

MEASUREMENT NEWS

6 - OCTOBER 26, 1983

Measurement News is a completely unofficial newsletter that the Editor sends out to those listed on the back page of NRDC News as regional representatives, plus selected others. Nothing you see here is official. It represents only the opinions of the Editor, and some contributions from some of you.

I put out this newsletter because I want to get smarter about measuring and because I like to change wrong things into right things. Often I get them mixed up, so if you see something that's off base write to:

Peter S. Riegel, 3354 Kirkham Road, Columbus, OH 43221
614/451-5617 (home, not after 10)
614/424-4009 (work, 8 to 4:30)

It's been a while since the last MN, and a bunch of stuff has accumulated that may be of interest, so here goes:

Feature Article - "The History of the Clain Jones Counter", by Alan Jones. You'll find it in the following pages. For you history buffs. An excellent example of what can be done with found materials when a good mind gets to work.

Course Upgrading - Readers of NRDC News now know that all courses with partial certification will lose their certification at the start of 1985. These courses won't meet cert standards at that time because they didn't have the extra 0.1 percent added on, and were measured using the guideline of measuring one meter from the curb, rather than one foot. The 0.1 percent would be easy to correct for, but the turns add another complication.

It would be nice if we could figure out a way to upgrade these courses without requiring a new measurement. I can think of several things, but none are totally satisfying because they are sloppier than I'd like.

Please send me any suggestions for solving this problem. I'll try to correlate what I get and let everybody know what's been suggested. We can save a lot of people a lot of work if we can come up with something that is reasonably simple to do, yet accurate enough so we have confidence in the length of the courses.

Standard Forms - I recently suggested to Ted Corbitt and NRDC some slight changes to the certification process that I thought might help things work faster. Ted, when he gets our applications, types out a data sheet on the course that he sends to NRDC. Bob Letson has been sending a similar sheet to Ted for years. When I started to do cert work I designed a form like Bob's.

These forms, I hope, should eliminate Ted having to type the summary himself. I send him two copies. One he signs, one he returns. The less he has to fiddle with paperwork the better the system works. I have high hopes that the reorganization in NY will streamline our paper flow. If we can each send Ted a standard summary sheet, as many copies as he needs, he should have no more to do than sign his name (assuming the course is OK).

THE HISTORY OF THE CLAIN JONES COUNTER
by
Alan Jones
October 1, 1983

When you run a particularly good time in a race, you often wonder right away if the course is short. If the course is advertised as "certified", you have some degree of assurance that it is accurate. Have you ever stopped to think what it is that makes one course certified and another not? Behind each certified course is a lot of work by dedicated people who want to give you that confidence in the times you run. There are many aspects to course measuring. One is the device used. My son, Clain, has made such a device that has been used to measure thousands of courses over the past ten years. Since he has now sold the business it seems an appropriate time to write a history of the device since one cannot claim such a history is being used to help sell the counters.

Before I go any further, I'd better explain what the Clain Jones Counter is. The Counter mounts on the front wheel of a bicycle and is used to measure road courses. The counter records 20 counts for each revolution of the wheel. By riding the bike over an accurately measured course to establish the number of counts per mile (or kilometer) one can then measure a course to a high degree of accuracy.

I have often been asked how my son began making the Clain Jones Counter which has been used to measure two Olympic Marathon courses as well as road race courses all over the world. By digging into some of his and my records I've created the following account.

Back in 1970 I ran in my first road race which was a local affair sponsored by a church advertised as "20 Kilometers". While I didn't run a fantastic time, I knew it was faster than seemed possible. I drove my car out on an Interstate highway and did a rough calibration of my car's odometer and then rode over the course. I found it to be about 11.4 miles instead of the 12.4 it should have been.

It so happened that this was the last running of the race since the priest who had been the meet director for 13 years was retiring and the parishioners did not want to carry it on. A few of us decided to try to pick it up and change it from a "here-to-there" format to a loop format. About this time an article appeared in *Runner's World* telling how to measure a course. Up until this time I had never heard of Ted Corbitt who did the certifying for the RRCA and AAU (to be replaced by TAC).

