MEASUREMENT NEWS

July 1991 Issue #48

In April, Mike Wickiser (left) responded to an emergency request by Ollan Cassell and traveled to the Caribbean to measure the Curacao International 10k. While he was there he gave a course of instruction to local measurers. This was Mike's first chance to use his recently-acquired status as "IAAF approved measurer" and he did it well. See his report inside.

MEASUREMENT NEWS

#48 - July 1991

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CALIBRATION COURSE LISTINGS

In this month's course listing you will see a group of old calibration courses from Florida. Doug Loeffler felt it would be helpful to him if they were carried in the main course list, so we listed them. If you have any calibration courses you would like to have listed, just send in a certificate for each and we will add them to the master list, and they will appear in future state printouts.

Please don't send any calibration courses unless you are pretty sure they are active. There's no reason to list deadwood just to run up a high course count.

From now on, certifiers need not send a $2.00 listing fee for calibration courses. Continue to send the fee for regular race courses. This is done to encourage the listing of calibration courses. Many people are scared of measuring calibration courses, and a listing of where they can be found may be helpful. In any case, it will do no harm.

Personally, since the 300 meter/1000 foot option became available I've not had occasion to use an old half-mile or kilometer, except once when some dodo illegally parked his car atop the north nail of my personal Kirkham Road 1000 footer. I had to use a nearby oldie of 2988.79 feet length, and didn't like the extra riding.

PROFESSIONAL COURTESY

A certifier who measures and certifies a course in a state not his own should send a copy of the certificate to that state's certifier. If I measure a course in West Virginia, I'll send a copy to Bob Thurston. If Bob Edwards certifies an Ohio course, he should send a copy of the certificate to Pete Riegel. Certifying out of your own area is generally discouraged (unless you do the measuring yourself) but it does happen. Mostly it happens in border areas where an active measurer gets around, and sends his work to the certifier he is used to.

If you are a certifier, you should forward any out-of-state submissions to that state's certifier, and let him or her handle it. His standards may not be the same as yours, and may wish that his state is handled his way.

CALCULATING DROP AND SEPARATION

We continue to receive certificates on which drop and separation are incorrectly calculated. This causes improper listings, and bad information. Please take the time to do it right. Remember, DROP is expressed in meters per kilometer, while SEPARATION is expressed as a percent, not as a decimal fraction.

MAKING THE BEST OF THE COURSE LISTS

Corrections and additions to the course list are not burdensome to us. We want the list to be as useful as possible to anyone who needs information. All additions and corrections are welcome. Certifiers may wish to have a list arranged in numerical order, or a list with the active courses separated from the inactive, or some other combination. No problem. Just say what you want.

SELECTION OF INTERNATIONAL MEASURERS

It doesn't happen often, but it does happen. I must ask someone to travel abroad to measure a foreign race course. What selection process is used? The following example was how I handled it for the Curacao 10k:

On Tuesday afternoon, April 9, I received a call from Ollan Cassell. He'd had a request from the Netherlands Antilles for a course measurer to assist them. Race day was Sunday, April 21. Ollan needed to FAX a measurer's name back to the Curacao folks, fast. I didn't have a name for him, since I didn't know who was available on very short notice. I told Ollan I'd FAX him a name the next morning.

I considered that I ought to send someone with IAAF credentials, and located in eastern US, to save plane fare. The first one I considered was Wayne Nicoll, since a last-minute flight cancellation by Pan Am had deprived him of a trip to Argentina. Unfortunately, I got his answering machine, and had no idea when he would return. I left a message. Next I called Mike Wickiser, and got Karen, his wife. I explained the situation and told her whoever gave me the first "yes" would be the one to go. I was about to call others of our IAAF anointed when the phone rang. It was Mike, and the answer was "yes." So I FAXed his name to Ollan, he FAXed to Curacao, and they called Mike and arranged tickets for him.

If more time had been available I might have used a fairer way, but the situation contained some time pressure. Suggestions as to how this might be better handled are welcome. Next time I still intend to call Wayne first, but Mike will move to the bottom of the list. I hope there's enough work so everybody gets to do this.

Mike may be directly invited to Curacao again next year, since what he did there was obviously pleasing to them. This arrangement is between him and them - I'm out of the loop on that.

A minor note: I experienced brief panic when I realized Mike might need a passport, because getting one in a hurry is difficult. He said he did not have one. I checked, and traveling to Curacao does not require one, so he was lucky. Anyone who would like to be considered on something like this would be well advised to have a current passport. You may never get to use it, but if the chance comes you'll be sick if you didn't get one.

On this subject, see this month's puzzle. You should send in an answer, or at least a comment. Those with known current abilities will get preference over those who are unknown. If you have a good measurement question, send it in. It may make a good puzzle. If possible it should deal with something a measurer would encounter in a real situation.

The Athletics Congress of the USA

The Governing Body for Athletics in the United States including Track and Field, Long Distance Running and Race Walking for men and women and boys and girls at all age levels.

MIKE WICKISER
2939 Vincent Road
Silver Lake, Ohio 44224
(216) 929-1605

CURACAO INTERNATIONAL 10 K

SEMINAR AND MEASUREMENT REPORT APRIL 8-21,1991

Measurement of this course was arranged through Pete Riegel T.A.C./ R.R.T.C. Chairman, Ollan Cassel T.A.C. Executive Director, Amadeo I.D. Francis, President North American, Central American and Caribbean Athletic Association and Anthony Minguel, President,Netherlands Athletic Unie (A.H.O.) Central American and Caribbean Athletic Confederation.

Upon making contact with Anthony Minguel all arrangements were made between He and I. In addition to actual measurement of the 10 k race,it was requested a seminar in I.A.A.F. race course measurement be conducted to familiarize the Athletic Technical Committee and prospective measurers with proper procedures, for race course measurement using the "calibrated bicycle" method.

For this purpose, Pete Riegel made available 10 copies of each I.A.A.F and T.A.C. road race course measurement manuals. He also sent along a new Jones Counter to be presented to Mr. Minguel as part of the measurement seminar and extension of good will. He was very pleased with this "gift" and expresses his gratitude.

Arriving in Curacao Thursday evening, we (my wife, Karen and I) met with Anthony Minquel and discussed a schedule for the weekend. The following morning we toured the race course,met with Phillip Elhage, the director of sports and recreation and explained basic measuring procedures. He assured us that 9 individuals would be attending the evenings seminar. Phillip presented Karen and I with a book on Curacao and it's history as well as pins with the Islands flag for each of us.

After lunch it was determined that to save time in the morning we would lay out a calibration course in advance. Anthony requested he be present so to advise his team on the procedure. We found a nice stretch of ocean front road on Kennedy Blvd. and with his assistance set down a 300m calibration course,then returned to the hotel to prepare for the seminar at 7PM that evening.

The seminar was productive, with all in attendance taking an active part. Soon they were asking questions and eagerly referring to the TAC and IAAF measurement books, gaining an understanding of calibrated bicycle measurement.

It was decided to measure at 4 AM the following morning, due to the fact that this is a resort area and people are out both late and early. Unfortunately, it would be pitch dark. This made the measurement a real challenge.

I was glad to see a good turnout for the measurement. They even brought a bicycle to mount a Jones Counter and have more than one student get some experience. Gratefully, we had a lead car, a follow car and a police car to guard me on both measurements. Although a second measurement is not required by IAAF, I felt it advantageous. We proceeded with both measurements, did calculations and found that their original course measured with a wheel, to be short by 75 meters. Anthony opted to relocate the start line and adjust all intermediate splits and finish line accordingly.

Since the mornings work was complete, members of the seminar returned to the calibration course along with observers for some real training. Aubrey Linzey and Yvette Roger volunteered to attempt calibration and measurement of the Start to One kilometer split. We had a rewarding session. Aubrey took much pleasure in challenging his comrades with hypothetical questions and both he and Yvette did well on calibrating after getting used to unfamiliar bicycles. They then went to the Start, measured to the 1 K mark and then returned to recalibrate and compare their numbers with each other as well as my own data. Traffic at this time was a great detriment. Both experienced a brush with traffic which caused their ride to be "off course". Their measurements would have been better if done earlier but they still did reasonably well. They also seemed to enjoy themselves and that is rewarding. All expressed an interest in putting the newly acquired skills to work on area race courses. I am anxious to see the results of their work.

The race was conducted Sunday afternoon with great success. Following the post-race activities, Anthony and a group of race officials treated Karen and I to dinner at one of the islands more scenic restaurants, we were informed it had previously been a fort. The dinner, true to form, was excellent and we were tenatively invited back for next years event as well as for some time to be tourists as the past three days had been a rather hectic adventure.

It would have been nice to see the beaches and be a little bit more of a tourist, but there was no time. The people we worked with were excellent hosts and I will always think of them fondly. I am grateful for the wonderful experience and thank Pete Reigel for delegating this job to me.

As we were preparing to leave the island, I was given a gift from Anthony, a clock depicting the architecture prevalent in the Otrabanda area. It will occupy a place of fond memories. In gratitude for the experience and gracious hospitality I presented Anthony with my Goodyear "permafoam" filled measuring wheel.

Enclosed are copies of measurement certificates for both the Curacao 10 Km race and Kennedy Blvd. 300 metre calibration course. I have also enclosed copies of some photos taken while there, a list of seminar attendees and other paperwork generated.

Sincerely,

copies to:
J. Disley
P. Riegel
A. Minguel
W. Nicoll

Curacao 10 k Measured: 04/20/91

Length of Calibration Course = 300 m
Measurements Computed using AVERAGE Constants INCLUDING 1.001 factor

Mike Wickiser

Pre-Calibration:

Start	Finish	Counts
53700	56550	2850
56550	59399	2849
59399	62249	2850
62249	65097	2848

Working Constant: 9506.9980 counts/km

Post-Calibration:

74500	77349	2849
77349	80197	2848
80197	83046	2849
83046	85895	2849

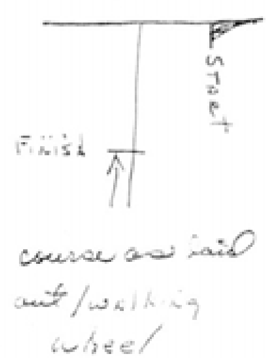
Finish Constant: 9505.3291 counts/km

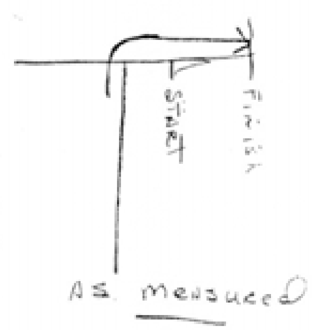
Constant for Day: 9506.1641 counts/km

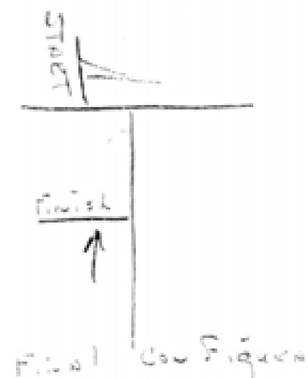
Course Measurement:

	Counter Reading	Interval (counts)	Interval (meters)	Counter Reading	Interval (counts)	Interval (meters)
Start	74300			69400		
1 k	83807	9507.0	1000.09	78914	9514.0	1000.82
2 k	93314	9507.0	1000.09	88415	9501.0	999.46
3 k	02821	9507.0.	1000.09	97919	9504.0	999.77
4 k	12328	9507.0	1000.09	07424	9505.0	999.88
5 k	21835	9507.0	1000.09	16931	9507.0	1000.09
6 k	31342	9507.0	1000.09	26444	9513.0	1000.72
7 k	40848	9506.0	999.98	35952	9508.0	1000.19
8 k	50356	9508.0	1000.19	45459	9507.0	1000.09
9 k	59863	9507.0	1000.09	54942	9483.0	997.56
10k	69370	9507.0	1000.09	64450	9508.0	1000.19
Totals:		95070.0	10000.88		95050.0	9998.78

(Sum of Shortest Splits = 9997.09 meters)
(added 1.25 m to course)







Curacao 10 k :start to 1 k   Measured: 04/20/91

Length of Calibration Course = 300 m
Measurements Computed using AVERAGE Constants INCLUDING 1.001 factor

Aubrey Linzey

Pre-Calibration:

Start	Finish	Counts
26500	29416	2916
29416	32328	2912
32328	35241	2913
35241	38154	2913

Working Constant: 9721.3779 counts/km

Post-Calibration:

63400	66314	2914
66314	69224	2910
69224	72134	2910
72134	75046	2912

Finish Constant: 9714.7051 counts/km

Constant for Day: 9718.0410 counts/km

Course Measurement:

	Counter Reading	Interval (counts)	Interval (meters)
start	47330		
1 k	57117	9787.0	1007.10
Totals:		9787.0.	1007.10

Yvette Roger

Pre-Calibration:

Start	Finish	Counts
98370	01221	2851
01221	04071	2850
04071	06921	2850
06921	09770	2849

Working Constant: 9509.5000 counts/km

Post-Calibration:

34600	37448	2848
37448	40296	2848
40296	43144	2848
43144	45992	2848

Finish Constant: 9502.8271 counts/km

Constant for Day: 9506.1641 counts/km

Course Measurement:

	Counter Reading	Interval (counts)	Interval (meters)
Start	18870		
1 k	28454	9584.0	1008.19
Totals:		9584.0.	1008.19

PUZZLE OF THE MONTH

You lay out a 5 km race course as follows:

1) You steel-tape a 500 meter calibration course twice, obtaining:
First measurement = 500.00 m
Second measurement = 499.98 m

2) You measure the taping temperature at 12 C, but assume the calibration course is 500 meters, figuring you'll catch the difference when you do your final calculations.

