MEASUREMENT NEWS

june 1986 issue #17

#17 - JUNE, 1986

Editor: Pete Riegel - 3354 Kirkham Road - Columbus, OH 43221
614-451-5617 (home, not after 10 PM EST)
614-424-4009 (work, 7 to 4:30 ex 11-12:30)
telex 245454 Battelle, Columbus Ohio

Measurement News (MN) is distributed free to all members of the Road Running Technical Committee of TAC. Some foreign people are also included in the free distribution.

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MN is our way to talk to one another, so that we all know what's going on. It also serves to provide communication between the RRTC Chairman and the regional certifiers.

MN wants to make measurement as good as it can be. All opinions and grievances are solicited. No cows are sacred. If you have a new measurement technique, or if you think things should be done differently, send in your contribution to MN. Your opinion will be given space. Nothing changes until somebody tries!

Nice, clean typed stuff is most welcome, but send what you can.

NEW PUBLISHER FOR MN

Kevin Lucas offered to have MN printed and mailed so I took him up on it. It's a big help to me. I collect the material and cut/paste. Kevin works his magic and has it printed and mailed. We are using this issue as an experiment to see how it works out. Any suggestions from readers are welcome.

THE CERTIFIED COURSE LIST

As NRDC prepares to terminate its TAC work, the future of the Certified Course list becomes an important problem to resolve. I had volunteered to do it, but because of the likely load of being Chairman I realized that I'd be biting off more than I could chew by taking it on. So I looked for help to a good friend.

The new list-keeper will be John White, a physicist at Battelle Memorial Institute, where I work. He has successfully maintained a comprehensive set of lists and records for the activities of the Wolfpack Track Club in Columbus, and has access to computers, word processing equipment, and copiers. Best of all, he is an extremely competent and enthusiastic person. We've been co-directors of the Wolfpack 50 Mile Run for the last three years.

At present NRDC is still the list-keeper. At some time courses will stop flowing to NRDC and begin to flow to John, through me. We will see that certificates are kept on file and that the list is updated monthly. It will be published in Measurement News. In addition, it will be published in as many other places as we can manage.

HIRING MEASURERS AND FINISH LINE PEOPLE

Race directors often like to bring in "experts" to help with the technical details of their races. In many cases the performance doesn't match the promise. What should a race director look for when hiring a course measurer or a finish line director?

The most important thing is for both buyer and seller to have the same idea of what is to be provided. If you're buying, and you don't understand what's involved, ask until you are satisfied. Be sure you know exactly what you are buying. If you have worked in the past with the person you're hiring, you'll know what to do, but if the person is unknown to you, get it on paper just what your money will buy. No reputable measurer or finish line operator will feel a request for a written quote is unreasonable.

Ask for references, including telephone numbers. Don't settle for just one - ask for a lot of them. Call some of them and get an idea of the person you're to deal with.

Don't pay all the money up front. You may have to pay some, but save a hefty amount in reserve until the goods (the Certification document) have been satisfactorily delivered.

Dealing with a Course Measurer - Be sure the following questions are answered:

1) Where is the course and how long is it to be?
2) Is the length of the course pretty well known, or must the measurer start from scratch?

3) What are some of the courses the measurer has measured for certification, and what was the name, address and phone number of the person who hired him?

4) Does the measurer require any help from you on the day he measures? Note: You had better be ready to have at least one knowledgeable person on the course while measuring is going on. Decisions have to be made, such as where the start or finish is to be - and you, not the measurer, must be prepared to make them. Don't assume the measurer can do it all himself. He has to have your input to the process. And he has to have it on the very day he measures.

If your course is in a heavily-trafficked area, the measurement may have to be done at night. You may have to provide police protection, or at least arrange so that the measurer does not get arrested for unsafe riding.

5) How much does the measurer want to do the job? How does he expect to be paid? Transportation money in advance is not unreasonable, but payment for a certified course need not be made until the actual certification papers are delivered to you.

6) Is there a time problem? If the certification must be accomplished before race day, all measurements must have been submitted for approval by that time. Be sure you give the measurer enough time. If you have a tight schedule, be prepared to have to cooperate mightily with the measurer.

Finish Line Operator - Since the only finish line this Editor has ever operated had 50 people crossing it in 12 hours, I don't feel qualified to expound on this. Finish Line Folks - front and center! How should a customer intelligently buy your services?

LETTERS TO PETE

March 18, 1986

Mr. Allan Steinfeld
Chairman, RRTC, TAC/USA
9 East 89th Street
New York, NY 10028

Dear Allan,

The enclosed proposal is a followup to my letter to Bob Hersh of January 6, 1986, a copy of which you received. At the suggestion of the Youngs, I have embellished the suggestions contained in that letter into a full-blown proposal to improve the relationship between TAC and the U.S. ultramarathon community. I hope you get a chance to study the whole proposal, but I call your attention specifically to section IV (bottom page 6 to top page 7).

I have briefly touched on some of the issues contained in this section in discussions with Peter Riegel who, as you know, is an ultrarunner and race director in addition to being Vice Chairperson of the RRTC. I believe Pete is receptive to implementation of some of these suggestions (though if I'm wrong we'll hear about it real quick!). I hope you get a chance to discuss them with Pete, and then to take section IV of my proposal into serious consideration.

Thank you for your consideration and attention. I look forward to hearing from you.

Sincerely,

Dan Brannen

Dan Brannen
3533 Stevens Road
Wallington, NJ 07057

cc: Pete Riegel ✓

IV. PROPOSAL TO RRTC FOR AMENDMENT OF ULTRAMARATHON CERTIFICATION:

-The following changes in certification protocol are suggested:

1. That an upper limit of 100 Kilometers be placed on the current certification protocol for point-to-point or single loop road courses.

2. That for point-to-point or single loop road courses longer than 100 kilometers, measurement by calibrated, computerized rally odometer be accepted for certification in place of the calibrated bicycle and steel-tape methods.

3. That special provisions, to be adopted by the proposed Ultramarathon and Trail Subcommittee of the Standing LDR committees, for validation of point-to-point road marks at events defined by time be accepted. For example, the technology does exist to post-validate, by the calibrated, computerized rally odometer method, a 24-hour mark achieved in a point-to-point 200 mile road race.

4. That a RRTC policy statement be issued on measurement of trails. That trails be declared "uncertifiable" according to the standards currently required for road courses, but that a separate category of "trail certification," much more loosely defined, be instituted so that relatively reliable information about the length of trail courses can be catalogued through TAC.

5. That a representative from the proposed "Ultramarathon and Trail Subcommittee" of the Standing LDR committees be appointed to the RRTC for an ongoing orderly flow of information.