A friend, Tom Young, gave me a revolution counter that was used many years ago in an IBM machine to record the number of hours of use. I still have this counter. It is made of metal and has inscribed on the end of the case:

THE VEEDER MFG CO.
PATENTED
VEEDER
OCT. 22, 1896
AUG. 15, 1911
HARTFORD, CONN., U.S.A.

I figured I might be able to use this somehow but needed a way to revolve it as the wheel turned. I went to a bike shop and rooted through a box of old odometer gears. It seems that odometers wear out faster than the gears so people come in to get an odometer repaired but the gear part is not replaced. Since every new odometer comes with a gear, the proprietor was developing a collection of them. I found one that I thought I could hook to my counter.

By filing the circular shaft on the counter into a square cross-section, I was able to attach it to the gear which was then slipped over the front axle of my bicycle.

Tom and I then went out to a section of unfinished Interstate highway and measured off a half-mile calibrated course. (I didn't know at this time that one should make the calibrated course in a location that could be permanent.) I rode the bike over it a few times to get a calibration factor and then measured the course we had laid out (which was 12 miles long).

I had Ted Corbitt's address from the *Runner's World* article and sent him my data. Much to my chagrin Ted wrote back asking if I had stretched the tape to a tension of 10 pounds. I hadn't since the article hadn't mentioned that. I was really discouraged. However, the next spring we modified the course to a 20 kilometer one and I went out again but this time I was armed with Ted's official instructions. We stretched the tape and did everything right. At that time Ted did not require a re-calibration after the measurement but I did one anyway since it seemed like a good thing to do. The before and after runs were not in good agreement. The difference resulted in a discrepancy of 30 yards over the entire 20K distance. I sent it in anyway and Ted again turned me down. I did it once more and this time got good agreement between the two calibrations and Ted finally certified the course on May 10, 1972.

Now I figured I was done. However, on October 28, 1972 Ted wrote to me for a "description of the mechanism" I used to measure the course. He said that Veeder-Root was no longer making the counter he was providing. This counter was a "star-wheel" affair that gave one count per wheel revolution. One had to count the number of spokes beyond the last strike to get an accurate measure.

What Ted wanted was a complete description so that someone else could duplicate what I had done. (It seems this is what they told us a lab report should be when I was in college.)

I went to the Thomas Register to get Veeder-Root's address and wrote to them. They provided me with a catalog and the name of a local dealer. I found a counter similar to the one I had used but the case was now plastic instead of the original metal. It cost \$6.50 for one. However, Veeder-Root required a minimum order of \$50.00. The dealer said he would hold my order until someone else ordered some Veeder-Root parts and combine our orders. After two months the dealer called me and asked if I was still interested in the counter. I said I was and asked him to just keep waiting. About a month later my counter was in.

Meanwhile I was looking for a gear that I could mate to the counter. I went back to the bike shop and asked where he got the gear I had used. He told me that he didn't have the slightest idea since it was just in a spare parts box. I finally found a Stewart-Warner bicycle odometer in a store. It looked like it would do the job but the best part was that it had part numbers for the different components. I wrote to Stewart-Warner and they referred me to a distributor who supplied the part.

I now filed the shaft of the counter square, cut some of the thread off of the gear where the flexible shaft is attached, and lashed it all together with soft steel wire. I made a drawing (Figure 1) and a description and sent it off to Ted figuring I was done. After all, now anyone else could make a counter like ours.

I was disappointed in Ted's reply. He told about the efforts he was making to get a counter replacement. At that time he was recommending a Huret bicycle cable and gear box. The arithmetic involved apparently gave problems to some users. He also mentioned a effort by Aldo Scandurra. It sounded like the older Veeder-Root striker method but it had four strikers rather than one. In any case, he thought all of these methods were too complicated for the user. Mine had the same problem of being too complex to put together. Ted didn't think the average user would be able to do the metal work.

His suggestion was: "If you are interested in putting together about 30 counter assemblies with all work done and ready to install, then proceed and let me know when you need possible."

He then suggested that he buy 15 of them and I would sell the other 15. However, he made it clear that this was only to be an interim solution with an eventual counter coming from Scandurra or an un-named person in Minnesota.