3) You calibrate your bike, getting 4896, 4896, 4896, 4895 as the elapsed counts for the 4 pre-measurement rides.

4) You lay out the course, obtaining counts as follows:

	FIRST RIDE RECORDED COUNT	SECOND RIDE RECORDED COUNT
START	61900	60004
1 KM	71702	50186
2 KM	81504	40373
3 KM	91306	30582
4 KM	(1)01108	20800
FINISH	(1)10910	11000

> Attention IAAF Measurers and potential candidates:
>
> Send in a solution! This is the first of a series of test questions that will attempt to evaluate candidates' talents.
>
> Best answer gets a t-shirt!

5) You recalibrate your bike, getting 4899, 4899, 4898, 4898 as the elapsed counts on the four post-measurement rides.

Condition 1: The race director wants to have certified distances of 1, 2, 3, 4 and 5 km, from the start.

Condition 2: He may also want each individual km to be certified.

He wants the shortest course you can legally give him. He understands you must use larger constant and 1.001, but wants to keep the course length to an absolute minimum within the rules. Your final adjustments should be the minimum permitted to comply with TAC procedures.

<u>Questions for the experts</u>:

1) To comply with Condition 1, how far must the 4 km split point be moved, and in what direction?

2) To comply with Condition 2, how far must the 4 km point split be moved, and in what direction?

3) Do you have any comments on the measurement?

Buying a METRIC Tape

by Bob Baumel

Given the prevalence of metric race distances, many measurers have learned how easy it is to measure entirely in the metric system—including use of a metric calibration course measured with a metric tape. Unfortunately, long steel tapes with metric graduations are not readily available in the United States. For example, you probably won't find any on the shelves of your local hardware or discount store. This article is therefore intended to help you find a suitable metric measuring tape.

I have actually wanted to write this article for a long time, but have only now gathered all the necessary information. On various occasions, I've discussed this with measurers and told them that I was researching this article (which would surely appear soon). I apologize to any measurers who have been waiting a year or more for this article to appear!

Researching this article was, in one sense, a bit depressing because I learned that metric tapes are currently **less** available in the United States than they were about 10-15 years ago. For example, I found that Lufkin, the major US manufacturer of steel tapes, now makes only about one-third or one-fourth as many metric models as they did a few years ago. On the other hand, the proprietor of a Houston surveying equipment store told me that interest in metric measuring devices seems to be picking up again. Thus, there appears to be cause for optimism.

Anyway, where can a US measurer go *right now* to buy a long metric steel tape? As I said, you won't find any on the shelves of your local hardware store. Can your friendly local hardware dealer *order* one for you? Probably not, because he doesn't buy directly from companies like Lufkin (which do make metric tapes) but, rather, from a distributor (i.e., middleman) who, in all likelihood, doesn't stock any metric models. If your hardware dealer is *extremely* friendly, and has enough sources of supply, he *may* actually be able to locate some metric tapes. But then you'll probably hit the *quantity* problem; for example, the dealer might have to order a dozen or more tapes even though he has only one customer who wants only one or two of them.

Clearly, a hardware store (in the US) is *not* the place to buy a metric tape. The best place to go, in my opinion, is a specialized **surveying equipment store**. You *can* get metric tapes from other sources (as discussed below), but the surveying equipment dealer can offer you the best selection. Even here, you may not find the model you want on the shelves, but they can almost certainly order it for you.

By the way, if you've never visited a surveying equipment store because you thought they carry only high-priced fancy equipment, you should know that such stores do carry tapes in the same price range as the ones sold in hardware stores (as well as higher priced models). In addition, the surveying equipment store is a great place to find various other measuring supplies (such as P-K nails) that you probably won't find in hardware stores.

If you live in a place like Ponca City, Oklahoma, you may need to visit a nearby larger city to find a surveying supply store. Most of these stores sell Lufkin tapes or tapes from the Lietz Catalog, and some carry both lines (Look in the Yellow Pages and/or phone the store before visiting them). The Lietz Catalog itself includes two lines of steel tapes: Lietz/Eslon tapes are made in Japan by various manufacturers (You may see a name other than "Eslon"), and Lietz/Rabone tapes are made in England by Rabone Chesterman.

In addition to surveying supply houses, other distributors of industrial or technical equipment may also sell metric tapes. The tape manufacturers themselves do not sell directly to individuals, but will help you locate distributors near your home who carry the desired items.

Another possible source of supply is an athletic supply company (not an ordinary sporting goods store, but a company that sells specialized equipment for putting on track meets). At last December's TAC Convention, *Mike and Karen Wickiser* found an ad from *Texas Athletic Supply* including a 60-meter steel tape—which they subsequently ordered. (This is the Irwin tape listed in the table below.)

Finally, although it's true that US hardware stores rarely sell metric steel tapes, the opposite is true outside the US. While it may not be cost-effective to travel abroad **just** to buy a metric tape, it's very easy to buy them whenever you do happen to travel outside the United States.

The following table lists some metric tapes that you can buy **within** the US:

Model #	Length	Grads	Zero	Clad	Holder	Price w. reel	Price refill
LIETZ/ESLON							
8653-44	30 m	MO	ZO	Ny	OR	48.00	35.50
8653-46	60 m	MO	ZO	Ny	OR	77.00	65.75
LIETZ/RABONE							
2153-44	30 m	MO	ZO	Ny	OR	110.00	49.50
2153-46	60 m	MO	ZO	Ny	OR	165.00	91.00
2454-44	30 m	SS	HR	Ny	OR	75.00	52.00
2554-24	30 m	SS	HR	Ny	CC	63.75	44.50
LUFKIN							
C216MD	30 m	FB(D)	ZO	Cr	CC	68.22	52.10
HW226ME	30 m	FB	HR	—	CC	30.71	25.67
HW227CME	50 m	FB	HR	—	CC	76.78	53.75
C2276ME	30 m	FB	ZE	Cr	OR	207.41	164.84
05100M	30 m	MO	ZO	—	OR	—	155.45
IRWIN							
AS200-60	60 m	FB	HR	—	OR	74.50	?

Key to the Table

Grads: Type of Graduations —

- MO — Metric Only (**BEST** Choice; least chance of error).
- FB — Metric/English on Front/Back faces of blade (Acceptable).
- SS — Metric & English Side-by-Side on **Same** face of blade (Try to **AVOID**; high chance of error; metric markings may be too small to read).

Note: Metric scales on all tapes are graduated in millimeters throughout, **except** on Lufkin model O5100M where the first & last decimeters are graduated in millimeters, with the balance of the first & last meter graduated in centimeters, and the balance of the tape graduated in decimeters.

All tapes with English scales are graduated in feet & inches except for Lufkin model C216MD where the English scale is divided decimally in hundredths of feet.

Zero: Location of ZERO POINT on Tape —

- ZO — Zero Offset from End (Blank Space Before Zero) — **BEST** style for the sort of measuring we do.
- ZE — Zero At End of blade. This style intended for taping on rough ground where tape held only at ends—hanging freely in middle. Tape comes with fitting for suspending plumb bob from zero point.
- AT — Add Tape — Has Extra Reverse-Graduated Meter before Zero. Possibly confusing unless you are very familiar with this style (See note below).
- HR — Hook-Ring — Ubiquitous "Construction Style" where Zero is not on the graduated blade at all, but occurs at outer end of Hook-Ring. Almost all inexpensive tapes from hardware stores, etc., come in this style.

Note: I didn't include any AT-style tapes in the table, but some tapes offer a choice of models in ZO, ZE, and AT styles. In such cases, I listed only the ZO model.

Clad: Type of cladding: Ny = Nylon, Cr = Chrome. All **other** tapes (not marked Ny or Cr) do have **some** coating (perhaps acrylic) to resist abrasion and rust. Usually it's a yellow coating, but Lufkin O5100M has a black ("Nubian") coating.

Holder: OR = Open Reel, CC = Closed Case. I've tried to list a price for each tape with and without the reel/case, but I don't have a price for the Irwin tape without reel. Lufkin O5100M is sold without a reel; a separate reel for it costs about $40.

Addresses

To obtain a Lietz or Lufkin catalog and/or locate the distributor nearest you, contact:

The Lietz Company
9111 Barton Street
Overland Park, KS 66201
(913) 492-4900 (in Kansas)
(800) 255-3913 (elsewhere)

CooperTools
Lufkin Road
P.O. Box 728
Apex, NC 27502
(919) 362-7510

The Irwin tape is available from:

Texas Athletic Supply
11210 Cedarhurst
Houston, TX 77096
(713) 721-8747

Recommendations

I like to have both a long open-reel 50 or 60 meter tape (which makes short work of a 300 m calibration course) and a shorter closed-case 30 m tape (to serve as a backup in case the longer tape breaks and to make short-distance measurements for start/finish, splits, etc.).

For the longer (50 or 60 meter) tape, the best buy is clearly the Lietz/Eslon 60 m (model 8653-46) for $77. Although Lufkin HW227CME (50 m) and Irwin AS200-60 (60 m) are similarly priced, the Lietz/Eslon 60 m tape will wear better due to its nylon coating and is easier to use because its Zero is offset from the end. (The others both have construction-style "hook-rings." Also, note that Lufkin HW227CME is a closed-case model—which makes it harder to detach the blade when measuring a calibration course.)

Lietz/Eslon 8653-46 is a Metric-Only model. Personally, I consider this an advantage, although I realize that some other measurers might prefer a tape with English as well as metric graduations. If you think **you** need the English markings, please consider the following:

You'll probably use the long 50 m or 60 m tape **only** for laying out calibration courses (because you'll use a shorter 30 m tape for other tasks such as split location). You may occasionally be called on to measure an English-distance race course. But does this mean you need to lay out an English *calibration course?* You have probably, at one time or another, measured a metric race course using an English calibration course. Clearly, it's **no more** difficult to measure an English race course using a metric calibration course. Given that the *great majority* of race distances are metric, you can simply decide, as a matter of policy, to lay out all your calibration courses at metric distances. Then you'll have no need for English markings on your 50 or 60 m tape.

I bought a Lietz/Eslon 60 m tape myself last year and have been very happy with it. I noticed, by the way, that the prices of Lietz/Eslon tapes haven't changed since I bought that tape. But during that same year, the prices of Lietz/Rabone tapes have jumped about 20%. Possibly, this reflects a change in the exchange rate between the dollar and pound.

Lietz/Rabone tapes are made of heftier steel than the Lietz/Eslon tapes, and may provide better service if you measure a great many calibration courses. *Glen Lafarlette* of Tulsa, OK, who does an *awful lot* of measuring, uses a Lietz/Rabone 60 m tape. (Note: Glen actually bought the "Add Tape" style—with an extra reverse-graduated meter at the end—instead of the simple "Zero Offset from End" style that I recommend. When laying out whole tape lengths, he includes this extra meter, so his lengths are 61 m. It really blew my mind the first time I saw these 61 m lengths on a certification application he sent me. I had to phone him and ask what sort of tape he was using.)