3354 Kirkham Road
Columbus, OH 43221
March 24, 1986

Dan Brannen - 3533 Stevens Road - Wallington, NJ 07057

Dear Dan,

Enjoyed your proposal of March 18. I will try to address myself mainly to Part IV, PROPOSAL FOR AMENDMENT OF ULTRAMARATHON CERTIFICATION, since that part you directed to Allan Steinfeld and RRTC.

1) First let me state that philosophically I see no distinction between road races of any distance. The term "ultramarathon" is a heroic-sounding term, but smacks a bit more of elitism than I would prefer. Still, I must admit to enjoying the amazement of my friends over my "superhuman" accomplishments (which we both know, since we've been there, to really be quite modest). But the long races have ever been rare and ignored by everybody but the participants, so why not have a special name?

I'd think TAC's best bet would be to simply eliminate the marathon as the present upper barrier and include the ultras as an extension of presently-recognized road distances.

2) As for using a car to measure courses that are unsuited to bike-measurements, it can be done. I used a Jones counter-equipped truck (and 4 enroute steel-taped cal courses) to measure the Midnight Sun Marathon (100 percent rock road), which actually came out a bit shy of a full marathon. If I had been trying for a certification at a recognized standard distance I would have used a slightly different technique, but I was confident that the measurement was OK. One thing I would have done, for a "standard" marathon, in that case, was to note on the certification that the legal route was in the middle of the road and that corner-cutters would be illegal. This would be unenforceable, but would really be of concern only to records-keepers, and would be the race director's problem, not the measurer's.

When I recommended to you the use of a rallye odometer as a measuring device, I was simply suggesting it as a pragmatic solution to a problem - getting a reasonable fix on how far competitors went in a cross-America run. In its present state of trim the art of using rallye equipment and autos is not suitable for measuring road courses. But it could be.

3) I stick with Ken Young's philosophy on courses. If a record is involved, the course can't be short. If you want to come up with a new method, be assured that RRTC (or, at least, I) will not arbitrarily reject it. We are open to any measurement procedure. But the user must demonstrate that it adequately does the job.

The experimental work needed to demonstrate the accuracy of rallye equipment is likely to be difficult, since the equipment is far more expensive than the simple Jones counter and bike. But it will have to be done before the method can be used. Questions arise:

a) What is the least count of this equipment? .1 mi? .01 mi? .001 mi? The least count of a Jones counter is .00007 mi.

b) Where will you calibrate? How will you know you're accurate? Freeway mileposts, I believe, are pretty good, but this is only an assumption.

c) How will you define your measured route, especially at corners?

d) How big will your Short Course Frevention Factor (SCPF) be? It would certainly have to be bigger than 0.1 percent, as we use with bikes, to assure non-shortness.

Bike measurement is time-consuming, but at least we know pretty well the limits of the method. And even if slow, it's a lot faster than more accurate methods. The car will be even less accurate than the bike, by an amount we do not know.

I am going to put Part IV of your proposal in the next Measurement News to see whether it strikes any sparks among the Brotherhood.

I can't see this becoming a big front-burner effort on RRTC's part, since the number of point-to-point long races is very small. I would rather personally measure a 100 mile point-to-point than figure out a way to do it with a car, unless an instrument like a Jones counter was used, and calibration courses like we use now were used. It took years to come up with the scheme we have now, and it will take a while to figure out what needs to be done with cars to get record-quality courses.

As for trail races, I think that's a can of worms better left unopened. I have no idea how that might be done. But, as I said, let's see whether the others in RRTC respond at all to your idea. Could be the work of developing the methodology will be yours. Show how it can be done, and you'll find RRTC receptive.

Best regards,

Pete

Pete Riegel
Vice Chairman, RRTC, TAC

xc:

Allan Steinfeld - 9 E 89th St. - New York, NY 10128

ONTARIO TRACK & FIELD ASSOCIATION
OTFA

Telex 06-986157 OSAC TORONTO
1220 Sheppard Avenue East, Willowdale, Ontario M2K 2X1
Telephone 416-495-4055

May 9, 1986

Pete Riegel
3354 Kirkham Road
Columbus, Ohio
U.S.A. 43221

Dear Pete;

I hope you can answer a question for me that has sparked some discussion here in the country to your north. In Canada we tend to look to the U.S. for information on such subjects and we have designed much of our measuring procedures from your methods.

My understanding is that, in trying to establish the true distance of a course measured with a Jones Wheel Counter, the average of the precalibration and postcalibration constants should be used. In other words, a rider measures the course according to the precalibration constant, then later adjusts the course once he has re-calibrated his bike in accordance with the average of the pre- and post- calibration rides.

In fact the article on page 4 of your Measurement News (#16 - April, 1986) seems to acknowledge that this is the correct method (copy enclosed).

One of our top measurers, on the other hand, disagrees with this method, citing pages 3 and 6 of The Athletics Congress of the USA Course Measurement Procedures manual which states: "the constant of the day, which is the larger of the pre-measurement (working) constant, or post-measurement (finish) constant" and, "for a mark to be accepted as an official record, the course length must be at least the stated distance." He argues along these lines, suggesting that the longer of the precalibration and postcalibration constants is the constant that must be used.

Who is right? Our future is in your hands.

I look forward to your reply. And thanks for the help...I enjoy your newsletter.

Sincerely,

John Craig

BESTEVER ONTARIO

THE ATHLETICS CONGRESS
OF THE USA

Road Running Technical Committee
Peter S. Riegel, Chairman

3354 Kirkham Road
Columbus, OH 43221
614-451-5617 (home)
614-424-4009 (office)
telex 245454 Battelle

May 16, 1986

John Craig - OTFA - 1220 Sheppard Ave E - Willowdale, ONT M2K 2X1

Dear John,

There is no conflict between your opinion, as stated in your letter of May 9, and that of your "top measurer". You are both right.

Our layout procedure in the US is designed to assure, with reasonable safety, that a TAC certified course will not be short. In order to counteract the effects of calibration change, variations is road roughness, and errors in riding (failure to adhere to the shortest route) we have three safety factors:

1) We use the larger of the two constants as official. This affects those with big variation more than those with small variation, which seems proper. Frequent calibration can keep the difference small.

2) We use the lowest figure for measured course length as official. This reflects the better ride.

3) We add 0.1 percent (1 meter per kilometer)

If a measurer uses the above factors, his course will generally exceed the desired nominal distance.