I really didn't want to get involved with this so I asked my son, Clain, who was nine years old if he wanted to help. Since Clain was good with his hands and loved money he agreed. The assembly was really too much for him but he was able to do a bit of the work and I paid him \$1.00 for each one. This made the manufacture a break-even proposition for me.

I mailed the first counter to Ted on September 29, 1973. He began to pass my name out to interested parties and, by the end of the year, all 30 counters were gone. These counters sold for \$8.25.

That fall Ted flew to England to run in a 24 hour run. While there he gave a counter to John Jewell, an official of the British Road Runners Club. In a letter he stated that he was still looking for a company to produce a counter.

On December 10, 1973 Ted wrote to ask me to put together another 30 counters since he still didn't have this (unnamed) company going. He would make sure that we did not get stuck with an unsold supply!

On January 5, 1974 Ted sent me the first certification application done with a Jones counter (other than my own). Unfortunately, I don't have a record of who this person was.

After getting the next 30 parts, the orders dried up. I wrote to Ted on June 11, 1974 that I hadn't gotten an order in over two months. This was after he had told me that my orders should be picking up since he had been giving my name out to a lot of people. However, business did pick up shortly after that. The following table shows how many counters Clain sold each year that he had the business.

1973	30	1978	452
1974	52	1979	419
1975	78	1980	397
1976	92	1981	416
1977	99	1982	306

The total number sold over these ten years was 2341.

On September 16, 1974 Ted wrote to ask if we had ever had failures with the counter. (We hadn't.) In this letter he made reference to Bob Letson of San Diego who had begun to use the counter. Bob eventually became Clain's greatest fan and bought over 100 counters. He bought them from Clain and sold them to people all over southern California at the same price he bought them for. Bob must have measured a few hundred courses over the years.

As time went on, Clain took over more and more of the business. For a while all I did was order the parts for him and give him an advance to cover the cost of his inventory. After a while, he was able to cover this out of his own assets. One time when he got behind, I offered to help him out. I made a few counters but they weren't up to his standards so I just stayed out of the way.

Clain had a lot of interesting things happen him to him. One of the most exciting was when he got a telegram in the spring of 1976 from the Montreal Olympics asking for the price for four counters. He sent a telegram right back and they replied that an order would follow. He made up four counters (he had trouble keeping them available off-the-shelf.) and we took them to the post office. A bill was sent but a couple of months went by with no reply. He sent off another note asking where his money was. A form letter came back saying there were no more tickets available! Another letter finally got a telegram reply, an apology, and, finally, a check. That summer we went to the Olympics and watched the marathon from the street. For years after that we wondered if his counters had indeed been used for the measurement. Early in 1983 Pete Riegel, in his measurement newsletter, reprinted an article that gave the details of the measurement and included the information that one of his counters had been used.

Clain got a lot of inquiries over the phone. People couldn't understand why he couldn't ship a counter to them COD. However, he checked it out at the post office and found you had to be a regular business to do this.

As you can see from the table above, Clain's business took off in 1978. The cause of that was the publishing of Jim Fixx' book "The Complete Book of Running". In an appendix of his book he listed where to get information on various aspects of running. He mentioned Clain's counter and said it was "a good one". He gave the price as \$12.00 (which it was then) and Clain has continued to get orders for this amount ever since.

The increased business was both a blessing and a curse. His supply of gears dried up when the factory went on strike just as orders were flying in. This was very distressful to Clain as he liked to get counters in the mail within a day or two of getting the orders. Once he got the gears it took him many weeks to clean out the backlog. During this time he received a number of calls from customers wondering where their counters were.

As Clain approached college age I told Ted Corbitt that we should all be looking for a person to take over the business. Clain offered it to Bob Letson who was interested if it was the only way to keep the counters coming. Finally, Ted got Allen Steinfield, President of the New York Road Runners Club, interested. The NYRRC bought the business and Bill Noel took over the job of running it.