Now let's consider the shorter 30 m tape you might use for short-distance measurements such as locating starts and finishes. Your best deal in buying such a tape within the United States is probably Lufkin model HW226ME, which is not only the least expensive tape in my table, but is probably also the most widely available. (The surveying equipment store I checked in Houston actually had this model in stock, meaning that you wouldn't have to order it—you could just go right in and buy it.)

This is, however, an area where you might do still better if you happen to travel outside the United States. For example, while in Canada two years ago, I picked up some nice Lufkin 30 m tapes (model HYT30CME) with Front/Back Metric/English graduations and a "Speedwinder" case. This particular model is not in Lufkin's US catalog, but is made by the Canadian division of Lufkin. Compared with HW226ME which is Lufkin's most widely available metric model in the US, this Canadian-made model (HYT30CME) is lighter in weight (lighter blade and lighter case), faster winding, and probably costs a few dollars less. (Of course, the price difference isn't worth much if you have to make a special trip to Canada to buy it.)

I found this Canadian-made Lufkin model at a *Canadian Tire* store. At that same store, I found another 30 m Metric/English model which illustrates a type of tape to **avoid**. That tape, carrying the Canadian Tire store brand (actually made by Evans), has side-by-side Metric/English graduations with metric markings that are really too small to be usable.

As a final observation in this area, if you want to buy just one tape, and you want both Metric and English capability, you might consider Lufkin model C216MD. This 30 m Chrome-clad tape ought to wear well, and its English markings are in decimal feet. (If you **have** to measure in English units then, surely, decimal feet are better than feet & inches.) It even appears (based on the picture in the catalog) to have its Zero offset from the end, which is unusual in closed-case models. Unfortunately, this tape is nearly as expensive as some of the 50 m and 60 m models.

Notes on Proper Tension for Steel Taping

At last year's IAAF Measuring Seminar in Columbus, OH, confusion was rampant regarding the correct force for pulling a steel tape. In one case, I discovered that the owner of a 60 m tape had been using it with nearly *twice* the correct tension. I showed him that the correct tension was marked right on the tape. In another case, when a group of measurers borrowed one of my 30 m tapes, they used only about *half* the correct force. In this case also, the correct tension was marked on the tape. But they pulled with too little force because Wayne Nicoll said it was a "skinny" tape.

Let's first discuss this matter of "skinny" tapes. There's a table of standard tape tensions on page 14 of the 1989-revised edition of *Course Measurement Procedures*. According to this table, the tension for "Nylon-clad steel tapes" is only 20 newtons (N), equivalent to about 2 kilograms-force (kgf) or about 4.4 pounds-force (lbf). That's a very tiny force—only 40% of the value listed for *standard* metric tapes.

I am now convinced that this tiny force of 20 N (≃ 2 kgf ≃ 4.4 lbf) is too small for **any** steel tape, with or without nylon cladding. Thus, the table entry for nylon-clad tapes is incorrect. (I assure you it will be removed whenever we get around to revising the book again.) But where did this erroneous listing come from?

It began in the early 80's when several Japanese manufacturers started exporting lightweight nylon-clad steel tapes to the US, accompanied by literature saying they should be used with this very light 20 N force. They were sold under various names including Keson and Lietz. (To this day, every Lietz/Eslon tape is sold in a plastic bag imprinted with a "Correction Chart" indicating that the correct force is only 4.4 lbf.) Some of these Japanese tapes found their way into the hands of course measurers, including both *Pete Riegel* and *Wayne Nicoll*.

In 1985, Wayne Nicoll measured the 400 m track at Emory University using his new Japanese-made Keson 200 ft tape. He pulled this tape with a force of 90 N (≈ 9 kgf ≈ 20 lbf) which is the value listed in *Course Measurement Procedures* for standard US-made 200 ft tapes. His measured distance for the track came out to 399.92 m.

Upon examining Wayne's data, Pete Riegel realized that Wayne had pulled the tape too hard. Pete calculated that if Wayne had used only the 20 N tension specified by the manufacturer, the measured distance would be 400.03 m. (This track now appears in the course list as GA 85020 WN with measured length 400.03 m.) Since that occasion, Wayne has been careful to apply only a very light force when using one of these "skinny" tapes.

Mindful of this incident, I included the listing for "Nylon-clad steel tapes" in the tape tension table when I revised the calibration course layout section of *Course Measurement Procedures* in 1989.

Finally, last year, I was able to determine the truth. As mentioned earlier, I bought a 60 m Lietz/Eslon nylon-clad tape. The packaging for this tape still included the "Correction Table" saying it should be used with that tiny 20 N tension. However, on the tape's blade itself, I found the marking "50 N" suggesting that the proper tension is really 50 newtons.

To find out which figure is correct, I did an experiment: Using a stretch of road that had previously been measured accurately by EDM, I measured this distance with my new Lietz/Eslon tape using tensions of both 50 N and 20 N.

My results showed that *this particular* tape is actually most accurate at a tension of about 60 newtons (which is slightly greater than *either* the 20 N or 50 N figure). What's more significant is that if you apply a 50 N force, the error is only about 1 part in 18 000, which is well within the US Government accuracy standard for steel tapes (1/12000). But if you pull with only a 20 N force, you get an error of about 1/5000, which clearly exceeds the Government standard. Viewed another way, if you lay out a calibration course using this tape at 20 N tension, the resulting cal course is so short that you have already lost about 1/5 of the "Short Course Prevention Factor."

Another observation I made during this experiment was that the smaller 20 N force simply **felt** totally inadequate, as it wasn't even enough to straighten the tape.

We learn from this that a tape specification marked directly on the tape's blade should be considered more reliable than one merely printed on the packaging material. But we also see specifically that 20 N is far too light a force to be usable in steel taping.

How did this misconception (on using 20 N tension with nylon-clad steel tapes) originate? A possible clue comes from the Lufkin catalog, which states that this is actually the correct tension for their **fiberglass** tapes. I wonder whether some Japanese manufacturer, back around 1980, got confused and mistakenly picked the standard *fiberglass* tape tension (instead of standard steel tape tension) to use with their new nylon-clad steel tapes.

If this happened, I imagine that the Japanese manufacturers soon discovered their error and switched to 50 N, which seems to be emerging as an international standard for steel tape tension. Of course, Lietz never fixed the table on the plastic bag used for shipping Lietz/Eslon tapes. And in 1989, we put the erroneous 20 N tension listing into the *Course Measurement* book.

As for Wayne's 1985 measurement of the Emory track, his 90 N pull was clearly too strong, as the correct tension was certainly no greater than 50 N. But there's no way to tell (from Wayne's data alone) whether proper tension for that tape was 20 N or 50 N. If he had just reduced the force from 90 N to 50 N, it would have brought the measured distance to 399.98 m. That's a perfectly reasonable possible result. By Wayne's own account, the *biggest* uncertainty in that measurement was due to the fact that the curb (consisting of numerous removable, flimsily attached rail segments) did not align properly with the inner edge of the actual track.

The 50 N tension figure, which seems to be emerging as an international standard, differs only slightly from the 45 N (≃ 4.5 kgf ≃ 10 lbf) figure which is usually cited as the tension for US-made 100 ft tapes. In fact, the 45 N and 50 N figures are, in practical terms, indistinguishable unless you have an extremely precise force gauge which is totally unnecessary for the tape measuring we do.

Which tapes need a tension *greater* than 50 N? It is often said that US-made tapes longer than 100 ft require a 90 N (≃ 9 kgf ≃ 20 lbf) pull. But here again, a useful insight comes from the Lufkin catalog, which notes that this applies only to "surveyor's tapes of heavy gauge steel". Thus, for example, Lufkin's 50 m model HW227CME is clearly longer than 100 ft, but probably takes only a 50 N pull because, with a blade thickness of only 0.2 mm, this closed-case model isn't exactly a "surveyor's tape of heavy gauge steel."

Lietz/Rabone tapes are advertised as taking a pull of 70 N (≃ 7 kgf ≃ 15.7 lbf). As I haven't closely examined or tested any of these tapes, I don't know whether this figure is any more reliable than the 20 N figure on the plastic bag that the Lietz/Eslon tapes are sold in. But it does sound more plausible.

Note: The tapes which truly do require tensions greater than 50 N are made of heavy gauge steel—which makes them relatively insensitive to errors in the applied tension. In general, errors in applied tension are significant only when using a *lightweight* tape.

My overall advice regarding tape tension is to take 50 N (≃ 5 kgf ≃ 11 lbf) as the "standard" value for all steel tapes, and use this value **unless** you see some other value (such as "70 N" or "7 kg") marked on the tape's blade or you have some *very good reason* to believe that another value is correct. Remember that specifications printed on the tape's packaging material tend to be less trustworthy than information marked directly on the tape.

THE ATHLETICS CONGRESS
OF THE USA

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June 20, 1991

Bob Baumel - 129 Warwick Road - Ponca City, OK 74601

Dear Bob,

Thanks for "How to Buy a Metric Tape." It's a nice piece and quite informative. In Rotterdam, in 1985, I can remember Lennart Julin and Helge Ibert making mirthful noises when I hauled out my 100 foot tape. They snorted derisively about "third-world measurement tools" and such. I huffed and puffed righteously about how it was just as accurate as their metric tapes (which, of course, it was), but it was a lost cause. To avoid future ridicule, away from the US I now always use a metric tape, and in general I prefer the metric system.

I have one practical objection to metric dimensions on US course maps. The race director, or the person who must set up the course, will not have access to a metric tape and, if the paint is gone, it's dollars to doughnuts they will get confused. This confusion is totally unnecessary, and can be eliminated if dimensions are given in feet. I do not believe the race director is well-served by giving him information he will not understand, especially when it is not necessary to do it.

We try to keep things as simple as possible, to eliminate mistakes, but metric dimensions on US course maps encourage them. That's a fact, not an opinion. The general public doesn't know a meter from a hole in the ground, and I don't think it's smart to communicate with them in terms they don't understand.

In my work I usually lay down 1000 foot calibration courses (fewer chances for a layout mistake when using a 100 foot tape), but do all my calculating in meters. However, my final map will <u>always</u> have its dimensions in feet.

Metric education must start somewhere, but if the price is race courses with misplaced splits, I say that's too high a cost. Our clients are nontechnical people who expect us to do our expert best, and then give them a simple document they can understand, so they can set the course up right. The vast majority of US race directors are better served if given feet and inches for locating critical points.

Best regards,

Pete

May 1, 1991

Measurement News
Pete Riegel
3354 Kirkham Road
Columbus, OH 43221
614-451-5617

Dear Pete,

As you are probably aware, Felix Cichocki was in town last weekend to officially validate our course for the World Best 50 mile run by Ann Trason on February 23, 1991.

This letter is to let you know that from my viewpoint, it seems that all went well. I also wanted to let you know how thorough Felix was in his validation. I was impressed with his work and thought you should know what a good job he did.

There is also someone else here who deserves more praise than I can give. Tom McBrayer has been a tremendous help to me regarding this race. I've worked with Tom on the Houston Marathon over the past 11 years, but not until 2 years ago did I work with him as a race director. He cares so much about running and about the accuracy of his courses. Without Tom on the Houston running scene, our races would not "run" smoothly. I wanted you to know what a great job he has done for this race as well as all the other races he works on.

