(the chairman of the National Standards Committee's course validation and remeasurment committee). This revalidation of the course to establish the credibility of any National Age Group record set on the course can only be done after the race has been run and the record set. In this validation, the manner in which the runners ran the course may also be reviewed to determine if the proper course was actually followed. Once a course has been remeasured and found short, the required distance must be added.

The intent of the short course prevention factor(adding 0.1% to the measured length of your course) is to reduce the likelihood that a remeasurement will find it short by more than the allowed short tolerance currently in effect at the time.

PA-TAC COURSE CERTIFICATION SUPPLIES LIST

PRICE			
	+	1.	10 speed bicycle.
$20.00	ñ	2.	Jones Counter measuring device for bike.
		3.	Pocket calculator.
	@	4.	Pocket size spiral notebook for field notes.
$30.00 case $2.65 ea.	*	5.	Flourescent marking spray paint.(12 cans to a case)
$12.00 ea.	*	6.	Orange safety vest. (Model #1100)
	+	7.	Bike helmet.
$18.95 ea.	+	8.	Bike pump and tire pressure gauge.(price for the cycle-pro)
	*	9.	Thermometer.
$6.80 bx.	*	10.	Masonary PK nails.(100 nails to a box).1¼"long.
$7.65 bx.	*	11.	Surveyor's flasher/spinner disks.(#8431 Lietz)
		12.	Hammer.
$50.66 a tape $3[illegible].68 for reel	*	13.	100 foot professional steel tape and reel.(Lufkin#05100B tape and #31-100 reel).
$4[illegible].20 30lb.	*	14.	Tension guage for steel tape.(Model #IN-30).
$85.50 a wheel	*	15.	Surveyor's walking wheel.(Rolatape 415 walking wheel).
		16.	Tables on metric/english conversions.
	@	17.	Masking tape(2"wide) and pencils for steel tape measurements.
	@	18.	Black ink pens (one fine, one bold)and straight edge for maps.

---

* Available through Haselbach Surveying Instruments
1447 Rollins Rd., Burlingame, Ca. 94010 (415) 348-7247
Take the 1st. exit south of the airport on Hwy. 101 heading west. First left turn is Rollins Rd. proceed almost to end of Rollins past Hiram Walker warehouse and Burroughs,its on the rt.

@ Available at any stationary store/art supply store.

\+ Available at most good bike shops.

ñ Available through New Road Runners Club att: Bill Noel
9 East 89th St. New York, N.Y. 10028 (212) 860-4455.

COURSE CERTIFICATION CHECK LIST

1. You must Calibrate your bike at least four times over a known Calibration Course before your measurement rides of the Race Course. The average of these four rides is known as your Riding Constant.

2. You must make at least two good measurement rides of the Race Course. Remember, if you measure on separate days, you must Calibrate and Recalibrate your bike for each day.

3. Remember when you measure the course, always ride the straightest line/shortest possible route (SPR) that a runner could legally run your course. This is most important.

4. At the end of each days ride, your bike must be Recalibrated on your Calibration Course, at least twice. The average of these two rides will be your Recalibration Constant.

5. You must then find the numerical average between your Recalibration Constant and your Riding Constant. This figure will give you your overall average number of counts per mile for that particular day. This is called your Constant for the Day. You then find the numerical difference between your Constant for the Day and the Constant you used while measuring the course (Your Riding Constant). This figure, multiplied by the length of your course, is the amount you have to re-adjust (backwards or forwards) your Start/Finish Line, to get your FINAL Finish Point.

6. Remember to keep all your field notes, and submit a copy of them with your application form.

7. Finally, on the Course Map, remember to include blow up diagrams of the Start, Finish, and Turnaround lines of your Race. These should include the Exact distance of these lines from a visible fixed object (ie. Finish Line is 21`10" West of light pole #25 on South Dr. just West of the intersection of South Dr. and Metson Rd.). Also indicate on the map, a blow up drawing of potentially confusing areas. Remember, this map should indicate visually, how all the Roads/Bike Paths/Trails were cut to get the SPR. This map should be able to give someone unfamiliar with your course, little trouble in reverifying the exact length of your course if a reverification measurement becomes necessary.

8. Call Carl Wisser or any member of the Course Certification Committee if you are in doubt on any point in the Course Certification process.

9. Lastly, remember if you change your course in any fashion, it must be Recertified.

— Course Certification Contacts —

Regional Representatives of the LDR Standards Committee

NY,New England	Allan Steinfeld, 9 E 89th St, New York NY 10022
DC,MD,VA,WV	A J VanderWaal, Rte 6 Box 154, Martinsburg WV 25401
NJ,DE,PA	George Delaney, 1012 Merrymount So, Turnersville NJ 08012
MI	Allan Phillips, 7833 Hillcrest Blvd, Westland MI 48185
OH	Peter Riegel, 3354 Kirkham Rd, Columbus OH 43221
IL	Len Evens, 2026 Orrington Av, Evanston IL 60201
WI	Raymond Hintz, 1119 Elizabeth St, Madison WI 53703
LA	Carl Jeansonne, PO Box 66424, Baton Rouge LA 70896
OK	Bob Baumel, 129 Warwick Rd, Ponca City OK 74601
AZ,sthn CA	Bob Letson, 4369 Hamilton St- #4, San Diego CA 92104
cntl/nthn CA	Carl Wisser, 2608 Ninth St, Berkeley CA 94710
OR	Donna Phillips, Providence Hospital, 1111 Crater Lake, Medford OR 97501
WA	Tom Duranti, 9907 NE 124th St, Kirkland WA 98033
HI	Gordon Dugan, 704 Ainapo St, Honolulu HI 96825

All regions not listed here, foreign courses and other courses measured by non-standard methods should be sent to:

Ted Corbitt, Apt 8H Sect 4, 150 W 225th St, New York NY 10463

NOTE: All course certifications reviewed and approved by the regional representatives MUST be finally approved by Ted Corbitt before the course can be placed on the official list of certified courses and can qualify for US records.

All persons listed above are VOLUNTEERS. They have full-time jobs. They have offered their time and expertise to help people obtain accurate courses.

TUCSON, AZ 857
FEB 14
PM
1983

USA 20c

Ken Young
NATIONAL RUNNING DATA CENTER
P. O. BOX 42888
TUCSON AZ 85733

Subscription Rate $15.00 yR. for N.R.D.C. Newsletter

TOM BENJAMIN
SUB TO MAY 1983
PO BOX 6715
SAN FRANCISCO CA 94128

first class mail

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.*

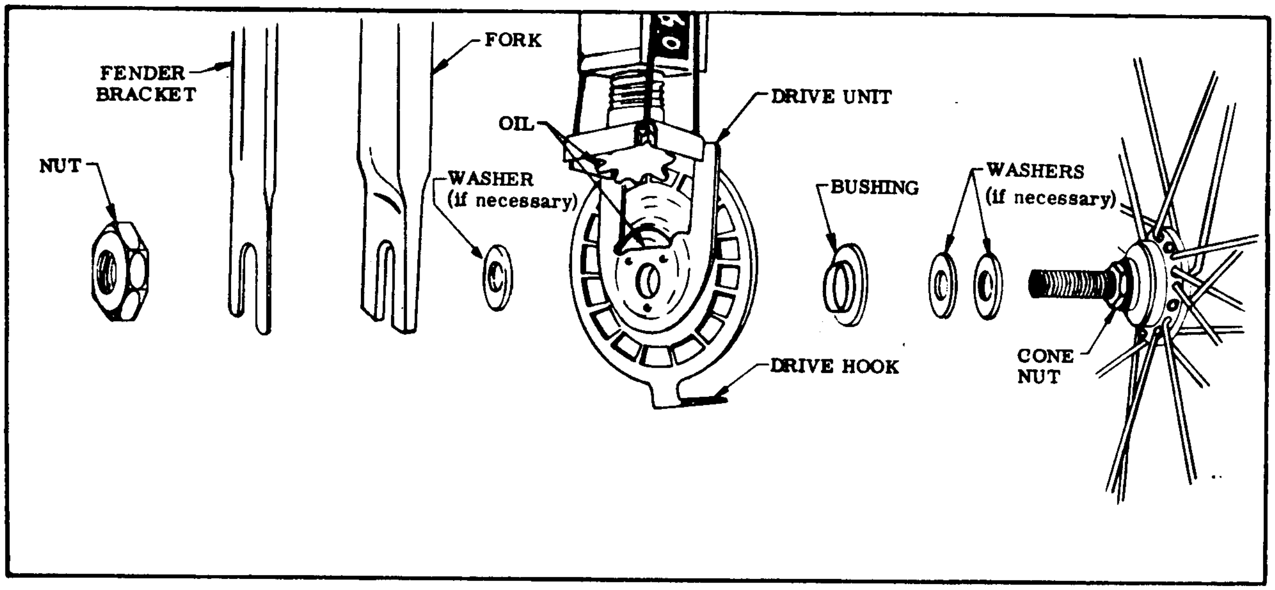


FIGURE 1

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.

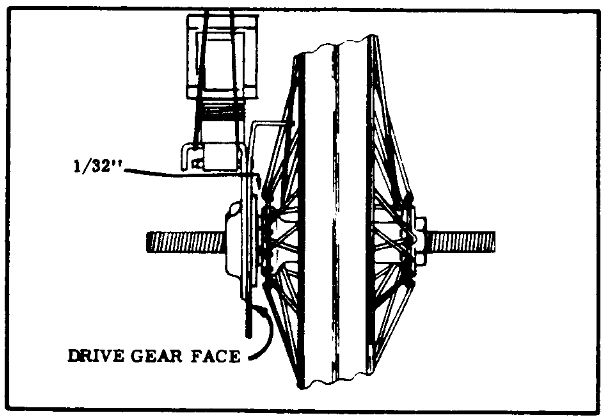


FIGURE 2

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.

INSTRUCTIONS FOR USE OF JONES COURSE MEASURING DEVICE

For course measurement, refer to Ted Corbitt's booklet, "Measuring Road Running Courses." This is available from:

Mr. Ted Corbitt, Chairman
RRCA/AAU Standards Committee
150 W. 225th Street
Apt. 8H Sect. 4
New York, NY 10463

The price of the booklet is $1.00.

To calibrate the counter, measure a half mile or one kilometer course using a steel tape with 10 lb. (4.5 kg) tension. See Ted Corbitt's pamphlet for details. Record the reading of the Course Measuring Device at the beginning and end of the course. Only read when the bike is advancing to the mark. If you overshoot by a few inches, back up behind the mark so that the counter is advancing as you come again to the mark. This will eliminate "backlash". Ride over the course at least twice. Record the results as shown in the example:

	Run 1	Run 2
STOP	86590	94449
START	- 78735	- 86592
Difference	7855	7857

Subtract and take the average. If a half-mile course, multiply by two for counts per mile. If a mile or kilometer course use the average. For this example we get (if from a half-mile course):

counts per mile = 15712 (9763 per km)

Then we use this to figure the number of counts for the desired distance. For example, for a 10 mile course it would be 157120 counts. Since the counter only records 5 digits, note that it will "turn over" about every 6.4 miles (10.2 km). For a 20 kilometer course (12.4274. . . miles) it would be 12.427424 x 15712 = 195260 counts or 20 x 9763 = 195260 counts. (We recommend the use of a calculator to aid in these computations.) When measuring the actual course, read the counter as the bike is set at the starting point and add the desired counts to get the number to obtain at the finish. You may want to compute the count for each mile (or kilometer) mark. Then each mile can be marked for use by the runners during the race.

If you measure an existing course and want to find its length, determine the total number of counts and divide by the counts per mile. For example, using the counts per mile from above, if the total counts for the course was 166734 this would be:

166734/15712 = 10.6119 miles = 10 miles 1077 yds
or 166734/9763 = 17.0782 km = 17 km 78 Meters

. . . .

For your convenience, the following conversion factors are given:

1 mile	=	1.609344 kilometers (exact)
1 kilometer	=	0.62137119. . . miles
5 kilometers	=	3.106856. . . "
10 kilometers	=	6.213711. . . "
15 "	=	9.320568. . . "
20 "	=	12.427424. . . "
25 "	=	15.534280. . . "
Marathon	=	42195 meters
	=	42.195 kilometers
	=	26 miles 385 yards
	=	26.21875 miles

The Jones Course Measuring Device is available from:

NEW YORK ROAD RUNNERS CLUB
Attention: Bill Noel
9 East 89th St.
New York, N.Y. 10028
(212) 860-4455. Price $20.00

PERSONAL DATA   PA-TAC Certification Committee

NAME____ DATE______________

ADDRESS_____________________________________ ZIP_______________

PHONE: Home_______________ Work_______________ Other_______________

Enter an X if you have training or experience in:

- [ ] Measuring via calibrated bicycle
- [ ] Using a Jones counter
- [ ] Measuring via surveyor's steel tape
- [ ] Measuring via calibrated walking wheel
- [ ] Measuring via electronic meter
- [ ] Map drawing
- [ ] Applying for certification
- [ ] Designing and creating a calibration course
- [ ] Designing a road race course
- [ ] Measuring a track oval (440 yards, 400 meters, or indoor)

List all calibration courses, road race courses, and track ovals that you have personally designed, measured, or had certified:

YEAR	NAME OF COURSE LENGTH	DESIGNED?	MEASURED?	CERTIFIED?

YEAR	NAME OF COURSE LENGTH	DESIGNED?	MEASURED?	CERTIFIED?

ENGLISH - METRIC CONVERSIONS

1 inch = 2.54 centimeters = .0254 meters

1 foot = 30.48 centimeters = .3048 meters

1 yard = 91.44 centimeters = .9144 meters

1 mile = 1,760 yards = 5,280 feet

1 mile = 1,609.344 meters 1.609344 kilometers

Note: 1 centimeter = .01 meter

1 kilometer = 1,000 meters = 1 KM

5 kilometers = 3.106856¯miles

8 kilometers = 4.970970¯miles

10 kilometers = 6.213712¯miles

15 kilometers = 9.320568¯miles

1/2 Marathon = 13.109375 miles = 13 miles + 192.5 yards

1/2 Marathon = 21,097.494 meters = 21.097494 kilometers

Full Marathon = 26.21875 miles = 26 miles + 385 yards

Full Marathon = 42,194.988 meters = 42.194988 kilometers

Others: 20 KM = 12.427424¯miles

25 KM = 15.534280¯miles

30 KM = 18.641136¯miles

50 KM = 31.068560¯miles

60 KM = 37.282272¯miles

100 KM = 62.137120¯miles* *rounded last digit up

FRACTIONS & PERCENTAGES

0.1% = .001 = 1/1,000

0.2% = .002 = 1/500

0.5% = .005 = 1/200

SAMPLE EXERCISES

1.) If I am required to add 0.1% to courses of the following lengths, how much distance should I add?

(a) 10,000 meters

.001 X 10,000 meters = 10 meters

(b) Full Marathon

.001 X 26.21875 miles = .02621875 miles

.02621875 miles X (1,760 yards/mile) = 46.1 yards

or .001 X 42,194988 meters = 42.2 meters

2.) Suppose my calibration constant (riding constant) is 15,100 counts/mile and my recalibration constant is 15,090 counts/mile; I ride an 8 KM course from a fixed finish line to the start and place down a start mark.

(a) How many counts must I ride?

(15,100 counts/mile) X (8 KM/ 1.609344 KM/mile) =

= (15,100 counts) X (4.970970) = 75,061.6 counts

(b) How far should my start mark be moved after recalibration to place it at 8,000 meters from the finish?

(5 counts/mile) X (4.970970 miles) = 24.9 counts

this is because the day's constant is the average of 15,100 & 15,090 or 15,095 counts/mile

since the day's constant is less than the riding constant, we would move the start mark in the race direction which will shorten the course.

(24.9 counts/ 15,095 counts/mile) x (1,609.344 meters/mile) =

= 2.65 meters in the race direction

SAMPLE EXERCISES (cont'd)

2.) (c) How far in meters is the course from the finish to the unadjusted course start mark?

8,000 meters + 2.65 meters = 8,002.65 meters

(75,061.6 counts/ 15,095 counts/mile) x (1,609.344 meters/mile) = 8,002.6+ meters

3.) Suppose I will set up a 10,000 meters course but have been told to to make it 0.1% or 10 meters long. If I have a calibration constant (riding constant) of 15,100 counts/mile and want to lengthen the course evenly throughout. (I will ride from fixed finish to start.)

(a) What actual riding constant should I use?

15,100 +(.001 X 15,100) = 15,115.1 counts/mile

(b) How many counts should I ride from the finish to the start?

15,115.1 X 6.213712 = 93,920.9 counts

(c) If my recalibration constant is 15,092 counts/mile , what should I do to make the 10,010 meters long?

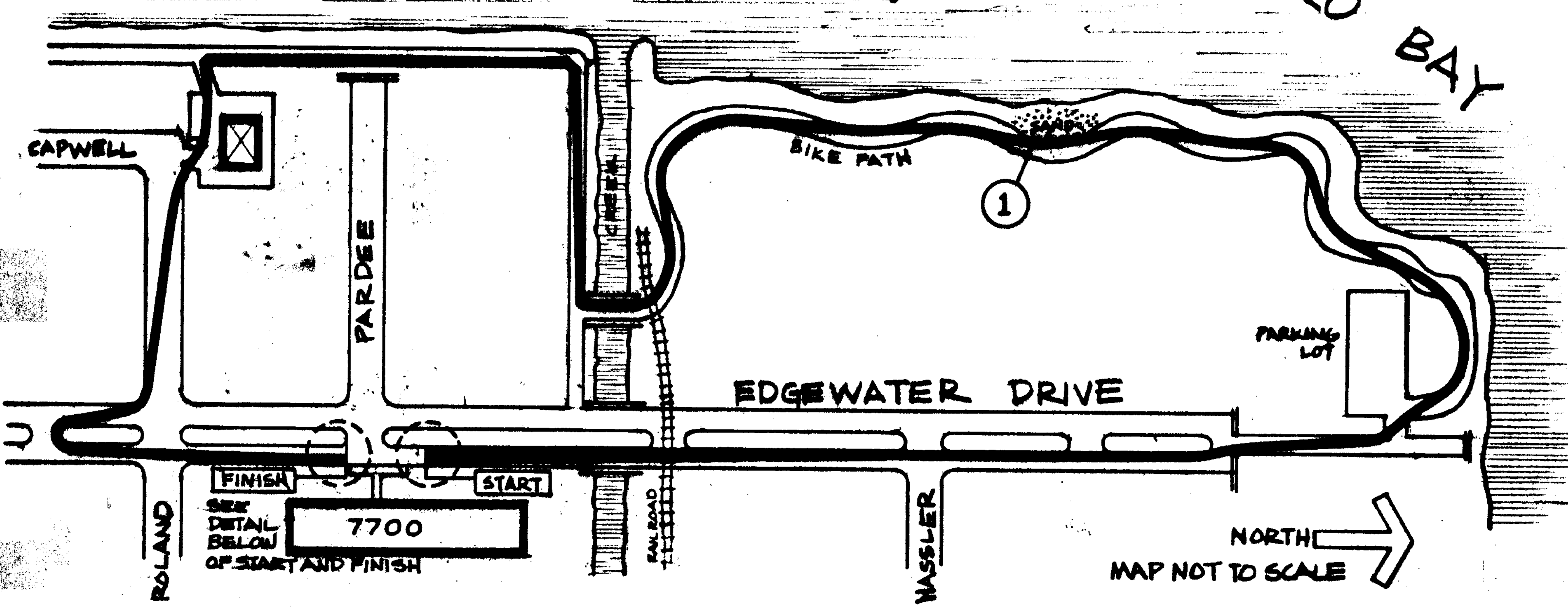
day's constant = 1/2 (15,100 + 15,092) = 15,096 counts/mile

(93,920.9 counts/ 15,096 counts/mile) x (1,609.344 meters/mile) = 10,012.7 meters.

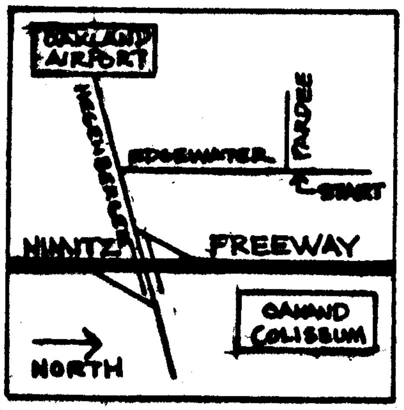
therefore to make the course 10,010 meters long I should move the start toward the finish (in the race direction) by 2.7 meters.

~~E. BAY AREA CERTIFICATION COMMITTEE~~

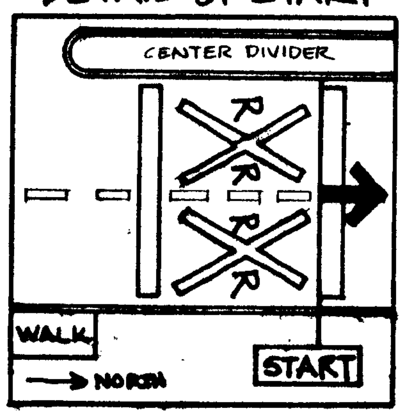
MEASUREMENT PRACTICE COURSE



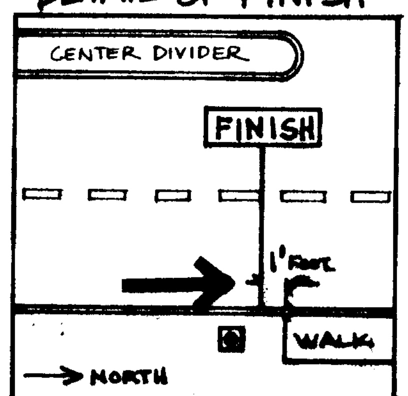
COURSE LOCATION



DETAIL OF START



DETAIL OF FINISH



LOCATION OF MILES

START: SOUTH EDGE OF NORTHERN MOST WHITE LINE NOTING RAILROAD CROSSING IN FRONT OF 7700 EDGEWATER.

1 MILE: ON BIKEPATH NEAR SAND AREA BEHIND CITY CORP YARD.

FINISH: 1 FOOT SOUTH OF WALKWAY IN FRONT OF 7700 EDGEWATER.

PORTIONS OF ROAD USED

BOTH LANES ON ALL ROADS AS INDICATED ON MAP.

The Athletics Congress of the USA NO. 25

CARL WISSER CHAIRMAN
PA LDR CERTIFICATION COMMITTEE
2608 Ninth Street, Berkeley, CA 94710 (415) 549-3688

TOM BENJAMIN
ASSOCIATION CERTIFIER
895 34th Ave
SAN FRANCISCO, CA. 94121
415-221-2195

MAR 1983

Dear Ken: (YOUNG)

Enclosed is a copy of the certificate of course certification for the 1982 San Francisco Marathon. The course was run as measured by Tom Knight and myself. I drove the lead pace car, Tom Knight ran the race, I had 8 cyclists spread through the lead open man to the first masters women. The course was also monitored by 378 people covering all turns and corners on the course, they had a total 772 barracades w/rope plus 550 cones to assist them in out and back sections of the course, as well as other potential trouble spots. From all reports gathered, all runners ran the measured course.

Scott indicated that you didn't have the distance between the start and the finish measured on a straight line. Unfortunately, it was 2.8 miles I tried for 2.62 but it was logistically unworkable.

I've also included a copy of the Ted Corbitt memo, which we discussed recently on the phone. Point number 4 in the memo is the point that concerned me the most. The .08% difference allowed between your two adjusted finish points is information critical to all course measurers, and hopefully you can insert this item in the next NRDC NEWSLETTER. Item 6 in this same memo seems to be in error, it's my understanding that the .00% error on a remeasurement was not to take effect until 1985 thus given Race Directors some grace period to bring all their courses up to scratch. This coupled with several statements made by David Katz in his recent article on course measurement in the

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The Road Race Management Newsletter [The IAAF accepting the TAC and NSC rules for course measurement, as well as the point about the acceptability of the bike measurement on a gravel surface]. point out again one of the major problems most certifiers have had in the past few years and that is having a central point of communication of the current acceptable methods for certification. Unfortunately, even with your efforts,this is not yet the case. We still get conflicting theories on accepted techniques from various people on the NSC [ie. Letson's ideas on using the bike on gravel vs. Katz's]. We also find out about changes in the NSC meausrement standards|rules by word of mouth [ie. the .08% allowable difference in two course rides before another ride must be made]. The only way to thourghly saturate the course certification world with these new rules and standards is through the NRDC NEWS, as you've suggested. Enough of this tirade, I'm sure you are only to well aware of the problems which can develope from conflicting ideas being published by various members of the NSC, as well as rule changes not receiving the widest possible distribution. On a more positive note: While there have been several minor points of error and disagreement in David Katz's articles, everyone on our committee extends their thanks to David and you for providing this much needed informational tool to the hundreds of course certifiers around the country who aren't plugged into the small course certification communications network, as we are. In all of our remeasurements of courses on the West Coast, the most glaring culprit has been lack of knowledge of current accepted measuring techniques

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Hence my sensitivity to these communications problems.

On to another topic; The Photo Verification of Finish Line Systems. Enclosed you'll find information on the Minolta X-700 camera and The Quartz Data Back system which attaches and produces the six digit time encoded on the film negative. Currently the Minolta system is the only one that produces the time in an hour/minute/second format with the race clock flexibilty to readjust the device to actual race time in the event the clock was not started at the starting line. I've included several examples,both original and photo copy, of what this device can do. I think it could have a great potential, both as a select timing device for finish line systems, and as a verification tool use to check the accuracy of a particular finish line system. As the lines between racing/racers on the track and those on the road continue to blurr, it seems one of the most important elements to continue this trend will be confidence of track and field officals in the accuracy of the road race course and its timing systems. I think we are making major strides in both these areas. To further facilitate confidence in these two areas with the track and field people it will probably become necessary to institute some form of Official supervision over major road race events (eg. TAC Officiating at major Track and Field Events). We have already unofficially instituted a policy in the Pacific Association of TAC to have members of the our certification committee ride and verify major races in our area to help confirm they were indeed run on the course certified. This independent official verification can be extended to the finish line

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895 34th Ave
SAN FRANCISCO, CA. 94121
415-221-2195

system through the use of the Minolta X-700 and it's Quartz Data Back system. I feel it could be feasible to institute these requirments on a limited basis initially, say at all TAC National Championship Events. You would receive a statement from the TAC Course Verification riders that they independently verified the course was run on the course as certified. You would also receive select photo's shot with the Minolta X-700 system by the independent TAC Finish Line Official which you would be able to then use in comparison to the finish results you received from that particular race. This duel verification system could go along way in helping to legitimize our sport in the eyes of the various skeptics (both Media and Track and Field) that our sport now has. Since the 1983 San Francisco Marathon is the National Open Mens TAC Championship, I'm sure Scott Thomason would be more than happy to serve as a test of this proposal, if you see any merit in it.

I've also enclosed a check for $15.00. It's payment for the booklet "CERTIFIED RACE COURSES 1983", the Jan. and Feb. issues of NRDC NEWS, and reimbursement for last weeks phone call.

It looks as if the Ave. of the Giants Marathon is not interested in remeasuring|recertifying their course. The PA/TAC/LDR Chairman John Mansoor has made repeted attempts to contact them, and they have not returned his calls. The Sacramento Marathon is being much more responsive and should comply with all your requests. If you could let Carl know the names of the races which have not responded to your letter we can put pressure on them locally. ----- THAT'S ENOUGH -------------. running out of paper.

Warmest Regards, Tom Benjamin

TAC USA

The Athletics Congress of the USA

No. 26

National Governing Body for Athletics in the United States

Please Reply To:
THE PACIFIC ASSOCIATION
P.O. Box 1495
Fair Oaks, California 95628
(916) 966-6185

The following is a list of some of the Nationally Certified Courses in the Pacific Association. As a service to the athletes in the Pacific Association, we will be periodically publishing courses that have been certified by the National Standards Committee in THE SCHEDULE. Please note that the lists are by no means complete, since we are constantly certifying new courses. If you do not see your course listed here, and you think it should be, please contact either the Certification Chair, Carl Wisser (415-549-3687) or Tom Benjamin (415-221-2195). Please also note the two symbols used on these lists: Number one is the ** symbol. This indicates that to our knowledge, this particular race is not currently being run, hence the course is <u>inactive</u>. Number two, is the ## symbol. This indicates that their has been a <u>change</u> in the Certified Race Route and the course, while still being run, has not been recertified. Finally, we would appreciate information on some of the race courses that were certified prior to 1982, most specifcally, wether or not the race is still being run on the same course as the one that was certified; or more generally, wether the race has been run on the same course year after year (This information is most crucial to the "upkeep" of certification due to race director changes, small course changes, etc. We would like to have this information included as part of the TAC sanctioning process).

NATIONALLY CERTIFIED COURSES..........AS OF 5/8/83

5 KILOMETER

CITY	RACE NAME	DATE CERTIFIED
Atherton	Sri Chinmoy	20 March 1982
Berkeley	Great Berkeley	11 Oct 1981
Palo Alto	Corporate Cup	18 July, 1980
San Fransico	Golden Gate Park	18 Nov 1982
San Fransico	Hook & Ladder SFPD	21 June 1981
San Fransico	Run to Home Plate	17 Aug 1981##
Oakland	Lake Merritt	2 Oct 1982
San Fransico	Over and Under	22 March 1983
San Fransico	Crystal Light	4 April 1983
San Bruno	S.F.I.A.-Hot Pursuit	5 April 1983
Modesto	YMCA of Stanislaus	18 May 1983

8 KILOMETER

Calistoga	Great Calistoga Race	23 June 1982
San Fransico	Chinatown YMCA	16 Jan 1982
Mt. View	Corporate Cup Road Test	3 March 1983

12 KILOMETER

San Fransico	Bay to Breakers	April 1983

15 KILOMETER

Berkeley	Great Berkeley	31 Oct 1982
Los Altos	PA-TAC Championship	13 June 1981
Los Gatos	Los Gatos	17 Feb 1975**
Oakland	Lake Merritt	2 Oct 1982
San Fransico	Bay Pacific	21 Mar 1982**
Santa Rosa	Heart of the Empire	10 July 1977
San Fransico	Avon	6 Mar 1983

20 KILOMETER

Oakland	Lake Meritt	2 Oct 1982
Santa Rosa	McCarthy Postal	29 Nov 1979
Sacramento	PA-TAC Championships	15 Jan 1982

25 KILOMETER

Guerneville	Fools Run	18 Feb 1978
Oakland	Lake Merritt	2 Oct 1982
San Fransico	TAC Championships	5 Jun 1983

50 KILOMETER

Oakland	Lake Merritt	2 Oct 1982
San Fransico	Challenge Cup	6 Nov 1982
San Mateo	West Valley TC Racewalk	1 Feb 1980

10 KILOMETER

CITY	RACE NAME	DATE
Alameda	Run for the Parks	June 1982
Atherton	SCRC	June 1982
Berkeley	Solomon Grundy	April 1981
Danville	Devil Mt. Run	April 1982
Foster City	Sri Chinmoy	June 1981
Grass Valley	Memorial Run	Feb 1980
Guernville	Watermelon Run	May 1979
Hayward	Run for the Health	May 1982
Kelseyville	Konocti Winery	Sep 1982
Kentfield	Pacific Sun	May 1982
Lakeport	Run for the Health	April 1981
Modesto	SOS Natural Light	Oct 1982
Modesto	Vicinty MJC W. Campus	Nov 1981
Modesto	YMCA of Stanislaus	May 1983
Oakland	Lake Merrit	Oct 1982
Palo Alto	Stanford	June 1982
Palo Alto	Streets of Palo Alto	March 1983
Pleasanton	Heritage Days	June 1981
San Fransico	Golden Gate Park	Nov 1982
San Fransico	Bonnie Bell 1981/82	Nov 1980**
San Fransico	Bonnie Bell 1983	Jan 1983
San Fransico	Christmas Charity Run	Dec 1982
San Fransico	St. Judes Hospital	June 1981
San Fransico	Hook & Ladder Run	June 1981
San Fransico	Big Heart Big Foot	July 1981
San Fransico	Over & Under	March 1983
San Jose	Center for Employment	Sep 1982
San Jose	Earthquake	Aug 1982
San Jose	San Jose Mercury News	March 1983
San Jose	Hyatt	Jan 1983
Santa Rosa	McCarthy Postal	Nov 1979
Santa Rosa	Spring Lake	July 1977
Santa Rosa	The Last 10K	Oct 1979
Stanford	The Great Race	Sep 1982
Stanford	Corporate Cup	July 1980
Woodside	Women's P.A.	Feb 1980

30 KILOMETER

Oakland	Lake Merritt	2 Oct 1982

100 KILOMETER

Oakland	Lake Merritt	2 Oct 1982

FORM 184-2 - DESIGNED FOR USE WITH COMPANION #771 DU-O-VUE® ENVELOPE
JETSETS – NEW ENGLAND BUSINESS SERVICE, INC., GROTON, MASS. 01450

NO. 27

CARL'S Handout

PA/TAC/LDR
CERTIFICATION COMMITTEE
2608 Ninth Street
BERKELEY, CA 94710

Carl Wisser, Chairman
(415) 549-3688

TO

DATE

SUBJECT

> This is your course measurement and certification "packet". It includes:

1. Suggested procedure sheet.
2. Course measurement diagram.
3. A sample application.
4. A sample map.
5. Application form.
6. Steel tape Method for measuring Calibration Courses.