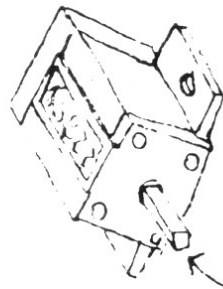
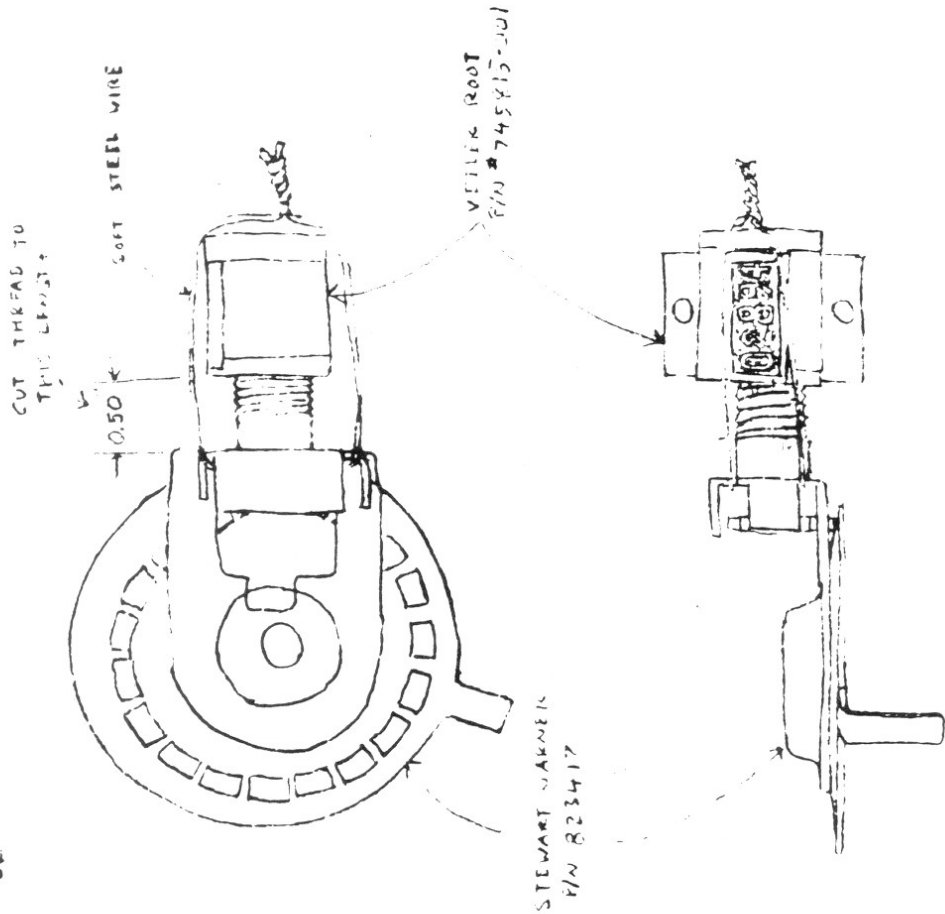
When we heard the Los Angeles Olympic Marathon had been measured by 13 volunteers, we wrote Bob Letson to see how many used the Clain Jones counter. Bob replied, "Whv. all of them. What other device is there?"

One interesting aspect of history of the counter that I have gotten a kick out of is the evolution of the name. We had always called it the Jones Course Measuring Device. It seems now to be universally called the Clain Jones Counter even as Bill Noel makes them.

Clain is now a sophomore at Cornell University in Ithaca, New York where he is studying agricultural engineering.

So it seems that a small effort to accomplish a single job (measure one course) evolved into a useful tool for the entire running community and provided a terrific business experience for my son.

ROAD COURSE MEASURING DEVICE
 FOR USE ON FRONT WHEEL OF
 BICYCLE



SHAFT OF VEEDEK-ROOT
 COUNTER MUST BE FILED
 TO A SQUARE CROSS SECTION
 TO ENGAGE IN SQUARE HOLE
 IN STEWART WARNER AXON
 BEARING

ALAN L. JONES
 3717 WILDWOOD DR.
 ENDEWELL, NY 13769
 APRIL 25, 1973

Turning Corners - Every so often I get an application that says "runners must keep to the right on Main Street" or the like. Sometimes Main Street comes right after a left turn. When I measure, I take the beeline or establish a spot for a cone to define the exact route. However, I'm sure that lots of measurers don't get this refined. I am unsure of how to deal with these applications. If they say they measured the SPR I take them at their word, but I'm sure that some of those left turns onto a right-side-only street are sloppy.