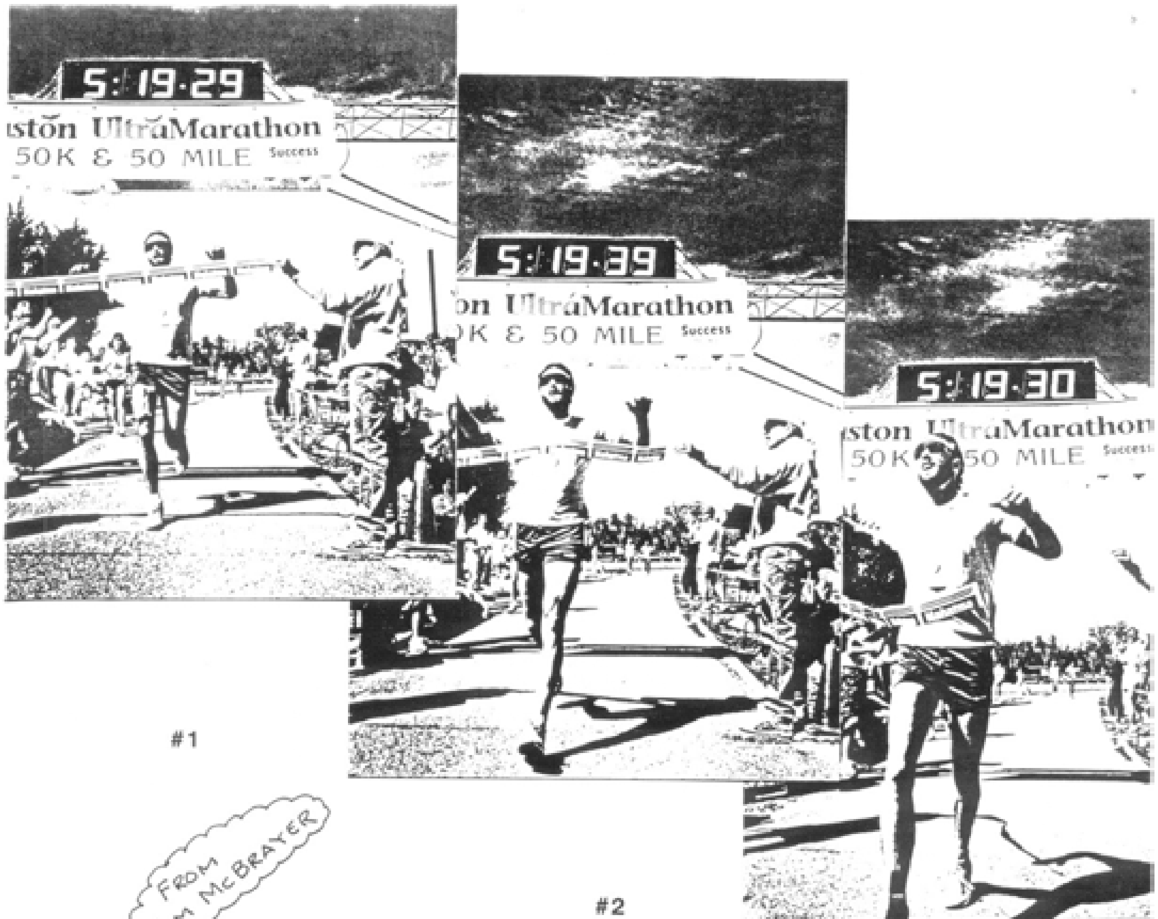
Sincerely,

Michael Fred
1513 Dunlavy
Houston, TX 77006
713-526-6605
fax/523-3130

RRCA Convention Report.......................Joan Riegel

The RRCA Convention was held in Kansas City, Missouri, in May. "What's New In Course Measurement" was the topic of a panel consisting of John Sissala, Bill Glass, and myself, chaired by Pete.

A very comprehensive report on methods, devices, and tricks to make measurement easier and more comprehensible was presented to a very receptive audience. When 185.5 was mentioned in passing, no one objected or commented. At the end of the presentation, Harold Tinsley warmly thanked us and our entire RRTC committee for all our work in making courses more accurate throughout the sport.



#1

FROM TOM McBRAYER

#2

#3

Something Funny Goin' on Here

What you see is what you get. Well, not always. . .

Sean Crom's 50-mile time at the Houston Ultras was 5:19:29, just as you see in photo number 1. But quickly move to Manny Chavez's second shot with his rapid advance camera, and you see 5:19:39, closely followed by shot number 3 at 5:19:30.

What **is** going on here?

Wayne Nicoll was confronted with this same situation several years ago and concluded it had to do with the sequence of the changing digits. The tens digit advanced slightly (a micro second?) faster than the units digit. It's not something that is visible to the normal eye (at least not this one), and can only be exposed by a rapid-shot sequence such as this.

Conclusion: The display clock at the finish line is not official. But it could be embarrassing if the papers happened to print the wrong (or even worse - different) pictures!

HILL EXPERIMENT UPDATE

An Update on Pete's Noontime Run Experiment

I've just finished my 100th timed noontime 8 miler, and have 600 individual timed miles of data to evaluate. After completing A Rough Experiment in Hill Running, which you saw in January MN, I realized that I could do a better job with the data, if I had more of it. I was seeing that wind made a measurable difference, and wanted to account for it if I could.

The six miles I used each day lie on a roughly east-west line (281° heading from mile 1 to mile 4). If I have wind from the west, this makes the first three miles seem steeper, since I must fight both the wind and the hills on the way out. Of course, on the way back, the wind makes the downhills seem even more downhill. Different wind directions produce different effects.

During each run I judged the principal direction of the wind, assigning it one of 8 principal compass directions. The wind almost always blows from some direction, and it was not hard judging which was correct, since there are two areas in my run that are wide open in all directions. If there was no wind, or if it was such that I could not judge, I called it "no wind." Only 5 runs fell into that category. 95 were assigned a wind direction. Wind speed was unmeasured, and variable.

My January Measurement News article used data that was unevenly weighted toward west winds, since that's the way it blew at the time. It's normal for winter in Columbus. In this analysis I have averaged the values for each wind direction individually, to assign equal weight to each.

I won't bother you with the calculation details, since I suspect few of you care to know them. If anybody wants to inquire individually, I'll be happy to share the information. I can give it to you in a Lotus 1-2-3 file if you like, or can provide a printout or an ASCII file of the raw data. Ask for it if you'd like to play with it. You may even reach different conclusions than I did.

In simple terms, I found that, on the average, for me, a foot of drop effectively removes 2.4 feet of course length, when I run in my ordinary way. A foot of climb adds 2.4 feet of effective length. Since there is some scatter to the data I prefer to express my conclusions as:

1 foot of elevation change is worth 2 to 3 feet of course length.
1 meter of elevation change is worth 2 to 3 meters of course length.
1 m/km of elevation change is worth 2 to 3 m/km of course length.

This correlates well with Ken Young's work, in which he compared results of two downhill marathons (with no adjustments for whatever wind might have existed) and got a value of 2.7 for the above. Ken's and my studies did not measure the runners' oxygen consumption, as did the treadmill study. In Bob Baumel's work, in which he analyzed the treadmill studies, he got 4.6 for the number. My analysis of that same data got 4. The treadmill studies used a wider range of grades than I had, with indications that steeper grades produced slightly greater effect. They were also performed in the absence of moving air, which means that the runners had an effective tailwind while running the treadmill. My own results under tailwind conditions show about 4.5 as the number.

AVERAGE TIMES UNDER VARIOUS WIND DIRECTIONS

	MILE 2	MILE 3	MILE 4	MILE 5	MILE 6	MILE 7	NO OF RUNS
N	09:01	09:06	08:52	08:48	08:32	08:43	10
NE	08:58	08:54	08:45	08:45	08:34	08:35	10
E	08:52	08:52	08:40	08:39	08:27	08:32	5
SE	08:58	09:01	08:47	08:49	08:33	08:40	18
S	08:59	09:08	08:56	08:58	08:37	08:46	11
SW	09:07	09:12	08:55	08:48	08:25	08:42	17
W	09:01	09:06	08:48	08:40	08:18	08:23	10
NW	09:07	09:13	08:54	08:43	08:24	08:35	14
NONE	09:03	09:06	08:55	08:53	08:36	08:45	5
OVERALL	09:01	09:04	08:50	08:47	08:29	08:38	100

AVERAGE MILES 4 & 5 (FLAT MILES) = 08:49 MIN/MILE 8.818
AVERAGE MILES (2,3,6,7) (HILLY MILES 08:48 MIN/MILE 8.808
PERCENT DIFFERENCE = -0.111 PERCENT
SECONDS PER MILE DIFFERENCE = -0.586 SEC/MILE

WIND FROM	BASE TIME = AVG TIME FOR MILE 4 & 5	MILE TIME/BASE TIME					
		MILE 2	MILE 3	MILE 4	MILE 5	MILE 6	MILE 7
N	8.84	1.020	1.031	1.004	0.996	0.966	0.988
NE	8.76	1.025	1.018	0.999	1.001	0.978	0.980
E	8.67	1.024	1.024	1.002	0.998	0.976	0.985
SE	8.81	1.019	1.024	0.999	1.001	0.971	0.985
S	8.95	1.004	1.020	0.998	1.002	0.962	0.979
SW	8.87	1.028	1.039	1.007	0.993	0.950	0.981
W	8.74	1.033	1.042	1.008	0.992	0.951	0.961
NW	8.82	1.035	1.046	1.010	0.990	0.953	0.974
NONE	8.91	1.017	1.022	1.002	0.998	0.966	0.983
OVERALL	8.82	1.023	1.030	1.003	0.997	0.964	0.980

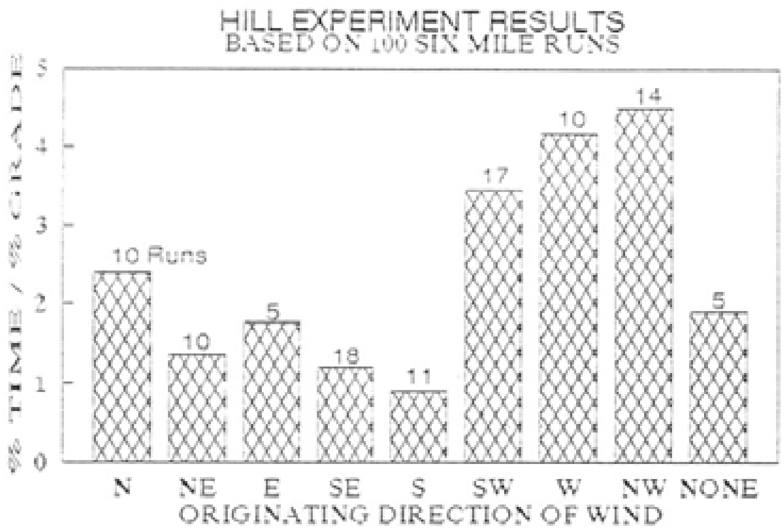
GRADE OF VARIOUS MILES (POSITIVE UPHILL) (FT/100 FT)

2	3	4	5	6	7
0.758	1.345	0.170	-0.170	-1.345	-0.758

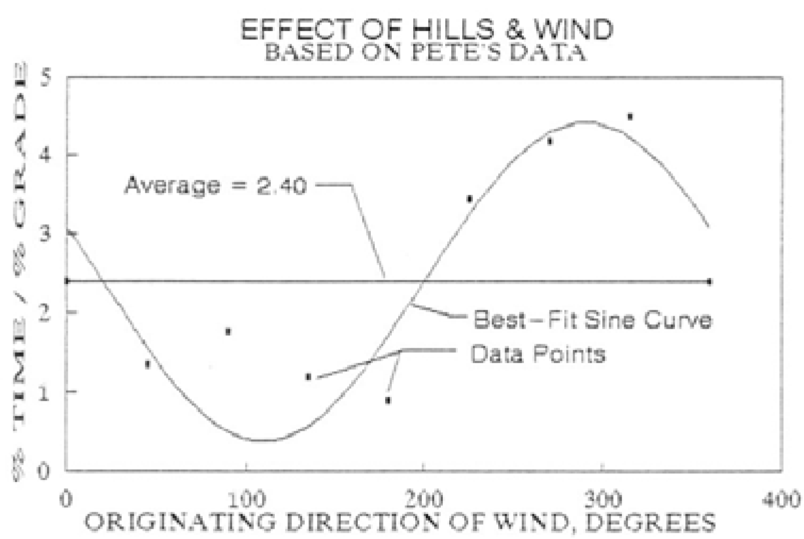
PCT TIME CHANGE/(PCT GRADE)

	MILE 2	MILE 3	MILE 4	MILE 5	MILE 6	MILE 7	AVG 2 THRU 7
N	2.68	2.29	2.60	2.60	2.52	1.63	2.39
NE	3.24	1.30	-0.33	-0.33	1.64	2.61	1.35
E	3.15	1.77	0.90	0.90	1.77	2.03	1.76
SE	2.52	1.80	-0.65	-0.65	2.18	1.94	1.19
S	0.54	1.51	-1.09	-1.09	2.79	2.75	0.90
SW	3.72	2.91	3.96	3.96	3.73	2.45	3.46
W	4.33	3.11	4.48	4.48	3.62	5.11	4.19
NW	4.57	3.42	6.06	6.06	3.48	3.45	4.50
NONE	2.27	1.67	1.32	1.32	2.53	2.27	1.90
OVERALL	2.99	2.20	1.91	1.91	2.70	2.69	2.40

If each individual mile speed is compared to the average speed on the relatively flat miles 3 and 4, the amount of speed change on each gradient can be found. It is shown in the graph below. Note that the results are affected strongly by which way the wind is blowing, and the sinusoidal trend of the data, which one would expect as one covers all angles of a circle.