You need to have:

1. Bicycle w/high pressure, quick release tires.
2. A Jones counter.
   For purchase: Write to ~~Clain Jones, 3717 Wildwood Dr., Endwell,~~ N.Y. ~~13760~~ ~~$17.00~~ postage paid
   -or-
   For loan: This office has a few available for loan.
3. ~~Dedication~~.

If you have any questions, please call me at the above number. Please include a $10.00 check with your application made payable to ~~Carl Wisser~~ PA/TAC/LDR.

SIGNED

☐ PLEASE REPLY ☐ NO REPLY NECESSARY

... average and then ... with the preliminary constant. This will give you your day's average digits per mile. (From which you will make your final adjustment-Item 17.) You must recalibrate on the same day as you measured the course. Check tire firmness from time to time*
*Do not alter your tire pressure.

8. Please use the enclosed "sample" application and map as your guide for filling out the application and for drawing a map which clearly depicts the running course. Neatness counts..Be complete.

If you have any questions contact any of the certifiers on the back of your application.

PA/TAC/LDR
CERTIFICATION COMMITTEE

2608 Ninth Street
Berkeley, California 94710

SUGGESTED COURSE MEASUREMENT PROCEDURES

1. Schedule course measurement at time of minimum vehicular activity.
2. Make sure your tires have good air pressure.
3. Calibrate your Jones Counter at a local certified half mile, one mile or kilometer calibration course.* Record date, time of day and temperature. Ride the course four (4) times. This gives you a preliminary constant in digits per mile. (Approximately 15,000 digits/mile.) *Course <u>must</u> have a certificate & registry number.
4. Before measuring the race course in question, be sure you are very familiar with the entire route. This means that you must know exactly where the runners can (and will) legally run-be it with traffic, 1 lane, 2 lanes, the whole street? Which side of the traffic islands? Across the vacant lot? etc. etc. Leave no route detail to chance!
5. At the course start, record your Jones Counter starting digits and with a calculator work out the various mileage counts using your preliminary constant. <u>Carefully ride the course in as short a manner as is possible</u>. Cut every corner to within 12" of the curb and where legally possible, ride a straight line when the street curves across your path-see accompanying diagram. <u>This is the most important step in the application process</u>.
6. After recording date, time of day and temperature, ride the course twice, being careful to record the differing ride results-both in your notebook and on pavement with spray can or crayon. It's a good idea to mark your mile markers at the same time (record their exact location-"10' south of light pole No. 1362 on Elm Street"). A good idea is to ride the course only once but with a partner* You catch each others mistakes and generally perform to a higher standard. *Partner with Jones Counter
7. Return to the calibration course, record date and time of day and recalibrate by riding the course twice. Obtain an average and then average it in with the preliminary constant. This will give you your day's average digits per mile. (From which you will make your final adjustment-Item 17.) You must recalibrate on the same day as you measured the course. Check tire firmness from time to time* *Do not alter your tire pressure.
8. Please use the enclosed "sample" application and map as your guide for filling out the application and for drawing a map which clearly depicts the running course. Neatness counts..Be complete.

If you have any questions contact any of the certifiers on the back of your application.

APPLICATION FOR CERTIFICATION OF ACCURACY

Name of course: ______________________________ Date: __________

Location (place, city, state): ______________________________

Measuring method used: Bicycle? Walking wheel? Steel tape? Electronic meter?

Describe the measuring device (make, model, dimensions, etc.):

Who was responsible for measuring the course?

Name: Address:

Who will be responsible for locating the start/finish points, marking the course, measuring future changes and reporting them to the National Standards Committee:

Name: Address:

DESCRIPTION OF THE COURSE

1. Is the course flat? rolling? hilly? mountainous? uphill? downhill?
   Elevation (feet above sea level): START______ Highest______ Lowest______ FINISH______
2. How much of the course is paved?________ grass?________ dirt?________
3. Straight-line distance between the START and FINISH:__________________
4. Describe exactly where the START, FINISH, TURNAROUND, and MILE/KM points are located with reference to unique permanent landmarks (e.g. 17 yds W of 934 Beach St. mailbox):
5. Submit a complete, detailed map of the course with names of all streets/trails, showing all dirt/grass stretches, and including a north arrow. Indicate which side/half of each road was measured, and how all turns were taken. Use additional sketches or writeups to clearly communicate the running/measured route.

COMPARISONS WITH A KNOWN STANDARD DISTANCE. Certification requires two comparisons of each measuring device with a known standard distance. If steel tape is used, the standard must have been created with utmost accuracy by other survey instruments. If a wheel is used, the standard must have been created via steel tape or electronic meter, and must be at least 880 yards long on a straight, flat, paved surface.

6. Describe the known standard distance:
   Name: ______________________________
   Location: ______________________________
   Length: ______________________________
   How measured: ______________________________
   Certified? ______________________________

   > If the known standard distance is not certified, apply now by answering all appropriate questions on another APPLICATION FOR CERTIFICATION OF ACCURACY for the known standard distance.

7. Describe how each measuring device was compared with the known standard distance. List the date, time, and raw data for each comparison:

8. If steel tape or walking wheel was compared, what is the average correction factor?

9. If a bicycle was compared, what is the average digits/mile for all of the comparisons for each person for each day:

Date:__________ Name:________________ Average digits/mile:____________________

Date:__________ Name:________________ Average digits/mile:____________________

COURSE MEASUREMENTS. Certification requires two measurements. If a bicycle is used, the known standard distance and the race course must both be ridden during the same day by the same person for each measurement (comparisons from a previous day are not acceptable).

10. Was the measuring route identical to the shortest route that can be permitted to be run by the winner of the race?

11. Were all left/right turns measured to within one yard of the inside edge of all turns? If not, explain.

12. If part of the race course is on dirt or grass, how were these stretches measured?

14. If steel tape was used, answer the following questions:

a. How many people were in the survey party? List their specific duties:

b. How was the tape tension maintained during measuring?

c. How was the tape increments count maintained?

d. How were the curves measured?

15. If a bicycle was used, answer the following questions:

a. Was the bicycle ridden over the known standard distance and over the race course both during the same day by the same person for each measuring occasion?

b. Was the known standard distance compared before and after measuring the race course? If not, explain.

16. List the date, time, and raw data for each measurement of the course:

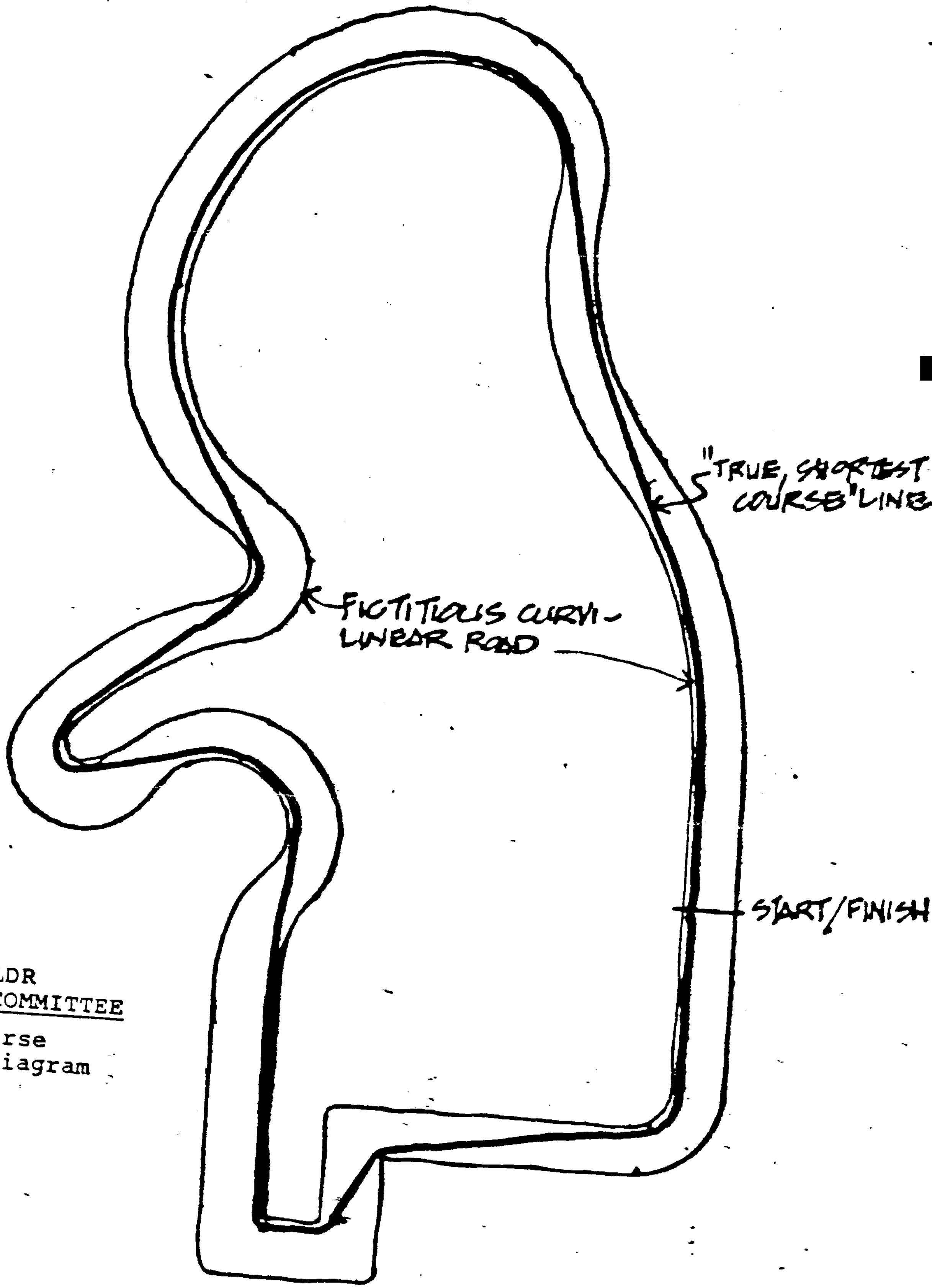
17. Describe any adjustments (calculations, measurements) made to create an exact length

18. What is the average length of the final course?

19. What is the difference between all of the measurements?

RETURN THIS FORM WITH ALL QUESTIONS ANSWERED TO ONE OF THE FOLLOWING PA-TAC CERTIFIERS:

Tom Benjamin:	P.O. Box 8715, San Francisco, CA 94128 221-2195
Ron Grayson:	2510 Greer St., Palo Alto, CA 94303 856-3743 Work/Home
Dick Hughes:	3462 Laurel Ave., Oakland, CA 94602 482-5212 Home 763-0500 Work
Carl Wisser:	2608 Ninth St., Berkeley, CA 94710 549-3687
John Mansoor:	10513 Fair Oaks Blvd. Apt. J, Fair Oaks, CA 95628 (916)-966-6185
Tom Knight:	724 Arastradero Rd., #107, Palo Alto, CA 94306 856-3349 854-3300 X2065
Pete Shandera:	40 Sante Fe, Pt. Richmond, CA 94801 234-8322 Home 845-5200 X234 Work



PA/TAC/LDR
CERTIFICATION COMMITTEE

Proper Course
Measurement Diagram

ALAMEDA RUN FOR THE PARKS

South Shore Center Island City Runners

SAMPLE SAMPLE

First Annual

ALAMEDA RUN FOR THE PARKS 10K

START Northerly* edge of crosswalk on Shore Line Drive at Movie/Shopping Center entry road. (*Leading edge going north on Shore Line)

1 MILE 100' short of Fairhaven on Shore Line.

2 MILE On Otis Drive 15' short of light post number 1250, north of Grand.

3 MILE East West Shopping Center Road crosswalk west of Market.

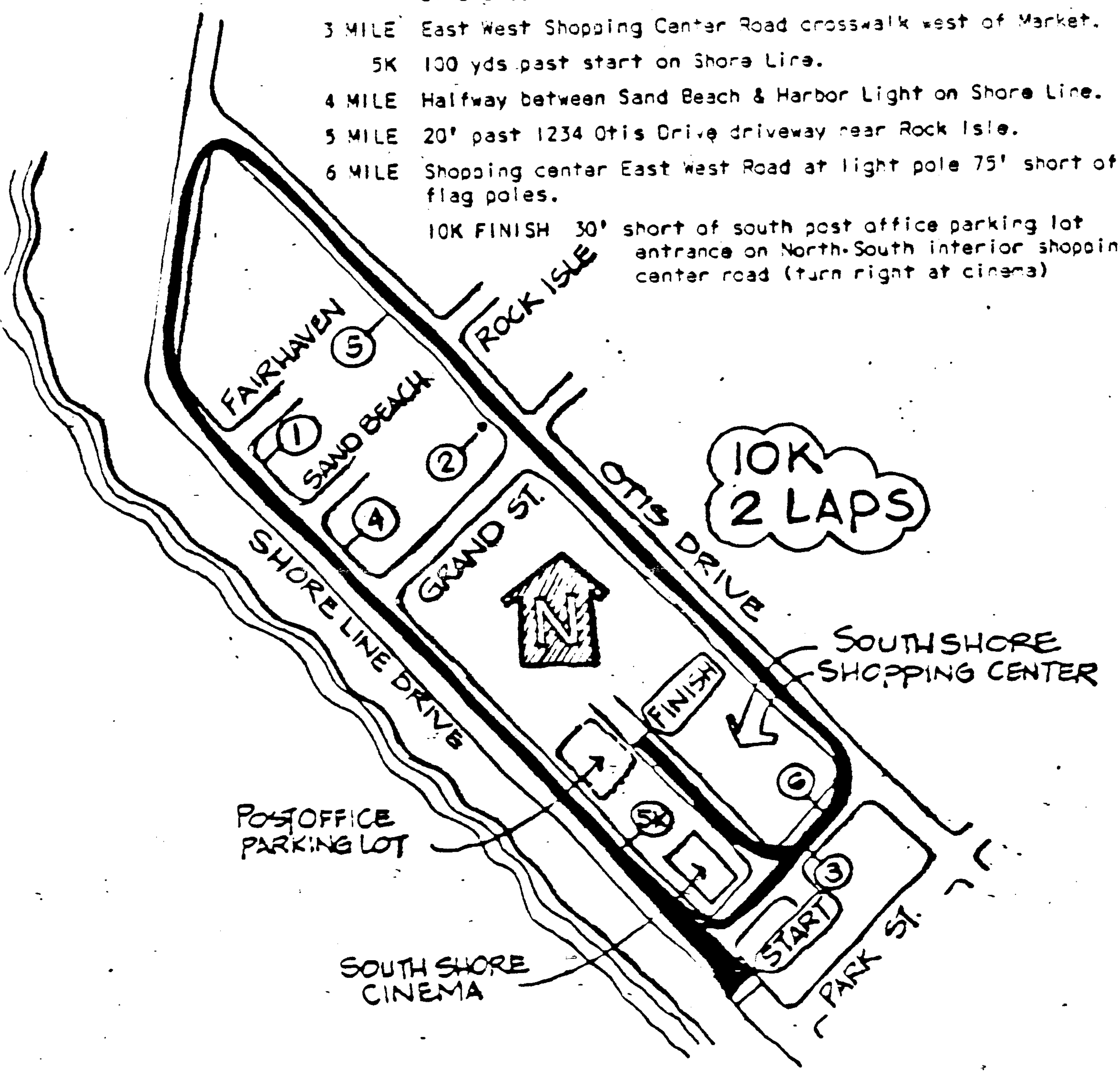
5K 100 yds past start on Shore Line.

4 MILE Halfway between Sand Beach & Harbor Light on Shore Line.

5 MILE 20' past 1234 Otis Drive driveway near Rock Isle.

6 MILE Shopping center East West Road at light pole 75' short of flag poles.

10K FINISH 30' short of south post office parking lot entrance on North-South interior shopping center road (turn right at cinema)



APPLICATION FOR CERTIFICATION OF ACCURACY

Name of course: "ALAMEDA RUN FOR THE PARKS" Date: 6/26/82

Location (place, city, state): SOUTH SHORE SHOPPING CENTER, ALAMEDA, CA.

Measuring method used: Bicycle? Walking wheel? Steel tape? Electronic meter?

Describe the measuring device (make, model, dimensions, etc.):
JONES COUNTER

Who was responsible for measuring the course? CARL WISSER
BICK HUGHES

Name: Address:

Who will be responsible for locating the start/finish points, marking the course, measuring future changes and reporting them to the National Standards Committee:

Name: CARL WISSER Address:

DESCRIPTION OF THE COURSE

1. Is the course flat? rolling? hilly? mountainous? uphill? downhill?
   Elevation (feet above sea level): START 15' Highest ____ Lowest ____ FINISH 15'
2. How much of the course is paved? 100% grass? ____ dirt? ____
3. Straight-line distance between the START and FINISH: 750' ±
4. Describe exactly where the START, FINISH, TURNAROUND, and MILE/KM points are located with reference to unique permanent landmarks (e.g. 17 yds W of 334 Beach St. mailbox):
   PLEASE SEE MAP
5. Submit a complete, detailed map of the course with names of all streets/trails, showing all dirt/grass stretches, and including a north arrow. Indicate which side/half of each road was measured, and how all turns were taken. Use additional sketches or writeups to clearly communicate the running/measured route.

COMPARISONS WITH A KNOWN STANDARD DISTANCE. Certification requires two comparisons of each measuring device with a known standard distance. If steel tape is used, the standard must have been created with utmost accuracy by other survey instruments. If a wheel is used, the standard must have been created via steel tape or electronic meter, and must be at least 440 yards long on a straight, flat, paved surface.

6. Describe the known standard distance:
   Name: "EDGEWATER HALF MILE" & "EASTBAY MILE"
   Location: EDGEWATER DRIVE OAKLAND CA
   Length: ½ MILE & 1 MILE
   How measured:
   Certified? YES PSA 8256 (HALFMILE) PSA 8207 (MILE)

> If the known standard distance is not certified, apply now by answering all appropriate questions on another APPLICATION FOR CERTIFICATION OF ACCURACY for the known standard distance.

7. Describe how each measuring device was compared with the known standard distance. List the date, time, and raw data for each comparison:

Carl Wisser 6/26/82 7:25 A.M. Mild

"EASTBAY MILE"

1. B. 26612 / A. 11209 > 15403
2. B. 42013 / A. 26612 > 15401
3. B. 57413 / A. 42013 > 15400

"EDGEWATER HALFMILE"

4. B. 80699 / A. 73000 > 15398
   B. 88399 / A. 80699 > 15400

15400

RECALIBRATION

6/26/82 11:15 A.M. WARM

HALFMILE

B. 98593 / A. 90900 > 15386
B. 106295 / A. 98600 > 15390
> 15388

15394

Dick Hughes

"EASTBAY MILE"

1. B. 44345 / A. 29200 > 15145

"EDGEWATER HALFMILE"

2. B. 52073 / A. 44500 > 15146
3. B. 59772 / A. 52200 > 15144

15145

RECALIBRATION

6/26/82 11:15 A.M.

B. 72168 / A. 64600 > 15136
B. 64562 / A. 57000 > 15124
> 15130

15137.5

8. If steel tape or walking wheel was compared, what is the average correction factor?

9. If a bicycle was compared, what is the average digits/mile for all of the comparisons for each person for each day:

Date: 6/26/82 Name: C. WISSER Average digits/mile: 15394.0

Date: 6/26/82 Name: D. HUGHES Average digits/mile: 15137.5

COURSE MEASUREMENTS. Certification requires two measurements. If a bicycle is used, the known standard distance and the race course must both be ridden during the same day by the same person for each measurement. (comparisons from a previous day are not acceptable).

10. Was the measuring route identical to the shortest route that can be permitted to be run by the winner of the race? YES

11. Were all left/right turns measured to within one yard of the inside edge of all turns? If not, explain. YES

N/A 12. If part of the race course is on dirt or grass, how were these stretches measured?

N/A 14. If steel tape was used, answer the following questions:

a. How many people were in the survey party? List their specific duties:

b. How was the tape tension maintained during measuring?

c. How was the tape increments count maintained?

d. How were the curves measured?

15. If a bicycle was used, answer the following questions:

a. Was the bicycle ridden over the known standard distance and over the race course both during the same day by the same person for each measuring occasion? YES

b. Was the known standard distance compared before and after measuring the race course? If not, explain. YES

16. List the date, time, and raw data for each measurement of the course:

	CARL WISSER	DICK HUGHES
START	90,000 + 15400	60,000 + 15145
1 MILE	105400	75145
2 MILE	120800	90290
3 MILE	136200	105435
5K MILE	137855	
4 MILE	151600	120580
5 MILE	167000	135725
6 MILE	182400	150870
10K FINISH	185691	154107

Wisser Distance Calculations
6-mile mark to finish: 15400 x .213711 = 3291 digi
182400 + 3291 = 185691
total distance: 15400 x 6.213711 + 90,000 = 185691

Hughes total distance calculation:
15145 x 6.213711 + 60,000 = 154107 digits

ADJUSTMENTS

A. 6.213711 x 15400 = 95691
B. 6.213711 x 15394 = -95654
37 digits
37 ÷ 15394 x 5280 = 12.7'

A. 6.213711 x 15145 = 94107
B. 6.213711 x 15137.5 = -94060
47
47 ÷ 15137.5 x 52 80 = 16.4'

Course will be long by 14.

17. Describe any adjustments (calculations, measurements) made to create an exact length:

18. What is the average length of the final course? 10K + 15ft.

19. What is the difference between all of the measurements? 3.7 FT.

RETURN THIS FORM WITH ALL QUESTIONS ANSWERED TO ONE OF THE FOLLOWING PA-TAC CERTIFIERS:

Tom Benjamin; PO Box 8715, San Francisco, CA 94128. 221-2195
Ron Grayson; 2510 Greer St., Palo Alto, CA 94303 835-3743 Home/Work
Dick Hughes; 3462 Laurel Ave., Oakland, CA 94602 482-5212 (home) 763-0500
Peter Shandera; 7849 Greenly Drive, Oakland, CA 94605 845-5200 x234 636-0981
Carl Wisser; 2608 Ninth Street, Berkeley, CA 94710 549-3687
John Mansoor; 10513 Fair Oaks Blvd. Apt. J, Fair Oaks, CA 95628 (916) 966-6185

If the walking wheel has a pneumatic tire, it may be necessary to reverify the wheel (compare it to the 880 yard course) every time it is used for measuring. Reverification of a pneumatic walking wheel is unnecessary only if a very accurate pressure gage is used to insure that the tire has exactly the same pressure it contained when it was verified.

Verification results in a "digits/mile" similar to the Bicycle Method. For example, if a Rolatape which was precalibrated in feet is verified, it may result in a number like "5273.5" feet/mile. This is the same as 5273.5 digits/mile.

If dirt or grass is measured using a paved digits/mile, this results in a slightly longer race course. This may be corrected by computing the digits/mile for dirt/grass, which can be accomplished by locating a length of dirt/grass adjacent to a paved surface, then rolling the wheel over the exact same length on each surface to determine the ratio, then using this ratio and the paved digits/mile to compute the dirt/grass digits/mile. These numbers should be saved as a permanent record for the wheel, to be used for future use. Ideally, the walking wheel will have verified digits/mile for paved, dirt and grass surfaces, and can be used as follows:

1. Compute: Calculate the counter readings required to locate the START, FINISH, and intermediate points. Write these calculated counter readings on a piece of paper and tape it to the walking wheel.
2. Measure: Roll the walking wheel over the race course, stopping at each precalculated counter reading to record the location on paper. (Avoid spray paint. Try to write the description on paper, with reference to the exact number of yards from unique permanent landmarks such as a mailbox or telephone pole.) If dirt/grass are measured, make compensations based upon the digits/mile for these surfaces.

Walking wheel measurements require more time than the Bicycle Method, but they also may not require recalibrating. Walking wheels can fit comfortably into most automobiles (unlike bicycles), but they also have greater difficulty in taking bee-lines (diagnols) accross busy streets and intersections.

Steel Tape Method

This method employs the following equipment:

1. A surveyor's steel tape
2. Force gage and thermometer
3. Masking tape and ball point pen

The surveyor's steel tape should have been previously verified by comparison with an ultra-accurate known standard distance.

Masking tape is stuck onto the pavement and the ball point pen is used to make a fine line to mark the measured point. The force gage is used to maintain the appropriate tension during measuring. The thermometer is used to record the temperature of the tape so that an adjustment can be calculated for thermal expansion/contraction. Most steel tapes have a thermal expansion coefficient of .0000065/1°F, and equal 100.000 feet at 70°F. This equates to .17 foot extra for 880 yards at 80°F (+10°F). Three people make the work easy: trailing end, leading end, recorder.

A sequence number should be written on each measuring point (on the masking tape) to insure that every interval is accounted for. And it is advisable to measure in the opposite direction for the second measurement.

Steel tape measurements are very useful for establishing 880 yard calibration courses, and are required for certifying 440 yard and 400 meter tracks. Steel tape is also useful for measuring dirt/grass/sand where they exist in a race course.

Electronic Meter Method

This method employs the following equipment:

1. An electronic distance meter that is precalibrated and verified by comparison with an ultra-accurate known standard distance.
2. Pencil, paper, and calculator.

An experienced operator is required to use an electronic distance meter. This device is capable of achieving an accuracy of within one inch per mile for straight line-of-sight measurements, but is incapable of measuring the type of non-linear curves/turns that most runners take during a typical road race. Electronic meters are therefore a valuable tool for establishing 880 yard road calibration courses, but have proven to be more trouble than they are worth for measuring road race courses. The major problem associated with road race measurements is reporting all of the measuring data, and spending many hours/days doing what could be accomplished with more accuracy via the Bicycle Method. This method is therefore ill advised for race courses, but is highly recommended for establishing 880 yard calibration courses.

SAMPLE

The Athletics Congress of the USA

Pacific Southwest Association Inc.

San Diego and Imperial Counties, California
1135 Garnet St.
San Diego, California 92109
(714) 275-1292

Certification

(ANY MULTIPLE OF 5 KM)

NAME OF COURSE: LAKE MERRITT 5, 10, 15, 20, 25, 30, 50, 100 KM

TYPE: [X] road race [ ] cross-country [ ] calibration [ ] track

LOCATION: LAKE MERRITT, OAKLAND, CA

TERRAIN: paved 100 % dirt ___ % grass ___ %

[X] flat [ ] rolling [ ] hilly

STRAIGHT-LINE DISTANCE BETWEEN START AND FINISH: 26 FEET PER 5KM

ALTITUDE: (feet above sea level) START: ___ FINISH: ___ HIGHEST: ___ LOWEST: ___

MEASURED BY (name, address, phone): CARL WISSER & PETE SHONDERA
WISSER: 2608 NINTH ST, BERKELEY, CA 94710 (415) 549-3687

MEASURING METHOD: [X] bicycle [ ] walking wheel [ ] steel tape [ ] electronic meter

NUMBER OF MEASUREMENTS OF THE ENTIRE COURSE: 6

DATES WHEN COURSE WAS MEASURED: 30 JANUARY '82

EXACT AVERAGE MEASURED LENGTH OF THE COURSE: 4993 METERS PER LAP*

DISTANCE BETWEEN THE SHORTEST AND LONGEST MEASUREMENTS: 2 METERS

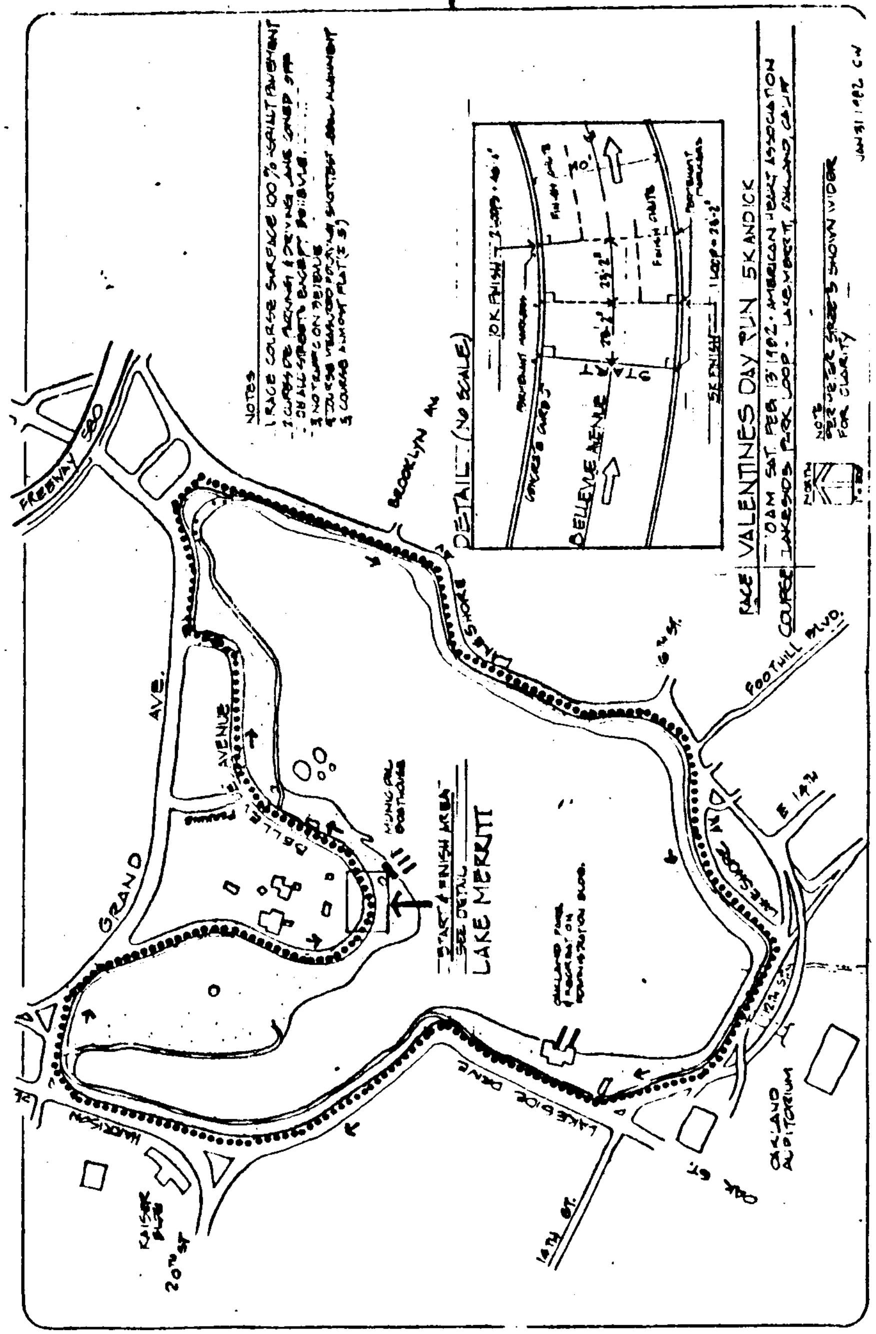
CERTIFICATION CODE: PSA- 8208

*INSIDE LANE ONLY, WITH CARS PARKED NEXT TO CURB

The course described above and defined by the attached map is hereby certified to fulfill national standards for accurate measurement. A copy of this letter and map should accompany race results mailed to the National Running Data Center, PO Box 42888, Tucson, AZ 85733.