Now we come to "true distance". Our system has teeth in it, in that we occasionally send out a validator - a person considered to be "expert" - to check a course on which a record has been set. Generally this person will be more skilled than the original measurer. He will ride straighter. It is the aim of the validator to determine to the best of his ability a measurement representing the true length of the course. If he finds the course is short, the record is rejected. The validator rides only once, and uses his average constant. He does not use the 0.1 percent.

Layout and validation are both integral parts of our system. If courses are to validate out to the proper nominal distance, it is essential that we add a bit of distance on the layout. Else we would be finding an unacceptable number of courses to be short. Experience suggests that we need all of our layout safety procedures to make courses bulletproof against validation.

Layout is concerned with obtaining a safely long course (but not ridiculously so). Validation is concerned with determining true length.

I hope this clears up your question. If you have further questions, please get in touch.

Sincerely, Pete Riegel

Gabriel Duguay
2903 Pierre-Tétreault
MONTREAL H1L 4Z6

Montreal, May 23, 1986

Pete Riegel
3354 Kirkham Road
COLUMBUS, OH 43221

Dear Pete,

Last October 2, you sent me a copy of a letter you sent BERNIE Conway(London Ontario, Canada) in regards to his measuring the Masters Games Marathon.

Since then,I didn't get any information from Mr. Conway, and yesterday, I returned the report you sent me,along with a copy of your letter to C.T.F.A. with the following comments:

a) course only measured twice

b) info required on CTFA forms is not supplied or only partly on USA forms

c) the report reads"IT(the course) WAS CERTIFIED IN CANADA" without the .1% SCPF

d) missing info on calibration course

e) measurer not qualified yet. Not tested on a 10KM and has never filed a proper well filled measuring report.

My comments to you:

In Canada, we require three valid measurements of a course that needs National Certification.(as written in the measuring documents and agreed at the National Clinic held July 1984.)
When Bernie says"The course was certified in Canada, he means in Ontario, I'm almost certain, because I never certified such a course.

When I say the measurer is not qualified, it means that we don't know how well he measures because none of the courses he measured has been remeasured by another recognized measurer.
As you know, we do not have a validation measurement practice, nor do we have statistics for road performances.
So, what I say is that , to start off with, we should have a pool of good measurers that have all been checked ,
But CTFA don't seem to be clear on this, as Sharon Clayton has submitted a list of national measurers to be recognized by the National Officials Committee, and that list contains names of people I don't know.

In my opinion, I cannot certifiy a course knowing that the measurer who measured the course came to the National clinic and came 20 meters short on the 10 kilometer course we laid out, OR not knowing how the measurer measures.

Would you certify any course in Canada, knowing that there is no validation re-measurement?
(Remember that I'm only talking of courses that need National Certification)

Should I let anybody measure, and certify everything, as long as it follows the rules?

It is also my opinion that if TAC certifies a course it is hard for me not to certify it. But as much as possible, a canadian organizer should get his course certified in his country before applying for outside certification.

That's all for now. Hope you won't get too tired with your new assignments and jobs. Thank you for your collaboration.

Yours Truly,

Gaby

THE ATHLETICS CONGRESS
OF THE USA

Road Running Technical Committee
Peter S. Riegel, Chairman

3354 Kirkham Road
Columbus, OH 43221
614-451-5617 (home)
614-424-4009 (office)
telex 245454 Battelle

June 2, 1986

Gabriel B. Duguay - 2903 Pierre-Tetreault - Montreal, Quebec H1L 4Z6 - CANADA

Dear Gaby,

In response to your letter of May 23:

1) First, please don't let a TAC certification stand in your way of seeing that Canadian courses meet Canadian standards. As far as I am concerned, a TAC certification of a foreign course has no official standing whatsoever in the foreign country.

If someone trys to use a TAC certification to force you to grant them a Canadian certification, tell them that the TAC document has no weight in Canada. I will back you up. We give our certifications as a matter of courtesy to all who apply properly, but we certainly do not expect them to have any weight outside the US.

2) When people request TAC certification, they can have it if they comply with our requirements, wherever they are. Thus I would certify a course in Canada or anywhere else, even knowing there is no validation remeasurement. But I certainly would not expect Canada to recognize records on the course, based only on a US certification.

3) In the US we will certify a course measured by anybody at all, just so the paperwork is correct. I recognize that this will give us some short courses. But it also allows measurers to develop on their own, in areas where they otherwise would not have a chance to be trained by experienced people.

This is the price we have to pay for having thousands of certified courses. If we insisted that each course be measured by a "certified expert" our percentage of good courses would be higher, but the number of measurers and courses would be a small fraction of what it is today in the US. Almost every expert measurer I know started off as an isolated amateur and got better with experience, guided by mail by Ted Corbitt. Some of us were pretty bad when we started, but we all got better with practice and correspondence.

4) As for whether you should certify anything that looks good on paper, even if you don't know the measurer, that's a choice I can't make for you. It depends on what you want - many good courses or a very few perfect ones. In the US, we have had a huge growth in the number of measurers because we allow anyone at all to do it. And, after a couple of courses, the measurer gets better with practice. He will initially produce some short courses, but probably not awfully short. I do not see a 9990 meter 10k as being the end of the world. Our system undoubtedly has a number of short courses in it. But overall, the state of course measurement in the US is quite healthy. The ordinary runners - as well as the champions - are well-served by our system.

5) I believe that the validation program we have in the US is an extremely valuable force for keeping things honest. No record will be accepted unless a validation is performed. Measurers know this and are very conscious that they may be checked. I think a system without a validation check has a serious flaw. I don't care who measures a course - even me - it should be checked if an important record is set. Nobody's perfect.

6) I agree - Canadians should get Canadian certification. Our TAC documents have absolutely no standing whatsoever in Canada.

Best regards,

Pete

MEASUREMENT OF MEMORIAL HIGH SCHOOL TRACK, TULSA, OK
(measured by Bob Baumel & Glen Lafarlette, 15 Mar 1986)

report by Bob Baumel

The need to measure this nominally 440 yd cinder track arose when Glen Lafarlette submitted an application for certification of the "Corporate Challenge Marathon". The first 35+ kilometers of that marathon take the form of a normal road course, but the race finishes up with 17 laps of the track (which sounds like a stupid way to run a marathon until you realize that the race is actually a RELAY event rather than an individual marathon, and the relay teams are free to split up those final 17 laps among the team members any way they want). Glen's initial application for certification of the marathon was based on simply assuming the track to have its nominal length of 1/4 mile. I didn't think it appropriate to just assume the track to be accurate, and thought it needed to be measured. Glen then even tried measuring the track by bike, but I still thought it needed to to be properly taped the way a track is supposed to be measured. (Nevertheless, Glen's bicycle data is of some interest, so I'll present it near the end of this report.) I arranged to meet Glen in Tulsa on the morning of March 15 to do the track taping.

