3354 Kirkham Road Columbus, OH 43221 December 6, 1982

TO: Ted Corbitt
Allan Steinfeld
A. J. Vander Waal
Len Evans
Bill Hauda
Bob Baumel
Bob Letson
Ken Young Alan Jones

Dear All,

I am writing this letter to introduce myself to you, and I hope to establish some correspondence which will result in our job as course-measurers and certifiers becoming easier.

In 1977 I began selling a small pace calculator. Alan Jones bought some, and a year later informed me that Bob Letson was selling his own. Curious, I wrote to Bob and we had some fun discussing our products. Last year I was asked to help out with certifying a course. I knew nothing about certification procedures, but remembered seeing Bob Letson's name in NRDC News so I wrote to him and Ted Corbitt, and I was off and running on my new career.

I'm a mechanical engineer, age 47, working at Battelle Memorial Institute. Been there 16 years. I work mostly in the field of underwater life support, but have many other things to do as well. Spent most of 1978 working in a coal mine in West Virginia Jack of all trades engineer. I've been married for 23 years and have two sons, age 16 and 18.

I've been a runner for ten years, and have finished over 100 races ranging from 1 to 109 miles. I've been involved in the numerical aspects of running performance for almost as long, and have written articles for Runner's World, American Scientist, and Ultrarunning on the subject of speed/distance/age.

When I got started in the certifying game, I began to see that certain aspects of accuracy were lacking. As an engineer I know that you can't have all the data you want, but sometimes have to to the best with what you've got. I think that we can do a better job than we're doing now, and that we can do it without much extra effort. The difference lies in how we use the data we get, not so much in how we get it.

I know that I'm the new boy on the block, and that many of you are old hands at this. Maybe I'm beating a dead horse. I certainly don't want to be a pain, but I'd like to do what I can to make course measurement better.

I think that if we discuss the subject, we may collectively find a more accurate approach to measurement. I have done some heavy thinking on the subject, and have written a proposed change to the measurement method. Please read it and let me know what you think.

If I get sufficient correspondence on the subject, I'll try to summarize it every month or so and send everybody a summary of how the thinking is going on the subject.

At the same time, I realize that Ted Corbitt has the last word on the subject. Since he has a correspondence load that I can only imagine, I'm assuming the role as communication center on this particular subject.

I believe that most of the courses certified today are shorter than the shortest possible route. I think it's a weakness in our method, and I think that we can improve it.

Want to help? Read the enclosed "MEASURING A 'SHORT' COURSE" and tell me what you think.

Best regards.

Peter S. Riegel Ohio Certifier

P.S. Just for fun I got ten engineers at the office to do some measuring on a flat floor paved with 12" tiles. When they were able to measure along a line their measurements had half the error as when they had to measure a diagonal.

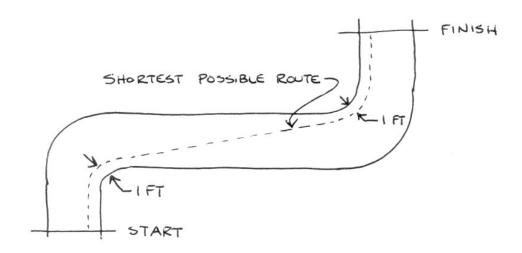
Also, using their measurements along a line as "calibration" measurements, and using the calibration to measure a diagonal. the measurements overwhelming resulted in "short course".

We all used a measuring wheel we'd never used before, and everybody did exactly the same thing. Only one out of the ten measured a "long course", and only by a little. The rest were short by a significant amount.

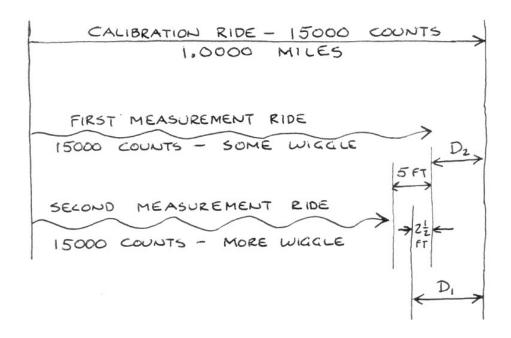
A measuring wheel isn't a bike, but the idea is the same. It does confirm to some degree my claim that we're measuring short. If anyone's interested I'll bore you with the technical details.