Robert A. Letson — February 11 1982
Association Certifier, Bob Letson — Assoc. Cert. date
4369 Hamilton St. #4; San Diego, CA 92104

Ted Corbitt — February 16, 1982
National Certifier, Ted Corbitt — National Cert. date
Apt 8H Sect 4; 150 W 225 St; NY, NY 10463



APPLICATION FOR CERTIFICATION OF ACCURACY

Name of course: LAKESIDE PARK LOOP Date: FEB. 1 1982
City and state: LAKE MERRITT OAKLAND CALIFORNIA
RACE ~~Sponsor~~: "VALENTINES DAY RUN" 5K & 10K 10AM 2/13/82 AMERICAN HEART ASSOCIATION
What type of measuring methods were used?
Bicycle Method? Walking Wheel? Steel Tape? Electronic Meter?
Describe each measuring device (make, model, dimensions, etc.):
JONES COUNTER
Who was responsible for measuring the course?
Name: CARL WISSER Address: 2008 9TH ST. BERKELEY, CA. 94710 (415) 549-3687
Who will be responsible for locating the start/finish points, marking the course, measuring future changes, and reporting future changes to the National Standards Committee:
Name: CARL WISSER Address:

DESCRIPTION OF THE COURSE

1. What is the advertised length of the race course: 5K
2. Is the course flat, rolling, hilly, very hilly, up or down? ± 6'
   Submit an elevation profile if possible.
3. How much of the course is paved? 100% grass? dirt?
4. Describe exactly where the START, FINISH, and ~~TURNAROUND points~~ (SEE MAP) are located with reference to unique permanent landmarks. Draw maps/diagrams if necessary.
   START = ANYWHERE
   5KM = START + 23 FEET
   x·5KM = START + 23x FEET
5. List the names of all streets/trails from start to finish, indicating all left/right turns and which side/half of each road is used. SEE MAP
6. Submit a complete, detailed map of the course with all names, showing all dirt/grass stretches, and including a north arrow.

COMPARISONS WITH A KNOWN STANDARD DISTANCE. Certification requires two comparisons of each measuring device with a known standard distance. If steel tape is used, the standard must have been measured with utmost accuracy by other survey tapes. If a wheel is used, the standard must have been certified via steel tape or electronic meter and must be at least 880 yards long on a straight, flat, paved surface.

7. Describe the known standard distance:
   Name: "EAST BAY MILE"
   Location: EDGEWATER DRIVE OAKLAND CA.
   Length: ONE (1) MILE
   How measured: WYKE TAPING & ELECTRONIC MEASURING DEVICE
   Certified? SEE LETTER & DIAGRAM —YES—

If the known standard distance is not certified, apply now by answering all appropriate questions on another APPLICATION FOR CERTIFICATION OF ACCURACY for the known standard distance.

8. Describe how each measuring device was compared with the known standard distance. List the date, time, and raw data for each comparison.

30 JAN '82 SHONDERA

	SHONDERA		WISSER	
8:15AM 53°F	108016 - 93000 = 15016	15016	20414 - 04851 = ~~15563~~	15551
	23018 - 08000 = 15018		35965 - 20414 = 15551	
	38015 - 23000 = 15015		51517 - 35966 = 15551	
	53015 - 38000 = 15015		67068 - 51517 = 15551	
11 AM	56603 - 41600 = 15003	15000	78376 - 62835 = 15541	15542
	71612 - 56615 = 14997		93919 - 78376 = 15543	
	AVG. = 15008/MILE		AVG. = 15546.5/MILE	

9. If steel tape or walking wheel was compared, what is the average correction factor?
10. If the bicycle method was used, what were the average digits/mile for the first measurement: for the second measurement
    SHONDERA = 15008/MILE
    WISSER = 15546.5/MILE } 30 JAN 82

COURSE MEASUREMENTS. Certification requires two measurements of the road course. If the bicycle method is used, the known standard distance and the race course must be ridden all during the same day by the same person for each measurement.

11. Was the measuring route identical to the shortest route most likely to be run by the winner of the race? TO THE BEST OF OUR ABILITY
12. Were all left/right turns measured to within one yard of the inside edge of curve? If not, explain. YES ON THE OUTSIDE CURVES BUT TRAFFIC WAS A PROBLEM ON THE INSIDE CURVES - WE ~~HAD~~ WILL COMB ACCORDINGLY
14. If part of the race course is on dirt or grass, how were these nonpaved stretches measured? N/A
15. If steel tape was used, answer the following questions:
    a. How many people were in the survey party? What were their specific duties? N/A
    b. How was the tape tension maintained during measuring? N/A
    c. How was the tape increments count maintained? N/A
    d. How were the curves measured? N/A
16. If the bicycle method was used, answer the following questions:
    a. Was the bicycle ridden over the known standard distance and over the race course all during the same day by the same person for each measuring occasion? YES
    b. Was the known standard distance compared before and after measuring the race course? YES If not, explain.
17. List the date, time, and raw data for each measurement of the road course.
    30 JAN '82 53°F 9-10 AM (MEASURE LENGTH OF ONE LOOP AROUND LAKE MERRITT ON ROAD —INSIDE LANE ONLY—

SHONDERA	WISSER
101554 - 55000 = 46554	117289 - 69069 = 48220
48112 - 01554 = 46558	65537 - 17289 = 48248
94660 - 48112 = 46548	114160 - 65900 = 48260
AVG. = 46553	AVG. = 48243
(4992 M)	(4994 M)

18. Describe any adjustments (calculations, measurements) made to create an exact distance:
19. What is the average corrected distance of the road course? 4993 M PER LAP AVERAGE
20. What is the difference between all of the measurements? 4 METERS BIKE #1

1. 3.101946 1¼"
2. 3.102212
3. 3.101546 3½'

BIKE #2

1. 3.101563 9½'
2. 3.103363
3. 3.104136 4'

RETURN THIS FORM WITH ALL QUESTIONS ANSWERED TO THE REGIONAL CERTIFIER IN YOUR AREA:

CT,ME,MA,NH,NY,RI,VT - Allan Steinfeld; Box 881, FDR Sta; NY, NY 10022
IL,IN,MI,NJ,OH,PA,WI - David Katz; Box 822; Port Washington, NY 11050
DE,DC,MD,VA,WV - A. J. Vander Waal; 75 E Wayne Av 310; Silver Springs, MD 20901
AZ and southern CA - Bob Letson; 4369 Hamilton St #4; San Diego, CA 92104
all others - Ted Corbitt; Apt. 8H Sect. 4; 150 W 225 St; NY, NY 10463

The Athletics Congress of the USA

PA/TAC/LDR
CERTIFICATION COMMITTEE
2608 Ninth Street
BERKELEY, CA 94710

(415) 549-3688

No. 28 Certification

NAME OF COURSE: ______________________

TYPE: ☐ road race ☐ cross-country ☐ calibration ☐ track

LOCATION: ______________________

TERRAIN: paved ______ % dirt ______ % grass ______ %

☐ flat ☐ rolling ☐ hilly

STRAIGHT-LINE DISTANCE BETWEEN START AND FINISH: ______________

ALTITUDE: (feet above sea level) START: ______________ HIGHEST: ______________
FINISH: ______________ LOWEST: ______________

MEASURED BY (name, address, phone): ______________________

____

MEASURING METHOD: ☐ bicycle ☐ walking wheel
☐ steel tape ☐ electronic meter

NUMBER OF MEASUREMENTS OF THE ENTIRE COURSE: ______________

DATES WHEN COURSE WAS MEASURED: ______________

EXACT AVERAGE MEASURED LENGTH OF THE COURSE: ______________

DISTANCE BETWEEN THE SHORTEST AND LONGEST MEASUREMENTS: ______________

CERTIFICATION CODE: PA- ______________

The course described above and defined by the attached map is hereby certified to fulfill national standards for accurate measurement. A copy of this letter and map should accompany race results mailed to the National Running Data Center, PO Box 42888, Tucson, AZ 85733.

______________________ ______________
Association Certifier, Tom Benjamin — Assoc. Cert. date
P.O. Box 8715, San Francisco, CA 94128

______________________ ______________
Association Certification Chairman — Assoc. Cert. date
Carl Wisser, 2608 9th St., Berkeley, CA 94710

______________________ ______________
National Certifier, Ted Corbitt — National Cert. date
150 W. 225th St., Sect. 4, Apt 8H, NY,NY 10463

THE ATHLETICS CONGRESS TAC USA

APPLICATION FOR CERTIFICATION OF ACCURACY

Name of course/ race ______________________ Date course measured __________

Lo' :on (place, city, state): ______________________ Date of race __________

Measuring method used: Bicycle? Walking Wheel? Steel Tape? Electronic Meter?

Describe the measuring device (make, model, dimensions, etc.): __________

Who was responsible for measuring the course?--NAME(S): __________

ADDRESS(S): ______________________ PHONE(S): __________

Who will be responsible for locating the Start/Finish points, marking the course, measuring future changes and reporting them to the Road Running Technical Committee/Certification Sub-Committee:

NAME: __________ ADDRESS: __________ PHONE: __________

DESCRIPTION OF THE COURSE

1. Is the course Flat? Rolling? Hilly? Mountainous? Uphill? Downhill?
   Elevation (feet above sea level): Start______ Highest______ Lowest ______ Finish ______
2. How much of the course is: Paved?________ Grass? ________ Dirt? ________ Other? ________
3. Straight-line distance between the Start and Finish: __________
4. Submit a complete, detailed MAP of the course indicating the START/FINISH/TURNAROUND points from from a fixed object (e.g. Start Line is 17 yards W. of 934 Beach St. mailbox):Then list all the Streets/Trails, in order that they will be run (see example map),showing all dirt/grass stretches and including a North arrow. Indicate how each one of these Street/Trail segments was measured, (Beach St. use the shortest possible route using the whole road-SPR-WR).(Jefferson St. measured to the centerline only, which will be coned and monitored to keep runners from crossing line). Also indicate how all turns were measured. (e.g. all turns measured 12"from curbs and 8"from uncurbed areas). Use additional sketches or writeups to clearly communicate the running/measured route, so that someone unfamiliar with your course would be able to do an accurate remeasurement if the need arouse. (see example MAP to help explain what we need, this map need not be to scale).

6./7.Describe known standard distance. Then describe how each measuring device was calibrated and recalibrated using the known standard distance. Listing date, time, temperature, and raw data for each.

Name of Certifier:

Calibration Course:	Name: Certified?	Distance: How?	
Date:	Temp:	Time:	Wx:
Calibration Rides	Start	Finish	Difference (x2 for Mile)
Ride 1.			
Ride 2.			
Ride 3.			
Ride 4.			
Avg. of 4 Rides or Riding Constant			
Avg. of 4 Rides Adding .1%			
Recalibration Rides	Temp:	Time:	Wx:
Ride No.	Start	Finish	Difference (x2 for Mile)
Ride 1.			
Ride 2.			
Ride 3.			
Ride 4.			
Avg. of 2/4 Rides Recal. Constant			
Avg. of 2/4 Rides Adding .1%			
Constant for Day (Avg. of Riding & Recal.)			
Equals ________ .Adding .1%			
Correction Factor(Dif. btwn.Riding & Days Avg = ______ Counts per Mile| Ft./Yd./Meter			

Name of Certifier:

Calibration Course:	Name: Certified?	Distance: How?	
Date:	Temp:	Time:	Wx:
Calibration Rides	Start	Finish	Difference (x2 for Mile)
Ride 1.			
Ride 2.			
Ride 3.			
Ride 4.			
Avg. of 4 Rides or Riding Constant			
Avg. of 4 Rides Adding .1%			
Recalibration Rides	Temp:	Time:	Wx:
Ride No.	Start	Finish	Difference (x2 for Mile)
Ride 1.			
Ride 2.			
Ride 3.			
Ride 4.			
Avg. of 2/4 Rides Recal. Constant			
Avg. of 2/4 Rides Adding .1%			
Constant for Day (Avg. of Riding & Recal.)			
Equals ________ .Adding .1%			
Correction Factor(Dif. btwn.Riding & Days Avg = ______ Counts per Mile| Ft./Yd./Meter			

6. If steel tape or walking wheel was compared, what is the average correction factor?

7. If a bicycle was compared, what is the average counts/mile for all of the comparisons for each person for each day:

Date:__________ Name:____________________ Average counts/Mile:______________

Date:__________ Name:____________________ Average counts/Mile:______________

COURSE MEASUREMENTS. Certification requires TWO measurements. If a bicycle is used, the known standard distance and the race course must both be ridden during the SAME DAY by the SAME person for each measurement. Your bike must also be recalibrated the same day. (comparisons from a previous day are not acceptable).

8. Was the measuring route identical to the shortest possible route (SPR) that can be permitted to be run by the winner of the race?______________

9. Were all left/right turns measured to within 12" inches of the inside edge of all turns?________ If not, explain.______________

10. If part of the race course is on dirt or grass, how were these stretches measured?______________

11. If steel tape was used, answer the following questions:

a) How many people were in the survey party?_______ List their specific duties:__________

b) How was the tape tension maintained during measuring? ______________

c) How was each segment of the tape measuring process marked and done?______________

d) How were the curves measured?______________

12. If a bicycle was used, answer the following questions:

a) Was the bike ridden over the known standard distance before and after the actual course measurement, as well as the course measurement itself on the same day by the same person for each measuring occasion? ______________

13. List the date, time, and raw data for each measurement of the course or at least the best two.

MEASUREMENT DATA: Desired Distance of Course_______ Riding Constant used incl. .1% add on factor. Ride #1 __________ Ride #2 __________

TIME STARTED______ TIME FINISHED______ TEMP. Start______ Finish______ WX______________.

Start/Finish Mile/Km/Turn Points	Name: Ride #1	Name: Ride #2	LOCATION FROM A FIXED POINT

TOTAL COUNTS-__________ __________

DIF. BETWEEN THE TWO RIDES-__________ __________

Dif. in counts between Riding Constant and Constant for D.

RIDE # 1______. RIDE # 2______. Total Course length must then be adjusted ahead/back ______Counts Ride #1. ______Counts Ride #2.

LONGEST ADJUSTED RIDE WAS ______________ by __________ FT/YD/M.

THE DIFFERENCE BETWEEN YOUR TWO LONGEST ADJUSTED RIDES .__________ FT/YD/M.

17. Describe any adjustments made to create your exact course length.______________

MEASUREMENT DATA: Desired Distance of Course ______ Riding Constant used incl. .1% add on factor.

Ride #1 ______

TIME STARTED ______ TIME FINISHED ______ TEMP. Start ______ Finish ______ WX ______. Ride #2 ______

Start/Finish Mile/Km/Turn Points	Name: Ride #1	Name: Ride #2	LOCATION FROM A FIXED POINT
TOTAL COUNTS-			
DIF. BETWEEN THE TWO RIDES-			

Dif. in counts between Riding Constant and Constant for Day.

RIDE # 1 ______. RIDE # 2 ______. Total Course length must then be adjusted ahead/back

LONGEST ADJUSTED RIDE WAS ______ by ______ FT/YD/M.

______ Counts Ride #1.

THE DIFFERENCE BETWEEN YOUR TWO LONGEST ADJUSTED RIDES . ______ FT/YD/M.

______ Counts Ride #2.

17. Describe any adjustments made to create your exact course length. ______

RETURN THIS FORM TO THE PA-TAC OFFICE: c/o Carl Wisser 2608 Ninth St. Berkeley, Ca. 94710/415-549-3687.

Name of Certifier:

Calibration Course:	Name: ______	Distance: ______
	Certified?	How?

Date:	Temp:	Time:	Wx:
Calibration Rides	Start	Finish	Difference (x2 for Mile)
Ride 1.			
Ride 2.			
Ride 3.			
Ride 4.			
Avg. of 4 Rides or Riding Constant			
Avg. of 4 Rides Adding .1%			
Recalibration Rides	Temp:	Time:	Wx:
Ride No.	Start	Finish	Difference (x2 for Mile)
Ride 1.			
Ride 2.			
Ride 3.			
Ride 4.			
Avg. of 2/4 Rides Recal. Constant			
Avg. of 2/4 Rides Adding .1%			
Constant for Day (Avg. of Riding & Recal.)			
Equals ______ .Adding .1%			
Correction Factor(Dif. btwn.Riding & Days Avg. = ______ Counts per Mile	Ft./Yd./Meter		

7b

The Athletics Congress of the USA

NO. 29

PA/TAC/LDR
CERTIFICATION COMMITTEE
2608 Ninth Street
BERKELEY, CA 94710

(415) 549-3688

Certification

NAME OF COURSE: JOHN MUIR 10,000 METER

TYPE: ■ road race ☐ cross-country ☐ calibration ☐ track

LOCATION: CIVIC CENTER, WALNUT CREEK, CALIFORNIA

TERRAIN: paved 100 % dirt ____ % grass ____ %

■ flat 80% ■ rolling 20% ☐ hilly

STRAIGHT-LINE DISTANCE BETWEEN START AND FINISH: 250'

ALTITUDE: (feet above sea level) START: 300' HIGHEST: 500'

FINISH: 275' LOWEST: 300'

MEASURED BY (name, address, phone): PETE SHANDERA - 40 SANTA FE, RICHMOND CALIF. 948
CARL WISSER 2608 9TH ST. BERKELEY, CA. 94710

MEASURING METHOD: ■ bicycle ☐ walking wheel ☐ steel tape ☐ electronic meter

NUMBER OF MEASUREMENTS OF THE ENTIRE COURSE: TWO

DATES WHEN COURSE WAS MEASURED: OCTOBER 31 1983

EXACT ~~AVERAGE~~ MEASURED LENGTH OF THE COURSE: 10,000 METERS

DISTANCE BETWEEN THE SHORTEST AND LONGEST MEASUREMENTS: 11.9 FT.

CERTIFICATION CODE: PA-8354

REPLACES PA 8348

The course described above and defined by the attached map is hereby certified to fulfill national standards for accurate measurement. A copy of this letter and map should accompany race results mailed to the National Running Data Center, PO Box 42888, Tucson, AZ 85733.

Carl E. Wisser — Association Certifier, Carl Wisser, 2608 Ninth Street, Berkeley, CA 94710

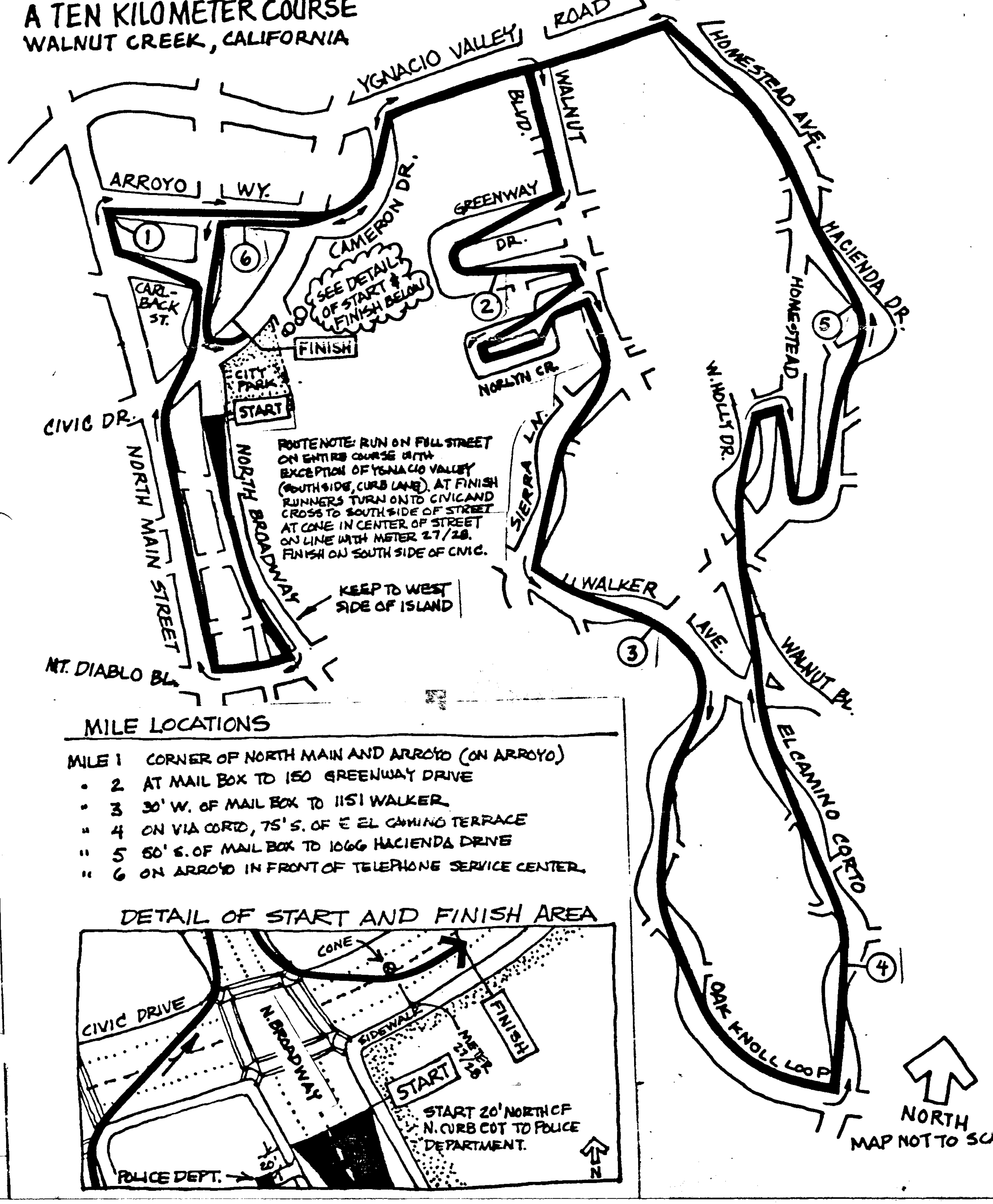
OCTOBER 31, 1983 — Assoc. Cert. date

National Certifier, Ted Corbitt, Apt 8H Sect 4; 150 W 225 St; NY, NY 10463

National Cert. date

THE JOHN MUIR RUN

A TEN KILOMETER COURSE
WALNUT CREEK, CALIFORNIA



MILE LOCATIONS

MILE 1 CORNER OF NORTH MAIN AND ARROYO (ON ARROYO)
" 2 AT MAIL BOX TO 150 GREENWAY DRIVE
" 3 30' W. OF MAIL BOX TO 1151 WALKER
" 4 ON VIA CORTO, 75' S. OF E EL CAMINO TERRACE
" 5 50' S. OF MAIL BOX TO 1066 HACIENDA DRIVE
" 6 ON ARROYO IN FRONT OF TELEPHONE SERVICE CENTER

APPLICATION FOR CERTIFICATION OF ACCURACY

Name of course: JOHN MUIR 10K   Date: 10/31/83

Location (place, city, state): CIVIC & BROADWAY WALNUT CREEK

Measuring method used: Bicycle? Walking wheel? Steel tape? Electronic meter?

Describe the measuring device (make, model, dimensions, etc.): JONES COUNTER
CARL WISSER 2608 9th ST. BERKELEY CA. 94710

Who was responsible for measuring the course?
Name: PETE SHANDERA Address: 40 SANTA FE, RICHMOND CA. 94801

Who will be responsible for locating the start/finish points, marking the course, measuring future changes and reporting them to the National Standards Committee:
Name: DAVID NICHOLS Address: 3440 WITHERSED LANE WALNUT CREEK, CA 94598 415-939-8392 WORK

DESCRIPTION OF THE COURSE

1. Is the course flat? & rolling? hilly? mountainous? uphill? downhill?
   Elevation (feet above sea level): START 300' Highest 500' Lowest 275' FINISH 300'
2. How much of the course is paved? 100% grass? ______ dirt? ______
3. Straight-line distance between the START and FINISH: 250' ±
4. Describe exactly where the START, FINISH, TURNAROUND, and MILE/KM points are located with reference to unique permanent landmarks (e.g. 17 yds W of 934 Beach St. mailbox):
   SEE MAP
5. Submit a complete, detailed map of the course with names of all streets/trails, showing all dirt/grass stretches, and including a north arrow. Indicate which side/half of each road was measured, and how all turns were taken. Use additional sketches or writeups to clearly communicate the running/measured route.

COMPARISONS WITH A KNOWN STANDARD DISTANCE. Certification requires two comparisons of each measuring device with a known standard distance. If steel tape is used, the standard must have been created with utmost accuracy by other survey instruments. If a wheel is used, the standard must have been created via steel tape or electronic meter, and must be at least 880 yards long on a straight, flat, paved surface.

6. Describe the known standard distance:
   Name: CONCORD CALIBRATION COURSE
   Location: MINERT ROAD & OAK GROVE ROAD. CONCORD, CA.
   Length: 2640 FT.
   How measured: STEEL TAPE, DEPT OF PUBLIC WORKS CITY OF CONCORD
   Certified? PA 8331

> If the known standard distance is not certified, apply now by answering all appropriate questions on another APPLICATION FOR CERTIFICATION OF ACCURACY for the known standard distance.

7. Describe how each measuring device was compared with the known standard distance. List the date, time, and raw data for each comparison:

70° WISSER 10/19/83 6:00PM
4. 196641
4. 188878.5 — 7763
3. 181117 — 7761.5
2. 173355 — 7762
1. 165594 — 7761
15524
DAYS CONSTANT 15531.5

55° 10/20/83 12:30AM
2. 363430 — 7769
2. 355660 — 7770
1. 347891
15539
ADD 7.5 DIGITS PER MILE
∴ ADD 15.8' FOR 10K

SHANDERA
42000 — 7702
1. 49702 — 7700
2. 57402 — 7701
3. 65103 — 7701
4. 72804
15402

1. 224962 — 7708
2. 232670 — 7707
2. 240377
15415

DAYS CONSTANT 15408.5
ADD 6.5 DIGITS PER MILE
ADD 13.9' FOR 10K

N/A 8. If steel tape or walking wheel was compared, what is the average correction factor?

9. If a bicycle was compared, what is the average digits/mile for all of the comparisons for each person for each day:

			RIDING	DAYS
Date: 10/19/83	Name: WISSER	Average digits/mile:	15524	15531.5
Date: 10/19/83	Name: SHANDERA	Average digits/mile:	15402	15408.5

COURSE MEASUREMENTS. Certification requires two measurements. If a bicycle is used, the known standard distance and the race course must both be ridden during the same day by the same person for each measurement (comparisons from a previous day are not acceptable).

10. Was the measuring route identical to the shortest route that can be permitted to be run by the winner of the race? YES

11. Were all left/right turns measured to within one ~~yard~~ foot of the inside edge of all turns? If not, explain. YES

12. If part of the race course is on dirt or grass, how were these stretches measured? N/A

14. If steel tape was used, answer the following questions: N/A

a. How many people were in the survey party? List their specific duties:

b. How was the tape tension maintained during measuring?

c. How was the tape increments count maintained?

d. How were the curves measured?

15. If a bicycle was used, answer the following questions:

NOTE: RECAL WAS AFTER MID-NIGHT - SO TECHNICALLY ITS THE NEXT DAY!

a. Was the bicycle ridden over the known standard distance and over the race course both during the same day by the same person for each measuring occasion? YES

b. Was the known standard distance compared before and after measuring the race cours If not, explain. YES

16. List the date, time, and raw data for each measurement of the course:

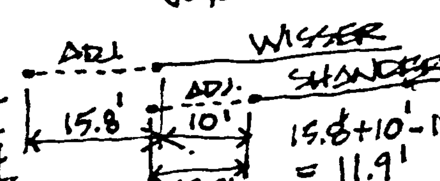
A. WISSER 10:30 PM
15524 × 10K (6.2137119)
= 96462 DIGITS

S. 248940
MILE 1. 264460
2. 279988
3. 295512
4. 311036
5. 326560
6. 342084
+ 3318
F. 6.2137119 · 345402

B. SHANDERA 10:30 PM 52°
15402 × (10K) = 95704 DIGITS

S. 128500
1. 143902
2. 159304
3. 174706
4. 190108
5. 205510
6. 220912
+3292
F 6.2137119 224204

NOTE:



15.8+10'-13.9 = 11.9' DIFF

NOTE: WISSER'S RIDE WAS THE LONGER ∴ FINAL FINISH BASED HIS F...

ADJUSTMENTS 17. Describe any adjustments (calculations, measurements) made to create an exact length...