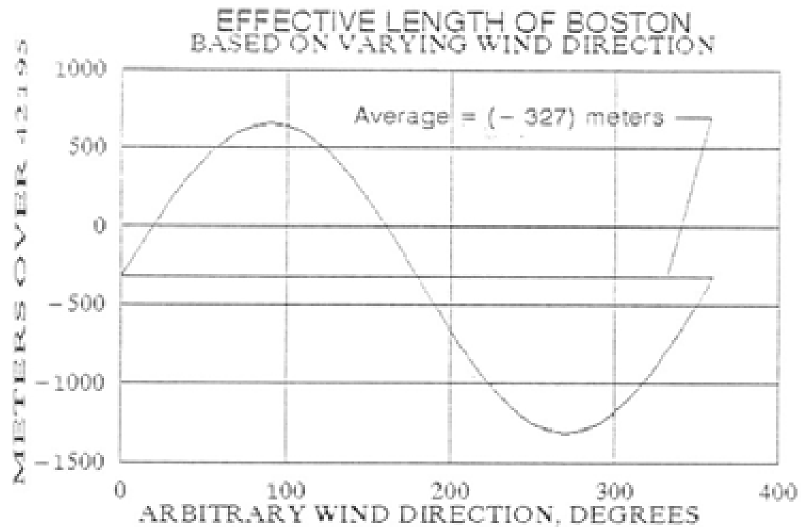
I decided to fit a curve to the data, and the figure below is what I got, after using a combination of regression and eyeball methods. I did not use the "no wind" data, since it has no associated wind direction. The sinusoidal curve has the benefit of being described by a simple equation, which can be used for making other calculations.



With an equation in hand it seemed natural to check out how I might do at Boston, since that's the course that has inspired all the analysis over the last few years. The Boston Marathon course has a total climb of 176 m, a total descent of 312 m, and a net drop of 136 m. The graph below shows Boston's effective length, for me, based on the wind conditions I encountered during the 100 runs. Stronger winds would exaggerate the effect, and weaker winds would flatten the curve. On the average, the winds did not seem particularly strong, but there were occasional days when it blew pretty hard.

If the weather was right, and I was fit and smart and had running room, Boston would offer me a good shot at a faster-than average time, since the combination of downhill and wind could effectively shorten the length of the course by over 1300 meters.

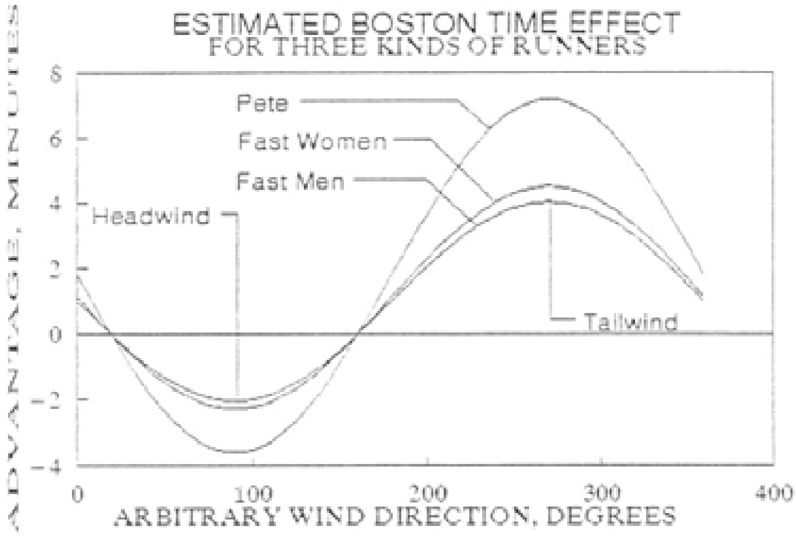
On a windless day at Boston, I'd enjoy 327 m of effective shortness.



What does this mean to my times? With the wind right, I'd gain about 7 minutes advantage over a standard course, if I ran at the same pace as I did during my noontime runs (3:51 marathon pace, which is 15 minutes slower than my last few marathons). For fun I've added what it might mean to world-class men and women. The right winds and slopes would give them about a 4 minute boost. Because they are faster than me, the effect is slightly less than shown, but if they got more than my average wind, it would be larger.

In the absence of wind they would receive aid of just over a minute at Boston. I, being slower, would get just under two minutes as my bonus.

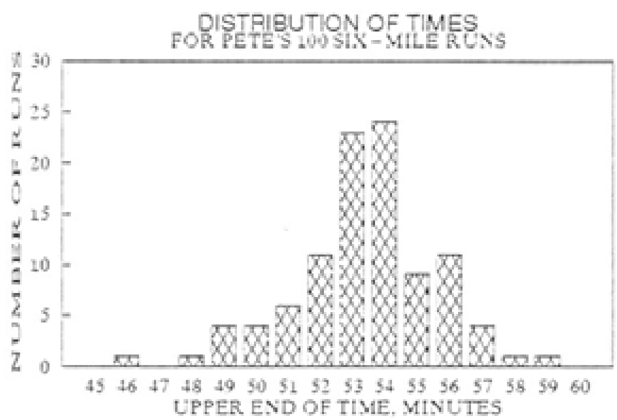
On a flat marathon course, an ordinary tailwind, such as I might encounter on any of my noontime runs, acting over the whole run, would effectively shorten my course by about 1 km, or over 5 minutes.



Is it true that the hills take away more than they give? Like most runners, I'd swear that the hills are having a terrible effect on my performance, but my numbers show no such effect. What I lost on uphills was regained on the downhills, and the effect on overall time was less than 1 second per mile. My two best marathons were run at the Athens Marathon, in Athens, Ohio, which has little overall drop but 800 feet of ascent and descent in four monstrous hills. It was not until I'd run it several times that I succeeded in getting it right, and learned how to pace it. Newcomers to Athens say it is a tough course, and they're right, if you're not mentally prepared.

I have now seen for myself the effects of uphill and downhill, and have an idea of the large boost I can get from wind. I hope someone else will wish to do an experiment of this kind. It's not hard to do. All it takes is a course with some hills, with accurately-measured splits, a stopwatch, and the desire and time to do it. I'll help with the planning and number-crunching if anybody wants to do the running. Get in touch.

Thanks for Bob Baumel for saving me from some deficiencies in the data presentation. I sent him a preliminary copy of this before I got to 100 runs, to see if he could find any glaring errors. I've been making the same mistake for two years, but he caught it again, as he has done so before.

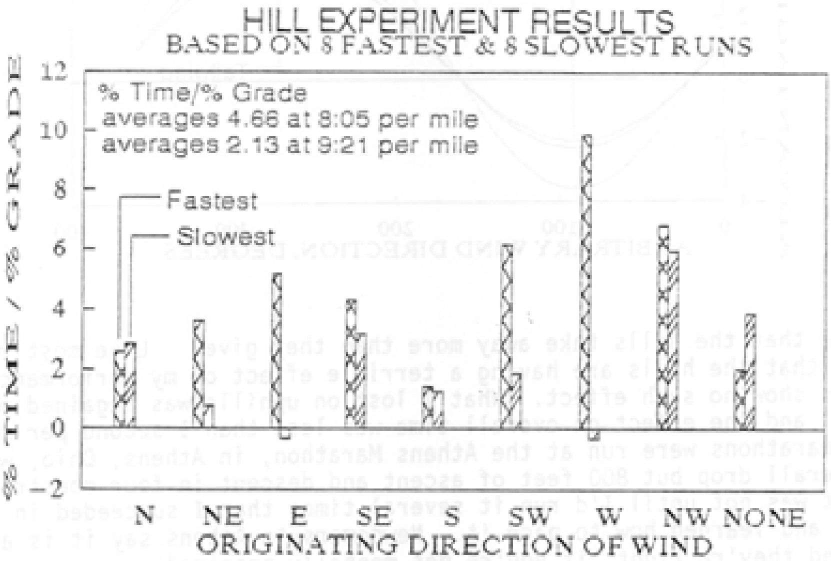


EFFECT OF SPEED ON RESULTS

My fastest 8 runs (one at each wind direction) averaged 8:05. At this pace the hill constant averaged 4.7.

My slowest runs at each wind direction averaged 9:21. At this pace the hill constant averaged 2.1.

This may have some meaning, but it will have to wait until next MN. Right now it is time to go to press.



MEASUREMENT VIDEO

A picture is worth 1000 words (1001 RRTC words). We talk and write until blue in the face, and still some people do not have a clear idea of the proper path to take when measuring. "Shortest Possible Route" seems unambiguous, but some people still have the idea that they should be riding like they think a runner would run the course.

A video would make things clearer. <u>This is a plea for help</u>. If you have, or can rent, a video rig that can produce standard VHS tapes, and are willing to tape a rider doing things right, RRTC will be happy to see that your expenses are covered for producing a simple measuring video. It need not be long, and it need not be fancy. Its principal purpose is to <u>show</u> how things are done, rather than <u>say</u> the same thing. Some tricks of the trade could be on it as well, such as offset maneuvers and eliminating counter backlash. And maybe some shots of somebody calibrating a bike.

The most important segment would show a rider measuring a nasty bit of winding road, with some sharp turns thrown in, taken from a following car (a car with sunroof or a pickup truck would be a handy platform).

When this is done we will have a video that can be shown to people as a lecture aid, or sent to them along with a printed guide to what they are seeing. A Hollywood production is not envisioned here - just a straightforward series of shots showing various aspects of proper bike riding.

If you would be willing to undertake this, please get in touch with Pete Riegel. You'll be rendering a great service if you do this. You may have some ideas of your own. They'll be welcome.

THE ATHLETICS CONGRESS
OF THE USA

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1991-06-18

Pete Riegel — 3354 Kirkham Road — Columbus, OH 43221

Dear Pete,

I have just received your draft of the tome entitled "HILL EXPERIMENT UPDATE" which you intend to put in *Measurement News*. The shear quantity of data you've collected is staggering: nearly 1000 kilometers of running—all in the interest of finding the true effects of slope and wind on running performance. I suppose that after all this data collection, you're probably now finding it impossible to run without developing an uncontrollable urge to punch buttons on your watch every 1.609 km.

Seriously, the data you've gathered makes it just about impossible for anybody to seriously argue that runners aren't aided by downhill courses or tailwinds.

I would, nevertheless, like to comment on a few aspects of your analysis. Of course, the timing of your mailing has left me virtually no time to respond (at least if I want my comments to appear in the same issue of MN). I admit that, as I write this, I haven't had time to thoroughly digest all your calculations, although they do look reasonably correct. But I would like to comment on two general areas:

1) The alleged three-way agreement between your present work, the work Ken Young did back in 1984, and the work I've done in recent years based on treadmill energy-cost measurements.
2) The extrapolation of results obtained for one middling-fast runner (i.e., Pete Riegel) to other runners of greatly differing ability, especially world-class runners.

With regard to the first point, please don't forget that all of my work was based on the assumption of *optimal* pacing—where the runner speeds up on downhills and slows down on uphills enough to maintain a steady rate of energy consumption (as explained in my article in Mar 91 MN). On the other hand, Ken's analysis of actual marathon performances, as well as your present blind "run as you feel" experiment, both studied runners **not** using the optimal pacing strategy. (For myself, I do try to use optimal pacing in my *races*—and my split data show that I've come pretty close—but I don't pace myself that way in daily *training runs*.)

Thus, it is reasonable to expect your current results to agree well with

Ken's, but I would expect both Ken's and your results to predict **less** aid than could be obtained by optimal pacing (which is what I've tried to calculate in my work).

You have observed, quite correctly, that running on a treadmill (in still air) is analogous to normal running with a slight *tailwind* (whose speed exactly matches the running speed). I made essentially this same observation in my Nov 89 MN article, although I never followed up on it quantitatively. You are also correct in pointing out that this observation tends to reduce the discrepancy between your results and mine. But the agreement you are claiming now is **too** good. Possibly, this has occurred because many of your runs were accompanied by tailwinds *faster* than your running speed.

In treadmill running, the runner experiences no wind resistance because there is no relative motion between the runner and surrounding air. But in normal running in calm (windless) conditions, the runner does experience some wind resistance due to relative motion between runner and air equal to the runner's own speed. Using equations presented in my Nov 89 MN article, it is possible to correct the treadmill-derived slope effect to account for the wind resistance that occurs in normal running in windless conditions.