Do any of you have a reasonable way to deal with this? I certainly don't want to call for a remeasurement on something so minor, but I'd like to find a way to even explain to these people why a cone might be needed.

Digital Cyclometer Update - Tom Knight reports that he got ahold of Avocet, whose new programmable cyclometer looked so good for a while. Seems they are having production difficulties. In addition, even though the unit is supposedly programmable to a gnat's eyebrow the unit will read out only to 1/10 mile. Too bad. Anyone for 5 mile cal courses?

Come to think of it, I don't remember seeing the Avocet advertised recently. Maybe they are rethinking its virtues and Tom's inquiries will cause a corporate about-face, and we'll wind up with a 1/10000 mile readout. My breath is not held.

Solid Tires - Bob Letson sent some dope on his solid tires. His tubes are solid black rubber (brand unspecified). He says "It took about 6 months to one year for my solid wheel to 'settle in'. Your graphs indicate that your wheel is still getting settled. After it is finally at home with itself, it might perform as mine did on April 24, 1983 (Olympic Marathon Measurement Day)."

Bob's tires changed only about 6 counts per kilometer on that day, while the rest of us were experiencing changes of two to four times that value.

Like me, he finds the ride harsh, and like me, he uses foam handlebar grips.

The Incredible Oscillating Inch - In response to my table of conversion factors Bob Baumel reminded me that although there are exactly 2.54 cm in an inch, the US still uses the US Survey Foot, which doesn't agree exactly. Fortunately for us, this discrepancy will disappear this year when the whole system gets somehow unified. Bob points out that most EDM devices are calibrated to read in Survey Feet, and hopefully all will be recalibrated on January 1. If they aren't it should not cause alarm, since the difference amounts to only 2 parts per million.

Calibration Change - Tires get fatter when it gets hot. Pre-measurement calibration rarely agrees with post-measurement calibration. How much difference should be allowed before things look fishy? Len Evens was curious about this because a measurement he reviewed showed a change of 15 to 18 counts in $\frac{1}{2}$ mile, from 6:30 AM to 4:00 PM, in summer heat. That's a lot, but some of the Olympic people had a 20 count change in a kilometer, and before I got high-pressure tires (and then solid tires) I used to get more variation than I liked. I'd like to hear from you about this. I'll summarize and shoot it back to you, and we'll all be wiser.

When to steel-tape - presently we are instructed that all non-paved parts of a course must be measured with a steel tape. Since a steel tape is more accurate than a calibrated bicycle this seems like a good idea.

however, what is gained? When a course has a few hundred feet of dirt (or, more commonly a cinder-track finish or start) do we really gain by trying to tape these lengths? I don't think so. On the other hand, when miles of dirt road are involved, substantial inaccuracy can result unless proper measurement procedures are followed.

In my home town I have measured a 5 mile course that's used for a Memorial Day race. It has a winding stretch of dirt road that's 1000 feet long. I have not applied for certification of the course because I would have to steel-tape the dirt portion. Normally I wouldn't mind - it's no big deal. however, because of the winding nature of the course it's extremely difficult to do a decent job of accurate taping. Tapes are designed to measure straight lines, not curves. The only accurate way to measure around a curve is to set a series of pins along the curve and measure the distances between the pins, and add up the short distances to get the length. To do this job right would take 2 or 3 hours, to measure 1000 feet.

I don't have a handle on the amount of error that a bike might have on this stretch of road. however, I would be surprised if amounted to more than a few feet in that 1000 feet. This would have no substantial effect on the length of the course. Because of the present rule I must steel-tape.

Therefore have three choices:

- 1) lie
- 2) do a half-assed taping job that complies with the rule
- 3) do a good taping job that improves the bike-measured accuracy by a few feet.

The first two options are unattractive to me. The third goes against my grain because the improvement in accuracy in a five-mile course is both insignificant and unverifiable.

Here's what I'd like to see:

1) Relax the steel-taping rule to permit bike-measurement of the whole course, as long as the dirt/grass doesn't exceed 10 percent of total course length. We must use some common sense here - rocky and rough areas are obviously unsuitable to bike measurement, but lots of dirt roads are easily ridden by bikes.