1. ADD 15.8' TO WISSER'S RIDE (DAYS CONSTANT - SEE ITEM 7.)
2. ADD 32.8' (.1%) FOR SHORT COURSE PREVENTION FACTOR

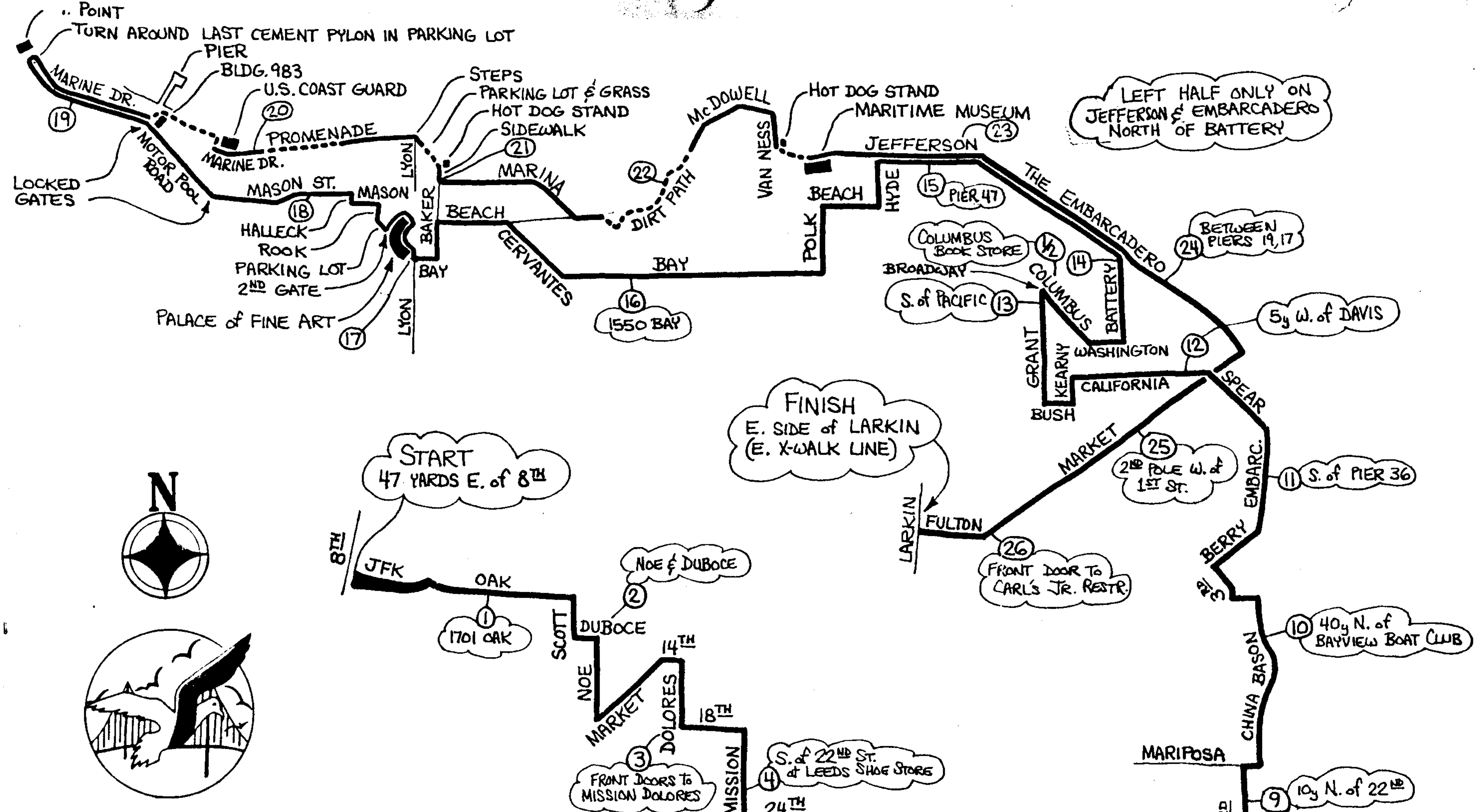
18. What is the ~~average~~ length of the final course? 10,000 METER PLUS 32.8 FT

19. What is the difference between all of the measurements? 11.9' (ADJUSTED)

ONK 10/31/83

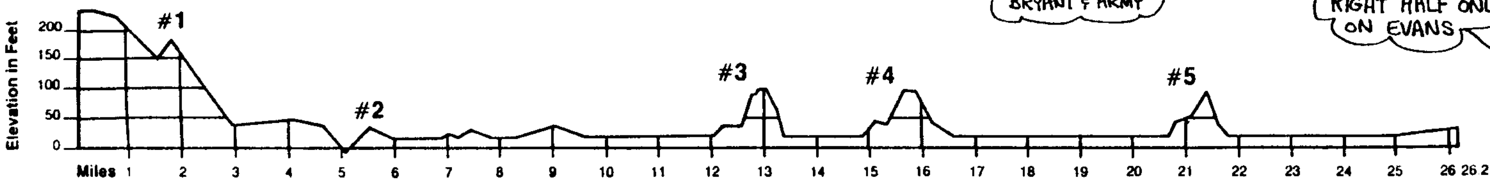
RETURN THIS FORM WITH ALL QUESTIONS ANSWERED TO ONE OF THE FOLLOWING PA-TAC CERTIFIERS:

Tom Benjamin:	P.O. Box 8715, San Francisco, CA 94128 221-2195
Ron Grayson:	2510 Greer St., Palo Alto, CA 94303 856-3743 Work/Home
Dick Hughes:	3462 Laurel Ave., Oakland, CA 94602 482-5212 Home 763-0500 Work
Carl Wisser:	2608 Ninth St., Berkeley, CA 94710 549-3687
John Mansoor:	10513 Fair Oaks Blvd. Apt. J, Fair Oaks, CA 95628 (916)-966-6185
Tom Knight:	724 Arastradero Rd., #107, Palo Alto, CA 94306 856-3349 854-3300 X2065
Pete Shandera:	40 Sante Fe, Pt. Richmond, CA 94801 234-8322 Home 845-5200 X234 Work



CONDUCTED BY PAMAKID RUNNERS

P.O. Box 27385 (415) 681-2322 · Ofc. San Francisco, California 94127



1982 San Francisco Marathon

PAGE 1.

San Francisco Marathon

1982 S.F. MARATHON SPLITS- START AND FINISH PTS.

Mile
1.- Opposite 1701 Oak st. on Oak.
2.- Intersection ofNoe and Duboce sts. at sewer grate.
3.- Directly opposite Mission Dolores front doors on Dolores st.
4.- Just south of corner of Mission st. and 22nd st. by Leeds Shoe Store.
5.- Right in middle of intersection of Bryant and Army sts.
6.- 20yds. West of intersection of Army and Indiana sts. on Army.
7.- On Evans st. opposite west edge of the new U.S. Post Ofc.
8.- On Cargo Way opposite East edge of Salmon colored shed. (see Map)
9.- On 3rd st. 30' north of intersection of 22nd st & 3rd st.
10.- On China Basin Way 120' north of Bayview Boat Club.
11.- Just South of Pier 36 on the Embarcadere.
12.- On California st. 15' west of intersection of California & Davis
13.- On Grant Ave. South side of intersection of Grant & Pacific st.
Half-Way On Columbus in front of the Columbus Book Store.
14.- On Battery st. just North of Levi Strauss Plaza across from Mildred's Pierces Bar& Grill.
15.- On Jefferson st. by Pier 47 opposite Capurro's Restaurant.
16.- On Bay st. opposite driveway at 1550 Bay st.
17.- On sidewalk leading through Palace of Fine Arts next to northern most column.
18.- On Mason st in the Presidio 30' from end of bend in road at west end of road.
19.- On Marine Dr. at Ft. Point 4 cement pylons west of where road opens up.
20.- At foot of bike path/sidewalk on promenade route 15' west of the 3 white posts at the start of the sidewalk.
21.- Eastern edge of intersection of Marina Blvd and Baker st. on sidewalk north side of Marina Blvd.
22.- On gravel rd. in Ft. Mason at 2nd junction on gravel rd.
23.- On Jefferson st. opposite the Wax Museum sign.
24.- On the Embarcadero between Piers 15-17.
25.- On Market st. by 2nd Muni power pole west of 1st. st.& Market st. intersection.
26.- On Market st. opposite front door of Carl's Jr. Restaurant.

NOTE: <u>SEE COURSE ATLAS FOR MORE EXACT LOCATIONS</u>

START: On John F. Kennedy Dr. in Golden Gate Park between 8th & 6th Avenues. The exact point is 141' East of the stop sign on the on the N.E. corner of 8th Ave. and 254' West of the stop sign on the N.W. corner of 6th Ave. mid way in the road which is 78' across at this point.

TURN-A-ROUND POINT - Turn is at Ft. Point making the turn as tight as possible 1 yd. from cement pylons assisted by directional moniters at this point (SEE MAP 74B. for visual)

FINISH - At edge of the Eastern most white line of Crosswalk at the intersection of Larkin and Fulton Sts. At the Civic Center Plaza at City Hall in S.F. California. (SEE MAP FOR BETTER VISUAL PERSPECTIVE- MAP NO. 97.

CONDUCTED BY PAMAKID RUNNERS

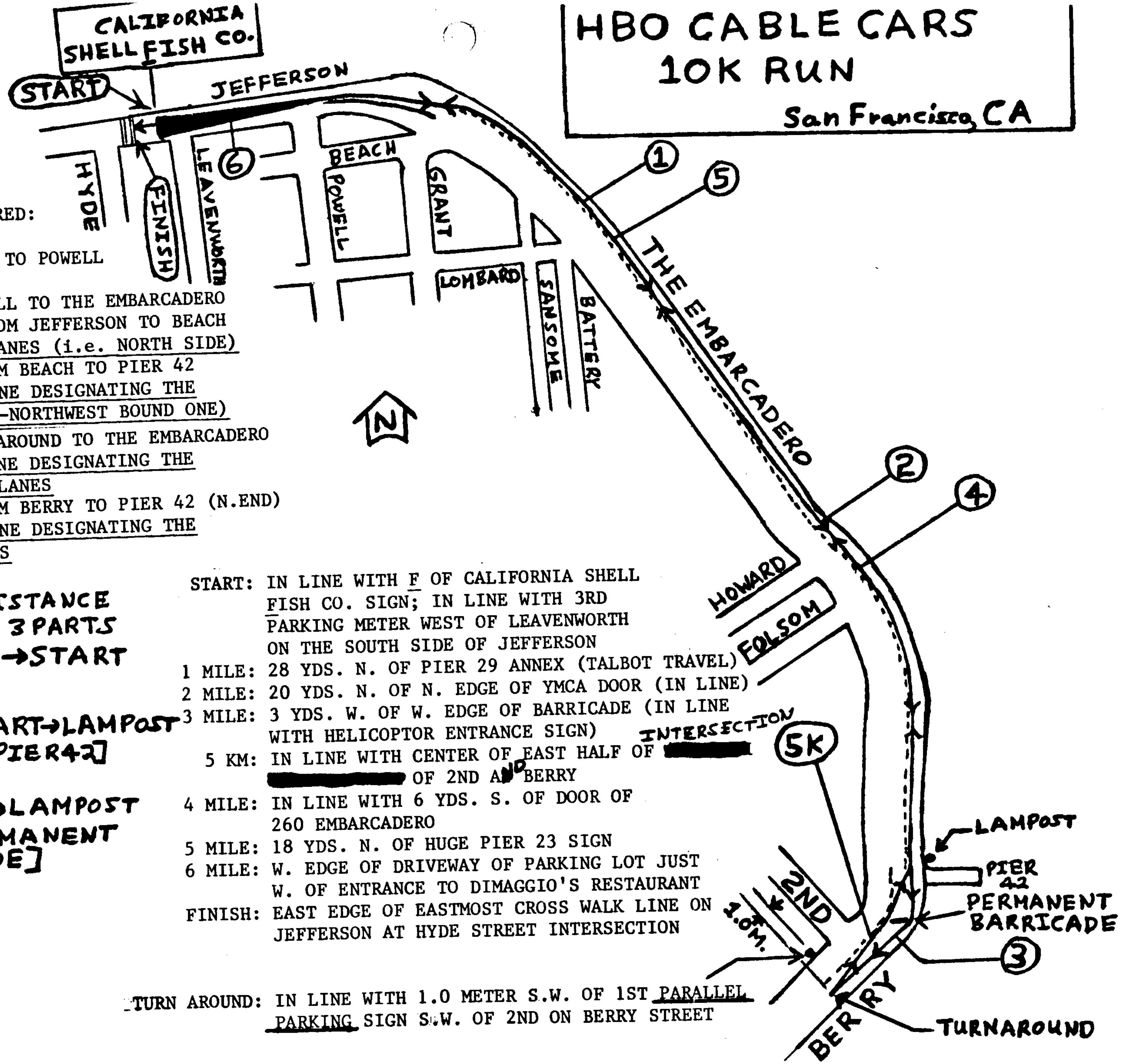
P.O. Box 27385 (415)681-2322 · Ofc San Francisco, California 94127

1982 San Francisco Marathon

START - 47 yards E. of 8th Av. on FJK Dr.
Proceed E. on JFK Dr.,
E. on Oak St.,
S. on Scott St.,
E. on Duboce Ave.,
S. on Noe St.,
NE on Market St.,
E. on 14th St.,
S. on Dolcres St.,
E. on 18th St.,
S. on Mission St.,
E. on 24th St.,
S. on Bryant St.,
E. on Army St.,
S. on 3rd St.,
SE on Evans Av. (right half of road only),
NE on Jennings St.,
NW on Cargo Way (right half of road only),
N. on 3rd St.,
E. on Mariposa St.,
N. on China Basin St.,
W. on China Basin St.,
NW on 3rd St.,
NE on Berry St.,
N. on Embarcadero,
NW on Spear St.,
W. on California St.,
S. on Kearny St.,
W. on Bush St.,
N. on Grant Av.,
E. on Broadway,
SE on Columbus Av.,
E. on Washington St.,
N. on Battery St.,
NW on Embarcadero,
W. on Jefferson St.,
S. on Hyde St.,
W. on Beach St.,
S. on Polk St.,
W. on Bay St.,
NW on Cervantes Blvd.,
W. on Beach St.,
S. on Baker St.,
W. on Bay St.,
N. at Lyon St. onto walkway along E. side of Palace of Fine Arts,
W. around north end of Palace of Fine Arts,
S. along W. side of Palace of Fine Arts to 2nd gate of pkng. lot,
NW thru parking lot to Rook St.,
N. on Rook St.,
W. on Mason St.,
N. at Halleck St. (Halleck St. becomes Mason St.),
W. on Mason St. to Motor Pool Rd.,
NW on Motor Pool Rd. (Presidio Maintenance Yard),
W. on Marine Dr. (left half of road only),
NW to Fort Point (left half of road only),
TURNAROUND - last concrete pylon in parking lot S. of Fort Point
SE from Fort Point (left half of road only),
E. on Marine Dr. (left half of road only) to bldg. 983,
N. from W. side of bldg. 983 towards pier,
E. on gravel road next to San Francisco Bay,
S. on driveway W. of U. S. Coast Guard Station,
E. on Marine Dr. to sidewalk to gravel road (GGNRA Promenade),
SE on Lyon St. steps thru parking lot across grass to hot dog stand,
S. on Baker St. sidewalk,
E. on Marina Blvd. sidewalk (north side),
SE on Marina Blvd. sidewalk (north side),
E. on Beach St. to dirt path above Ft. Mason tunnel,
NE on dirt path to McDowell St.,
E. on McDowell St.,
S. on Van Ness Av. to S. side of hot dog stand,
E. on dirt road to Acquatic Park sidewalk,
E. on Jefferson St. (left half of road only),
SE on Embarcadero (left half of road only until Battery St.),
SW on Market St.,
W. on Fulton St. (United Nations Plaza) to FINISH.
FINISH - E. edge of crosswalk at E. side of Larkin St., on Fulton St.

HBO CABLE CARS 10K RUN

San Francisco, CA



PARTS OF ROADS MEASURED:

1.) JEFFERSON FROM HYDE TO POWELL
WHOLE ROAD

2.) JEFFERSON FROM POWELL TO THE EMBARCADERO & THE EMBACADERO FROM JEFFERSON TO BEACH
ALL WEST BOUND LANES (i.e. NORTH SIDE)

3.) THE EMBARCADERO FROM BEACH TO PIER 42
OUT TO DOTTED LINE DESIGNATING THE CURB LANE (NORTH-NORTHWEST BOUND ONE)

4.) BERRY FROM THE TURNAROUND TO THE EMBARCADERO
OUT TO DOTTED LINE DESIGNATING THE NORTHEAST BOUND LANES

5.) THE EMBARCADERO FROM BERRY TO PIER 42 (N.END)
OUT TO DOTTED LINE DESIGNATING THE NORTH BOUND LANES

NOTE: COURSE DISTANCE IS SUM OF 3 PARTS

1.) LEG: FINISH → START

2.) OUT & BACK:
2 TIMES START → LAMPOST
[NORTH SIDE PIER 42]

3.) LOOP:
LAMPOST → LAMPOST
[AROUND PERMANENT BARRICADE]

START: IN LINE WITH F OF CALIFORNIA SHELL FISH CO. SIGN; IN LINE WITH 3RD PARKING METER WEST OF LEAVENWORTH ON THE SOUTH SIDE OF JEFFERSON

1 MILE: 28 YDS. N. OF PIER 29 ANNEX (TALBOT TRAVEL)

2 MILE: 20 YDS. N. OF N. EDGE OF YMCA DOOR (IN LINE)

3 MILE: 3 YDS. W. OF W. EDGE OF BARRICADE (IN LINE WITH HELICOPTOR ENTRANCE SIGN)

5 KM: IN LINE WITH CENTER OF EAST HALF OF INTERSECTION [redacted] OF 2ND AND BERRY

4 MILE: IN LINE WITH 6 YDS. S. OF DOOR OF 260 EMBARCADERO

5 MILE: 18 YDS. N. OF HUGE PIER 23 SIGN

6 MILE: W. EDGE OF DRIVEWAY OF PARKING LOT JUST W. OF ENTRANCE TO DIMAGGIO'S RESTAURANT

FINISH: EAST EDGE OF EASTMOST CROSS WALK LINE ON JEFFERSON AT HYDE STREET INTERSECTION

TURN AROUND: IN LINE WITH 1.0 METER S.W. OF 1ST PARALLEL PARKING SIGN S.W. OF 2ND ON BERRY STREET

The Athletics Congress of the USA

PA/TAC/LDR
CERTIFICATION COMMITTEE
2608 Ninth Street
BERKELEY, CA 94710

(415) 549-3688

Certification

NAME OF COURSE: CALIFORNIA TEN 10 MILER '83 DATE JAN. 9

TYPE: [X] road race [ ] cross-country [ ] calibration [ ] track

LOCATION: STOCKTON, CALIFORNIA [Lincoln Senior Elementary Area]

TERRAIN: paved 100 % dirt ____ % grass ____ %

[X] flat [ ] rolling [ ] hilly

STRAIGHT-LINE DISTANCE BETWEEN START AND FINISH: 300 Feet

ALTITUDE: (feet above sea level) START: 15 HIGHEST: 15

FINISH: 15 LOWEST: 15

MEASURED BY (name, address, phone): Frank Hagerty 7309 Camellia Ln. Stockton, CA 95207 (209) 473-4124
Tom Knight 724 Arastradero Road #107 Palo Alto, CA 94306 (415) 856-3349 Tom Benjamin 895 34th Avenue San Francisco, CA 94121 (4..) 221-219..

MEASURING METHOD: [X] bicycle [ ] walking wheel [ ] steel tape [ ] electronic meter

NUMBER OF MEASUREMENTS OF THE ENTIRE COURSE: 3

DATES WHEN COURSE WAS MEASURED: 11/26/82 Hagerty; 12/12/82 Knight & Benjamin

EXACT AVERAGE MEASURED LENGTH OF THE COURSE: 10.0028+ Miles = 10 Miles + 4.9+ Yards

DISTANCE BETWEEN THE SHORTEST AND LONGEST MEASUREMENTS: 10.6+ Yards

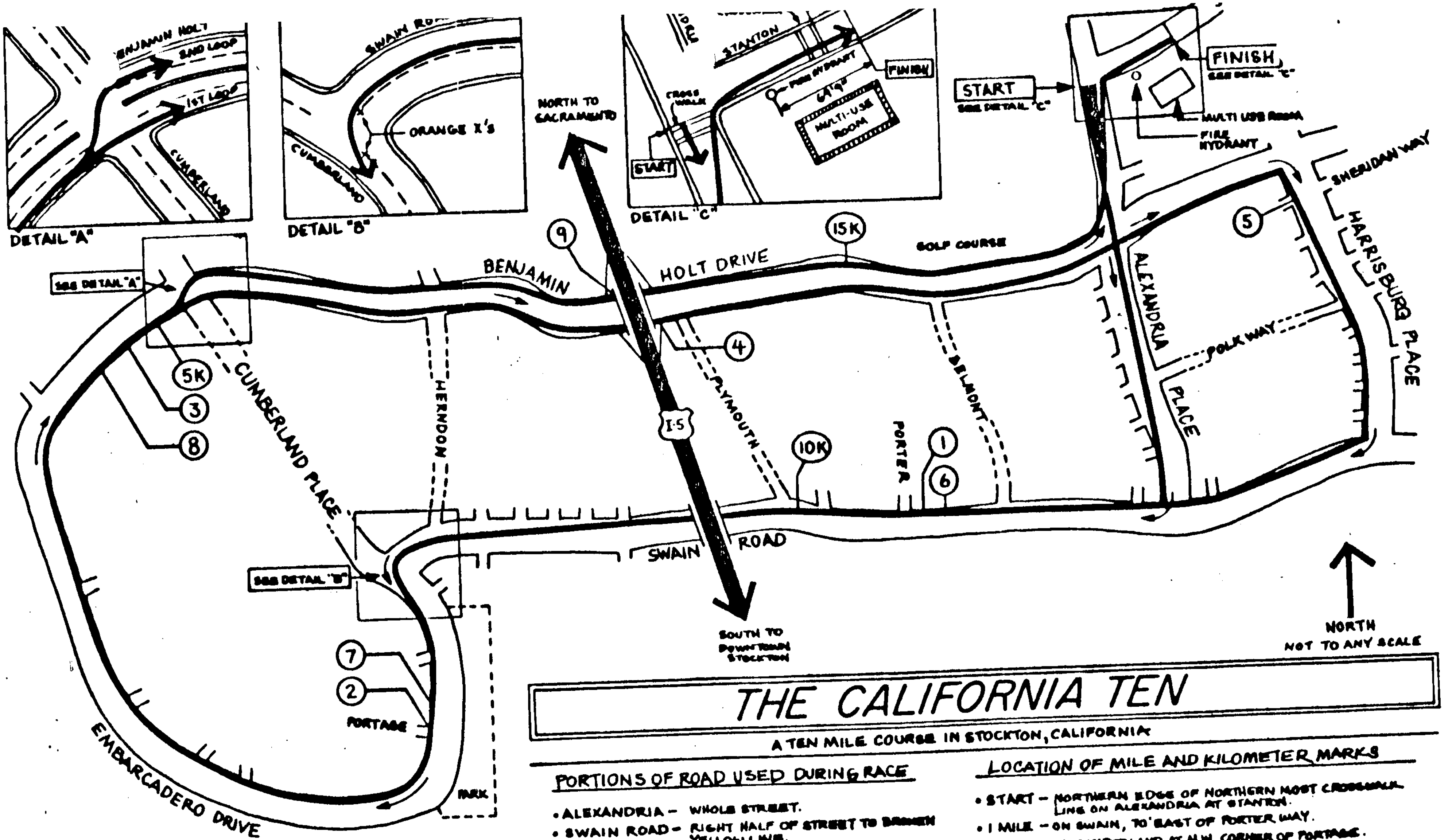
CERTIFICATION CODE: PA- 8231

The course described above and defined by the attached map is hereby certified to fulfill national standards for accurate measurement. A copy of this letter and map should accompany race results mailed to the National Running Data Center, PO Box 42888, Tucson, AZ 85733.

Tom Knight — December 12, 1982
Association Certifier, Tom Knight — Assoc. Cert. date
724 Arastradero Rd. #107, Palo Alto, CA 94306

[signature] — DECEMBER 31, 1982
Association Certification Chairman — Assoc. Cert. date
Carl Wisser, 2608 9th St., Berkeley, CA 94710

Ted Corbitt — January 15, 1983
National Certifier, Ted Corbitt — National Cert. date
150 W. 225th St., Sect. 4, Apt 8H, NY, NY 10463



THE CALIFORNIA TEN

A TEN MILE COURSE IN STOCKTON, CALIFORNIA

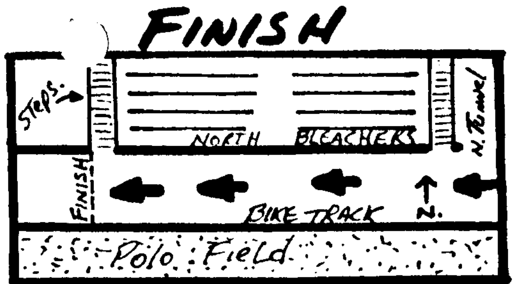
PORTIONS OF ROAD USED DURING RACE

- ALEXANDRIA – WHOLE STREET.
- SWAIN ROAD – RIGHT HALF OF STREET TO BROKEN YELLOW LINE.
- CUMBERLAND – RIGHT SIDE OF STREET.
- EMBARCADERO – RIGHT SIDE OF STREET.
- BENJAMIN HOLT – (FIRST LOOP) RIGHT HAND LANE OUT TO BROKEN WHITE LINE TO THE FREEWAY – AFTER FREEWAY, RIGHT SIDE OUT TO BROKEN YELLOW LINE... STAY TO RIGHT OF LEFT TURN LANE AT ALEXANDRIA.

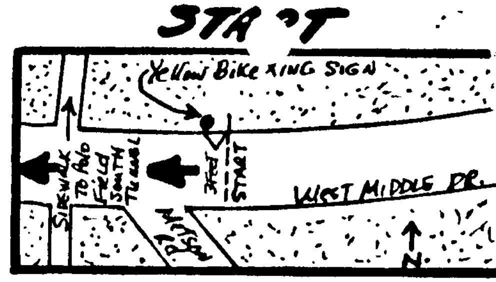
  (SECOND LOOP) CROSS OVER AT CUMBERLAND TO LEFT HAND LANE... FACING TRAFFIC... WHOLE LANE TO FREEWAY. AFTER FREEWAY, LEFT SIDE OF STREET TO BROKEN YELLOW LINE. TURN LEFT ONTO ALEXANDRIA.
- HARRISBURG – WHOLE STREET.

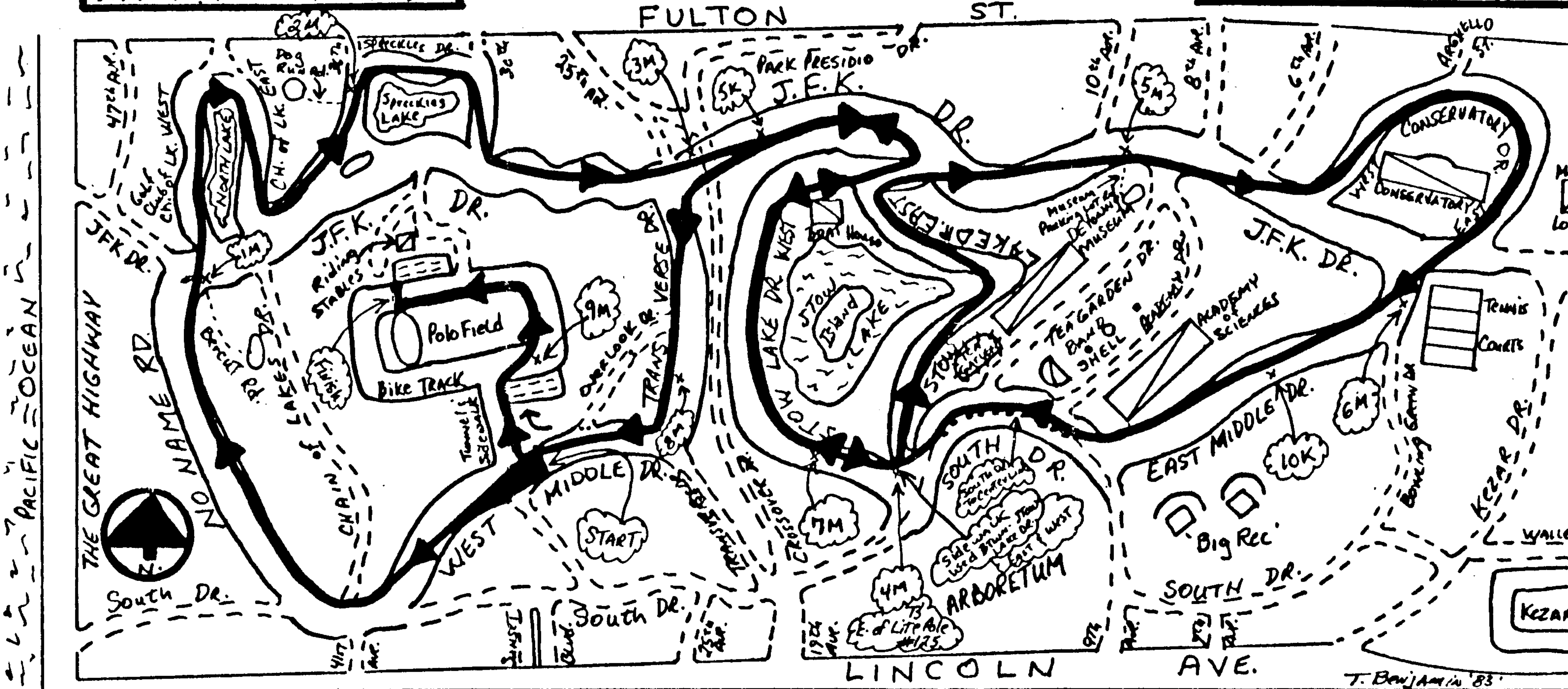
LOCATION OF MILE AND KILOMETER MARKS

- START – NORTHERN EDGE OF NORTHERN MOST CROSSWALK LINE ON ALEXANDRIA AT STANTON.
- 1 MILE – ON SWAIN, 70' EAST OF PORTER WAY.
- 2 MILE – ON CUMBERLAND AT N.W. CORNER OF PORTAGE.
- 3 MILE – 4' SOUTH OF FIRE HYDRANT ON BENJAMIN HOLT WEST OF CUMBERLAND.
- 5 KM – 10 YARDS EAST OF DRIVEWAY AT 9770 BENJAMIN HOLT.
- 4 MILE – ON BENJAMIN HOLT, 2' EAST OF "NO RIGHT TURN" SIGN ON EAST SIDE OF FREEWAY.
- 5 MILE – ON HARRISBURG AT CENTER OF INTERSECTION WITH SHERIDAN.
- 6 MILE – ON SWAIN, 4' EAST OF TREE BETWEEN DRIVEWAYS AT 2555 & 2567.
- 10 KM – ON SWAIN, 57' EAST OF STREET SIGN ON N.W. CORNER OF PLYMOUTH.
- 7 MILE – ADJACENT TO WALKWAY AT 5717 CUMBERLAND.
- 8 MILE – ON BENJAMIN HOLT, 54' SOUTH OF LIGHT POLE # 90395.
- 9 MILE – ON BENJAMIN HOLT, UNDER WEST EDGE OF FREEWAY OVERPASS.
- 15 KM – 28' EAST OF DOOR TO 2644 BENJAMIN HOLT.
- FINISH – ON STANTON WAY, 69'9" EAST OF FIRE HYDRANT BY THE MULTI-USE ROOM. 31'2" EAST OF EASTERN EDGE OF CROSSWALK



Bay Pacific 15 KM





	Mileage Locations
S	START- 3′East of Yellow Bike Xing sign on West Middle Dr. just East of Metson Rd.
1	1 MILE- On JFK Dr.- Directly across from Bercut Rd.
2	2 MILE- On 36th Ave.- 88′ North of crosswalk to Dog Training Rd.
3	3 MILE- On JFK Dr.- Directly opposite lite pole #49 just West of overpass.
5k	5 KM- On JFK Dr.- 10′ East of lite pole #48 across from RAINBOW FALLS.
4	4 MILE- On Sidewalk connecting Stow Lake Dr′s East & West.
5	5 MILE- On JFK-at DRIVEWAY TO DeYoungMus
6	6 MILE- On E. MIDDLE Dr.-44′N. lite pole #I15 opposite Tennis Courts.
10	10KM- On E. MID. Dr.-199′W. lite pol#I17
7	7 MILE-On Stow Lake Dr. W.540′N.of S.Dr.
8	8 MILE-On Transverse Dr.-18′S.of pole 51
9	9 MILE-On Bike Track 129′W.of last gate. on S. side of stadium.
F	FINISH- At AVON 15K Finish.At far West edge of North Bleachers in Polo Field Stadium.