Personally, I welcomed the opportunity to measure a track. During the past year, there has been much discussion and controversy within the RRTC concerning track measurement. And I had actually been theorizing about track measurement for several years before that. I hoped that by getting some first-hand experience in measuring a track, I would learn something about the real problems involved, and the best techniques to use. For these reasons, we devoted considerably more effort to this measurement than the situation at hand (i.e. measuring a high school cinder track for use as part of the Corporate Challenge Marathon) probably deserved.

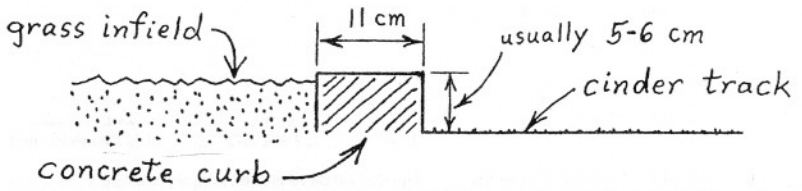
We taped the curb circumference using two different steel tapes: a 50 m surveyor's tape which I had used for many calibration course layouts (which weighs about 25 grams per meter), and a lightweight 30 m tape weighing only about 10 g/m. We also measured the track by the Length-Width method (using the 30 m tape in this case). Considering that this particular track has a curb which is perfectly suitable for stretching a tape around, there was really no need to do a Length-Width measurement. But I wanted to see how well a Length-Width measurement would agree with curb circumference measurements. In addition to the above, we attempted some "radius checks" (to see how close the curves were to ideal circular arcs) as suggested by Pete Riegel in Measurement News #15.

Some of the lessons we learned (to be described more thoroughly in the following pages) were:

1) Taping around the curb is easier with a heavy tape than a light tape.
2) Friction between the tape and curb was NOT a problem, although I had feared that it might be.
3) Even when taping around the curb, the dominant sources of measurement uncertainty are the same as in more "normal" taping in a straight line: knowing the calibration of your tape, applying proper tension, and being careful about the temperature used for the steel tape temperature correction.
4) A technique developed by Wayne Nicoll is very effective for marking the intermediate tape lengths on the grass infield when using the Length-Width method.
5) It is possible to obtain excellent agreement between measurements by the Length-Width method and direct taping of the curb.
6) The "radius checks" suggested by Pete Riegel are not as easily done as one might be led to think by Pete's article.

As for the Memorial High School track itself, the upshot of all our measuring was that this track is about 15 cm short of its nominal distance of 402.336 m (440 yd), so that even with the generous standard agreed on at the Dec 1985 TAC meeting, it cannot be certified as a 1/4 mile track. I could, if desired, write a certificate for it as a 400 m track, but I doubt that any of the people running races on this track really wants that. I will, at the end of this report, describe how we used the track for the certified Corporate Challenge Marathon course, and how the track was used for OTHER Corporate Challenge events on 12 April 1986.

Turning now to description of the track, it has a CONCRETE CURB with a well-defined vertical face on the side facing the track. The curb is 11 cm wide, and its vertical face on the track side is generally about 5 to 6 cm high. (The height of the curb above the track surface is not exactly a fixed dimension, since the cinder track surface tends to get swept around.) The side of the curb facing the grass infield is generally not very visible, since the infield surface is, in most places, nearly flush with the top of the curb:



Before doing any tape measuring, we set out thermometers, both exposed to the sun and shaded from the sun. We took readings from both thermometers before and after each tape measurement. We started out in conditions of hazy sun, but cloud cover thickened as the day wore on, so that by the time we finished, there was no difference between the readings of the thermometers in the sun and shade.

RAW DATA

Time of Day	Temp (sun)	Temp (shade)	Quantity Measured	Tape Used	Raw Measurement
9:54	18°C	14°C			
			Curb Circumference	50 m	400.314 m
10:22	24°C	16°C			
10:48	17°C	15°C			
			Curb Circumference	30 m	400.285 m
11:30	19°C	17°C			
12:10	17°C	17°C			
			Length	30 m	162.258 m
12:30	17.75°C	17.75°C			
			Width (S. end)*	30 m	66.3765 m
12:37	17°C	17°C			
			Width (N. end)*	30 m	66.350 m
12:46	17°C	17°C			

* The Width measurements were taken along the 5-yard lines of the football field. The long axis of this track runs North-South.

TEMPERATURE CORRECTED MEASUREMENTS

1) First curb Circumference meas:

Avg temp = 18°C

Corr Factor = 1.0000000 + 0.0000116 (18 - 20) = 0.9999768

Corrected Circumference = 400.314 m x 0.9999768 = **400.305 m**

2) Second curb Circumference meas:

Avg temp = 17°C

Corr Factor = 1.0000000 + 0.0000116 (17 - 20) = 0.9999652

Corrected Circumference = 400.285 m x 0.9999652 = **400.271 m**

3) Length Measurement:

Avg temp = 17.375°C

Corr Factor = 1.0000000 + 0.0000116 (17.375 - 20) = 0.99996955

Corrected Length = 162.258 m x 0.99996955 = **162.253 m**

4) Width (South end):

Avg temp = 17.375°C

Corrected Width (S) = 66.3765 m x 0.99996955 = **66.3745 m**

5) Width (North end):

Avg temp = 17°C

Corrected Width (N) = 66.350 m x 0.9999652 = **66.3477 m**

CALCULATIONS OF TRACK LENGTH

1) By direct taping of curb with 50 m tape:

Track Length (at 30 cm from curb)

= 400.305 m + 2π(0.30 m)

= 400.305 m + 1.885 m

= **402.190 m (or 14.6 cm short of 402.336 m)**

2) By direct taping of curb with 30 m tape:

Track Length = 400.271 m + 1.885 m

= **402.156 m (or 18.0 cm short of 402.336 m)**

3) By Length-Width measurement with 30 m tape:

In general, given a length measurement "L" and width measurements "W_1" and "W_2", the calculated curb measurement is:

$$\text{Curb Circumf} = 2\left(L - \frac{W_1}{2} - \frac{W_2}{2}\right) + \frac{\pi W_1}{2} + \frac{\pi W_2}{2}$$

$$= 2L + \left(\frac{\pi}{2} - 1\right)(W_1 + W_2).$$

In the present case,

Curb Circumf = 2 (162.253 m) + ($\frac{\pi}{2}$ - 1) (66.3745 m + 66.3477 m)

= 400.263 m

$\therefore$ Track Length = 400.263 m + 1.885 m

= **402.148 m (or 18.8 cm short of 402.336 m)**

NOTES ON TAPE USAGE

1) Heavy vs. Light Tape: Before doing the measurement, I expected that the light 30 m tape would be easier to handle than the heavier 50 m tape. As it turned out, the HEAVY tape was considerably easier to set up flush with the vertical curb face when taping around the curves. (Note: I don't remember any wind during this measurement. Obviously, the heavy tape would have had an even greater advantage if it had been windy.)