2) If more than 10 percent of the course is dirt, consider it uncertifiable.

The 10 percent limit is large enough so that it lets people use a cinder track for a start/finish area, yet is small enough so that a relatively large error in bike measurement in the dirt stretch will still be covered by the relatively large effect of the extra 0.1 percent that's added to the whole course.

When I saw the "cloud of dust" near the end of the NY Marathon I knew they were running over dirt. I asked David Katz jokingly whether that 100 feet or so of dirt had been steel-taped. He replied that it indeed had been. Does anyone feel that the accuracy of the NY Marathon was substantially improved by that measurement? I certainly don't. It was done because the rule said it had to be done.

Does anybody out there know just what the procedure is for measuring on a winding dirt road? Do you just lay out the tape along the shortest path? Most dirt roads have two smooth surfaces where the cars have packed down the grits. On curves the shortest route goes through the stones at the inside edge of the turn. Do we measure here? I'd say no-stony edges are practically unrunnable. I just shot down a nice 10 miler in Indiana because it contained 3 miles of dirt road. The measurer had done everything right, except that he had been unaware that he had to steel-tape the dirt sections, twice. My fault - My directions were not explicit enough, and I've changed them. I gave him the option of finding a $\frac{1}{2}$ mile of straight dirt road and doing a standard bike calibration on dirt, or steel-taping.

I privately advised him that I thought his course was probably as accurate as he could reasonably get it, and that he should rest easy and forget about certifying the course. I told him he'd done a good job, about the best possible under the circumstances.

A straight line is easy to measure with a tape. A curved line is not. I am skeptical that most of us can do substantially better with a tape on a winding road than we can with a bike, and as for the common herd of measurers, forget about it. They are bound to get things screwed up. It's difficult to get many of them to understand how to marry two different types of measurements and have them come out right. We can do it OK, but our procedures must be simple enough so that ordinary people can follow them. I think that our present taping rule creates more problems than it solves.

I realize that I may be blowing in the wind about this. I may be totally off base. I don't think so, but I hope that you all will let me know what you think on this subject, because I think that the present rule creates more problems than it solves.

Course maps

Many of us have been fortunate enough to see a course map drawn by Bob Letson. I've never seen anybody else's maps come close to doing as clear and attractive a job of describing a course. They represent a standard to which we all can aspire.

My own maps are not as nice as Bob's. I lack the artistic talent, the time, and the patience to do the same beautiful work. I try to produce maps that provide the essentials. I don't do too badly, in my own (biased) opinion.

The maps I get from my measurers are another story. They are just awful. sometimes they are scotch-taped giant assemblies of township maps, sometimes just messy sketches that look like they took about 10 minutes to draw. I hate most of them. In these cases the guide + use is one of necessity. Does the map show the route? Can I determine the exact locations of start, finish and turnarounds? If I can somehow pick out all the relevant dope, I go ahead and live with the map. I am an engineer and I work in an office where copying machines are available. I know about cut/paste. Many of my measurers don't know how copying machines can be used to make a decent map out of cut/paste, so they do the best they can (or are willing to do) and send it to me. It pains me to see the rough junk that I sometimes get.

Still, the operating requirement is: Is the course, on the ground where the runners will run, the proper distance?

Sometimes a nice pretty map is needed by the race director for publicity purposes. Whether he gets it is between him and the measurer, in my opinion. Once I have determined that the on-the-ground distance is proper, the map is of no further use to me. It is a tool for helping me understand the measurement. It also serves as the guide, should a remeasurement be required. The map and measurement dope must contain the needed information to define the route. I insist on that. But I don't insist on neatness or a very high standard of mapmaking, because most of my measurers don't have the skill to produce good maps. But some are pretty good measurers, even if they draw lousy maps.

Do you cringe when you get a bad map? Let me know.

Money, Money, Money - Some of us charge for the work we do in the certification game. I myself ask everybody to send me 3 dollars with their applications. My earlier forms didn't ask for anything, but I found that I was losing a small amount of money, so I decided to charge for the processing. Everybody doesn't send the fee, but some send \$5 because they think it's worth it. I keep it. I don't keep records of expenditures but I figure I'm just on the good side of breaking even.