KEY TO ABBREVIATIONS

SPR= Shortest Possible Route a runner can take.

WR= Whole Road.

SPR-WR.=The Shortest Possible Route a runner can take using the Whole Road.

R A C E   R O U T E   D E S C R I P T I O N

START - On WEST MIDDLE DRIVE heading West.

WEST MIDDLE DR.-SPR-WR.

SOUTH DR.-SPR-WR.

NO NAME RD.-SPR-WR.

JFK DR.-SPR-WR.

CHAIN of LAKES DR. WEST-SPR-WR.

CHAIN of LAKES DR. EAST-SPR-WR.

JFK DR.-SPR-WR.

36th AVE.-SPR-WR.

SPRECKLES LAKE RD.-SPR-WR.

30th AVE.-SPR-WR.

JFK DR.-SPR-WR.

STOW LAKE DR. WEST-SPR-WR.

SIDEWALK CONNECTOR (between Stow Lake drive's West and East) SPR-Whole Sidewalk.

STOW LAKE DR. EAST-SPR-WR.

JFK DR.-SPR-WR.

CONSERVATORY DR.-SPR-WR.

JFK DR.-SPR-WR.

EAST MIDDLE DR.-SPR-WR.

SOUTH DR.-SPR-*To Centerline only(should beconed & monitored)

SIDEWALK CONNECTOR (between Stow Lake Drive's East & West) SPR-Whole sidewalk

STOW LAKE DR. WEST-SPR-WR.

JFK DR.-SPR-WR.

TRANSVERSE DR.-SPR-WR.

WEST MIDDLE DR.-SPR-WR.

SIDEWALK CONNECTOR TO BIKE TRACK IN POLO FIELD STADIUM-SPR-whole sidewalk.

FINISH-ON BIKE TRACK counter clockwise around Bike Track to Finish in front of West end of North Bleachers.-SPR- Whole Bike Trac

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**NOTE: The course was measured 12"from the curb roads and 8"from uncurbed areas

No. 30

Ideas for Discussion at Certification Meeting of 1/13/83

Thomas D. Knight

1.) Should we start adding 0.1% to all our courses for shortness prevention; if so, should we always use the longest course to add the 0.1% to?

2.) We need a phone answering machine for the office phone!

3.) Why shouldn't our phone #s appear in the Schedule in addition to our addresses? Should we send information to other running media?

4.))More EDM calibration courses are needed, particularly in the East Bay, Danville, etc.

5.) Our committee chairman should write a letter to several race directors asking for copies of their certification paperwork; perhaps we can develop a form letter; of course, this will be somewhat intimidating to some race directors but if written in the proper way as an offer of help and a channel of communication we can expect a good response. In particular since through all of 1983 the NSC & Ken Young are allowing 0.2% error, but then tightening up, there is never going to be a better chance to correct any course shortness that exists. Carl Wisser told me that Ken Young wouldn't allow any records on courses that haven't been measured after December 31,1978.
(Napa Valley & Avenue of Giants Marathons should be written to immediately)

6.) Scheduling a race to make money for the Committee.
7.) We need some women measurers & committee members.
8.) A 9-10 Week delay in signing a certification is way too long. If all that is needed is signing, then I think 2 weeks should normally be sufficient.
9.) Redesign of our 2 page form to leave more space for the data etc.
10.) How come Tom Knight keeps grabing all the headlines in the press???

Thomas D. Knight

No. 31

Proposed: (A. Snardera Drawing)
Copy Ready For
Race Flyer - Logo
For our Committee
To help eliminate
uncertainty by Race
Flyer wording whether
Course is Actually
National Certified

PA-TAC
NATIONALLY
CERTIFIED COURSE
1983

PA-TAC
NATIONALLY
CERTIFIED COURSE
1983

PA-TAC
NATIONALLY
CERTIFIED COURSE
1983

PA-TAC
NATIONALLY
CERTIFIED COURSE
1983

RE: FRONT WHEEL vs. REAR WHEEL

NO. 32

Several comparisons were made with front & rear mounted Jones counters — on hills, wind, terrain (grass, dirt).

The FRONT was best.

The REAR counter is on the drive wheel, which is affected by dissimilar peddling (hills, with/against wind).

Bob Letson
Sept. 3, 1980

LETSON ON MATERIAL ON

1. REAR wheel vs. Front wheel J. counter
2. [redacted] J. Counter on Various Surfaces incl. walking [redacted] Bike [redacted]
3. Variations in use of Solid Front Tire
4. "ACID TEST" — A Suggested method For refining our Knowledge of the Real Accuracy of The Jones Counter

8AM

Standard pedals (so up)

	FRONT	REAR
~~TOP~~	~~37631~~	5575
BOTTOM	43226	96070
TOP	48836	01734.5
BOTTOM	54432	07346.5
TOP	60043	13012
BOTTOM	65639	18619
TOP	71254	24283
BOTTOM	76851	29889.5
TOP	82463	35557.5
BOTTOM		

Stark Hill / Texas St. Hill

Both 5605.3 ± 8.5 5640.6 ± 30.1

Down 5596.3 ± .6 5608.5 ± 3.0

Up 5612 ± 2.2 5664.8 ± .6

Bike Ran Dirt Road

9AM

	FRONT	REAR	
START	10890	64175	2547
FIN	13424	66722	
START	13747	67046	2541.5
FIN	16278	69587.5	
START	16599	69910.5	2540.5
FIN	19129	72451	
START	19467.5	72797	2539.5
FIN	21996.5	75336.5	

2531 ± 2.2 2542.1 ± 3.35

FRONT WHEEL BEST. PEDDLING AFFECTS DRIVE WHEEL especially for hills & wind.

10 AM

		FRONT	REAR
CONCRETE	START	56396	09918
	1/3 MILE	61473	15038
	2/3 MILE	66552	20151
	MILE	71629.3	25271
	~~START~~	" 4999.1	" 5065.5
GRASS	1/3 MILE	76629	30336.5
	2/3 MILE	81676	35456.8
	MILE	86672	40524
	4/3 MILE	91712	45642
CONCRETE DOWN		96791.5	50755.5

B.P. 10K (5K)

Tire out from grass

all 5049.44 ± 34.2 5104.7 ± 23.8

up 5077.0 ± 0 5120.0 ± 0 5113.25 ± .35

down 5019.25 ± 35 5119.15 ± 1.62

10:20 AM

	Front	Rear	
START	0927	63321	47695.5
5km	56594	11016.5	
START	60820	15273	
5km	08122	62953	
START	09183	64013	47686
5K	56492	11699	
STR.	57617	12823	47690
5K.	04922	60513	

47308.75 ± 7.37

47687.88 ± 6.53

Noon (against wind)

12:30 / 1 PM

		FRONT	REAR	
60 psi	BEGIN	49595	05440	15362
	MILE	64820	20802	against wind
	BEGIN	80048.5	36148.5	with wind 10 knots (15364.3)
	MILE	95271	51518	15346.7
	BEGIN	10499.5	66859.5	
90 psi	BEGIN	11013	67340	15308
	MILE	26175.5	82648	15286
	BEGIN	41343	97934	

60 psi 15226.13 ± 3.01

15223.7 ± 1.84

15228.55 ± .07

15354.88 ± 9.60

15363.15 ± 1.61

15346.60 ± .14

7

WILL RASMUSSEN
1452 HILLSMONT DR.
EL CAJON, CA 92020

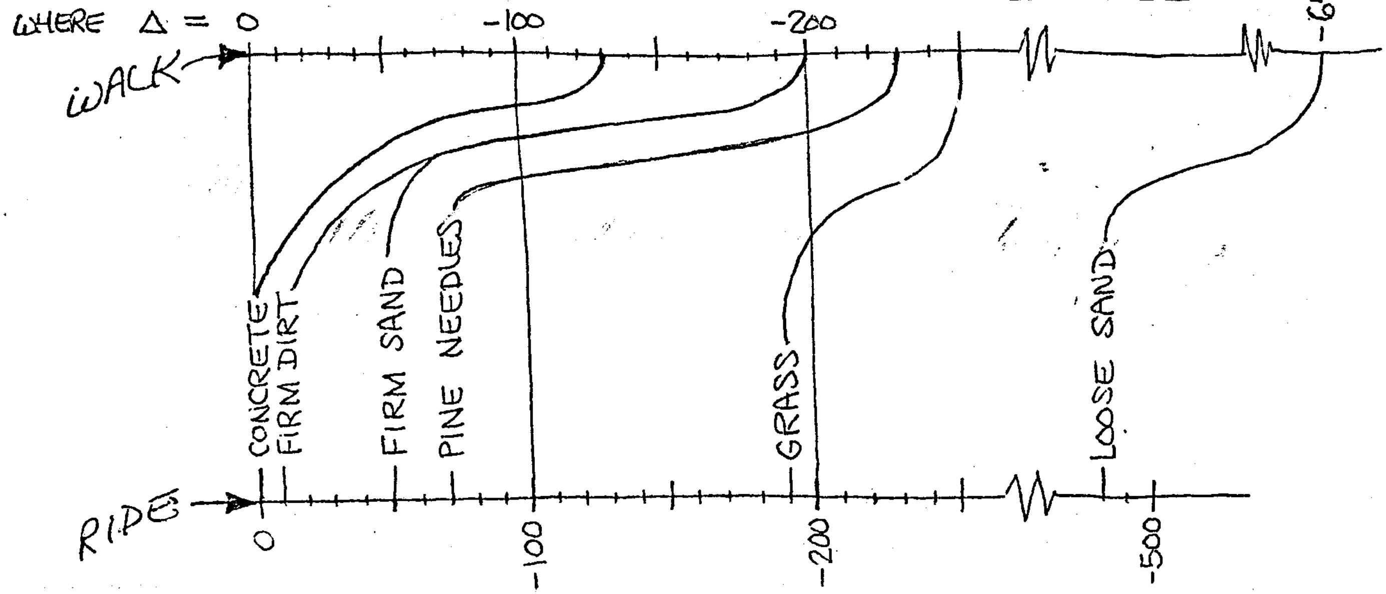
SEPT 3, 1980

NO. 33

RE: CALIBRATION CONSTANTS for GRASS, DIRT, ETC.

IN MAY, 1976, I PERFORMED A STUDY USING 400 FT. STEEL TAPED INTERVALS ON VARIOUS SURFACES TO OBSERVE THE VARIATION IN CALIBRATION CONSTANT USING JONES COUNTER & BICYCLE, WITH THE FOLLOWING RESULTS (ALL NUMBERS ARE JONES COUNTS):

CALIBRATION CONSTANT(SURFACE) = CALIB. CONST.(CONCRETE) + Δ COUNTS/MILE



APPARENTLY CONCRETE GIVES THE MOST COUNTS/MILE. THIS MEANS THAT IF A CONCRETE (PAVED) 880 YD COURSE IS USED TO CALIBRATE, MEASUREMENTS WILL ALWAYS PRODUCE COURSES THAT ARE EQUAL TO OR LONGER THAN THE INTENDED DISTANCE.

THEREFORE, I ACCEPT MULTI-SURFACE COURSE MEASUREMENTS USING PAVED CALIBRATIONS WITH OR WITHOUT! COMPENSATIONS FOR THE SURFACES.

THE ONLY DISADVANTAGE OF NOT COMPUTING COMPENSATIONS FOR SURFACE IS THAT THE COURSE IS LONGER THAN NECESSARY.

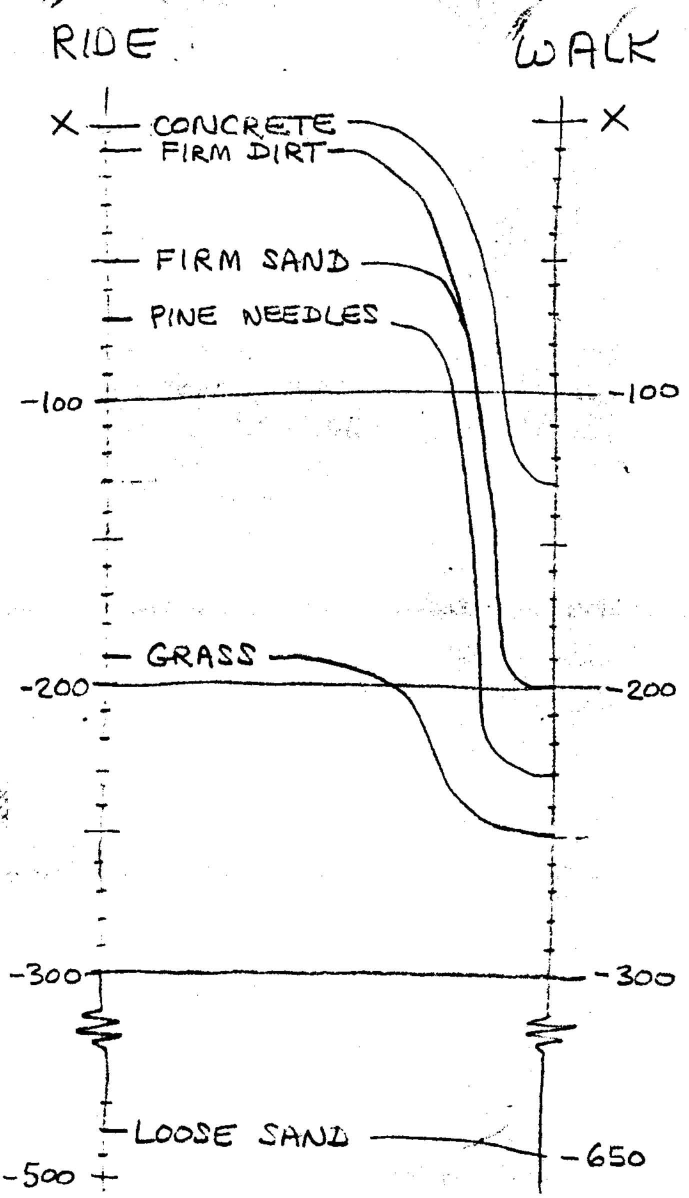
Robert A. Letson
4369 HAMILTON ST. #4
SAN DIEGO, CA 92104

CC: TED CORBITT

	RIDE		WALK	
CONCRETE	X	±3 ft/mile	(X − 130)	±3
FIRM DIRT	(X−10) ± 20	±7 ft/mile	(X − 200) ± 20	±7
PINE NEEDLES	(X −70) ± 20		(X−230) ± 20	
GRASS	(X−190) ± ~~20~~ 50	±18	(X−250) ± ~~60~~ 80	±28
FIRM SAND (DAMP)	(X−50) ± 20	±150	(X−180)	±165
LOOSE SAND	(X−480)		(X−650) ±70	

wheel held from truck tailgate (constant) = walking constant − 10 feet
eg 15000 = 15030 − 30 counts

CALIBRATION CONSTANT = X Alan Jones counts/mile on concrete



Measured by Bob Fetson, Saturday, May 1, 1976, 2:30 pm – 4:30 pm, 85°F, 70% humidity, dry, sunny

ITEM	Type of Surface (COURSE DESCRIPTION)	length (feet)	slope	ride/walk	uphill/downhill	Start	Finish	Δ	counts/mile	counts/mile difference from C	ERROR in FEET/mile
1	CONCRETE (ROAD CALIB. COURSE)	1760.00 steel taped twice with force gauge and temperature correction	0	RIDE	—	19300	24316	5016		C = 15051 counts/mile	
						24400	29415.5	5015.5			
2	FIRM DIRT	500.0 steel taped	6%	RIDE	UP	35000	36422	1422	15016	-35	-12.3
					DOWN BOTH BRAKES	36500	37925	1425	15048	-3	-1.1
					UP	38000	39423	1423	15027	-24	-8.4
					DOWN BOTH BRAKES	39500	40925.5	1425	15048	-3	-1.1
				WALK	UP	41000	42405	1405	14837	-214	-75.1
					DOWN	42500	43906	1406	14847	-204	-71.6
					UP	44000	45406	1406	14847	-204	-71.6
					DOWN	55000	56408.5	1408.5	14874	-177	-62.1
3	PINE NEEDLES OVER FIRM DIRT	250.0 steel taped	6%	RIDE	DOWN REAR BRAKE ONLY	45600	46312	712	15037	-14	-4.9
					UP	46400	47110	710	14995	-56	-19.6
					DOWN BOTH BRAKES	47200	47909	709	14974	-77	-27.0
					UP	48000	48709.5	709.5	14975	-76	-26.7
					DOWN REAR BRAKE ONLY	48800	49512	712	15037	-14	-4.9
					DOWN BOTH BRAKES	50400	51108.5	708.5	14963.5	-87.5	-30.7
				WALK	UP	49600	50302.5	702.5	14837	-214	-75.1
						51200	51902.5	702.5	14837	-214	-75.1
					DOWN	52000	52701.5	701.5	14816	-235	-82.4
						53500	54201	701	14805	-246	-86.3
4	CONCRETE (ROAD CALIB. COURSE)	1760.00 steel taped twice with Force gauge and temperature corrections	0	RIDE	—	64800	69818.5	5018.5			
						69900	74918	5018			

Measured by Bob Letson, Sunday, May 2, 1976, 8:00 am – 10:00 am, 65°F, 45% humidity, damp, cloudy

ITEM	COURSE DESCRIPTION: Type of Surface	length (feet)	slope	ride/walk	uphill/downhill	ALAN JONES COUNTS: Start	Finish	Δ	counts/mile	counts/mile difference from C	Δ FEET
1	CONCRETE (CALIBRATION COURSE)	1760.00	0	RIDE	—	72000	77024.5	5024.5	15070	C = 15068.25	
						77000	82023	5023			
				WALK		82000	86978	4978	14934	−134	−47.0
2	CONCRETE	1000.0 steel taped	3% South end Downhill	RIDE	DOWN both brakes	90000	92854	2854	15069	.75	.3
					UP	93000	95853	2853	15064	−4.25	−1.5
					DOWN	96000	98856.5	2856.5	15082	13.75	−4.8
					UP	99000	01837.5	2837.5	14982	−86.25	−30.2
3	GRASS, grass blades average 1", tend to lie downhill towards sunlight	1000.0 steel taped	3% SOUTH end DOWNHILL	RIDE	DOWN	02000	04818	2818	14879	−189	−66.2
					UP	05000	07837	2837	14979	−89	−31.2
					DOWN	08000	10818	2818	14879	−189	−66.2
				WALK	UP	11000	13817	2817	14874	−194	−68.0
					DOWN	14000	16788.5	2788	14721	−347	−121.6
					UP	17000	19816.5	2816.5	14871	−197	−69.0
					DOWN	20000	22789	2789	14726	−342	−119.8
4	GRASS, grass blades average 1", tend to lie downhill towards sunlight.	404.0 steel taped	3% SOUTH end DOWNHILL	RIDE	DOWN	26000	27138.5	1138.5	14879	−189	−66.2
					UP	27000	28140.5	1140.5	14905.5	−163	−57.1
					DOWN BOTH BRAKES	28000	29137.5	1137.5	14866	−202	−70.8
					UP	29000	30140.5	1140.5	14905.5	−163	−57.1
				WALK	DOWN	30000	31132.5	1132.5	14801	−267	−93.6
					UP	31000	32135.5	1135.5	14840	−228	−79.9
					DOWN	32000	33131.5	1131.5	14788	−280	−98.1
					UP	33000	34136	1136	14847	−221	−77.4
5	GRASS, grass blades average 1", tend to lie towards South East facing morning sunlight.	unknown	3% North end Downhill	WALK	DOWN	35000	35695.5	695.5			
					UP	36000	36694	694			
					DOWN	37000	37695.5	695.5			
					UP	38000	38693	693			

Measured by Bob Peterson, Monday, May 3, 1976, 7:30 am, 63°F, 80% humidity, cloudy

Item	COURSE DESCRIPTION: Type / Surface	length	slope	ride/walk	uphill/downhill	ALAN JONES COUNTS: Start	Finish	Δ	Counts/mile	counts/mile difference from C
1	ASPHALT Calib. course	2640.00	0	ride	—	29000	36532.5	7532.5		C = 15066.75
						36532.5	44065.5	7533		
2	Firm Dirt/sand small rocks	2640.00	0	ride	—	44000	51526	7526	15052	-15
						51526	59053	7527	15054	-13
				jog	—	59000	66455.5	7455.5	14911	-156
						66455.5	73920	7464.5	14929	-138
3	ASPHALT Calib. course	2640.00	0	ride	—	74000	82534	7534		
						82534	90068	7534		
4	FIRM Dirt, DIRT, WEEDS, RUTS, Terribly rugged (hard surface dry)	4100.0	0	ride	—	90000	101673	11673	15032.5	-35

Note: [illegible]

					UP	40000	40694	694			
6	CONCRETE (Calibration Course)	1760.00	0	RIDE		47500	52521	5021	~~15008~~		
						53000	58022.5	5022.5			23 1/4" for $375
				WALK		58000	62979	4479	14937		
7	FIRM DIRT	500.0	6%	RIDE	UP	69000	70425	1425	15048	-20	-7.0
					DOWN FRONT BRAKE ONLY	70000	71428	1428	15080	11.7	4.1
					UP	72000	73424	1424	15037	-31	-10.9
					DOWN FRONT BRAKE ONLY	73000	74427	1427	15069	.75	.3
8	BEACH SAND DAMP, FIRM La Jolla Shores	600.0 steel taped	0	RIDE		25000	26705.5	1705.5	15008	-60.	-21.0
						27000	28708	1708	15030	-38	-13.3
				WALK		29000	30692	1692	14890	-178	-62.4
9	"	"	"	WALK 26" Schwinn 60 psi		59000	60738.5	1738.5	15299	-109	37.4
						61000	62739.5	1739.5	15308	-100	-34.3
	BEACH SAND DRY, LOOSE CHOPPY	600.0 steel taped	0	WALK		30900	32546.5	1646.5	14489	-579	-202.9
						32600	34231	1631	14353	-715	-250.5
						34300	35942	1642	14450	-618	-216.6
				WALK 26" Schwinn 60 PSI		64600	66296	1696	14925	-483	-165.5
						66300	67994	1694	14907	-501	-171.7
						68000	69698.5	1698.5	14947	-461	-155.0

C = 15408 for 26" ~~schwinn~~ × 1 3/8" Schwinn (fat tire)
15555 for dry dirt?

Make a separate table for 26" schwinn

JAN 18, '82

TC

RE: AN EXPERIMENT WITH SOLID RUBBER INNER TUBE

PURPOSE — ① TO OBSERVE THE VARIATION OF $\frac{\text{JONES COUNTS}}{\text{MILE}}$ VERSUS °F FOR A 27 × 1 1/8 SOLID RUBBER TIRE

② TO REPAINT MOST OF SAN DIEGO'S 880 YD CALIB. COURSES

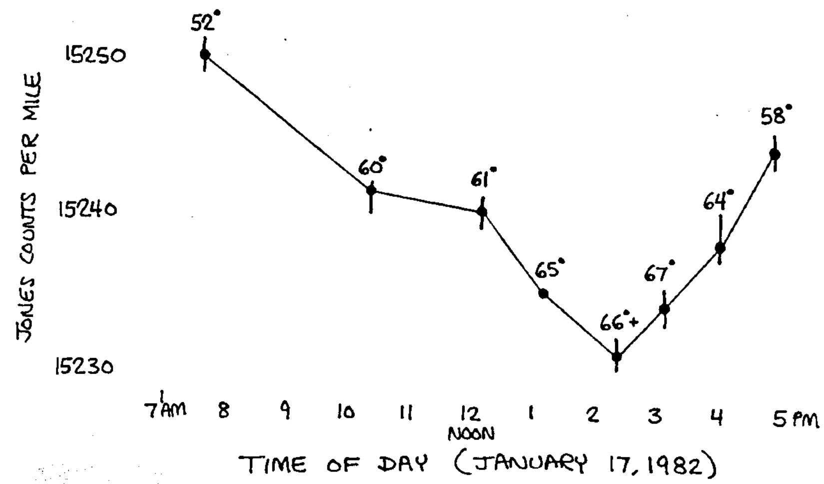
METHOD — PERFORM 4 CALIBRATION RIDES ON AS MANY OF SAN DIEGO'S 880 YD CALIBRATION COURSES AS POSSIBLE IN ONE DAY. MEASURE TIME AND TEMPERATURE (IN SHADE) AT EACH LOCATION.

DATA —

DATE	TIME	LOCATION	TEMP. (°F)	JONES COUNTS
1-17-82	7:40 AM	MISSION BAY MILE	52°F FOGGY DAMP	73000 > 7625 80625 88000 > 7629 95629 > 7625 03254 > 7625.5 10879.5 > 7624.5 18504
1-17-82	10:20 AM	CORONADO 880 yd	60°F DRY HAZY/SUNNY	83000 > 7621 90621 > 7621 98242 > 7620 05862 > 7621 13483
1-17-82	12:10 AM NOON	TIJUANA 880 yd	61°F SUNNY/HAZY	42000 > 7619.5 49619.5 > 7620.5 75240 > 7620 64860 > 7620.5 72480.5
1-17-82	1:10 PM	SW COLLEGE CHULA VISTA 880 yd	65°F SUNNY DRY	76000 > 7617.5 83617.5 > 7617.5 91235 > 7617.5 98852.5 > 7617.5 06470
1-17-82	2:20 PM	EL CAJON 880 yd	66°F	07000 > 7616 14616 > 7615 22231 > 7615.5 29846.5 > 7615 37461.5

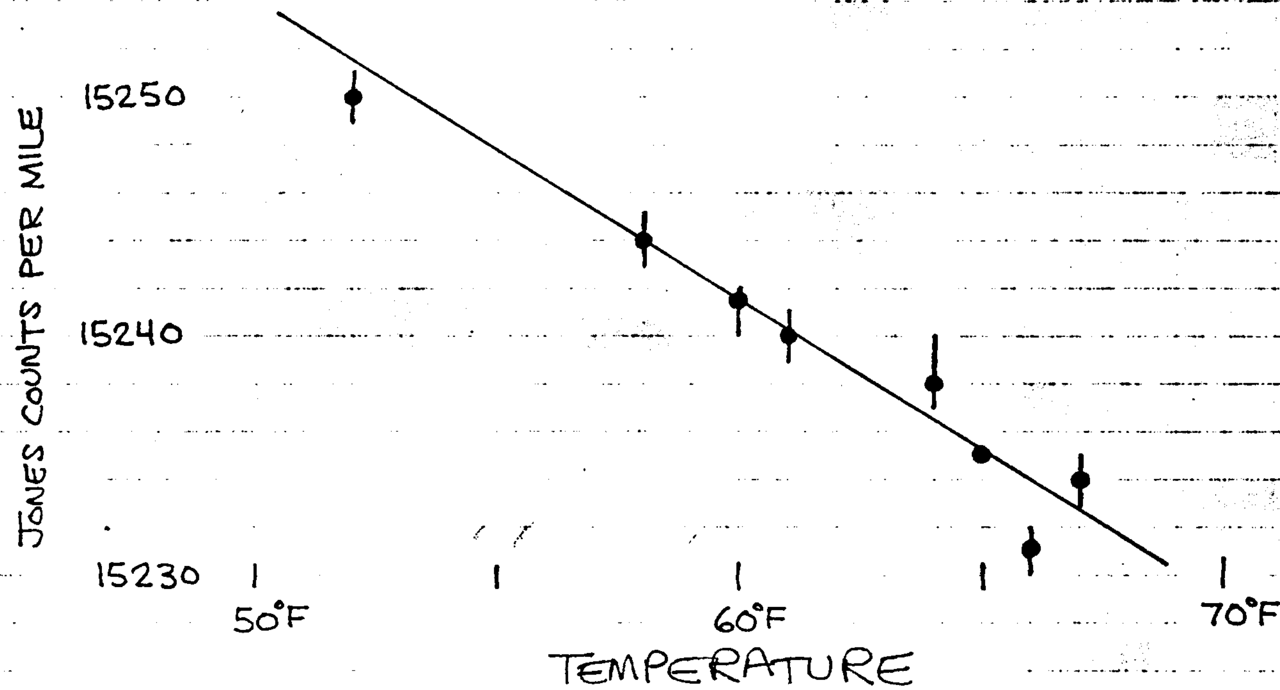
No. 34

DATE	TIME	LOCATION	TEMP (°F)	JONES COUNTS
1-17-82	3:05 PM	ALPINE 880 yd	67°F SUNNY	38000 > 7617 45617 > 7617 53234 > 7616.5 60850.5 > 7617.5 68468
1-17-82	4:00 PM	RAMONA 880 yd	64°F SUNNY	70000 > 7619 77619 > 7618.5 85237.4 > 7618.5 92856 > 7620 00476
1-17-82	4:50 PM	BLACK MTN. RD. 880 yd	58°F FOGGY	01000 > 7621.5 08621.5 > 7622 16243.5 > 7622.5 23866 > 7622 31488



EVALUATION

THE PLOT OF COUNTS/MILE VERSUS TEMPERATURE IS:



TEMPERATURE WAS DIFFICULT TO MEASURE ACCURATELY. ALL READINGS WERE IN SHADE, WHERAS MEASURING WAS OFTEN ON SUN-BATHED PAVEMENT.

NEVERTHELESS, THE CORRELATION OF TEMPERATURE VERSUS COUNTS/MILE IS GOOD. THE LARGEST "ERROR" ABOVE IS 1 FOOT/MILE.

FURTHER STUDY IS NEEDED TO OBSERVE COLDER (BELOW 50°F) AND WARMER (ABOVE 70°F) TRIALS, AND TO SEE THE EFFECT OF TIRE WEAR/AGE.