MEASURING A "SHORT" COURSE - AN EXAMPLE

I am contacted by the director of the "Miracle Mile" who wants to have his course measured for certification. The proposed course is shown below:



I ride my one-mile calibration course and find that my measurement should take 15000 counts (my final calibration also gives this value, so my constant for the day is 15000). Now I go out and measure the course. What happens? See below:



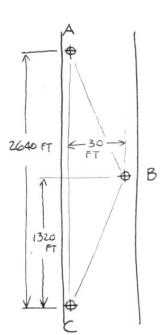
Because I could follow a line (the curb or centerline) on my calibration run I rode it nice and straight. When I did the actual measurement, however, I had to eyeball the shortest possible route, and my path deviated from that route by an amount that depended on my judgement and riding skill. As a result, both my measurements came out short.

I average the measurements. The average is short as well. How much is it short? Nobody knows - all I know is that my two measurements agreed to within 5 feet per mile. To account for potential shortness I add 0.1 percent (5.3 feet) to the measured course. Is the course now long enough? Once again, nobody knows. My course could well be short, even though I went by the book and got "good" seeming measurements.

This is a bad situation. If a person follows our instructions conscientiously, and winds up with a short course, something is wrong with the instructions. What? Here's what I think:

- The calibration ride should somehow be made to better reflect the actual riding and measurement situation.
- 2) Once two measurements are done, and they agree within reasonable precision (.1 percent), the measurement that gives the <u>longest</u> course should be used, <u>not</u> the average of the two measurements.

Improving the Calibration Procedure - Refer to the following diagram:



Lay out A-C on one side of road.
Lay out B about halfway between A&C (small error here won't affect overall accuracy)
Measure offset of B from line A-C and calculate path length A-B-C.

Path A-C = 2640 feet ($\frac{1}{2}$ mile) Path A-B-C = 2640.68 feet

Calibration of Bike

Ride path A-B-C as the calibration course. You will have no curb to guide you, and the calibration will better reflect your performance under actual conditions.

Improving the Measurement Procedure

Measure the course in the usual way, following the shortest possible route and trying to stay one foot from the road edge on turns and curbs. Both measurements should agree within O.l percent. This is our protection against a <u>mistake</u> being made (a <u>mistake</u> is a human screwup, like reading the counter wrong. An <u>error</u> is an inherent part of the measurement process. We try to minimize error, and totally eliminate mistakes). Once we are satisfied that both readings were done right, we use the one that makes the course the <u>longest</u> (i.e. the lead bike, after post measurement recalibration).

It can be argued that we should use the average, since we supposedly used the improved calibration method that simulates the way we measure. However, I believe that calibration will always be done better than measurement. In measurement we often have to avoid a car, a pothole, or other road nuisance. Also, it isn't always possible to accurately judge the shortest possible route (while approaching a hilltop, where you can't see beyond the crest). As a result, our measurement runs will still probably be a hair on the short side, both measurements.

Finally, add 0.1 percent to the course length. This is important, because it will provide the margin of error when the course is remeasured.

If the course has to be remeasured, the same measurement procedure should be used, except that the remeasurers should measure the exact distance, not adding 0.1 percent. Hopefully the 0.1 percent cushion should be adequate to assure that our courses are measured slightly long, although I confess I'm not totally at ease with that figure.

Our measurement process is lacking, in that we have no way to know for sure the accuracy of a measurement. When we're in doubt, we just throw in another measurement as a check. It would be interesting to see how we'd do when measuring a course that had its SPR accurately measured by surveying techniques. Unfortunately, they're nonexistent.

I'm certain that these proposed changes to our messurement procedure will not make things perfect, but I know that they will make things better.

Think about this. I'd like to hear from you on the subject. Let's get our act together by next spring, when measurement blooms anew!

Peter S. Riegel - Ohio certifier

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