2) Dynamic Tensioning of Tape: The "dynamic" method of tensioning the tape described in item 3 on the upper portion of page 9 of the TAC Course Measurement book (where the rear tape-person first pulls the tape to a point a little behind the mark, and then lets it slowly slide toward the mark as the lead tape-person applies tension) apparently worked as well when taping along the curb face around the curves as when taping straight segments. (I had feared that friction between the tape and concrete curb might be a problem, but it wasn't.)

3) Marking intermediate tape lengths in Length-Width method: Here we used a method due to Wayne Nicoll. I fashioned a pair of wooden sticks about 2 cm square in cross-section and about 22 cm long, with nails driven through at each end, and covered with masking tape. These were planted into the track's grass infield to serve as stable platforms for marking the end of each tape length.

4) Choice of tape for the Length-Width method: The length and width measurements were performed with the 30 m tape simply because this tape, which is graduated throughout in millimeters, has finer markings than the 50 m tape. Most of this 50 m tape is marked only in whole meters, although its first and last meters are marked in decimeters, with the first and last decimeters marked in centimeters. This 50 m tape is great for laying out calibration courses (just measure 20 lengths of 50 m), and also works out very nicely for direct curb measurements of a track (where the distance to measure is very close to 400 m). But the 30 m tape is handier in situations where precise measurements of partial tape lengths are required.

5) In computing temperature corrections, we not only averaged the temperatures recorded before and after each measurement, but also averaged the readings from the thermometers in the sun and shade. The latter sort of averaging seems reasonable for curb circumference measurements, where the tape is exposed to the sun while on one side of the track, but is shaded on the other side. Such averaging would NOT have been appropriate for the length-width measurements, but fortunately, by the time we did our length-width measurements, it had become so cloudy that both thermometers gave identical readings.

6) We used both tapes with 45 newtons (10 pounds-force) of tension. It is generally true that most tapes of length greater than 30 m/100 ft sold in this country require 90 N (20 pounds-force) of tension. But I always use my 50 m tape with 45 N tension due to previous experience in comparing measurements done with this tape against EDM measurements (see next section).

CALIBRATION DATA FOR STEEL TAPES

Neither of these tapes has been calibrated by the National Bureau of Standards, or compared against a tape that was so calibrated. But on four occasions, the 50 m tape has been used for measuring a calibration course that was also

measured by EDM:

1) On 15 Jan 83, Joe McDaniel and I used this tape (which was then brand new) to lay out the Port Road (1 km) calibration course in Tulsa. On that occasion, we used tension of 90 N, which is the conventional value for tapes longer than 100 ft. However, a subsequent EDM check of this cal course indicated it to be 19.5 cm longer than 1 km.

2) On 6 Mar 83, John Sinton and I used this tape to lay out a pair of 1 km calibration courses in Ponca City (along the northern and southern edges of Hubbard Road). Tape tension of 45 N was used for this measurement as well as all later measurements done with this tape. The two cal courses laid out on this occasion were later checked by EDM, which indicated them to be about 1 cm and 3 cm longer than 1 km.

3) On 11 Jun 83, Glen & Coneil Lafarlette and Joe McDaniel and I used this tape (at 45 N tension) to lay out the West 21st Street calibration course (1 km) in Tulsa. A subsequent EDM check indicated that course to be 12 cm longer than 1 km.

4) On 6 Oct 84, Jim Smith and I used this tape (again at 45 N tension) to check the Pennsylvania Ave cal course in Oklahoma City (an old half-mile course that had been laid out using EDM on 7 Jun 82 by members of the Oklahoma City traffic department). Our tape check indicated the course to be 2.3 cm longer than its nominal distance of 804.672 m. This differs from the three comparisons described above by being the only time that the EDM-measured distance came out below the tape-measured distance.

Cases (2) and (4) display excellent agreement (within 3 cm/km, or about 1 part in 30000) between tape and EDM. (Note that the tape was used at 45 N tension in both these cases.) The agreement was not as good in cases (1) and (3). It is important to realize that cases (1) and (3) were NOT INDEPENDENT, since they were both done with the SAME EDM instrument operated by the same person (a member of the Tulsa Running Club who is also a registered land surveyor). Cases (1) and (3) were extremely SELF-consistent, as the 7.5 cm difference between the EDM measurements in those two cases is almost exactly what one would expect due to the difference between the 90 N tension used in case (1) and 45 N tension in case (3). (See equation below.)

Since cases (1) and (3) were not independent, there were really only THREE independent EDM checks of this 50 m tape. And two of those three independent tests (namely cases (2) and (4)) indicated the tape to be very accurate at 45 N tension. This suggests that the EDM device used in Tulsa for cases (1) and (3) might have had some calibration problem causing its readings to come out too high. If so, then the W 21st Street calibration course laid out in case (3) would be considerably more accurate than indicated by its EDM check. Of course, the Port Road cal course laid out in case (1) would still be about 7 cm longer than the W 21st Street course, due to use of greater tape tension in case (1).

The amount that a steel tape stretches due to changes in applied tension can, to a good approximation, be found from the formula

$$\text{"stretching"} = \frac{4\,(\Delta P)}{W} \qquad (1)$$

where the "stretching" is expressed in cm/km (or parts per 10^5), and ΔP is the

change in tension (or "pull") given in newtons, while W is the tape's linear density (or "weight") in grams per meter. For our 50 m tape weighing 25 g/m, this equation predicts that a 45 N increase in tension would cause a stretching of about 7 cm/km (which is almost exactly the observed difference in the EDM checks of the Port Road and W 21st Street cal courses). Note that for my 30 m tape weighing only 10 g/m, an increase in tension of 45 N would stretch the tape by 18 cm/km. Clearly, the lighter the tape, the more sensitive it is to errors in tape tension.