POTENTIAL

IT MAY BE POSSIBLE TO ACCURATELY PREDICT COUNTS/MILE WITHOUT DAY-OF-MEASUREMENT-CALIBRATING BY USING TEMPERATURE AND AN EMPERICAL GRAPH.

Robert A. Letson
4369 HAMILTON St. #4
SAN DIEGO, CA 92104

NO. 35

1-15-83

THE ACID TEST*

for finding out how accurate you are

SO, YOU THINK YOU'RE A GOOD MEASURER? OR, MAYBE YOU'RE JUST CURIOUS TO SEE HOW ACCURATE YOU ARE? OR HOW ACCURATE YOU CAN BE?

NOW THAT ROAD RACING IS ATTEMPTING TO ACHIEVE THE SAME DEGREE OF CREDIBILITY ATTAINED BY TRACK, IT IS TIME THAT WE "MEASURED UP". WE NEED TO TEST OUR ABILITY TO PERFORM SURVEYS ACCEPTABLE FOR TRACK RECORDS.

HOW? BY TESTING OUR MEASUREMENTS ON AN EXTREMELY ACCURATE SLALOM TEST COURSE, A COURSE WE CAN CREATE CLOSE TO HOME. AND WHERE IS THAT? ON YOUR OWN LOCAL 440 YARD TRACK OVAL! USING TRASH CAN LIDS! (AND A STEEL TAPE TO LOCATE THE LIDS EXACTLY).

THE FIRST STEP IS TO FIND A 440y TRACK THAT IS PAVED, HAS A 2-INCH-HIGH CURB, AND 330-FT STRAIGHTWAYS. (IT IS ADVISABLE TO CERTIFY ITS LENGTH BY STEEL TAPING THE CURB LENGTH, AND ADD 2π, TO DETERMINE THE LAP LENGTH). THE ATTACHED SLALOM DESIGN ADDS 78.07 FEET TO THE LAP LENGTH.

NEXT, FIND NINE (9) TRASH CAN LIDS (DIAMETER=22"), AND USE A MEASURING TAPE (STEEL) TO POSITION THEM EXACTLY AS SHOWN IN THE FOLLOWING DIAGRAM.

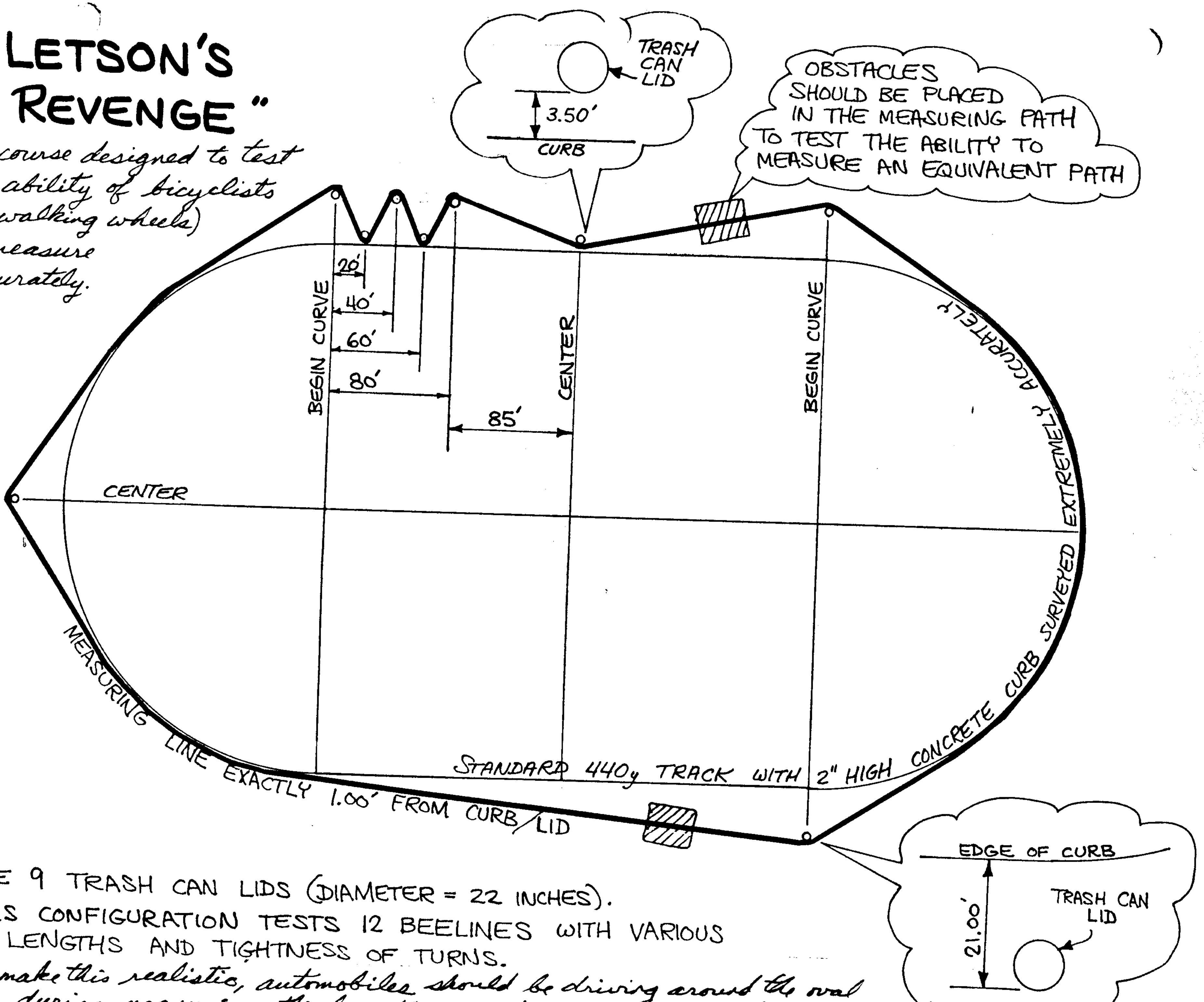
FINALLY, YOU CAN MEASURE THIS CIRCUIT VIA CALIBRATED WHEEL METHODS, AND SEE HOW CLOSE TO (LAP+78.07') YOU COME.

designed by R.A. Letson
MS-83 PSA-TAC Certifier
1-15-83

*OTHERWISE KNOWN AS "LETSON'S REVENGE"

"LETSON'S REVENGE"

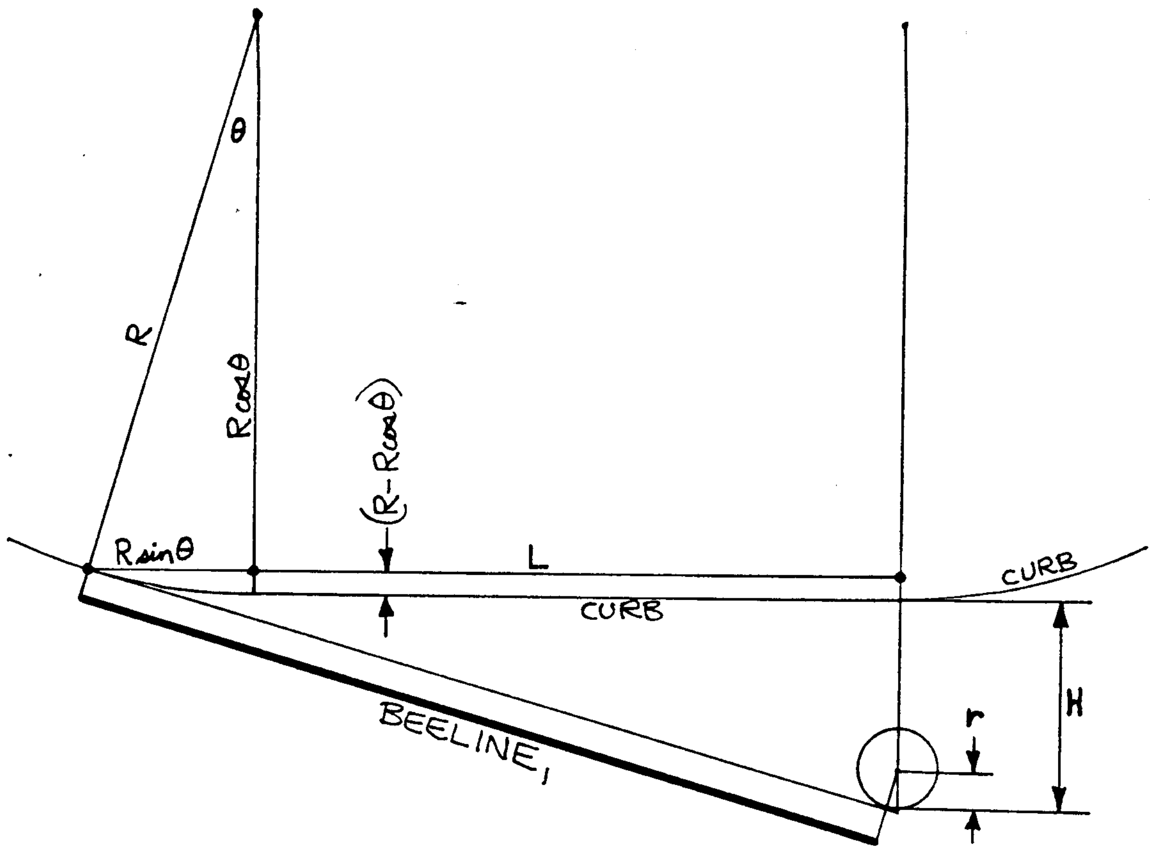
A course designed to test the ability of bicyclists (or walking wheels) to measure accurately.

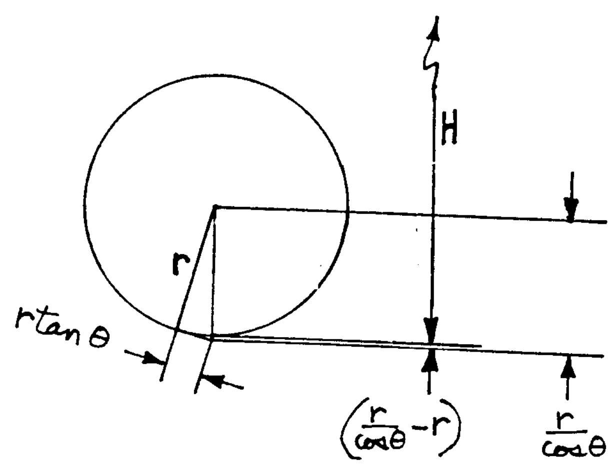


USE 9 TRASH CAN LIDS (DIAMETER = 22 INCHES).

THIS CONFIGURATION TESTS 12 BEELINES WITH VARIOUS LENGTHS AND TIGHTNESS OF TURNS.

To make this realistic, automobiles should be driving around the oval during measuring, thereby interefering & causing "aborts," to test the ability





$$\theta = \tan^{-1}\left[\frac{H + (R - R\cos\theta) + \left(\frac{r}{\cos\theta} - r\right)}{R\sin\theta + L}\right]$$

$$\text{BEELINE}_1 = \frac{R\sin\theta + L}{\cos\theta} - r\tan\theta$$

HP55 PROGRAM$_1$

1. L = 330.0000′ (STANDARD 440y TRACK STRAIGHTWAY)
2. R = 104.04226′ (RADIUS OF TRACK CURB)
3. r = 11 INCHES = .9167′ (RADIUS OF TRASH CAN LID)
4. H = 21.0000′

```
STO
5       θ
f
COS
STO
6       cos θ
√x
1
-
RCL
3
×
1
RCL
6
-
RCL
2
×
+
RCL
4
+
RCL
5
f
SIN
RCL
2
×
RCL
1
+
÷
g
tan⁻¹
GTO ØØ
```

$\theta_1 = f(\emptyset) = 3.641185255°$

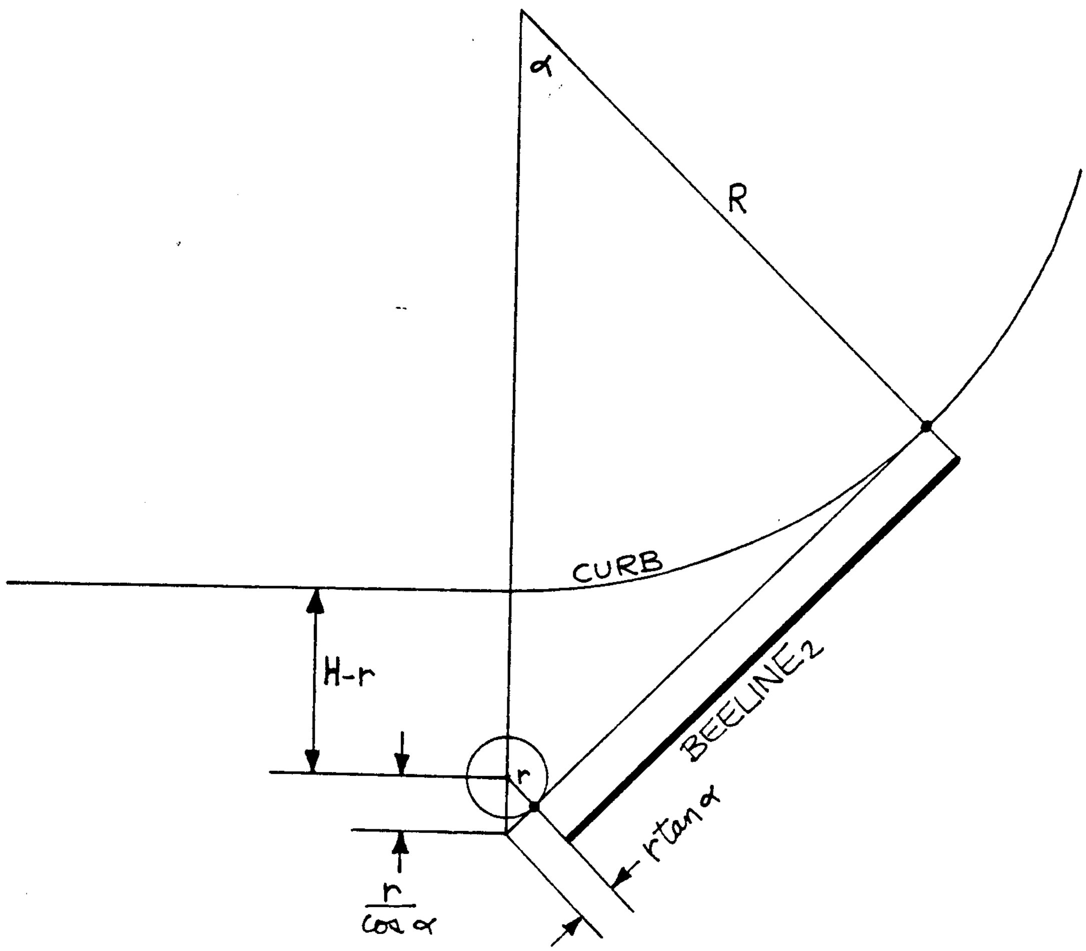
$f(3.641185255) = 3.605820642°$

$f(3.605820642) = 3.605811192°$

$f(3.605811192) = \underline{\underline{3.605811192°}}$

4 iterations to obtain an accurate θ

BEELINE$_1$ = $\underline{\underline{337.1532'}}$



$$\alpha_1 = \cos^{-1}\left[\frac{R}{R+(H-r)+\frac{r}{\cos\alpha}}\right]$$

$$\text{BEELINE}_2 = R\tan\alpha - r\tan\alpha = (R-r)\tan\alpha$$

HP55 PROGRAM$_2$

[2] $R = 104.04226'$ (STANDARD 440y TRACK CURB RADIUS)
[3] $r = .9167'$ (RADIUS OF TRASH CAN LID)
[4] $H = 21.0000'$

```
STO
(5)        α
f
COS
RCL
3
x⇄y
÷
RCL
4
+
RCL
3
−
RCL
2
+
RCL
2
x⇄y
÷
g
cos⁻¹
GTO ØØ
```

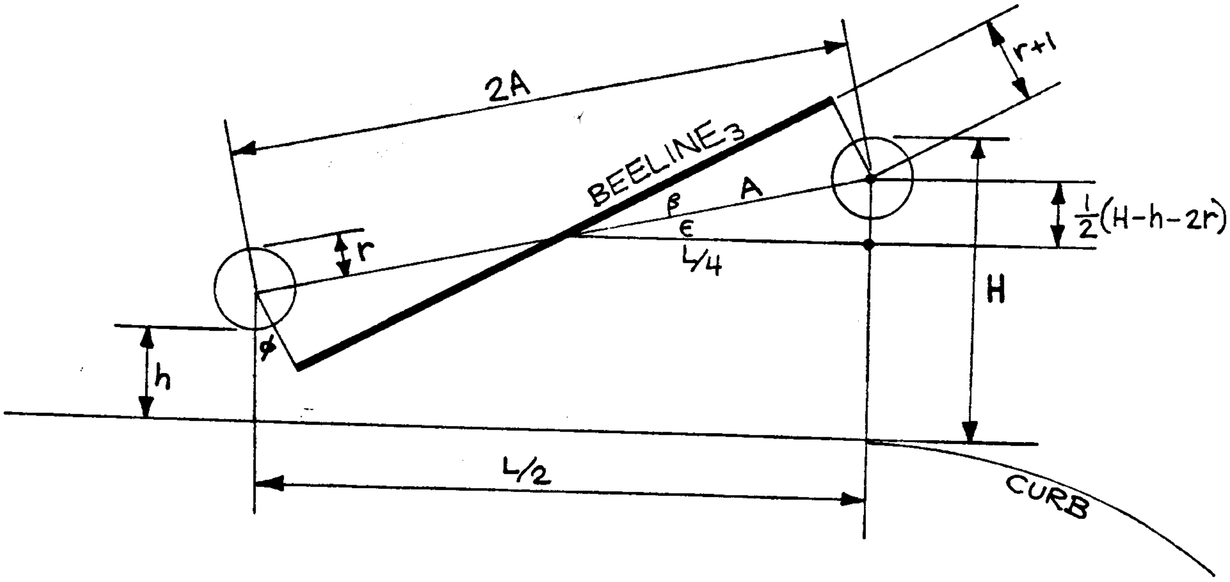
LET $\alpha_0 = 20°$

$\alpha = f(20) = 33.72979303°$

$f(33.72979303) = 33.81652493°$
$f(33.81652493) = 33.81728746°$
$f(33.81728746) = 33.81729413°$
$f(33.81729413) = 33.81729421°$
$f(33.81729421) = \underline{33.81729421°}$

} 5 iterations to obtain an accurate α

BEELINE$_2$ = $\underline{69.08165'}$



$$\epsilon = \tan^{-1}\left[\frac{\frac{1}{2}(H-h-2r)}{L/4}\right] = \tan^{-1}\left[\frac{2(H-h-2r)}{L}\right]$$

$$A = \frac{L}{4\cos\epsilon}$$

$$\beta = \sin^{-1}\left(\frac{r+1}{A}\right) = \sin^{-1}\left[\frac{(r+1)\,4\cos\epsilon}{L}\right]$$

$$BEELINE_3 = 2A\cos\beta = \frac{2L\cos\beta}{4\cos\epsilon} = \frac{L\cos\beta}{2\cos\epsilon}$$

$$\phi = \epsilon + \beta$$

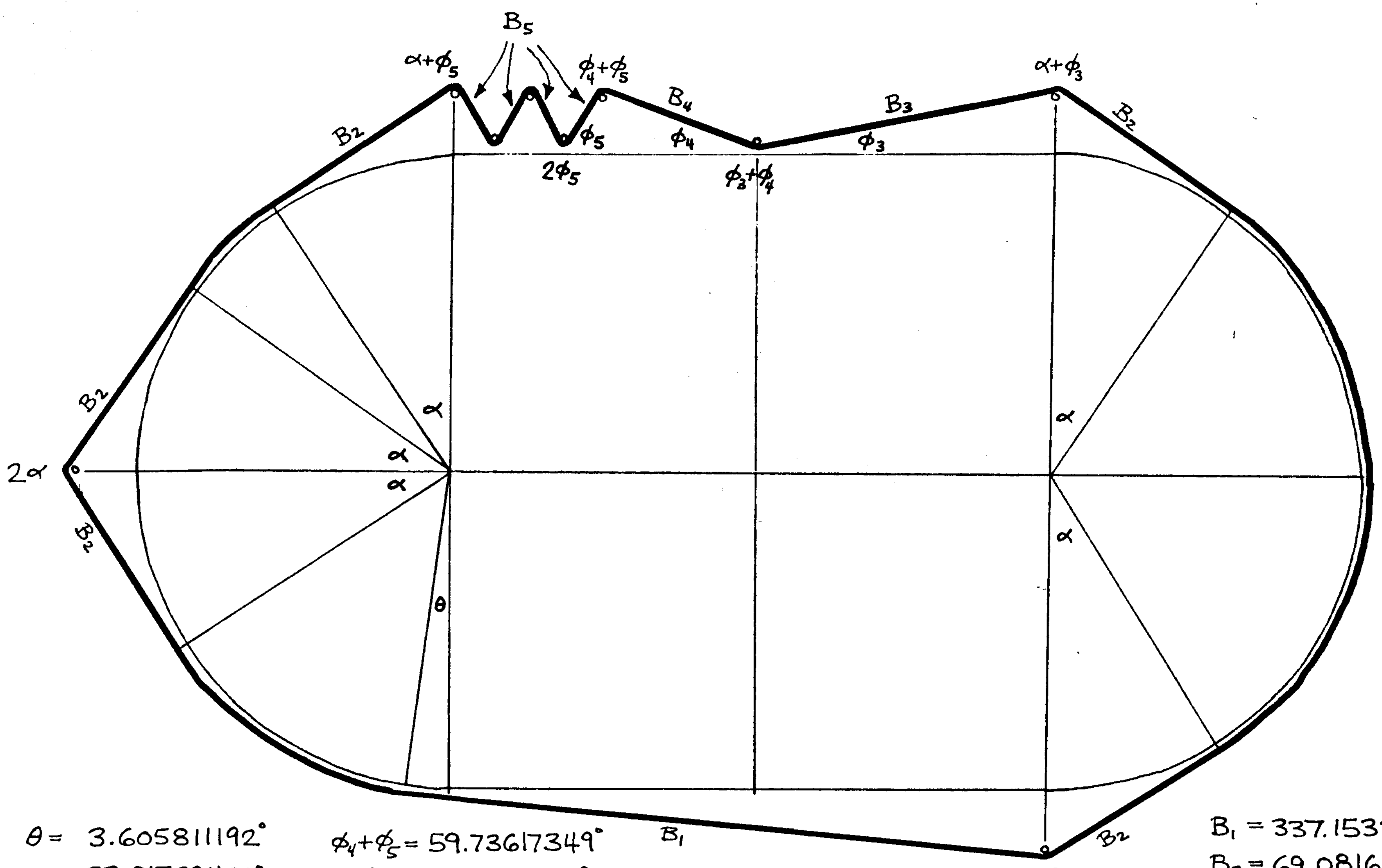
H = 21.0000′
h = 3.5000′
r = .9167′
L = 330.0000′ (STANDARD 440y TRACK STRAIGHTWAY)

ϵ = 5.423944638°
A = 82.87105113′
β = 1.325272236°

$BEELINE_3$ = 165.697767′
ϕ_3 = 6.749216874°

L = 40.0000′
ϵ = 38.07278188°
A = 12.702799′
β = 8.678238926
$BEELINE_5$ = 25.11473671′
ϕ_5 = 46.7510208°

L = 170.0000′
ϵ = 10.44319407°
A = 43.21587′
β = 2.541958622°
$BEELINE_4$ = 86.34668′
ϕ_4 = 12.98515269°



$\theta = 3.605811192^\circ$
$\alpha = 33.81729421^\circ$
$\phi_3 = 6.749216874^\circ$
$\phi_4 = 12.98515269^\circ$
$\phi_5 = 46.7510208^\circ$

$\phi_4+\phi_5 = 59.73617349^\circ$
$\alpha+\theta = 37.4231054^\circ$
$\alpha+\phi_3 = 40.56651108^\circ$
$\phi_3+\phi_4 = 19.73436956^\circ$
$2\phi_5 = 93.5020416^\circ$
$\alpha+\phi_5 = 80.56831501^\circ$
$2\alpha = 67.63458842^\circ$

$B_1 = 337.1532'$
$B_2 = 69.08165'$
$B_3 = 165.697767'$
$B_4 = 86.34668'$
$B_5 = 25.11473671'$

$$\sum \text{BEELINES} = B_1 + 5B_2 + B_3 + B_4 + 4B_5$$

$$= \underline{\underline{1035.0648'}}$$

$$\sum (R+1)\text{TURNS} = \frac{\pi(R+1)}{180}(360 - 5\alpha - \theta)$$

$$= \underline{\underline{343.3975'}}$$

$$\sum (r+1)\text{TURNS} = \frac{\pi(r+1)}{180}\left[(\alpha+\theta) + (\alpha+\phi_3) + (\phi_3+\phi_4) + (\phi_4+\phi_5) + 3(2\phi_5) + (\alpha+\phi_5) + 2\alpha\right]$$

$$= \frac{\pi(r+1)}{180}(5\alpha + \theta + 2\phi_3 + 2\phi_4 + 8\phi_5)$$

$$= \underline{\underline{19.60896'}}$$

LENGTH OF COURSE = 1398.07'	= .264786 MILE

EXTRA DISTANCE = 78.07'

No. I Draft

GENERAL CONSIDERATIONS

NO. 36 'Recieved mid 1982'

Road Racing is an activity which is dependent on many parameters such as weather, number of participating athletes, the area of the competition, the course, the time of day, etc.

Accordingly, a set of Rules and a series of recommendations have been adopted to assist Race Directors, Sponsors, and Games Committees to comply to the standards of an International Road Racing Event.

a. The following distances are contested at international road racing meetings:

- 3,000 meters
- 5,000 meters
- 10,000 meters
- 15,000 meters
- 20,000 meters
- 25,000 meters
- 30,000 meters
- Marathon
- 50,000 meters
- 50 miles

ORIGINAL IAAF WORK-UP NO. I. By Allan Steinfeld & IAAF Technical Committee. Note Missing Page 4. / Allan Couldn't find it but sent me Revised Handbook (see II)

All road courses shall be certified by the I.A.A.F. Cross Country and Road Racing Standards Sub-Committee.

Other road races may be held at various distances of one mile or greater.

b. The course shall be mostly on paved roads (including: asphalt, concrete, brick, and all weather running tracks). All other surfaces shall not exceed

10% of the total race distance. example: not more than 1000 meters of a 10,000 meter course shall be on grass.

i. A loop course in which the length of each loop exceeds at least one fifth of the contested distances. This is recommended for distances of the marathon or greater.

ii. A one way course also known as a point to point course.

iii. A two-way course on the same roadway. In this instance, the turning point shall be clearly marked and the radius of the turn shall be made as wide as possible.

iv. A two-way course using adjacent roads wherever possible.

v. A single loop course usually around a park or lake or on city streets.

The single loop or point to point course is recommended for races with large numbers of entries.

c. Sharp turns, climbs, turns or descents shall be avoided. Where necessary markers will be used to define the path. It is highly recommended that race officials monitor all turns and potential hazards.

d. Water and refreshments must be provided throughout the course at regular intervals. Distances between refreshment stations shall not exceed 2 miles/3 kilometers. In addition, water must be provided near the start and the finish.

i. Sponging points are recommended at regular intervals throughout the race. Sponging stations must be provided in races with distances greater than popularity of the marathon and shorter races, sponging stations can be unpractical - but are recommended.

ii. In warm weather, additional water stations shall be provided equiped with hoses and showers.

e. For distances of a half-marathon (13.109 miles) or less, distance markers must be displayed every mile and kilometer. For distances greater than a half-marathon, distance markers must be displayed every mile and every five kilometers.

The distances markers shall be large enough to allow large numbers of participants high visibility.

f. The elapsed time (split times) shall be called out or displayed at:

For distances of less than 13.109 miles at every mile and every five km.

or

For distances of less than 13.109 miles at every kilometer and five miles.

For distances longer than 13.109 ate every mile and every five km.

g. The race route shall be traffic free except for official vehicles. Dangerous intersections should be adequately staffed to regulate traffic and spectators. Every effort should be made to insure the athletes a clear and unobstructed path.

h. A lead vehicle shall be provided. All race vehicles shall be equipped with a vertical exhaust pipe. An electrical lead vehicle is recommended. The lead vehicle must maintain a minimum of 100 meters distance from the lead runner(s).

i. Transportation shall be provided to assist the athletes who desire to leave the competition or who may be ordered to stop by monitors or medical advisors.

ii. Additional official vehicles may be provided to assist in monitoring the event, timing or other required functions.

i. A road calibration course is available. (See e below for details).

ii. The measurement has been repeated a minimum of two times.

c. Experience indicates that the Bicycle Method lends itself easily to preliminary measurement and layout. Maps and aerial photographs are of a great value at this stage. Automobile odometers can be helpful but yield inaccurate course by as much as 3-10%.

d. Once the course has been layed out the procedure is to:

i. Establish a calibration course.
ii. Calibrate the bicycle or surveyor's wheel.
iii. Measure the course.
iv. Recalibrate the bicycle or surveyor's wheel.
v. Check the course by a different method or a second measurement.
vi. Establish refreshment stations, sponging stations.
vii. Define areas of difficulty requireing special consideration (start, finish, traffic).

e. Road Calibration Course

i. The road course must be paved, straight, level and free of possible from traffic or pedestrians. Its length should be between one half to one mile.

ii. The distance must be measured by steel tape using a team of three or more men. A professional surveyor is recommended to measure the calibration

iii. The measurement must be done at least four times preferably on different days.

iv. The spread between the shortest and longest measurement must not exceed two parts in 10,000 0f the measured distance. This corresponds to 2/10 meter in a kilometer or 6.3" per half mile.

v. To obtain this accuracy, measurement must be conducted in clear days and the tape tension must be maintained with proper temperature correction incorporated.

It is recommended that a 100 foot steel tape is used with a twenty pound tension. Longer steel tape measures may be more difficult to work with.

f. Bicycle or surveyor's wheel calibration consists of riding the bicycle (the surveyor's wheel must be walked at slower than three miles per hour) over the road calibration course a minimum of four times and calculating the bicycles or wheels or wheels constant. The bicycle is fitted with a counter mounted to the front wheel that reads revolutions (or parts of revolutions). The widely used Clain Jones Counter registers approximately 15,000 counts per mile and is the recommended counter for all bicycles.

This calibration must be done before and after course measurement and on the same day by the same rider. An acceptable bicycle calibration requires that the greatest error be within ± 5 parts in 10,000. For a 27" bicycle this requires that the difference between the two extreme readings be within 1/3 of a revolution per mile.

g. The chaining method uses a 100 foot steel tape with a spring balance and tape thermometer. Care must be used to record the number of 100 foot lengths.

i. The course is to be measured along the path the runner is expected to take.