As in previous articles, I use "A" to denote the coefficient describing the first-order slope effect. This is the number of meters of course length change equivalent to a 1 meter elevation change. Your results suggest that A=2.5. My treadmill-derived value (as presented in the Mar 90 MN article co-authored by Alan Jones and myself) was A=4.6. – (AS OF 94 RUNS)

Let A_o denote the treadmill-derived value. The *corrected* value, which accounts for the wind resistance obtained in normal running in calm conditions, is A_{corr} given by the equation:

$$A_{corr} = A_o / (1 + 3cv^2) \qquad (1)$$

where "v" is the runner's speed and "c" has a numerical value of about 0.002 when v is expressed in meters per second. Here are some values of A_{corr} computed for runners of various speeds (based on A_o=4.6):

Speed(m/s)	2.5	3.0	3.5	4.0	4.5	5.0	5.5
10 km Time	1:06:40	55:33	47:37	41:40	37:02	33:20	30:18
Marathon Time	4:41:18	3:54:25	3:20:56	2:55:49	2:36:17	2:20:39	2:07:52
A_{corr}	4.43	4.36	4.29	4.20	4.10	4.00	3.89

As you can see, the corrected A-value ranges from about 4.4 for a rather slow runner to about 3.9 for a world-class runner. Thus, the effect of wind resistance is to reduce the treadmill-derived value of 4.6, and this reduction is greater for faster runners. But the amount of reduction is rather slight. In all cases, the corrected value is pretty close to A=4.

You obtained about A=2.5 in your recent experiment. That's about 2/3 of the corrected value (roughly A=4) obtained from the treadmill data. This treadmill-derived result represents the first-order slope effect for a runner using optimal pacing.

Notice, by the way, that in my Mar 91 MN article, I referred to a value of only A=4 (instead of the earlier 4.6 figure from the Mar 90 article). The A=4 value is very close to the "corrected" value that accounts for wind resistance. Actually, I used A=4 in the Mar 91 article because of its close agreement with split data recorded in my own races (as depicted in the graph on page 13 of Mar 91 MN). In those races, I was *consciously trying* to follow the optimal pacing strategy (which is rather different from the protocol of your recent experiments). Unfortunately, I have no record of wind conditions during those particular races.

Now, let's turn to my second topic. Based on your own results, you predicted the effects for world-class men and women by assuming they would experience the *same amount of effective length change* as you. It seems that I've written about "meters of effective length change" so often that you've assumed this concept applies to all slope and wind effects.

The "effective length" concept does work reasonably well for the *slope* effect. That's because the effect of a given elevation change is to alter the times of both fast and slow runners by roughly the same *percentage* — which is the same effect as you'd get by altering the course length.

However, *wind* effects scale very differently than slope effects. For a given headwind or tailwind, the percentage change in running time tends to be considerably greater for a fast runner than a slow runner. In fact, based on the approximation of relatively light winds, the fast and slow runners both obtain roughly the *same actual change in race time* (in minutes).

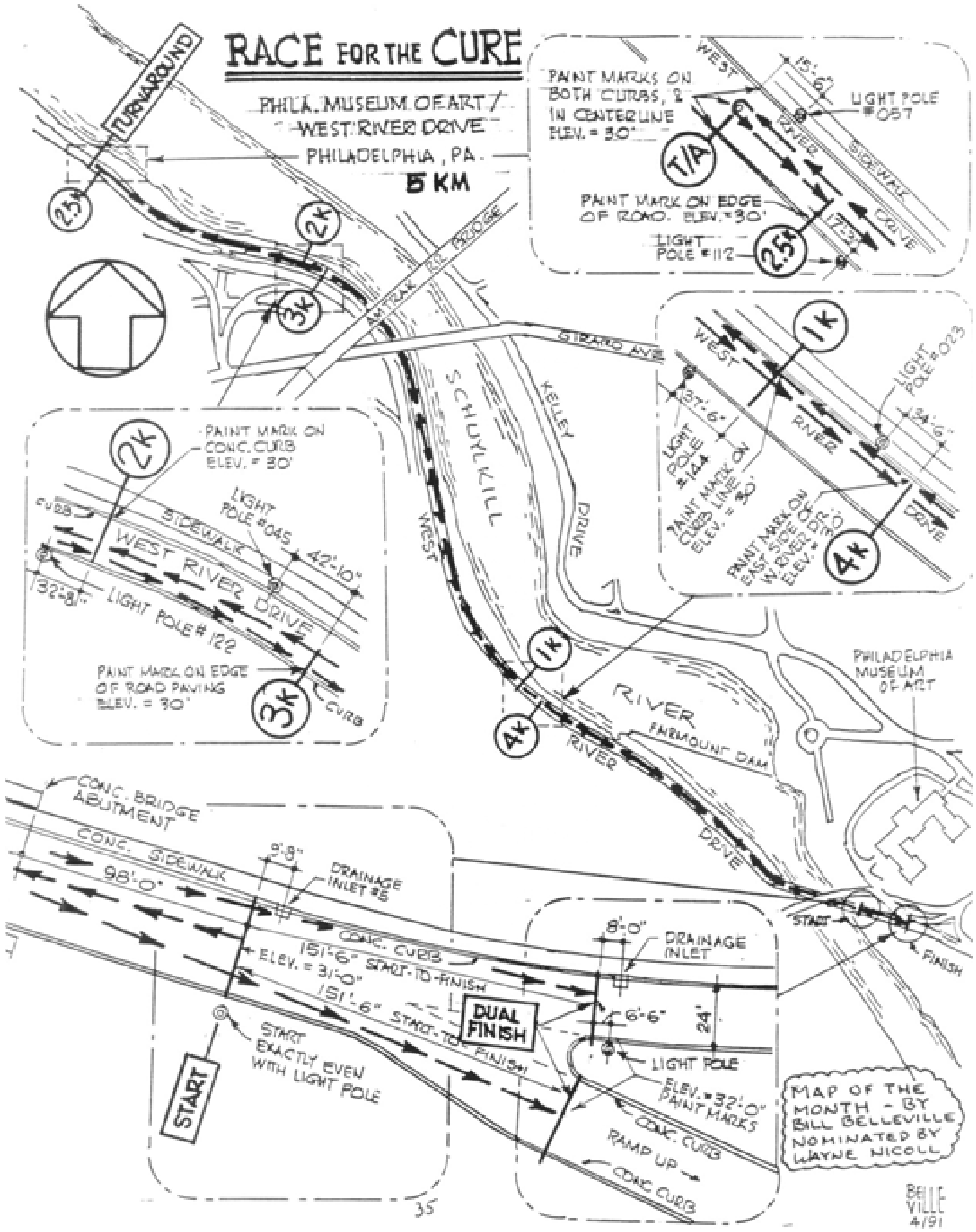
How does this affect your sinusoidal graph showing time predictions for both you and world-class runners? For those wind directions where the dominant effect is due to slope (i.e., the wind is crosswise to the course), your graph is probably pretty accurate. But where the dominant effect comes from a headwind or tailwind, the predictions for the world-class runners (in minutes) should be closer to the predictions for yourself.

We do not yet have a comprehensive treatment of the combined effects of slope and wind. *Maybe* I'll attempt that in a future MN article.

In writing the present letter, I have tried to refine the conclusions from your recent experiments. The results of these experiments are quite significant because they show that even *without* using an optimal pacing strategy, runners can still obtain about two-thirds the amount of aid that I've calculated from the treadmill data. For a course like Boston, that's still a lot of aid.

Best regards,

Bob



RACE FOR THE CURE
PHILA. MUSEUM OF ART / WEST RIVER DRIVE
PHILADELPHIA, PA.
5 KM
TURNAROUND
2.5K
2K
3K
1K
4K
AMTRAK RR BRIDGE
GIRARD AVE
SCHUYLKILL
RIVER
KELLEY DRIVE
WEST RIVER DRIVE
FAIRMOUNT DAM
PHILADELPHIA MUSEUM OF ART
START
FINISH
PAINT MARKS ON BOTH CURBS, & IN CENTERLINE ELEV. = 30'
T/A
LIGHT POLE #057
15'-6"
WEST RIVER DRIVE
SIDEWALK
PAINT MARK ON EDGE OF ROAD. ELEV. = 30'
17'-2"
LIGHT POLE #112
LIGHT POLE #023
37'-6"
34'-6"
LIGHT POLE #144
PAINT MARK ON CURB LINE ELEV. = 30'
PAINT MARK ON EAST SIDE OF W. RIVER DR. ELEV. = 30'
PAINT MARK ON CONC. CURB ELEV. = 30'
CURB
SIDEWALK
LIGHT POLE #045
42'-10"
32'-8"
LIGHT POLE #122
PAINT MARK ON EDGE OF ROAD PAVING ELEV. = 30'
CONC. BRIDGE ABUTMENT
CONC. SIDEWALK
98'-0"
9'-8"
DRAINAGE INLET #5
CONC. CURB
151'-6" START-TO-FINISH
ELEV. = 31'-0"
151'-6" START-TO-FINISH
DUAL FINISH
8'-0"
DRAINAGE INLET
6'-6"
24'
LIGHT POLE
ELEV. = 32'-0" PAINT MARKS
CONC. CURB
RAMP UP
CONC CURB
START EXACTLY EVEN WITH LIGHT POLE
START
MAP OF THE MONTH - BY BILL BELLEVILLE NOMINATED BY WAYNE NICOLL
BELLEVILLE 4/91

DERIVATION ALTERNATIVES OF THE SECOND ORDER HILL FORMULA

Donald E. Davis
Department of Mathematics
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University Drive
Newark, Ohio 43055

Introduction:

During the spring of 1990, my long distance running skills were near their peak. I had run a PR at the Columbus Marathon and accomplished a feat I felt was beyond my reach -- I had qualified for the Boston Marathon. My training up to the race went perfectly. I had run literally hundreds of hills preparing for the Heartbreak Hills section of the course, so was hoping to shave even more time off my personal best. But while en route to the race, *Ohio Runner* magazine editor Donny Roush gave pause to my P.R. expectations, telling me that the race was not "official for record purposes" because of its elevation loss from start to finish. He pulled out documents and *Measurement News* articles explaining the reasoning behind Rule 185.5.

Briefly put, I held 6:50 pace during the race except for a grueling 9:00 mile thrown in in the midst of the Heartbreak Hill series. I missed my three hour goal and, while being escorted from the medical tent after the race, wondered how such a demanding course could be ruled as too easy for record purposes. This year my brother Tom ran Boston and called it the toughest marathon he had ever done. I found his comment surprising, as he lives and trains in Athens, Ohio, literally in the foothills of the Appalachian Mountains. So, armed with this antidotal evidence, I began investigating the mathematics behind the drop/separation rule.

The Five-Point Polynomial:

The derivation of the Second Order Hill Formula[1] is based on the Margaria data[2] which compares steepness of terrain to energy costs. That data is shown in the first two columns of Figure 1.

XI	YI	s(S)	|YI - s(XI)|	Q(x)	|YI - Q(XI)|	Reg.	|YI - Reg|
-0.1	2.33	2.338	0.00799999	2.33	0	2.532	0.202
-0.05	3.05	3.034	0.01600000	3.05	0	3.342	0.292
0	3.86	3.86	0	3.86	0	4.152	0.292
0.05	4.8	4.816	0.01599999	4.8	0	4.962	0.162
0.1	5.91	5.902	0.00800000	5.91	0	5.772	0.138
		mean ei	0.00960000	mean ei	0		0.2172

Figure 1

---

[1] Bob Baumel and Alan Jones, *Uphills, Downhills and the Boston Marathon*

[2] Margaria, Cerretelli, Aghemo and Sassi, "Energy Cost of Running," *Journal of Applied Psychology*

Baumel and Jones then fit a quadratic polynomial a(S) through the data points. The polynomial they derive is:

$$a(S) = 3.86 + 17.82S + 26S^2 \tag{1}$$

where the functional values yield the energy cost per meter at slope S in meters/meter[3] They then compute the "discrete steepness integral" (more correctly this is a form of Riemann Sum).

$$SI \equiv \sum_{i=1}^{N} \frac{(\Delta y_i)^2}{\Delta x_i} \tag{2}$$

They then define total energy costs E as:

$$E = a_0(\text{course length}) + a_1(\text{net drop of course}) + a_3 SI. \tag{3}$$

As best as I can determine, Baumel and Jones find the coefficients for (1) by computing the least squares fit for the data. In column 4 of Figure 1, the residuals $e_i \equiv |y_i - a(S_i)|$ are computed and the average residual $\bar{e} = \frac{1}{5}\sum_{i=1}^{5} e_i$ is shown. Note that for (1), this value is 0.009600 which is not inside the accepted measurement error bound ε, where $\varepsilon \leq |.001|$. Moreover, we can show that for the Margaria data points, there does not exist a quadratic polynomial a(S) such that $e_i = 0\ \forall i,\ i = 1,\ldots,5$.