Equation (1) is fairly accurate (within about 5%) for any steel tape of more or less standard construction (i.e. basically solid steel), but will underestimate the degree of stretchiness when a significant portion of the tape weight W is due to a coating of nylon or similar material. Thus, the Japanese-made "Keson" nylon-clad tape (for which I have some manufacturer-supplied calibration data courtesy of Wayne Nicoll) stretches about 35% more than indicated by equation (1). That Keson tape weighs about 15 g/m, but has no more steel than my 30 m tape which weighs only 10 g/m. (By the way, the Keson tape reportedly has a thermal expansion coefficient of 0.0000093/°C which is only 80% of the usual steel tape value of 0.0000116/°C. Is it possible that the nylon coating somehow prevents the steel from expanding with temperature as much as it would do by itself?)

Turning now to my 30 m steel tape, I really don't have any calibration data for it, although the package in which it was sold contained the legend, "The blade in this tape conforms to all United States Government Specifications for accuracy." According to material obtained by Pete Riegel several years ago, the US government standard is 1/12000. Note that the (temperature corrected) curb circumference measurements obtained by the 50 m and 30 m tapes differed by 3.4 cm, which is just about 1/12000 of the measured distance. If we assume that the 50 m tape is accurate at 45 N tension (as suggested by the EDM checks), it would imply that the 30 m tape is oversized by about 1/12000, which would put it at about the upper end of the range allowed by the government standard.

Glen and I did perform one direct comparison of the 30 m tape against a 30 m interval of the 50 m tape: This showed that the 30 m tape was 2.5 mm longer than the selected interval of the 50 m tape (with both tapes at 45 N tension). While it is not necessarily correct to assume that the intermediate markings on the 50 m tape are at exactly the intended fractions of one full tape length, this comparison did obtain just about the same 1/12000 difference as we found in our measurements of the curb circumference with the two tapes. It may be noted that we would have obtained better agreement between our measurements with the 30 m and 50 m tapes if we had used the 50 m tape at 90 N tension. But every EDM check of the 50 m tape has indicated that it is accurate (or else oversized) at just 45 N of tension.

By the way, after we had completed all our measuring, I remembered that the 30 m tape has a marking saying to use it with a tension of 5 kilograms-force (about 50 newtons). Thus, we really should have pulled the 30 m tape with 50 N of force rather than 45 N. If we had done so, then according to equation (1), we would have found the track 8 mm shorter when using the 30 m tape. (Note: The "kilogram-force" is an obsolete metric unit, from the days when the "kilogram" could be used as either a unit of mass or a unit of force, just as "pounds" can denote either mass or force in the English system. In the modern SI metric system, the kilogram is the unit of mass and the newton is the unit of force. The old "kilogram-force" was equal to exactly 9.80665 newtons, since by convention, the "standard" value of earth gravitational acceleration is taken as 9.80665 meters per second squared.)

HOW LONG IS THE TRACK?

The curb measurements made with the 50 m and 30 m tapes, after temperature correction and adjustment to the assumed runner's path 30 cm from the curb, indicated the track to be short of its intended 1/4 mile (402.336 m) distance by 14.6 cm and 18.0 cm respectively. The Length-Width measurement using the 30 m tape, with similar correction and adjustment, indicated the track to be short by 18.8 cm.

It is gratifying that the Length-Width measurement and the Curb measurement done with the 30 m tape agreed to 8 mm (or about 1 part in 50000). During our very first curb measurement (i.e. with the 50 m tape), the temperature was more variable than for any of the later measurements, thus making its calculated temperature correction less certain. Nevertheless, it is for the 50 m tape that I have lots of EDM comparisons verifying its accuracy. For this reason, I tend to assign the most weight to our measurement with the 50 m tape (in spite of the problem with temperature variation). My conclusion is that the track is probably about 15 cm shorter than its nominal distance.

WHY WAS THE TRACK 15 cm SHORT?

I had a phone conversation with Ken Young on March 16 (the evening after we measured the track). When told how short we found this track, Ken suggested a very plausible-sounding explanation -- namely, that the builders neglected to account for the thickness of wooden forms used when pouring the concrete for the curb (i.e., they positioned the outside edge of the wooden forms at the locations where the outside edge of the curb should have gone). Assuming the wooden forms to have had a thickness of 3/4" (1.905 cm), this would have made the track short by

$$2\pi \times 1.905 \text{ cm} = 11.97 \text{ cm.}$$

Ken's suggestion can thus explain about 12 cm of the observed 15 cm shortness of this track. The remaining 3 cm might be due to the difference between the 12 inch and 30 cm standards. The builders probably assumed that track length should be measured 12 inches (30.48 cm) out from the curb. We actually measured/calculated the distance at 30 cm from the curb, which is now the rule. This would have caused us to find the track shorter by

$$2\pi \times 0.48 \text{ cm} = 3.02 \text{ cm.}$$

RADIUS CHECKS

After the measurements already described, we attempted to locate one of the arc centers (at the southern end of the track, to be precise), and check some distances from this arc center to various points on the south curve. This produced systematic discrepancies on the order of 5 to 10 centimeters.

Now, in spite of the amazing 8 mm agreement between our Length-Width and Curb measurements using the 30 m tape, the geometry of this track is rather obviously far from perfect. If you sight down the curbs along the straightaways, it becomes clear that the straightaways aren't straight. (So it's pretty hard to believe that the curves form perfect circular arcs.) Nevertheless, it soon became apparent that the discrepancies we were getting in our attempted radius checks were NOT due to defects in the track geometry, but simply showed that we hadn't located the arc center precisely enough. In particular, we had apparently wandered off the track's center-line when we measured inward from the southern end of the track in our attempt to locate the arc center.

It is interesting to realize that a deviation from the track's mid-line which would be totally insignificant when taping the Length measurement in the Length-Width method, can nevertheless be large enough to produce very obvious discrepancies when doing radius checks. For example, if the lead and rear tapemen were out of alignment by 10 cm (in a 30 m tape length) when taking the Length measurement, this would affect that length measurement by a measly 1 part per 180000.

After realizing that our putative arc center wasn't on the center-line of the track, we tried making some width measurements through this arc center. This didn't work out too well. When we had previously done our official Width measurements for the Length-Width method, we had maintained proper alignment by taping along grid lines of the football field (in particular, we used the 5-yard lines). Unfortunately, the arc centers did not lie on grid lines, but were within the end zones of the football field. We did try measuring parallel to the goal line, but did a pretty bad job of it due to a severe "optical illusion" sort of effect.

At this point, it was getting pretty late, and Glen and I both had other things we needed to do that day. I'm sure that if we had stayed at it longer, we could have located the arc center reasonably well and made some meaningful radius checks. But somehow it didn't seem all that important, so we gave up.