3. COURSE MONITORING AND MARKING

a. During the race there must be markers and/or people at strategic points to keep the runners on course and to attend to their needs.

b. Every turn and intersection must be marked (we must assume that every runner will be a total stranger to the area and that he will remember little if any pre-race description of the course). The best marks consists of white arrows on both sides of the road. The arrows should be large and easily seen from either side of the street, when approaching a corner. It is highly recommended that race officials be stationed at these points.

c. All signs should be used with caution. If used, they should be large and easy to see from 100 meters away and monitored. Orange traffic cones are helpful but must be monitored periodically to insure their proper position.

d. All course monitors and sentries must be in position at their posts 1/2 hours prior to the start of the race and should be wearing vests or attire that clearly indicates their role. Sentries located at intersections and corners should be visible to the runners as they approach that area.

e. Scorers shall keep a continuous record of the run at specific points. Because of the high density races today, it is recommended that tape recorders, video tape recorders and additional methods be used. In most cases during high density races, it is recommended that the top 10% of the men's and women's field be monitored with accuracy.

f. Refreshment stations must be located at intervals of 2 miles/3 km or less.

These stations should be equipped with drinking water and accessory equipment - paper cups, tables and trash receptacles. In addition to the basic ingredients of water and cups, additional fluids such as electrolyte replacement fludis and orange slices can be provided. Any other drinks than water should be clearly marked in a different colored cup for easy identification by the runner.

i. Large visible signs should indicate each water station.

ii. The density of the race should dictate the number of workers needed at each refreshment station.

iii. The refreshment station should be set up and manned at least one half hour before the start.

iv. For international championships and world championship, the runners must pick up their own refreshments from the tables.

Recommended a minimum of 4 ounces per runner for each aid station

4. IDENTIFICATION OF THE FINISHERS

There are various successful methods used to identify the runners. The size and density of the event should dictate the method used.

Density is determined by the number of participants and the distance of the race. A density of 1500 runners in a 10 km race is equivalent to 3000 runners in a 20 km race. Experience indicates that this particular density (1500 @ 10 Km) is important in determining various finish line systems.

a. Numbers. Probably the most common method is to have each runner pin a number on his/her chest and or back. If only one running bib is used it should be pinned on the front for easy identification by the course monitors. The number must be visible at all times. In races where age group awards are given, the numbers can be coded with a letter prefix or issued within a number block example #'s 1-100) for a specific age group and sex. Pre-race registration lists the names that corresponds to the various numbers. The number should be made of light and strong material so as not to fall apart if it rains. Running.

...ers must be exposed at all times.

b. Tags. In many cases tages are used that are pinned to the runners shirts containing all the required information (name-age-sex-team,etc.). These tags are valuable for scoring the event but make course monitoring difficult (and if used alone, impossible). If tags are used, it is recommended that they be used in conjunction with the numbers. Experience indicates that a combination of the tag and number system is one of the most accurate available without utilizing expensive computer services.

c. Electronic Recording Devices. Pull tags are available today that can be scanned electronically. These methods are expensive, but accurate. It eliminates many transcribing errors at the finish but should be used along with running numbers.

In some large participation events, the low numbers are reserved for the top male and female competitors. These low numbers are easy to identify by course officials during the race.

). RECORDING TIMES AND FINISHERS AT THE FINISH LINE

There are various methods of recording the times of finishers in conjunction with the identification of these individuals. The range of equipment can vary from the use of a stopwatch to the incorporation of expensive computers and timing devices.

The basic finish line system times runners as they cross the finish line, directs the runners in order (that they crossed the finish line) into a long roped off lane called a chute. The runner's number or tag is recorded at the end of the chute where the runners are walking or moving at a slower pace than at the finish. Most finish line systems utilize several lanes to accomodate the large numbers of runners.

The runners can be timed in various ways:

a. By using stopwatches and recording sheets. This requires a team of two people. Utilizing a clipboard and stopwatch, one acts as a caller and the other as a recorder. As each runner crosses the finish line, the caller calls out the time and the recorder writes that time. At the same time, another team of recorder and caller write down the runners numbers in order. The two lists (time and runner's numbers) are then matched. This method should only be used with densities of 100 runners or less at the 10 kilometer distance. Usually no chute is used for this size event.

b. In higher density events, the same equipment can be used to produce fairly accurate results. In this case, Select timing is incorporated. A team of recorder and caller at the finish line with a stopwatch and clipboard will select a runner as he or she is approaching the finish line. The caller will call out the runner's number to the recorder and the recorder will wirte down that number. When that runner crosses the finish line, the caller will call out the time to the

c. Individual timing using a printing timer and select timing is the most highly recommended method. In this case, a timer utilizing a printing timer (an instrument that has a push-button switch which records and prints time and sequential place) will press the switch every time a finisher crosses the finish line. All runners will be directed (in the order in which they finished) into the chute system where their running number will be recorded. Select timing is utilized as reference points to maintain the integrity of the times from the electronic timer. Some adjustments of the times from the printing timer will be necessary from information obtained from the select timers.

i. A minimum of two teams of select timers are required for all finish lines.

ii. Every finisher must receive his/her time and place.

iii. All records require a minimum of three official times. In the event of two of three watches agreeing and the third disagreeming, the time shown by the two shall be the official time. If all three watches disagree, the watch with the middle time shall be used. If only two watches are used, the watch showing the slower time is used.

iv. The time shall be taken from the flash of the pistol or approved apparatus to the moment at which any part of the body of the competitor (i.e. torso, as distinguished from the head, neck, arms, legs, hands, or feet) reaches the perpendicular plane of the nearer edge of the finish line.

v. Mechanical movement watches must be calibrated by the manufacturer. Times are read to the next highest tenth of a second for races less than twenty kilometers.

vi. For races twenty kilometers or longer, times are read to the next highest full second (example: 1 hour 2 minutes 32.2 seconds, 1'32.2" is read 1'33".)

vii. As most electronic apparatus times to 1/100 second, all times for distances under twenty kilometers are read to the next highest tenth of a second:

.00	is read	.00
.01		.10
.02		.10
.03		.10

only .00 stays .00

viii. When a printing timer is used, all times shall be adjusted by the first official watches and select timing.

d. High Density Races.

Races with densities greater than 1500 runners at the 10 km distance are nearly impossible to individually time all runners. Timers using printing timers are only capable of pressing the timing button at 2-3 times per second for short periods of time (with varying degrees of accuracy). It is highly recommended that in races of this nature two or more finish line systems constructed adjacent to each other serve to time the high densities. The method is to split the finishers as they approach the finish area to one of the two finish lines (which to the untrained eye appears as only one). Each finish line is independent of the other and requires its own set of officials. This system is usually put into operation after the first 10% of the finishers have crossed only one of the finsih lines. This allows for easy scoring of the top finishers. Practice and timing is needed to successfully switch the system from one to two (or more) finish lines during the race.

6. RECOMMENDED FINISH LINE CHUTE SYSTEM

The following system is capable of handling a density of approximately 1000 finishers or less at the 10 km distance (equal to about 4200 finishers at the marathon distance).

a. The basic system utilizes four lanes or chutes. The length of the chute is determined by the density and temperature of the day.

i. On warm days, the chute length should be under 100 meters.

ii. The chutes should always be monitored by chute officials to assist runners through the chutes. It is recommended that additional chute workers be used for the longer distance such as the marathon. The chute workers also maintain the integrity of the order of finish.

iii. The ideal situation is to have the runners who have just finished moving continuously through the chute. This can be achieved by using several chutes and not filling each to its capacity. Practice will allow the chute captain to switch chutes at the proper time to allow free movement through the chute.

i. The funnel area (space between the finish line to the entrance of the chutes should be a minimum of 15-20 meters. Races such as the marathon with runners crossing the finish line at a relatively slower rate than in a 10 km run would require a slightly shorter funnel area. Races wth high densities such as 2000+ in a 10 km would require a funnel area of 20-25 meters.

i. The funnel area is manned by funnel area workers who maintain the order of finish from the time the runners cross the finish line until the time they enter the chute.

v. The recommended finaih line system splits the funnel area into two sides. Each side may be constructed with 1, 2, 3 or more chutes. By splitting the finish line funnel area, two funnel areas are formed enabling a smoother finish line and alternate funnel areas in case of a fallen athlete.

b. As runners approach the finish line, the following will occur:

i. Finish line traffic controllers positioned in front of the finish line will direct the approaching runners to one of the two sides of the funnel area.

ii. As each runner crosses the finish line, he/she is timed with the recommended printing timer or other form and select individual runners will be "select timed".

iii. Funnel area workers will direct the runners to one of the chutes. The first runner will be lead with a messenger carrying an alphabetically sequenced card (A or B or C) which will be taken to the recorder and caller at the end of the chute. The cards enable the scorer of the race to determine the order in which the chutes were filled.

iv. At the end of the chute the caller will call out the card letter to the recorder. The information will be recorded. The caller and recorder will then proceed to record the runners number and/or tag in the order in which they come through the chute. Care must be taken by the chute workers to maintain the order of finish and to assist and/or take the place of a runner who cannot go through the chutes on their own.

v. Just before the flow of traffic is about to stop in that chute, the chute captain will call for a "switch", to switch the incoming runners to the other funnel area. The configuration of the funnel area is that which will not permit the mixing of the two groups of runners (the chute just filled and the one being filled). The first runner down this second chute used is led with a messenger card indicating the "B" chute. At the end of the chute, the recorder and caller will record the necessary data. This system allows more than one chute to empty at a time while only one chute is filled at a time.

c. Two main scorers are needed to assist in the result tabulation:

i. One scorer will match the times from the finish line with the tags and/or runners numbers utilizing the select timing system. Experience shows that the matching occurs more quickly with runners numbers recorded on sheets of paper than working with many tags.

ii. The second scorer will scan the sheets and determine the award winners. Besides for the obvious first few finishers, the age group winners (if there are awards in this category) can be determined by previously coded numbers.

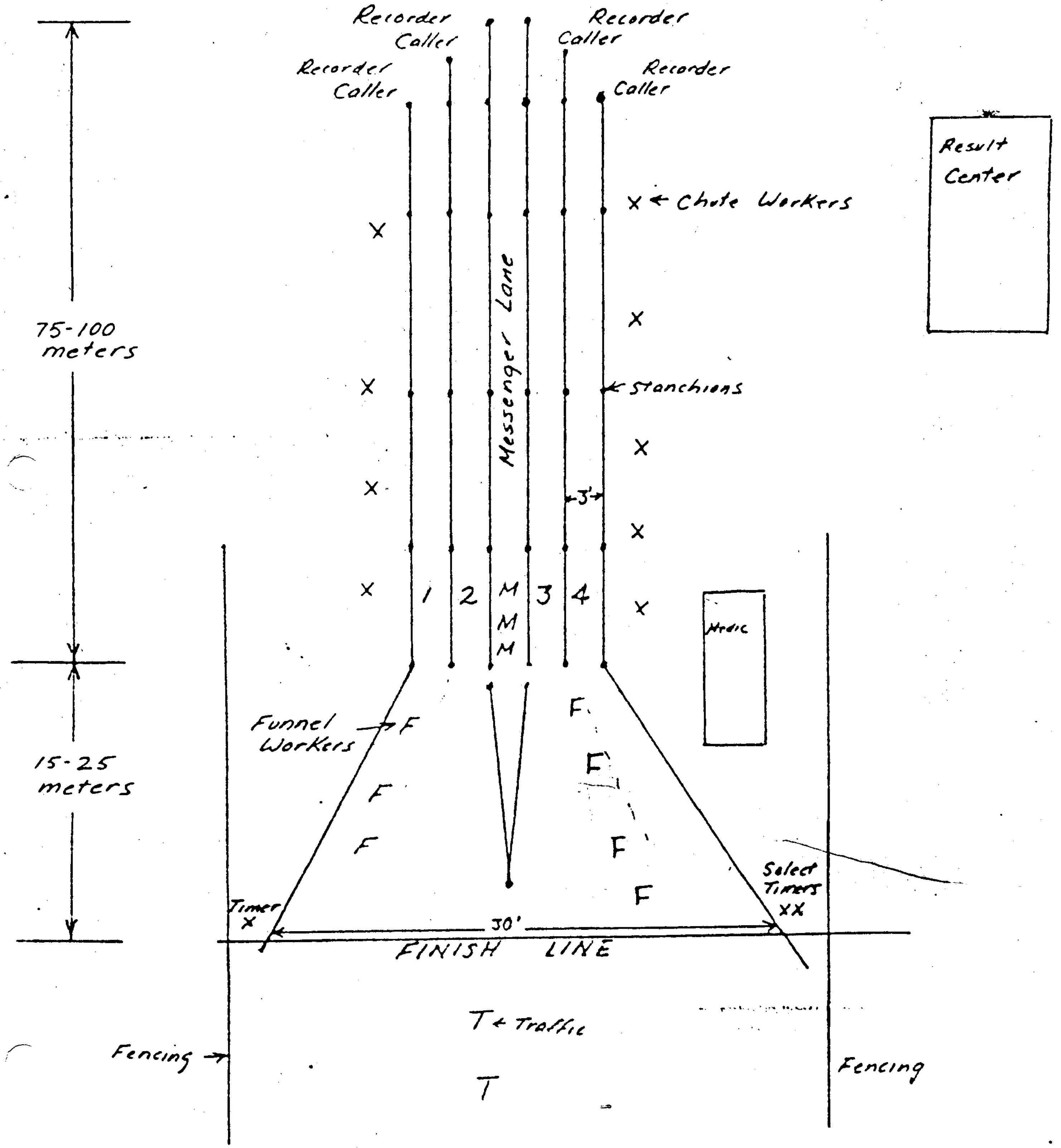
d. The following chart may assist in determining the density of an event and the proper number of chutes needed. It should be noted that above 1500 finishers at the 10 km distance, a human cannot press the button on a printing timer with prolonged efficiency. In this case, two or more finish line s may be used constructed next to one another appearing as only one finsih line to the untrained eye. Each finish line is manned with its own set of officials and works independently of the other. When a multiple finish line system is used, the first 5-10% of the finishers can be directed down a single finish line and the mass can be split to the two finish lines as the density increases. By doing this, the first finishers can be scored quickly. All other finishers from the two finish lines will eventually have to be meshed according to time. In many races a separate finish line is used for female competitors. This practice greatly speeds up race results.

e. **Finish Line Density Chart**

Number of finishers				
marathon	20 km	10 km	5 km	# of chutes or finish lines recommended
100	47	24	12	one chute
500	237	119	60	2 "
1000	470	240	120	2 "
2000	948	474	237	2 "
3000	1422	711	355	4 "
4000	1896	948	474	4
5000	2370	1190	600	6
6000	2844	1422	711	6
7000	3318	1659	829	8 chutes or 2 finish lines of 4 chutes
8000	3791	1896	948	2 finish lines of 4 chutes each
9000	4265	2133	1066	2 finish lines of 4 chutes each
10000	4739	2370	1185	2 finish lines of 4 chutes each
12000	5687	2844	1422	2 finish lines of 6 chutes each
14000	6635	3318	1659	2 finish lines of 6 chutes each
16000	7583	3791	1896	3 finish lines of 4 chutes each
18000	8531	4265	2133	3 finish lines of 6 chutes each
20000	9479	4739	2370	3 finish lines of 6 chutes each
22000	10427	5213	2607	3 finish lines of 6 chutes each
24000	11374	5687	2844	3 finish lines of 6 chutes each
26000	12322	6161	2920	3 finish lines of 6 chutes each
28000	13270	6635	3318	4 finish lines of 6 chutes each
30000	14218	7109	3555	4 finish lines of 6 chutes each
35000	165888	8294	4147	4 finish lines of 6 chutes each

Standard Finish Line Chute System

This chute design is adequate for densities of 1000 finishers or less at the 10 Km distance. The chutes would be filled in the following order: 2-3-1-4 & repeat of the cycle: 2-3-1-4. It is highly recommended that fencing be used to keep the spectators away from the finish line system to allow freedom of movement by officials.



g. Metric Distance in Imperial Distances:

One inch = 2.54 cm exactly

One meter = 1.09 361 329 8337 yards

One yard = 0.9144 meters exactly

Distance	Yards (equivalent)		Yards	Feet	Inches	Miles
1,000 meters	1,093,613 298 337	1/2 mile plus	213	1	10.07	0.621
1,500 meters	1,640.419 947 5055	1 mile plus	119	1	8.88	0.932
2,000 meters	2,187.226 596 674	1 mile plus	427		8.15	1.2427
3,000 meters	3,280.839 895 011	2 miles less	239		5.76	1.864
5,000 meters	5,468.066 491 685	3 miles plus	188		2.39	3.107
8,000 meters	8,748.906 386 696	5 miles less	51		3.37	4.971
10,000 meters	10,936.132 983 370	6 miles plus	376		4.78	6.214
12 km	13,123.359 580 044	7 miles plus	803	1	0.82	7.457
15 km	16,404.199 475 055	9 miles plus	564		7.17	9.321
20 km	21,872.265 966 740	12 miles plus	752		9.56	12.428
25 km	27,340.332 458 425	15 miles plus	940		11.95	15.535
30 km	32,808.398 950 110	18 miles plus	1128	1	2.34	18.642
35 km	38,276.465 441 795	21 miles plus	1316	1	4.73	21.749
40 km	43,744.531 933 480	24 miles plus	1504	1	7.12	24.856
50 km	54,680.664 916 850	31 miles plus	120	1	11.9	31.070

SCORING

a. The IAAF under Rule 167 paragraph 5.6.7 suggests a number of permissable scoring methods for team races. The method of scoring shall be optional and may be any one of the following:

i. By scoring the least number of points, according to the positions in which the scoring members of a team finish. The finishing positions of the nonscoring members of a team shall be scored in computing the scores of other teams, but when a team fails to finish the requisite number to score, it shall be eliminated; or

ii. By scoring the least number of points according to the scoring positions in which the scoring members of a team finish. The positions of the nonscoring members of a team, whether it finishes all its members or not, shall be scored in computing the scores of toher teams; or

iii. By scoring the least number of points according to the positions in which the scoring members of a team finish. The finishing positions of the nonscoring members of a team, and the members of a team which fails to finish the requisite number to score, shall be eliminated; or

iv. By scoring the lowest aggregate of the times recorded by the scoring members.

v.- If two or more competitors tie for any place the points for the places concerned shall be aggregated and divided equally among the competitors so tying.

vi.- In case of a tie on points, the team whose last scoring member finished nearest to first place shall be the winning team.

b. When individual athletes are permitted to enter the recommended socring systems are:

i. Score each team according to the positions in which the scoring members of a team finish without deleting the unattached runners or the nonscoring team members.

ii. Score each team according to the positions in which the scoring members of a team finish deleting the unattached runners but retaining the nonscoring team members.

iii. Deleting from the scoring both unattached and nonscoring team members.

iv. When scoring is limited to team competition, it is recommended that a sepcial set of numbers be assigned to the unattached athletes for quick identification. Four (4) digit numbers are recommended.

v. Scoring cards should be numbered in groups of 25 finishers. A typical scoring sheet in Figure 2.

c. In lap courses scoring must be done after establishing that each athlete has completed the event. This requires a review of the scoring cards from the various checking stations established for this purpose. An athlete who fails to appear in checking stations must be eliminated from the competition.

d. Weatherproof numbers shall be used in all championships to prevent a loss of the competitor numbers during heavy rainfall.

a. A steel tape is considered as standard when it has been calibrated by the Bureau of Standards and found to conform to the following specifications:

i. It shall be made of a single piece of metal ribbon.

ii. None of the graduations shall be on pieces of solder or on sleeves attached to the tape or wire loops, spring balances, tension handles, or other attachments liable to be detached or changed in shape.

iii. The error in the total length of the tape, when supported horizontally throughout its length at the standard temperature of 68°F (20°C) and at standard tension, shall not be more than 0.1 inches per 100 feet (2 mm per 25 m).

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iv. The standard tension is 10 lbs. (4.5 kg) for tapes 25 to 100 feet or from 10 to 30 m in length and 20 lbs (9 kg) for tapes longer than 100 feet or 30 m.

b. Tapes conforming to the above specifications will be certified by the Bureau and a precision seal showing year of standardization will be placed on each tape so certified. The Bureau's serial number on a tape signifies that it has been tested by the Bureau and either a certificate or a report issued.

i. Ordinarily, the length of a steel tape is certified or reported by the Bureau to the nearest 0.001 ft. or 0.0002 m (0.2 mm).

ii. The standard tension given in the specification is for a tape when supported on a horizontal flat surface. No standard tension has been officially adopted for a tape when supported in any other manner.

iii. It is suggested that, dependent on the length of the tape and its weight per unit length, tensions in the range of 20 to 40 lbs. (9 to 18 kg) be used for tapes used in single catenary type of suspension. Tapes weighing 0.018 lbs./ft. or more may be considered as heavy tapes. Tapes weighing 0.009 to 0.0011 lbs./ft. may be considered as light tapes.

iv. In the standardization of invar tapes, the following tensions are used unless otherwise specified: 20 lbs. for 50, 100, and 150 feet tapes, and 15 kg. for 30 and 50 m tapes.

c. Tapes made by the manufacturers that supply the surveying and engineering trade with high grade steel tapes are almost universally correct for total length and standard tension and temperature within 0.01 ft., and ordinarily within 0.006 ft. Hence, for most work not requiring an accuracy better than 0.01 ft., it is not necessary to submit the tape to the Bureau for a calibration. As high grade tapes are ordinarily uniformly graduated within a few thousandths of a foot, the calibration of subintervals of a tape is not required except when rather precise measurements are to be made with the tape, that is, measurements to a few thousandths of a foot. The owner of a tape can check the uniformity of division of the tape by measuring, for example, a 25 foot distance by using the intervals from 0 to 25 feet, 25 to 50 feet, 50 to 75 feet, and 75 to 100 feet on the tape.

d. **Based on the above considerations, all measurements of a standard 400 m or 440 yard track must be made with a certified tape as the basic standard.**

i. At least four independent measurements must be made. The maximum

...ference between any two measurements cannot exceed 10 cm for the perimeter of the inside lane.

ii. The measurements of the start of distance events (in a 440 yard or 400 m track may not differ by more than 5 cm between any two measurements.

iii. Similar tolerances apply for 220 yard tracks used for indoor competition.

STANDARDS OF LENGTH

a. The primary standard of length in the United States is the United States Portotype Meter 27, a platinum-iridium (90% platinum, 10% iridium) line standard having an X-shaped cross section. The length of this bar, which is deposited at the National Bureau of Standards in Washington, is known in terms of the International Prototype Meter at the International Bureau of Weights and Measures at Sevres, near Paris, France.

i. The U.S. yard is defined following the policy stated in the Mendenhall Order of April 5, 1893 as follows:

$$1 \text{ U.S. yard} = \frac{3600}{3937} \text{ meter}$$

ii. The relation one (1) U.S. yard = $\frac{3600}{3937}$ meter, derived from the Law of 1866 that made the use of the metric system legal in the United States, was confirmed by later comparisons of copies of the British yard with the U.S. national copies of the meter. Since the Mendenhall Order it has been used as an exact relation. From this it follows that one (1) U.S. inch is slightly larger than 0.025 400 05 meter, or 25.400 02 millimeters.

iii. For industrial purposes, a relation between the yard and the meter has been adopted by the American Standards Association (ASA B48.1-1933), and by similar organizations in 15 other countries. This relation is:

1 inch - 25.4 millimeters (exactly), that is, 0.025 4 meter (exactly), from which 1 yard - 0.914 4 meter (exactly), or 914.4 millimeters (exactly).

Great Britain the Imperial Yard is represented by a ... made of bronze in 1844. The relation between that yard and the meter according to the most recent published determinations is:

$$1 \text{ British Imperial Yard} = \frac{3\,600\,000}{3\,937\,014} \text{ meter}$$

v. Based on these considerations, it is recommended that for measurements of long distance events the relation one inch = 2.54 centimeters exactly be considered in all calculations.

10. LONG DISTANCE AND ROAD RUNNING TRACK STANDARDS

a. One inch = 2.54 centimeters exactly. One yard = 0.9144 meters.

b. The perimeter of the track (for all long distance track events) shall be 400 meters or 440 yards for out-of-door competition and 220 yards or less for indoor competition.

i. The direction of running shall be left-hand inside (counter-clockwise).

ii. The track shall allow at least six lanes 1.22 meters wide. Width of lanes shall not exceed 1.25 meters.

iii. The deviation for lateral inclination is 1:100 of the width and for the inclination in the running direction 1:1000 of the length.

iv. The race must be conducted on the perimeter of the track with the exception of the steeplechase where the path leaves the perimeter to include the water jump. Refer to IAAF Rule 164.

c. The running track shall not be less than 7.32 meters in width (six lanes) and preferably 9.76 meters (8 lanes), and,

i. be bordered on the inside with cement, wood or other suitable material, 5 centimeters in height, and not more than 5 centimeters in width.

ii. Where it is not possible for the inner edge of the running track to have a raised border, the inner edge shall be marked with lines 5 centimeters in width.

iii. Where it is a grass track it shall also be flagged at intervals of 5 meters. Flags must be so placed on the line as to prevent any competitor running on the line, and they shall be placed at an angle of 60 degrees with the ground away from the track. Flags approximately 25 centimeters by 20 centimeters in size mounted on a staff 45 centimeters long are the most suitable for the purpose.

d. Measurement of the inner lane shall be taken 30 centimeters outward from the inner border of the track, and where no border exists, 20 centimeters from the line marking the inside of the track. The remaining lanes are also measured 20 centimeters from the outer edges of the lines marking the lanes. The line on the right of each lane only shall be included in the measurement of the width of the lane.

e. A maximum of twelve competitors may start from a single starting line.

f. A maximum of 18 competitors may start if more than one starting line is used.

g. The start, as defined in Paragraphs e and f above, shall be staggered that the distance from the start to the finish shall be the same for each competitor.

h. Qualifying times fro long distance competition shall be made only on a track which meets the criteria outlined in Paragraphs b and c and subparagraphs thereof.

i. Qualifying times for indoor may be made on a 220 yard perimeter track (or less in length) or outdoor as defined by the Standards Subcommittee and must comply with Paragraphs b and c above.

ii. Qualifying times made on a 300 yard track or longer up to and including

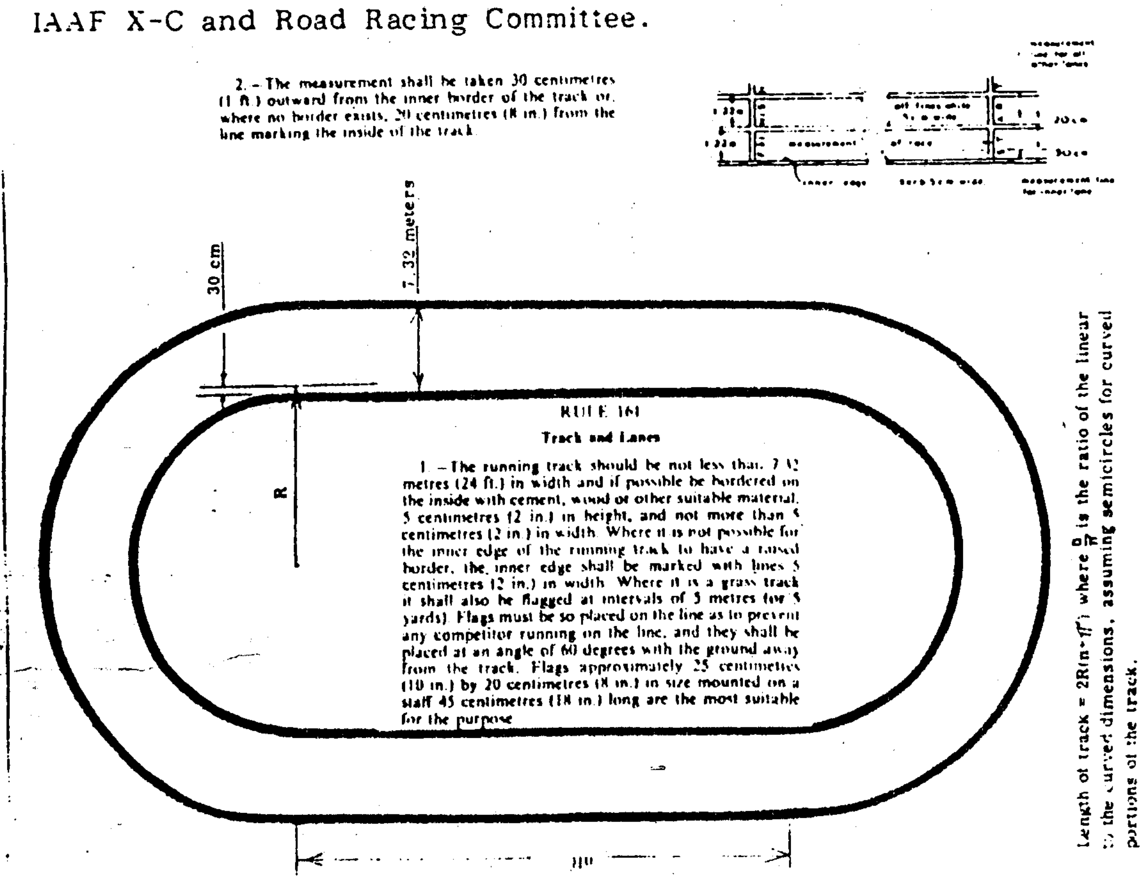
440 yards shall be considered the same as outdoor performances.

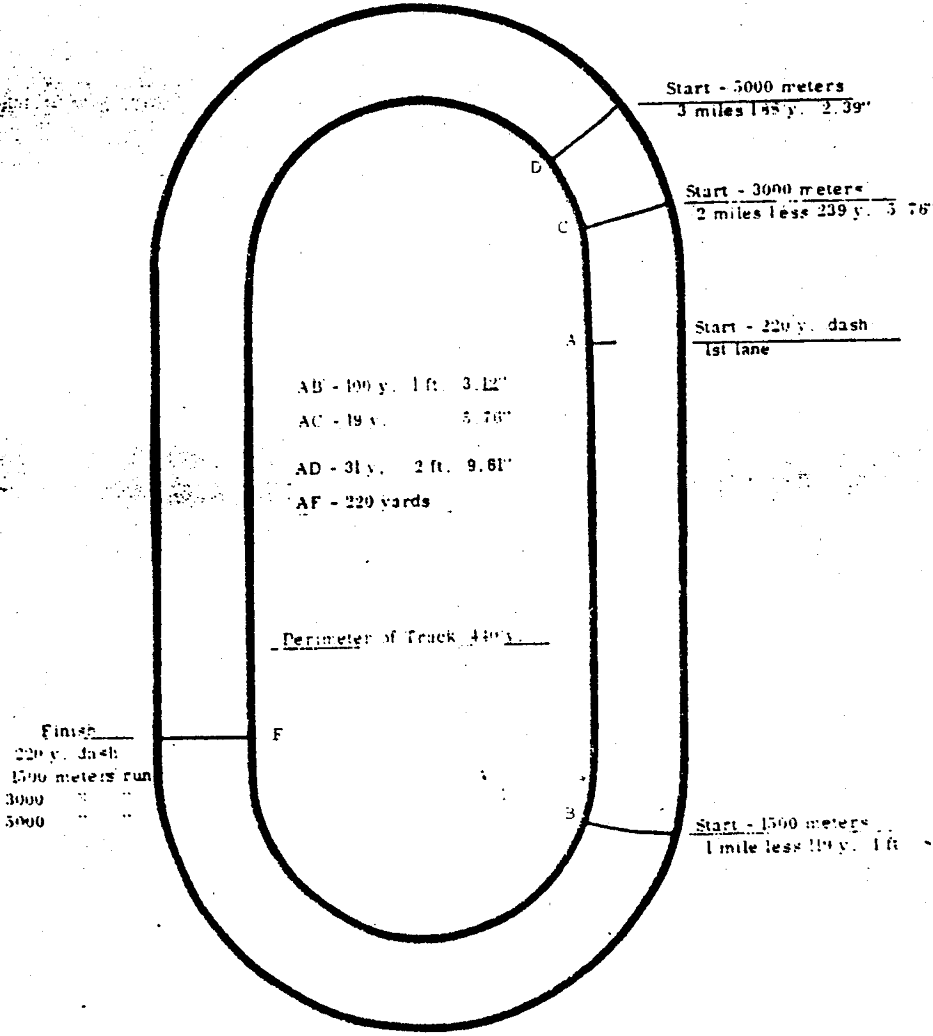
iii. Qualifying times for International competition may be made only on a track 400 meters or 440 yards in length with a 5 centimeter raised border and complying with Paragraphs b and c in their entirety. (These criteria are subject to change by the IAAF Council or Congress).

iv. World records for long distance events must be made out-of-doors and must not have been made on a wooden surface.