I heard that one of us was charging \$50 for certification, and I was shocked. Seemed like a ripoff. Then I learned that the \$50 covered measurement of the course as well, and I'm glad I didn't sound off about it. That's dirt cheap for measurement work.

I myself measure courses for money. In general I charge \$50 plus \$10 per mile. I make it clear that I'd just as soon advise them how to do it themselves, and definitely don't want to give an impression of subtle blackmail. I want to develop a cadre of experienced measurers in my area, and I think I'm succeeding. Of course, every so often some race director feels that it's a cheap way to get the measurement and paperwork hassle off his back. I'm glad to oblige. Of course, since I'm a member of a couple of running clubs I'm expected to help out at a couple of races each year. I usually discharge this obligation by measuring several freebies during the year.

My view is that my advice is free, but my labor is worth whatever I can get for it.

I have often felt that Ted and NRDC should get some recompense for their work in this area. I hope to see a fee structure developed that will be reasonable, yet will make the races pay for the services they get. I am sure that some of you may have had similar thoughts. Let me know what you think about this. Any suggestions for such a system will be welcomed. I continue to send Ted the SASE which is all he ever asked for, but if he'd ask for 5 or 10 bucks I would not think it out of line, and I'd send it. Also the same fee for NRDC. Let the runners pay for the privilege of reading about all those good performances on certified courses.

Elevations

We ask measurers to provide elevation information about the course. This information is used by Ken Young to separate point-to-point courses from loop courses. I get my elevation information from USGS topographic maps, when I can. I sometimes estimate, based on known local conditions.

USGS maps are available in many large cities, but measurers who live in the sticks, as many of mine do, must go through a 6 week process of map-ordering to obtain the answers to the elevation questions, if they want to do it right. Most don't know what a USGS topo map is, and I suspect that many couldn't read one if they had one. I don't ask where they get their elevations.

A similar problem arises as to the "straight-line distance between start and finish". Many are confused by the question. Generally I can get it straightened out when I review their measurement dope and their map.

I don't know whether Ken has yet had a borderline case of point-to-point vs loop. Maybe it's not a problem. If a course starts and finishes at nearly the same point there's no ambiguity, and the elevation info becomes unnecessary. If the course is clearly a point-to-point because of separation of start/finish the same applies - elevation information is unnecessary.

This is a loose end that needs tying up. Does anybody have any ideas? I hate to ask people to go through the hassle of obtaining USGS maps when they have a course that starts and finishes in a one-block section of Main Street.

In mountainous areas, where contours may be as much as 80 feet apart, determination of elevation information may be impossible to do. In this case, what should be done? Just take the measurer's word? How do we check? With a level survey?

This may be a tempest in a teapot. Still, I hate to ask my measurers to go to a lot of trouble for information that may not really be needed. If sufficient information can be developed to separate point-to-point from loop courses without specific elevation information, I'd say let's not require it.

Let's hear the arguments!

	PRE-MEASUREMENT CONSTANT	POST-MEASUREMENT CONSTANT
<u>BIKE "A"</u>	15106	15092
<u>BIKE "B"</u>	15382	15372

	<u>BIKE "A"</u>	<u>BIKE "B"</u>
START	00000	00000
1	15106	15382
2	30212	30764
3 (FINISH)	45318	46146

BIKES SEPARATED BY 3 FT AT END

THIS IS TYPICAL OF DATA I GET FROM PEOPLE WHO STILL LAY OUT TWO SETS OF MARKS.

EXERCISE FOR READER

- 1) WHAT WAS THE DIFFERENCE BETWEEN MEASUREMENTS?
- 2) WHICH MEASUREMENT GAVE THE LONGER COURSE? DISTANCE?
- 3) JUDGE THE OVERALL QUALITY OF THE MEASUREMENT.

DO YOU BELIEVE THAT LAYING OUT TWO SETS OF MARKS IS A BETTER WAY THAN USING A SINGLE SET, AND USING THE SECOND RIDE TO CHECK THE SAME POINTS? LET ME KNOW.