GLEN'S BICYCLE MEASUREMENT

On 26 Feb 1986, about $2\frac{1}{2}$ weeks before the tape measurements already described, Glen tried measuring this track by bike. His data was as follows:

Precal on 1 km calibration course:
9389, 9389, 9391, 9391 (average = 9390)

Rides around the track:
3763.5, 3760.5, 3762, 3764 (average = 3762.5)

Postcal on 1 km calibration course:
9385, 9384, 9387, 9386 (average = 9385.5)

If this is evaluated by average measurement (without the safety factors normally used when certifying a road racing course), the calculated track length is:

$$\frac{3762.5}{\frac{1}{2}(9390 + 9385.5)}\ \text{km} = 0.400788\ \text{km} = 400.788\ \text{m}.$$

Now, in our tape measurements of 15 Mar 86, our smallest measured value for the curb circumference was 400.263 m (by the Length-Width method using the 30 m tape). These figures would imply that Glen's distance from the curb while riding his bike was no more than

$$\frac{400.788\ \text{m} - 400.263\ \text{m}}{2\pi} = 0.084\ \text{m} = 8.4\ \text{cm}.$$

Maybe Glen wasn't QUITE this close to the curb. Remember that the track has a cinder surface, so that Glen's bike wheel might have been SLIPPING on this surface, causing it to make fewer revolutions than on a paved surface. Last summer, Gaby Duguay and Pierre Larue observed reductions in their bicycle counts of 0.140% and 0.066% respectively by riding a fine gravel surface alongside a paved 1 km calibration course (see Measurement News #13, Oct 85). If those results are applicable to Glen's rides of this cinder track, they suggest that Glen's distance from the curb might really have been 12.5 to 17.5 cm rather than the 8.4 cm result calculated above. But however you look at it, this was pretty tight riding!

USE OF TRACK FOR CORPORATE CHALLENGE RACES (12 Apr 86)

Since the track we measured was too short to be certified as a 440 yd track, one might think that it would have to be considered a 400 m track. But this was not done for either the Corporate Challenge Marathon course, or any of the other Corporate Challenge events held on this track on 12 Apr 86.

For the Marathon course, we used an approach that had been agreed on in my phone conversation with Ken Young on 16 Mar 86. Instead of regarding the track specifically as a TRACK, we simply viewed it as some arbitrary distance measured as part of a road course. (Thus it was certified using the full 0.1% short course prevention factor as would be done for any road course.) In particular, I chose the lesser of our two curb circumference measurements (i.e., the curb measurement made with the 30 m tape), which indicated the track length at 30 cm from the curb to be 402.156 m. This was divided by 1.001, yielding a result of 401.754 m. Thus, for the purpose of certifying the Marathon course, the track was regarded as having a measured length of 401.75 meters.

The Corporate Challenge competition also included track races of 5000 and 10000 meters. Perhaps the only way to do these totally legitimately would have been to treat the track as 400 m and therefore run the races as exactly $12\frac{1}{2}$ and 25 laps. But Glen said that the race organizers didn't care about having these events fully official and certified. After some discussion, we chose to establish the 5 km and 10 km courses based on our actual measured length of the track, including a reasonable safety factor to insure that the races are at least the advertised distance (but not as big as the 0.1% factor used when considering the track as part of the Marathon course. While the 0.1% factor is standard procedure for road courses, it was really rather excessive in view of the accuracy of our tape measurements.) In looking at our measurement data, I decided that I can say, with great confidence that the track length at 30 cm from the curb is definitely at least 402.00 meters. We therefore chose to consider the track as having a length of 402 m for these races. The 10000 m course was established as 50 m less than 25 laps. The 5000 m race was run as 12 laps of 402 m plus an extra 176 m. (This 176 m distance goes around one curve, so it was taped along the curb face as 175.06 m.) The courses so established may not be fully legitimate track courses. But I am far more confident that THESE races had at least their full advertised distance than I am for almost all more "normal" track races.

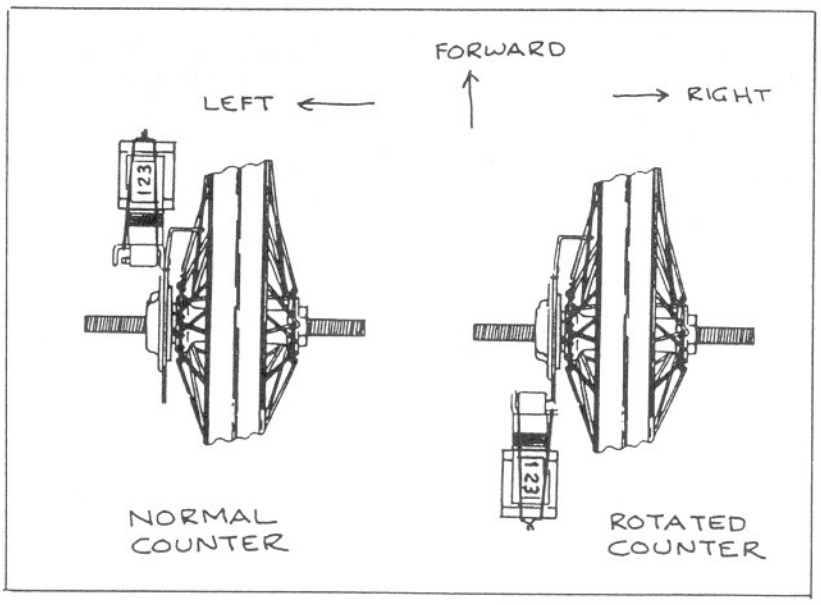
In addition to the events mentioned so far, the Corporate Challenge also included some short English-distance races on the track, namely one mile run and mile relay. These were run using exact laps of the track, as if the track had its nominal length of 1/4 mile. Thus they were definitely NOT legitimate events, as they were run on short courses.

TWIST YOUR COUNTER MISTER?

A standard Jones counter is set up so that it is mounted on the left side of the bike, with the counter forward of the axle. There's one disadvantage to this. When you stand on the left side of the bike, the numbers on the counter are upside-down. It makes the counter just a bit hard to read.

If you untwist the wires that hold the counter together, and rotate the counter 180 degrees, and wire it up again, you'll solve this problem. The counter will still be on the left side of the bike, but now it will be <u>behind</u> the axle, and the numbers will be right-side up when you look at it from the left side.

Your personal preferences or your bike geometry may make this fix impractical. But I tried it and I like it. Let me know how you make out.