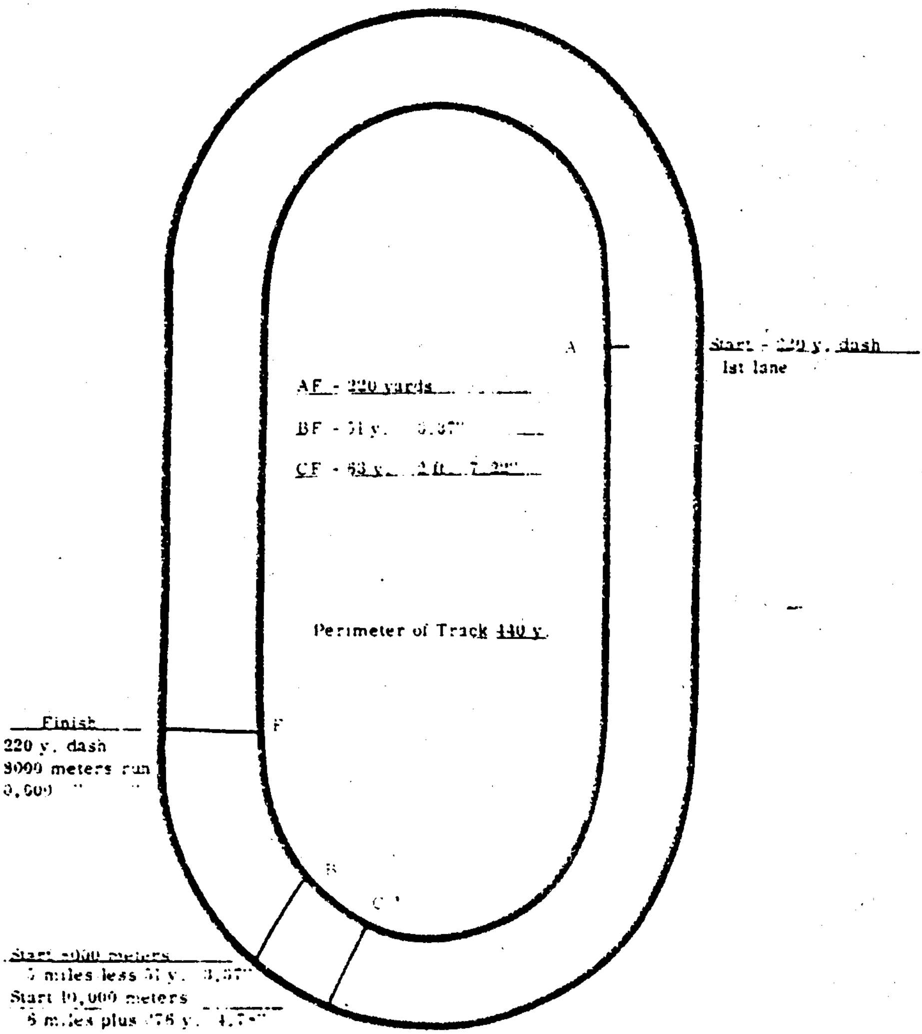
v. Track records may be made on a 400 meter or 440 year perimeter track (which is not banked) meeting the inclination requirements of Paragraph (b) (iii) above and will be recognized only if the track has a raised border as specified in Paragraph c above.

vi. World records for long distance events conducted on the roads may be made only on courses certified by the Standards Sub-Committee of the IAAF X-C and Road Racing Committee.





Starting and Finish Lines Measurements for Distance Events
(1500 meters, 3000 meters, 5000 meters)



Starting and Finish Lines Measurements for Distance Events

(5000 meters, 10,000 meters)

Received Early 1983

No. II DRAFT

Allan Stienfeld is The Chairman of The IAAF Technical Committee For Road Running.

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IAAF HANDBOOK

GENERAL CONSIDERATIONS

NO. [redacted]37

Road Racing is an activity which is dependent on many parameters such as weather, number of perticipating athletes, the area of the competition, the course, the time of day, etc.

Accordingly, a set of rules and a series of recommendations have been adopted to assist Race Directors, Sponsors, and Games Committees to comply to the standards of an International Road Racing Event.

a. The following distances are contested at international road racing meetings:

- 5,000 meters
- 10,000 meters
- 15,000 meters
- Half-marathon
- 30,000 meters
- Marathon
- 100 kilometers
- 100 miles

DRAFT II Replaced original Allan S. Sent me unfortunately This is also missing A page (No.5) also missing page concerns Course Cert.

All road courses shall be certified by the I.A.A.F. Cross Country and Road Racing Standards Sub-Committee.

SEE NOTE A.

Other road races may be held at various distances.

b. The course shall be mostly on paved roads (including: asphalt, concrete, brick and running tracks). All other surfaces should not exceed 1% of the total race distance.

SEE NOTE B.

See Appendix A for typical courses.

c. Where necessary markers will be used to define the path. It is highly recommended that race officials monitor all turns and potential hazards.

d. Water and refreshments must be provided throughout the course at regular intervals. Distances between recommended refreshment stations shall approximate 3 kilometers/2 miles. In addition, water must be provided near the start and the finish.

SEE NOTE C.

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i. Sponging points are recommended at regular intervals throughout the race. Sponging stations must be provided in races with distances greater than the marathon. Due to the popularity of the marathon and shorter races, sponging stations can be impractical—but are recommended.
SEE NOTE D.

ii. In warm weather, additional water stations shall be provided equipped with hoses and showers.
SEE NOTE E.

e. For distances of a half-marathon (21.0975 km) or less, distance markers should be displayed every kilometer. For distances greater than a half-marathon, distance markers should be displayed every five kilometers.
SEE NOTE F.

The distances markers shall be large enough to allow large numbers of participants high visibility.

f. The elapsed time (split times) shall be called out or displayed at: A minimum of every 5 km or more frequently where possible.
SEE NOTE G.

g. The race route should be traffic free except for official vehicles. Dangerous intersections should be adequately staffed to regulate traffic and spectators. Every effort should be made to insure the athletes a clear and unobstructed path.
SEE NOTE H.

h. A lead vehicle shall be provided. All race vehicles in close proximity to the athletes should be equipped with a vertical exhaust pipe. An electrical lead vehicle is recommended. The lead vehicle must be maintained at a safe distance from the lead runner(s).

i. Transportation should be provided to assist the athletes who desire to leave the competition or who may be ordered to stop by monitors or medical advisors.
ii. Additional official vehicles may be provided to assist in monitoring the event, timing or other required functions.

i. The health and safety of runners is of paramont importance in road races, especially in mass events.
i. Medical facilities shall be available at the start, along the course at various aid stations, and especially at the finish. Medical doctors, nurses and ambulances should be present at medical stations.

ii. Toilets should be available in sufficient quantities at the start, along the course at various locations, and at the finish.

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COURSE CERTIFICATION

A course is said to be satisfactorily measured if it is measured with an accuracy of one part in one thousand (1:1000). This results in a maximum allowable tolerance of plus 42.195 meters at the marathon distance and 10 meters at the 10,000 meter distance. It is highly recommended that 1/2000 of the distance be added to the course to make it slightly longer.

SEE NOTES I & J

All international championship courses must be certified by a member of the I.A.A.F. Cross Country and Road Racing Standards Sub-Committee.

a. There are a number of methods of measuring available to achieve this accuracy. The simplest being:

Calibrated Bicycle Method*

Calibrated Surveyor's Wheel*

*Calibrated refers to calibration of the equipment before and after each measurement on that particular day.

A more exact method of measurement is chaining or measurement with a steel tape. Additionally, the measurements may be performed using the Electronic Distance Measure (EDM).

The Allowable Tolerance of 1:1000 can be achieved through the use of the calibrated bicycle and or the calibrated surveyor's wheel, and accordingly, these shall be considered the standard methods of measurement for course certification for all long distance road races.

NOTE: Other methods such as map reading and aerial photographs are helpful in laying out race courses but are unacceptable for certification.

b. To satisfactorily measure a course requires that the following conditions be met:

i. A road calibration course is available. (See *e* below for details).

ii. The measurement has been repeated a minimum of two times.

c. Experience indicates that the Bicycle Method lends itself easily to preliminary measurement and layout. Maps and aerial photographs are of a great value at this stage. Automobile odometers can be helpful but yield inaccurate courses.

(4)

d. Once the course has been layed out the procedure is to:

- i. Establish a calibration course.
- ii. Calibrate the bicycle or surveyor's wheel (minimum diameter of 50 cm).
- iii. Measure the course.
- iv. Recalibrate the bicycle or surveyor's wheel.
- v. Check the course by a different method or a second measurement.
- vi. Define areas of difficulty requiring special consideration (start, finish, traffic).

Note: The bicycle is the preferred method for distances 10km or greater.

e. Road Calibration Course

- i. The road course must be paved, straight, level and free if possible from traffic or pedestrians. Its length should be between one kilometer and one and one-half kilometers or between one-half to one mile.
- ii. The distance must be measured by steel tape using a team of three or more men. A professional surveyor is recommended to measure the calibration course.
- iii. The measurement must be done at least four times preferably on different days.
- iv. The spread between the shortest and longest measurement must not exceed two parts in 10,000 of the measured distance. This corresponds to 2/10 meter in a kilometer or 6.3″ per half mile.
- v. To obtain this accuracy, measurement must be conducted in clear days and the tape tension must be maintained with proper temperature correction incorporated.

It is recommended that a 30 meter (100 foot) steel tape is used with a 9kg (20 pound) tension. Longer steel tape measures may be more difficult to work with.

f. Bicycle or surveyor's wheel calibration consists of riding the bicycle (the surveyor's wheel must be walked at slower than 5 kilometers (three miles) per hour) over the road calibration course a minimum of four times and then calculating the bicycle's or wheel's

e. Scorers should keep a continuous record of the run at specific points. This should include runners number and split times. Because of the high density races today, it is recommended that tape recorders, video tape recorders and additional methods be used. In most cases during high density races, it is recommended that the top 10% of the men's and women's field be monitored with accuracy.

f. Refreshment stations should be located at intervals of 3 km/2 miles or less. These stations should be equipped with drinking water and accessory equipment—paper cups, tables and trash receptacles. In addition to the basic ingredients of water and cups, additional fluids such as electrolyte replacement fluids and orange slices can be provided. Any other drinks than water should be clearly marked in a different colored cup for easy identification by the runner.

1. Large visible signs should indicate each water station.
ii. The density of the race should dictate the number of workers needed at each refreshment station.
iii. The refreshment station should be set up and manned at least one half hour before the start.
iv. For international championships and world championships refreshments should be placed in such a manner that they are easily accessible for the competitors or so they may be put into the hands of the competitors.
SEE NOTE K.
Recommended a minimum of 4 ounces per runner for each aid station.

IDENTIFICATION OF THE FINISHERS

There are various successful methods used to identify the runners. The size and density of the event should dictate the method used.

Density is determined by the number of participants and the distance of the race. A density of 1500 runners in a 10 km race is equivalent to 3000 runners in a 20 km race. Experience indicates that this particular density (1500 @ 10 km) is important in determining various finish line systems.

a. Numbers. Probably the most common method is to have each runner pin a number on his/her chest and or back. If only one running bib is used it should be pinned on the front for easy identification by the course monitors. The number must be visible at all times. In races where age group awards are given, the numbers can be coded with a letter prefix or issued within a number block (example -1-100) for a specific age group and sex. Pre-race registration lists the names that corresponds to the various numbers. The number should be made of light and strong material so as not to fall apart if it rains. Running numbers must be exposed at all times.

b. Tags. In many cases tags are used that are pinned to the runners shirts containing all the required information (name-age-sex-team, etc.). These tags are valuable for scoring the event but make course monitoring difficult (and if used alone, impossible). If tags are used, it is recommended that they be used in conjunction with the numbers. Experience indicates that a combination of the tag and number system is one of the most accurate available without utilizing expensive computer services.

c. Electronic Recording Devices. Pull tags are available today that can be scanned electronically. These methods are expensive, but accurate. It eliminates many transcribing errors at the finish but should be used along with running numbers.
In large participation events, the low numbers should be reserved for the top male and female competitors. These low numbers are easy to identify by course officials during the race.

RECORDING TIMES AND FINISHERS AT THE FINISH LINE

There are various methods of recording the times of finishers in conjunction with the identification of these individuals. The range of equipment can vary from the use of a stopwatch to the incorporation of expensive computers and timing devices.

The basic finish line system times runners as they cross the finish line, directs the runners in order (that they crossed the finish line) into a long roped off lane called a chute. The runner's number of tag is recorded at the end of the chute where the runners are walking or moving at a slower pace than at the finish. Most finish line systems utilize several lanes to accomodate the large numbers of runners.

The runners can be timed in various ways:

a. By using stopwatches and recording sheets. This requires a team of two people. Utilizing a clipboard and stopwatch, one acts as a caller and the other as a recorder. As each runner crosses the finish line, the cal'er calls out the time and the recorder writes that time. At the same time, another team of recorder and caller write down the runners numbers in order. The two lists (time and runner's numbers) are then matched. This method should only be used with densities of 100 runners or less at the 10 kilometer distance. Usually no chute is used for this size event.

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b. In higher density events, the same equipment can be used to produce fairly accurate results. In this case, Select timing is incorporated. A team of recorder and caller at the finish line with a stopwatch and clipboard will select a runner as he or she is approaching the finish line. The caller will call out the runner's number to the recorder and the recorder wil write down that number. When that runner crosses the finish line, the caller will call out the time to the recorder who will write the time down next to the number. Then the team will pick another incoming finisher. The key to this system is that the team will not try to time every individual finisher. The team should work at a continuous pace only recording the times of the runners that they are positive of. All of the finishers will be directed into the chutes. The select times will act as reference point times and all runners who finished between these points will have their time interpolated. Using several select timing teams, this system is accurate for high density races (over 1500 at the 10km distance). It is not recommended for use with lower density events unless incorporated with other timing methods.

c. Individual timing using a printing timer and select timing is the most highly recommended method. In this case, a timer utilizing a printing timer (an instrument that has a push-button switch which records and prints time and sequential place) will press the switch every time a finisher crosses the finish line. All runners will be directed (in the order in which they finished) into the chute system where their running number will be recorded. Select timing is utilized as reference points to maintain the integrity of the times from the electronic timer. Some adjustments of the times from the printing timer will be necessary from information obtained from the select timers.

i. A minimum of two teams of select timers are required for all finish lines.

ii. Every finisher must receive his/her time and place.

iii. All records require a minimum of three official times. In the event of two of three watches agreeing and the third disagreeing, the time shown by the two shall be the official time. If all three watches disagree, the watch with the middle time shall be used. if only two watches are used, the watch showing the slower time is used.

iv. The time shall be taken from the flash of the pistol or approved apparatus to the moment at which any part of the body of the competitor (i.e. torso, as distinguished from the head, neck, arms, legs, hands, or feet reaches the perpendicular plane of the nearer edge of the finish line.

v. Mechanical movement watches must be calibrated by the manufacturer. Times are read to the next highest tenth of a second for races less than twenty kilometers.

vi. For races twenty kilometers or longer, times are read to the next highest full second (example: 1 hour 2 minutes 32.2 seconds, 1 hr. 2'32.2 is read 1 hr. 2'33".)

vii. As most electronic apparatus times to 1/100 second, all times for distances under twenty kilometers are read to the next highest tenth of a second:

.00 is read .00
.01 is read .10
.02 is read .10
.03 is read .10
only .00 stays .00

viii. When a printing timer is used, all times shall be adjusted by the first official watches and select timing.

(World records for long distance events conducted on the roads may be made only on courses certified by the Standards Sub-Committee of the IAAF X-C and Road Racing Committee.

d. High Density Races.

Races with densities greater than 1500 runners at the 10 km distance are nearly impossible to individually time all runners. Timers using printing timers are only capable of pressing the timing button at 2-3 times per second for short periods of time (with varying degrees of accuracy). It is highly recommended that in races of this nature two or more finish line systems constructed adjacent to each other serve to time the high densities. The method is to split the finishers as they approach the finish area to one of lthe two finish lines (which to the untrained eye appears as only one). Each finish line is independent of the other and requires its own set of officials. This system is usually put into operation after the first 10% of the finishers have crossed only one of the finish lines. This allows for easy scoring of the top finishers. Practice and timing is needed to successfully switch the system from one to two (or more) finish lines during the race.

The following system is capable of handling a density of approximately 1000 finishers or less at the 10 km distance (equal to about 4200 finishers at the marathon distance).

a. The basic system utilizes four lanes or chutes. The length of the chute is determined by the density and temperature of the day (*SEE APPENDIX B FOR DIAGRAM).*

i. On warm days, the chute length should be under 100 meters.

ii. The chutes should always be monitored by chute officials to assist runners through the chutes. It is recommended that additional chute workers be used for the longer distance such as the marathon. The chute workers also maintain the integrity of the order of finish.

iii. The ideal situation is to have the runners who have just finished moving continuously through the chute. This can be achieved by using several chutes and not filling each to its capacity. Practice will allow the chute captain to switch chutes at the proper time to allow free movement through the chute.

c. The following chart may asist in determining the density of an event and the proper number of chutes needed. It should be noted that above 1500 finishers at the 10 km distance, a human cannot press the button on a printing timer with prolonged efficiency. In this case, two or more finish lines may be used constructed next to one another appearing as only one finish line to the untrained eye. Each finish line is manned with its own set of officials and works independently of the other. When a multiple finish line system is used, the first 5-10% of the finishers can be directed down a single finish line and the mass can be split to the two finish lines as the density increases. by doing this, the first finishers can be scored quickly. all other finishers from the two finish lines will eventually have to be meshed according to time. In many races a separate finish line is used for female competitors. This practice greatly speeds up race results.

Finish Line Density Chart

	Number of finishers			
marathon	20 km	10 km	5 km	# of chutes or finish lines recommende
100	47	24	12	one chute
500	237	119	60	2 "
1000	470	240	120	2 "
2000	948	474	237	2 "
3000	1422	711	355	4 "
4000	1896	948	474	4
5000	2370	1190	600	6
6000	2844	1422	711	6
7000	3318	1659	829	8 chutes or 2 finish lines of 4 chu
8000	3791	1896	948	2 finish lines of 4 chutes each
9000	4265	2133	1066	2 finish lines of 4 chutes each
10000	4739	2370	1185	2 finish lines of 4 chutes each
12000	5687	2844	1422	2 finish lines of 6 chutes each
14000	6635	3318	1659	2 finish lines of 6 chutes each
16000	7583	3791	1896	3 finish lines of 4 chutes each
18000	8531	4265	2133	3 finish lines of 6 chutes each
20000	9479	4739	2370	3 finish lines of 6 chutes each
22000	10427	5213	2607	3 finish lines of 6 chutes each
24000	11374	5687	2844	3 finish lines of 6 chutes each
26000	12322	6161	2920	3 finish lines of 6 chutes each
28000	13270	6635	3318	4 finish lines of 6 chutes each
30000	14218	7109	3555	4 finish lines of 6 chutes each
35000	165888	8294	4147	4 finish lines of 6 chutes each

SCORING

a. The IAAF under Rule 167 paragraph 5.6.7 suggests a number of permissable scoring methods for team races. The method of scoring shall be optional and may be any one of the following:

i. By scoring the least number of points, according to the positions in which the scoring members of a team finish. The finishing positions of the nonscoring members of a team shall be scored in computing the scores of other teams, but when a team fails to finish the requisite number to score, it shall be eliminated; or

ii. By scoring the least number of points according to the scoring positions in which the scoring members of a team finish. The positions fo the nonscoring members of a team, whether it finishes all its members or not, shall be scored in computing the scores of other teams; or

iii. By scoring the least number of points according to the positions in which the scoring members of a team finish. The finishing positions of the nonscoring members of a team, and the members of a team which fails to finish the requisite number to score, shall be eliminated; or

iv. By scoring the lowest aggergate of the times recorded by the scoring members. *SEE NOTE L*

v. If two or more competitors tie for any place the points for the places concerned shall be aggregated and divided equally among the competitors so tying.

vi. In case of a tie on points, the team whose last scoring member finished nearest to first place shall be the winning team.

b. When individual athletes are permitted to enter the recommended scoring systems are:

i. Score each team according to the positions in which the scoring members of a team finish without deleting the unattached runners or the nonscoring team members.

ii. Score each team according to the positions in which the scoring members of a team finish deleting the unattached runners but retaining the nonscoring team members.

iii. Deleting from the scoring both unattached and nonscoring team members.

iv. When scoring is limited to team competition, it is recommended that a special set of numbers be assigned to the unattached athletes for quick identification. Four (4) digit numbers are recommended.

v. Scoring cards should be numbered in groups of 25 finishers.

c. In lap courses scoring must be done after establishing that each athlete has completed the event. This requires a review of the scoring cards from the various checking stations established for this purpose. An athlete who fails to appear in checking stations may be eliminated from the competition.

d. Weatherproof numbers shall be used in all championships to prevent a loss of the competitor numbers during heavy rainfall.
SEE NOTE M

APPENDIX A
TYPICAL ROAD RACE COURSES

a. A loop course in which the length of each loop exceeds at least one-third of the contested distances. This is recommended for distances of the marathon or greater.

b. A one-way course also known as a point to point course.

c. A two-way course on the same roadway. In this instance, the turning point shall be clearly marked and the radius of the turn shall be made as wide as possible.

e. A two-way course using adjacent roads wherever possible.

f. A single loop course usually around a park or lake or on city streets.

The single loop or point to point course is recommended for races with large numbers of entries.

Sharp turns, climbs, turns and descents shall be avoided.

APPENDIX B

As runners approach the finish line, the following will occur:

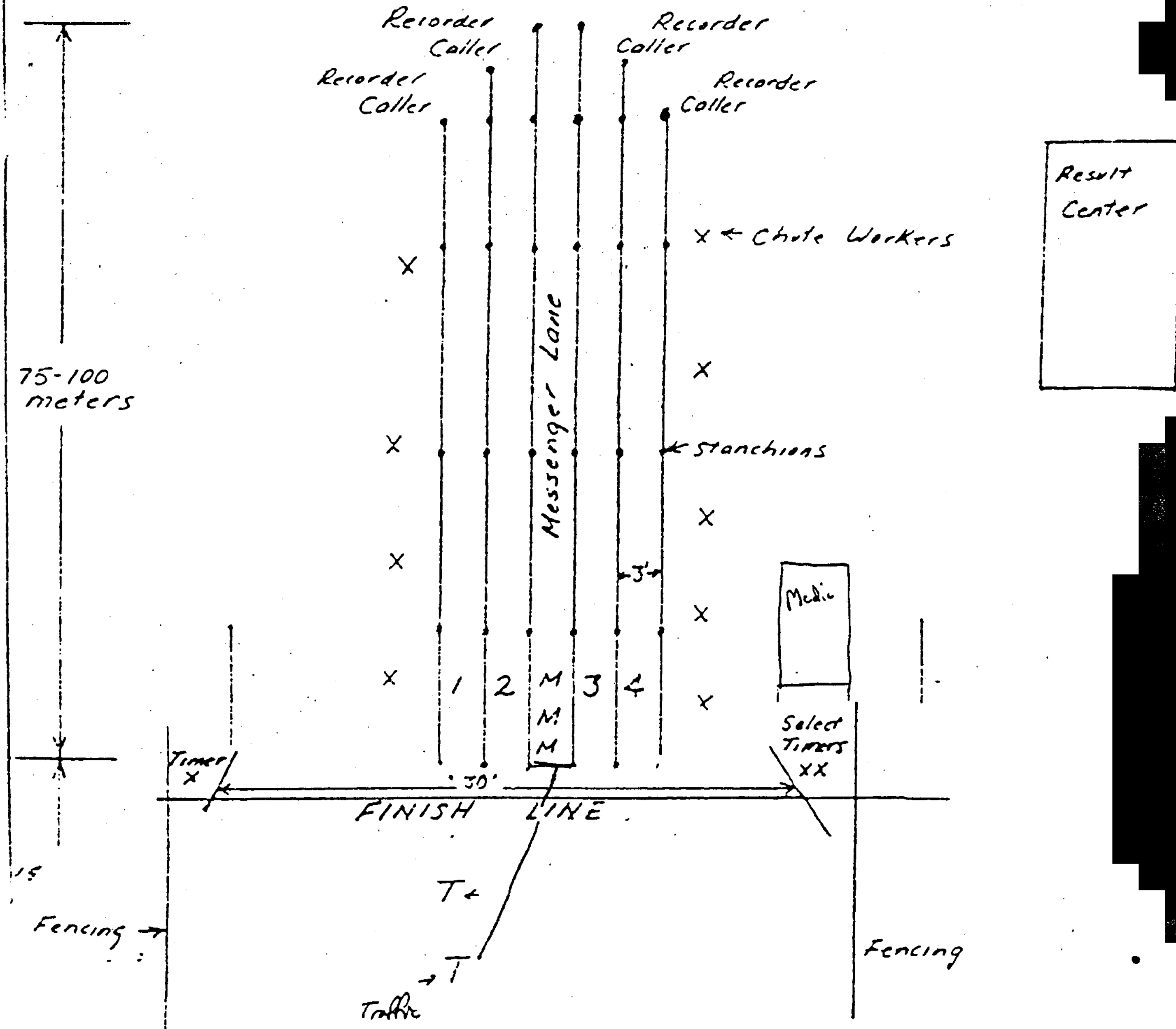
a. Finish line traffic controllers positioned in front of the finish line will direct the approaching runners to the appropriate finish lane.

APPENDIX 13

(14)

Standard Finish Line Chute System

This chute design is adequate for densities of 1000 finishers or less at the 10 km distance. The chutes would be filled in the following order: 2-3-1-4 & repeat of the cycle: 2-3-1-4. It is highly recommended that fencing be used to keep the spectators away from the finish line system to allow freedom of movement by officials.



b. As each runner crosses the finish line, he/she is timed with the recommended printing timer or other form of finishing system and select individual runners will be "select timed."

c. Finish line personnel will direct the runners to one of the chutes. The first runner will be lead with a messenger carrying an alphabetically sequenced card (A or B or C) which will be taken to the recorder and caller at the end of the chute. The cards enable the scorer of the race to determine the order in which the chutes were filled.

d. At the end of the chute the caller will call out the card letter to the recorder. The information will be recorded. The caller and recorder will then proceed to record the runners number and/or tag in the order in which they come through the chute. Care must be taken by the chute workers to maintain the order of finish and to assist and/or take the place of a runner who cannot go through the chutes on their own.

e. Just before the flow of traffic is about to stop in that chute, the chute captain will call for a "switch," to switch the incoming runners to another chute. The configuration of the finishing area is that which will not permit the mixing of the two groups of runners (the chute just filled and the one being filled). The first runner down this second chute used is led with a messenger card indicating the "B" chute. At the end of the chute, the recorder and caller will record the necessary data. This system allows more than one chute to empty at a time while only one chute is filled at a time.

APPENDIX C
MEASURING TAPES

a. A steel tape is considered as standard when it has been calibrated by the Official Government Standards Bureau and found to conform to the following specifications:

i. It shall be made of a single piece of ribbon.

ii. None of the graduations shall be on pieces of solder or on sleeves attached to the tape or wire loops, spring balances, tension handles, or other attachments liable to be detached or changed in shape.

iii. The error in the total length of the tape, when supported horizontally throughout its length of the tape, when supported horizontally throughout its length at the standard temperature of 20°C (68°F) and at standard tension, shall not be more than 2mm per 25 meter (0.1 inches per 100 feet).

iv. The standard tension is 4.5 kg (10 lbs.) for tapes 10 to 30 m or from 25 to 100 feet in length and 9 kg (20 lbs.) for tapes longer that 30 m or 100 feet.

b. Tapes conforming to the above specifications will be certified by the Government Standards Bureau and a precision seal showing year of standardization will be placed on each tape so certified. The Bureau's serial number on a tape signifies that it has been tested by the Bureau and either a certificate or a report issued.

i. Ordinarily, the length of a steel tape is certified or reported by the Bureau to the nearest 0.0002m (0.2mm) or .001ft.

ii. The standard tension given in the specification is for a tape when supported on a horizontal flat surface. No standard tension has been officially adopted for a tape when supported in any other manner.

iii. it is suggested that, dependent on the length of the tape and its weight per unit length, tensions in the range of 20 to 40 lbs. (9 to 18 kg) be used for tapes used in single catenary type of suspension. Tapes weighing 0.018 lbs./ft. or more may be considered as heavy tapes. Tapes weighing 0.009 to 0.0011 lbs./ft. may be considered as light tapes. (Aldo note: this needs to be converted totally to metric—)

iv. In the standardization of invar tapes, the following tensions are used unless otherwise specified: 15 kg. for 30 and 50 m tapes (20 lbs. for 50, 100, and 150 feet tapes).

c. Tapes made by the manufacturers that supply the surveying and engineering trade with high grade steel tapes are almost universally correct for total length and standard tension and temperature within 3mm(0.01 ft.), and ordinarily within 2mm (0.006 ft.). hence, for most work not requiring an accuracy better than 3mm (0.01 ft.) it is not necessary to submit the tape to the bureau for a calibration. As high grade tapes are ordinarily uniformly graduated within a few thousandths of a foot, the calibration to subintervals of a tape is not required except when rather precise measurements are to be made with the tape, that is, measurements to a few thousandths of a foot. The owner of a tape can check the uniformity of division of the tape by measuring, for example, a 30 meter distance by using the intervals from 0 to 10 meters, 10 to 20 meters, 20 to 30 meters, on the tape.

SEE NOTE M