Perhaps using (3) to explain the energy costs, and consequently forcing (3) to be quadratic, does not account for all the conditions in total running energy spent. Certainly headwind/tailwind phenomena needs to be incorporated among other conditions. In lieu of using (3) as the general form, it may be more appropriate to use the Margaria data to find an exact polynomial of different degree to explain slope vs. energy costs, restricting E to terrain slope only. In order to find this polynomial, consider the matrices below.[4]

$$V = \begin{bmatrix} (-.1)^4 & (-.1)^3 & (-.1)^2 & -.1 & 1 \\ (-.05)^4 & (-.05)^3 & (-.05)^2 & -.05 & 1 \\ 0 & 0 & 0 & 0 & 1 \\ .05^4 & .05^3 & .05^2 & .05 & 1 \\ .1^4 & .1^3 & .1^2 & .1 & 1 \end{bmatrix} \qquad b = \begin{bmatrix} 2.33 \\ 3.05 \\ 3.86 \\ 4.80 \\ 5.91 \end{bmatrix} \tag{4}$$

By computing $\vec{a} = V^{-1} \cdot b$ we get the coefficients a_i from column vector $\vec{a}$ for the polynomial $Q(x) = \sum_{i=0}^{n} a_i x^i$ which exactly fits the Margaria data points (x_i, y_i), $i = 1,\ldots,5$. This five-points polynomial is, in this case, cubic and is computed as

$$Q(x) = \frac{160x^3}{3} + 26x^2 + \frac{521x}{3} + \frac{193}{50}. \tag{5}$$

---

[3] From Baumel and Jones, *Appendix: Derivation of 2nd Order Hill Formula*

[4] Such a matrix V is known as a *Vandermonde* matrix.

We see from column 6 of Figure 1 that the average of the residuals for (5) is $\bar{e} = 0$ as $e_i \equiv 0\ \forall i$, $i = 1, \ldots, 5$ trivially making $\bar{e} \in \varepsilon$. Note also that in Figure 2, that for the steepest slopes, (1) and (5) are significantly different. Consequently, it may make more sense to use the available existing data to find the best polynomial function possible, rather than speculate on the components of the function and then find a polynomial to fit that assumption.

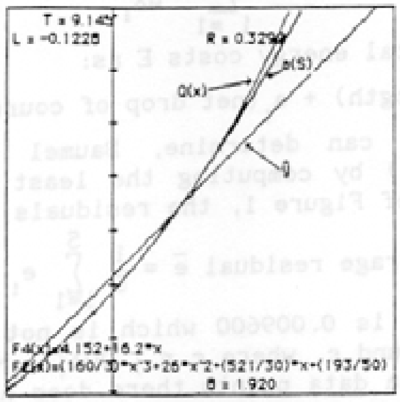

Figure 2

The Regression Model:

Alternatively, it seems reasonable to question if any exact polynomial function is appropriate for use. Certainly to some degree, slope vs. energy costs is a random phenomenon based on many factors, so it seems reasonable that we may wish to apply regression analysis to the Margaria data. Computing the regression, we find that the correlation coefficient is $r = .9681$ with coefficient of determination $r^2 = .9372$, certainly a high correlation for such data. We then see that the linear regression model becomes:

$$\hat{y} = 4.152 + 16.2x \,. \qquad (6)$$

We see here that even though the residual average for (6) is $\bar{e} = .2172 \notin \varepsilon$ intuitively, this may be a more practical approach to mathematically explain slope vs. energy costs.

Conclusion:

I do not claim to be sufficiently schooled in exercise physiology to be able to make decisive conclusions on the physical effects of hill steepness vs. time loss or gain. However, a new look of the present data on the topic, along with more research on the effects of hills on runners should take place. Keep in mind that the Margaria was first generated back in 1963. The Boston course is a perfect example of how the location of the hills (those coming rather late in the race) for most of us, seem to be a more important factor than the simple net elevation gain/loss between the start and finish. It is these kinds of factors that add more mathematical conditions and consequently higher order terms to the true energy function.

THE ATHLETICS CONGRESS
OF THE USA

3354 Kirkham Road
Columbus, OH 43221

Road Running Technical Committee
Peter S. Riegel, Chairman

614-451-5617 (home)
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FAX 614-424-5263

June 19, 1991

Dear Don,

Thanks for your article "Derivation Alternatives of the Second Order Hill Formula." I admit I could not follow its mathematics, but enjoyed the narrative. I'll put it in July Measurement News.

It is interesting that you and your brother Tom, as well as several famous runners, say that Boston is not an easy course. Some of the most famous of these same runners have their personal bests at Boston. Do we believe what they say, or what they do? Boston is not easy - no marathon is - but it is a predominantly downhill course, on which fast times can be run by those prepared to take advantage of it.

If one could take a standard marathon course and put it down next to the Boston course, on any given day, the smart runner would be well advised to run the Boston course. Note the word "smart." It takes a fit brain as well as a fit body to run a decent Boston Marathon.

What makes Boston a tough course is that few of the fast runners are skilled at running its tricky combination of hills. The road-running game is mostly played on much flatter courses, in which the runner simply settles into a pace and holds it, making minor adjustments for such hills as are encountered. A runner who wishes to make money on the road-racing circuit need not do a lot of homework about the courses, since they're largely fairly flat, compared to Boston. Few can take the time to make a concentrated training effort solely for a win at Boston, since this may not be the best way to train for their bread and butter.

It is lack of mental preparation that makes Boston tough, and any claim to the contrary evades personal responsibility. The student who neglects his homework, and then fails the test, should not blame his failure on a hard test. Boston is an open-book test. Those runners who have taken the time to train at Boston, and become intimately familiar with its contours, have done well. Those who just show up and run are surprised, and get shot down. Rather than accept responsibility for poor preparation and planning, it makes them feel better to blame the course. Hill training alone is not enough. One must know when to speed up, when to maintain, and when to back off.

Every trained runner has a speed at which he can run a marathon and not "hit the wall." A runner who sets a record will have accurately judged his physical condition, the weather of the day, and the nature of the course, and will pace himself accordingly. A runner who hits the wall does not do so because the course made him do it - it's a self-inflicted wound, resulting from bad pace judgment. The most important part of effective pacing is knowing where you are and where you are going.

To run well at Boston it is necessary to cover the first half at a faster-than-even pace. This can be done without penalty, since the first half is steeply downhill. Level off to even pace until Heartbreak Hill is encountered, and when it comes, slow down deliberately and maintain the slower pace to the top. If you do this you'll hit 20 miles in reasonable shape. Then it's a downhill plunge to the finish, which is the time to cut loose all you have left. Even pace at Boston is a bad way to run it. You lose the advantage on the downhills, and kill yourself on the uphills.

Many top runners get caught up in pack psychology, believing that there is some collective wisdom there. Sometimes there is, sometimes not. It's certainly more reassuring to stay with the bunch than to bet it all on your own assessment of the situation.

Although Boston does offer distinct help, it is available only to runners who have the mental capacity to take the proper advantage of it. In this sense it is indeed a supreme test of skill. Anyone who has run a fast time at Boston has shown running aptitude of a high order. Plenty of flat-course fast horses have come to grief at Boston. It's not enough to be merely fast - one must be fast, prepared and wise to run a fast Boston Marathon.

Any course with big hills requires study and preparation, if a fast time is greatly desired. Note that I do not say a win. A runner will do best if he approaches a hilly course as a tricky form of time-trial, with a pace that continually varies, but maintains the same level of work. The runner should set a time goal and pace himself toward it, ignoring the others. This will bring the runner something close to the desired time, if his initial judgment of his condition was correct. Some days you just haven't got it.

It may not win the race, however, if someone runs faster. The runner must make a choice - run his own race or go with the pack and hope for the best.

Last year's Boston had the leader going out in something like 1:02+ for the half. The press called it "suicidal," ignoring the fact that the first half is downhill. The leader did not slacken, I recall, until a muscle tied up near the top of Heartbreak Hill, when he was passed. I believe that the mistake was to not slow down going up the hill. He got the first half right, and was on the way to a fine finish time. He blew it by not backing off on Heartbreak Hill.

Is this a cold-hearted way to look at racing? To think of Boston or Charleston (400 foot climb from mile 2 to mile 5 in a 15 miler) as a form of solo time trial? Many would think so, I'm sure. The interactions between the runners going head-to-head are certainly more dramatic than the solitary thinker ignoring the others.

Runners are gifted with brains as well as bodies. The runner who cannot adjust to the demands of varying terrain would be well advised to stick to flat courses. Boston takes forethought and practice to get it right.

Thanks again for the article.

Best regards, Pete

National Governing Body for Athletics in the United States

The Athletics Congress of the USA

One Hoosier Dome, Suite 140, Indianapolis, Indiana 46225 (317) 261-0500
Cable Address: ATHCONGRSS IND • Telex 27-332 • FAX (317) 261-0481

Please reply to:
DON KARDONG, Chairman
Men's Long Distance Running Committee
807 Paulsen Building
Spokane, WA 99201
(509) 838-8784 - Office

June 12, 1991

TO: Interested Parties
FROM: Don Kardong, Chair, Men's LDR Committee
RE: TAC Rule 185.5

On February 10 of this year, a special TAC committee met in Tampa, Florida, to consider TAC Rule 185.5, which deals with slope and separation standards for road courses on which records may be set. Committee members included Don Kardong, Julia Emmons, Charles DesJardins, Jeff Darman, Jack Moran, Basil Honikman, Bob Baumel and Kim Jones. After considerable discussion of the rule, the committee has issued the following statement:

"In recognition of races of historic magnitude, the publication and communication of Best Times and Records will be accomplished as follows:

> TAC will annually publish a list of all-time U.S. and World Bests and Records. This combined list would include marks accomplished on all certified courses.

"The Special TAC Committee on Rule 185.5 has also unanimously recommended that Rule 185.5 be amended at the 1991 TAC convention to ensure that runners are able to set U.S. records on courses that exceed the 30% separation rule unless it can be shown that substantial advantage was afforded the runner due to a significant tailwind on the course at the time of the race."

"The Special Committee feels that if its recommendations are accepted by the TAC Long Distance Running Committees the effect of this policy will assure that significant athletic performances that occur at major historical events will be given the recognition they deserve."

Sincerely,

Don Kardong

Don Kardong, Chairman
Men's LDR Committee

HOW LONG IS A 400 METER TRACK?

Every so often we are asked to measure or "certify" a track. In doing this we don't have a lot of guidance from the rule book. The IAAF Handbook says:

"Two independent measurements must be made, which may not differ from each other by more than 0.0003xL + 0.01 metres. Note - This formula gives a highest permitted difference between two measurings for

100 m.........0.04 m   400 m.......0.13 m"

These are very generous limits, for steel taping. Nowhere is it stated what the acceptable length is, nor how it is determined. If I measure the 100 meters twice and get 99.97 and 100.01, is the 100 meters OK? I don't know.

These tolerances may be of interest to those who believe that terrible injustices arise from differences in road measurements. If the maximum track tolerance is taken to 10,000 meters, we see that the 10,000 could measure somewhere in the range of 9997 to 10,003. But nobody cries "foul" because "all tracks are equal" in people's minds.

We on the road running side may be fortunate because we oversee the measurement and layout of the courses we use. I recently had a call from a track coach who wanted to know what he should be looking for in a new track. I referred him to the United States Tennis Court & Track Builders Association (USTC&TBA) because they are the only organization that has any standards for track construction that I'm aware of.

No part of TAC has any concern, of which I'm aware, with how tracks are laid out. No TAC nor IAAF standard exists to determine whether a given track is accurate. Instead the rule books specify that the track shall be measured by a surveyor before the event, and leave it at that. The result is generally a document that attests that such-and-such track is "exactly 400 meters" in length. If such a document can be found we are not called. Usually we get called when the race organizer cannot come up with the track measurement certificate.