SHORTNESS ON REMEASUREMENT - A LOOK AT THE RULES

TAC Rule 185.3 deals with remeasurements of courses as it affects acceptance of record performances. Since April 1, 1981 the tolerance for shortness has been shrinking. As it shrank, the rule stated criteria for acceptance of a record, and required the remeasurement to show that the course was longer than a given value (not shorter = longer). For a 10k, the value progressively went from 9950 meters (before 1 April 1981) to 9980 meters (1 April 1981 to 31 December 1983) to 9990 meters (1984).

At that point (December 31, 1984) the criterion changed. The rule now sets a criterion for rejection of a record. For a record to be rejected, the remeasurement must now show the course to be shorter than a given value.

Past interpretation of Rule 185.3 gave a bit of a break to the record claimant. On the Azalea Trail 1984 run, the course was remeasured at 9991 meters, and the record of Mark Nenow was accepted. At the time, it was required that the course be shown longer than 9990 meters.

Based on what we know today (and knew then), it takes a measurement of at least 9995 meters (by bike) to demonstrate clearly that a course is longer than 9990 meters. That the course was longer than 9990 meters was not shown - yet the record was accepted.

Today we are struggling with what to do about a 10k that comes out to 9999 upon remeasurement. I think the rule and its past interpretations are clear. The course must be shown to be shorter than 10000, and it takes 9995 or less to do that if a single bike measurement is used as a criterion.

TAC Rule 185.3 correctly states the rejection criterion. We do not need a rule change. We need a test case, and when it comes we need to be ready to put our measurement knowledge at the service of the Records Committee. We have a clearly-written rule, and we have a precedent for its interpretation. I am willing to wait.

RULE 185

RULES APPLICABLE TO LONG DISTANCE RUNNING EVENTS

1. No non-winning performance in a road race shall be accepted as a record unless it can be independently (of the primary timing systems) verified that a specific time was recorded for that particular runner. If it cannot be verified that such a time was recorded for the runner, the next slower recorded time that can be verified as being recorded after that runner finishes may be assigned to that competitor.
2. A winning performance in a race shall be timed in accordance with Rule 37 or Rule 38. The winner of each sex division shall be considered a winning performance.
3. Road running performances made prior to April 1, 1981 may be accepted as records if the remeasurement shows the actual course distance to have been not shorter than 0.5% of the stated race distance. Performances made between April 1, 1981 and December 31, 1983 may be accepted if the remeasurement shows the actual course distance to have been not shorter than 0.2% of the stated race distance. Performances established between January 1, 1984 and December 31, 1984 may be accepted if the remeasurement shows the actual course distance to have been not shorter than 0.1% of the stated race distance. Performances made after January 1, 1985 will not be accepted if the remeasurement shows that the actual course distance was shorter than the stated distance.
4. For track records at distances longer than 10,000 meters, lap sheets must be kept. Such lap sheets must record the total elapsed time for the record applicant for each lap. Only laps for which a time was recorded

CERTIFICATION FRAUD?

Does the certificate on the opposite page look ususual to you? There's no reason it ought to, but it does have one unique property. The "Bar Cheese (Scheese) Classic" was never certified. I issued this certificate for the [redacted] in [redacted] Indiana. Everything on the certificate is genuine except for the name and location of the race.

April 28 - I talked with Arthur Brindle, Bar Scheese Race Director, who brought it to my attention. He was curious as to whether his course was really certified. He inherited a pile of documents when he took over as race director, and this certificate was among them. He called me to check.

Someone did some xerox-tampering with the certificate. Brindle and I are both curious, and we will get to the bottom of it if we can. We have no idea of who did it at the time of this writing.

April 29 - Had a call from Brindle. He learned, from two sources, that [redacted] did indeed come up to Marshall to measure the course. He sent the certificate you see. He was paid for the job. I said some explanations were in order, and that [redacted] seemed to be a prime candidate to do the explaining. Brindle will get back to me with what he learns.

May 8 - After trying unsuccessfully to get [redacted] on the phone, a compadre of Brindle's called him yesterday at 7 AM and explained that there was a "problem" with the certification. [redacted] said he'd get with me and clear things up. Brindle was surprised that I had not been contacted yet, and he was concerned about the status of his certification, since the race is two weeks away. I advised him to get ahold of Scott Hubbard, and offered to come up myself and do it, but said that Hubbard would probably be cheaper since he lives nearby.

I told Brindle that it didn't much matter what [redacted] sent me. I simply will not deal with him again on a certification. If he can come up with a plausible explanation for the certificate I may change my mind. I'm dying to see what he says. If he calls at all. I advised Brindle not to worry too much about misrepresenting his certification. He dealt honestly throughout, and very much wants things to be right. Also advised Brindle to put the screws to [redacted] and get a complete refund.

May 14 - Brindle said he got ahold of [redacted] yesterday and explained the situation. [redacted] replied that he had been working with "another guy" on that job, and that the "other guy" screwed up the paperwork. Said he'd send a refund of the money that was paid.

Brindle was getting ready to send a follow-up letter to [redacted] to get the money, but the check arrived in the mail. So the matter is closed. But not forgotten. Brindle has engaged another measurer recommended by Michigan Runner to do his course. [redacted] to date has not contacted me, nor do I expect him to.

THE ATHLETICS CONGRESS TAC USA

ROAD RUNNERS CLUB RRCA OF AMERICA

NATIONAL STANDARDS COMMITTEE
TAC/RRCA

Course Certification

Name of Course: Bar-Cheese Classic

Location: Marshall, MICH

Terrain: Mostly Flat

Straight-line distance between start & finish: 65 feet

Altitude (feet above sea level)	Start: 612	Finish: 615
	Highest: 630	Lowest: 607

Measured by: [redacted], [redacted], [redacted]

Measuring method: Calibrated bicycle

Number of measurements of entire course: two

Date of measurement: 27 August 1983

Exact length of course: 10 kilometers plus 0.1 percent

Distance between longest and shortest measurements: 4 feet

Certification code: [redacted]

* * * * * * * * *

Based on our examination of data provided by the above-named measurer, the course described above and in material submitted to us is hereby certified to fulfill national standards for accurate measurement. A copy of this certificate should accompany race results sent to the National Running Data Center, PO Box 42888, Tucson, AZ 85733. If any changes are made to the course, this certification is void until the change is measured and data submitted for recertification.

Peter D. Riegel
Regional Certifier - Peter Riegel

Oct 24, 1983
Regional Certification Date

Ted Corbitt
National Certifier - Ted Corbitt

OCT. 31, 1983
National Certification Date

FULL CERTIFICATION

David Foley Editor will call as per Carol Coffey. 141421486

OFF 614-424-4009

HOME 614 451-5617

Ken & Jenny Young 602-326-6418