I think that the overall size of a track is generally laid out before construction, leaving marks for a contractor to follow. I suspect it is then assumed that the contractor got things right. Once the curb is finished, and surface is dry, the lane markings are added. Does anybody know whether it is general practice for a surveyor to check what has been done <u>after</u> the work is done?

RRTC experience with tracks would suggest that there is considerable variation in the size of tracks. Most of the really bad ones have been old high school tracks. We've had little call to measure any big-time tracks, since that's generally outside our road-running area of concern. If anybody really took a good look I wonder what they would find?

Until the rules make it clearer, if you have to measure a track, certify it at the length you find it, using average, temperature-corrected measurement with no short course prevention factor. Put the resulting number on the certificate, and leave its interpretation to others. Be sure to note whether it has a curb.

Fri May 31, 1991 1:33 pm

Peter Riegel
3354 Kirkham Road
Columbus, OH 43221

Dear Peter,

Alan Jones from Endwell, NY suggested that I send this letter to you regarding a recent measuring experience - of possible interest for publication in a newsletter called "Measurement News." (I'm not familiar with the publication and would be interested in reading it.)

To wit:
Recently I ordered the TAC booklet: Course Measurement Procedures *after* installing a calibration course, i.e, "if in doubt, read the directions last!"

Here is something I discovered that may be overlooked in the course measurement procedures: it has to do with "heat-stretch" of a 100' steel tape. Though the handbook covers the subject and gives ambient temperature correction factors, I apparently stumbled across a "real life" measuring flaw - "Radiant" energy (one of three forms of heat transmission - convection, conduction and radiation. The latter is particularly misunderstood, often unknown, in home air-conditioning/home construction.

To be brief - how it applies to course measurement: I drafted the Mrs. to help me establish the calibration course (which was done *before* the arrival of the course measurement handbook). We started about 10 a.m. under the typical Florida sunshine and carefully laid out a quarter-mile "benchmark" on a flat, straight rural road (faded, very light gray asphalt) that was straight and center-striped (13 - 100' marks plus 20'). The temperature was about 83 degrees *with* full Florida sunshine.

The first 10 100' marks were completed under full sunshine, the air temperature was around 83 degrees to start (but not on-site accurately measured), at the end cloud-cover was blocking the sun.

After completing the 1/4-mile benchmark, we decided to check the accuracy of an Engineer's "wheel" we had brought along. After a half-hour of fiddling with that and becoming totally frustrated with widely variable 100' measurements (-3" to +13" per 100'), we decided to "check" the first several 100' segments for accuracy with the original steel tape . . . maybe we screwed up in the initial marks, was our thought. We didn't, they were consistent. (It is now about two hours after we first started, the ambient air temperature had *increased* maybe only a few degrees, but the sun was *not* visible).

Much to our astonishment, now measuring from the "zero point" under shaded conditions (with a slightly higher ambient temperature), the first series of 100' measurements were consistently "too long" by 3/32"! Apparently the sun (radiant temperature) shining on the dark colored taped warmed it enough to cause the extra stretch. Even forcibly pulling the steel tape would not stretch it to reach the original 100' marks. (The tape was in the shade after completing the first 1/4-mile measurement (1 1/2 hours) until it was retrieved at hour-2 to recheck those first few marks. The tape was stored inside the car, in a garage during the preceding overnight period, i.e, it started the day "cool").

Again, the ambient air temperature change across those two hours was negligible - if anything, the increase would cause the tape to read "too-long." When we initially started the project: sunshine *was* hitting our dark brown (rust) colored 5/16" wide steel (Dietzgen) surveyor's tape. Effectively, at the two-hour mark - with a slightly higher ambient temperature - the steel tape should be fractionally longer . . . not shorter, as it turned out to be!

The course measurement procedures handbook specifically says to shield the thermometer when taking the "correction factor" (ambient temperature) to avoid the influence of (radiant) temperature from the sun. (Obviously, different color thermometers would give varying results). Possibly the subject of radiant temperature needs to be addressed in the book, especially since this was a calibrated benchmark course I was trying to establish and 3/32" per 100' would cause a 10k course to be about 30" too long. Granted, the error is in the acceptable direction, too long, but as nit-picky as the measuring booklet implies, and computer timing equipment errors that you have addressed in TAC/STATS, maybe the "sunshine factor" needs to be included.

Asides I can pass along from 15 years running experience: sunshine (radiant temperature) affects the runner by 10 to 12 degrees. That is, 80 degrees under sunny skies is about the same as running with 92 degrees and cloud cover. (*Humidity's* effect on runners is another whole ballgame.)

Another point worth noting: On a sunny day the ambient temperature in the *shade and sun* is the *same* . . . excepting the radiant temperature causes any body exposed to the sun to heat up . . . but sunshine does not heat the air.

Sincerely, Ed Okie

Post Office Box 448 • Lake Wales, FL 33859 • (813) 676-1374

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June 6, 1991

Ed Okie - PO Box 448 - Lake Wales, FL 33859

Dear Ed,

Here is a copy of the May Measurement News. I will put your letter in the July issue. It's a good real-life example of something we have known about for a long time. The section on taping (in Course Measurement Procedures) wa written by Bob Baumel with full awareness of the effect of radiation. However, since it is well-nigh impossible to determine an actual temperature for the tape itself, it was felt that a standardized measurement of air temperature was as good as we could do without getting into arcane and complicated procedures. People have a hard time with the temperature correction as it is, without making it any tougher.

It's true that the air temperature is unaffected by the presence of sunshine. However, the thermometer must be shaded because sunshine radiation will raise the temperature of the thermometer itself, above that of the surrounding air. This will give a misleading temperature. In some cases it may be closer to the temperature of the tape, in some cases not. Tape temperature is more affected by the temperature of the pavement itself, since the tape lies directly against it. That's why we ask that the thermometer be placed on the pavement. Was yours so placed?

If greatest accuracy is desired, it is best to do taping in the early morning before things heat up, but this sort of accuracy is not required, since calibration course errors are far smaller than those introduced by the use of the calibrated bicycle.

I personally think temperature corrections could be dispensed with entirely, since they have only a minor effect on overall course length, and the difference is covered by the short course prevention factor of 1.001, even in cold conditions. Many people simply ignore temperature correction in hot weather since, as you found, it simply adds a small extra length to the final course.

It is interesting that we tend to notice these measured distances in road rac courses, and some people get very upset at the effect on runners' times. However, if we did an all-out effort to measure tracks we would find that there are also measurable differences between them. Yet it is widely assumed that "all tracks are equal." The same attitude should be taken for roads. Measure them using a standard procedure, and assume equality. It's the only way to look at it without losing one's sanity. If proper procedures are followed, they are close enough to equal that the differences can be ignored, and should be.

Best regards,

Pete

Mon Jun 10, 1991 9:14 am

Pete Riegel
RRTC
3354 Kirkham Road
Columbus, OH 43221

Dear Pete,

Thanks for the sample copy of Measurement News. Enclosed is my $15 check for a year's subscription.

Enjoyed your personal comments, ". . . if we did an all-out effort to measure tracks we would find that there are also measureable differences between them. Yet it is widely assumed that 'all tracks are equal'."

Interesting aside: Last year while casually wondering about the accuracy of a new 8-lane 400-meter local track, I found it several feet short. "Hum-m-m," I said to myself. "I wonder how two other (non-metric) tracks in the area compare?" (One was 10 years old, the other about 20 years). You guessed it: They too varied in distance. Three tracks, three different distances to their assumed dimensions.

Tounge-in-cheek intended: On track work, I wonder if we also should consider "leg-length" discrepencies of individual runners? After all, the left leg *is* running a shorter distance than the right leg . . . but if one leg is shorter than the other . . . the moon is in the third phase and it's the second Tuesday of the month . . .

Another humorous real-life story. Last year at a new 5k event in Central Florida all my runners (adults) finished the event with PRs. Obviously they were elated since I introduced a new track training method about a month before the race. "Hey, coach really knows his stuff!" the runners exclaimed.

But "coach" new better . . . It's near impossible for 10 bodies to all PR on the same day . . . in spite of their "obvious coaching excellence" they enjoyed the past month.

Talking with the guy in charge of getting the event off the ground after the race brought a twinkle in my eye, and a sinking feeling to the stomach. And this is the truth. To wit:

He bought a new "Cateye" odometer for his bike - advertised in the bicycle magazines as accurate to 1/10 of one percent (which is true). The instructions with the unit said it comes preset for a 27 inch bike wheel. His bike had the standard 27 inch wheel. Yes, you guessed it. He slapped it on and without a second thought measured off precisely 3.1 miles! "Can't get much better than that!" I'm sure he said to himself.

In the "no surprises department" the course was off - about a quarter mile short.

Boy, it's tough breaking the news to your runners that their PRs "ain't so." Even if they are adults.

In hindsight, runners seem to have memories like elephants - they never forget. The best solution I've found: Whenever they bring up these PRs . . . I remind them not to forget the great coach!

Nuff said.

Sincerely, Ed Okie

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AMERICA'S FASTEST MILES

The following list was generated by beginning with the 153 listed certified miles. All miles from the old NRDC list were discarded, since drop and separation are not on the list for those oldies, and I did not wish to examine individual certificates or calculate from old lists. I also eliminated all the miles that were level or uphill. What remains is a menu for those who would like to attempt a downhill-boosted personal best at this classic distance. Note that the US's premier road mile, New York's Fifth Avenue Mile, the granddaddy of them all, is uncertified.

Course ID	Location	Name of Race	m/km Drop	pct Sep	Measurer
DE 88004 WN	Wilmington	Penn Avenue Mile	19	100	White
VA 87059 RT	Arlington	The Arlington Mile	17	76	Scrborough
VA 87041 ACL	CliftonForge	Dabney-Lancaster Mile	17	80	Linnerud
OH 91018 PR	Columbus	The Fast Lane Mile	16	99	Riegel
IL 87038 WG	Rockford	State Street Mile	14	94	Roland
CT 87009 DR	Wallingford	Wallingford Mile	13	100	Morss
NY 89010 AM	Auburn	Downtown Auburn Mile	10	57	Oja
CO 91011 DP	Denver	Mile High Mile	9.3	96	Poppers
IA 87008 JL	Des Moines	Court Avenue Mile	8.9	100	Franks
NJ 87016 DB	Ridgewood	Ridgewood Mile	7.6	80	Brannen
MI 88006 SH	Marshall	Bar Scheeze Classic	6.8	100	Dewey
MA 91007 WN	Worcester	Worcester Mile	5.7	100	Rudman
OK 87019 BB	Tulsa	Corp Challenge 1 mile	5.5	44	Lafarlette
NC 88053 ACL	Roanoke Rpds	Festival Road Race	4	10	Linnerud
SC 91009 BS	Columbia	Devine Mile Road Race	3.8	100	White
NH 88002 BT	Durham	Just for the Health of It	3.8	100	Teschek
OK 88004 BB	Tulsa	Corporate Challenge Alt	3.1	40	Lafarlette
NC 87060 ACL	Charlotte	Summer Breeze	2.9	100	Linnerud
SC 87006 WN	Blythewood	Long Creek Plantation RR	2.8	7	Nicoll
GA 87001 WN	Glynco	FLETC - 1 mile	2	10	Nicoll
PA 88043 RE	Harrisburg	The Harrisburg Mile	1	100	BarnerJr
MD 87004 RT	Kensington	Beach Dr Bike Path,Mile 4	1	76	Sissala
AL 89005 JD	Montgomery	Senior Olympics One Mile	1	15	Harrison
MD 87010 RT	Kensington	Beach Dr Bike Path,Mile10	1	97	Sissala
TN 91003 EL	Memphis	Les Passes 1 Mile Run	0.8	99	Laywell
SC 90019 BS	Charleston	The King Street Mile	0.4	100	Moran
OK 89042 BB	Tulsa	Metro Mile	0.3	100	Lafarlette

THE ATHLETICS CONGRESS/USA
13th ANNUAL NATIONAL CONVENTION

Sheraton New Orleans Hotel
New Orleans, LA
December 2-7, 1991

Schedule as of June 6, 1991

C = Conference
C-T = Conference/Theatre*
S = Schoolroom
S-T = Schoolroom/Theatre**
T = Theatre

Time	Monday, December 2	Number	Set-up
12 Noon - 5 p.m.	Registration Desk		
	National Convention Office		
	Typing Room		
	Press Room		
	U.S. Athletics Calendar Office		
p.m.			
2-5:30	TAC Executive Committee	30	C-T
7:30-9:30	TAC Executive Committee	30	C-T

Time	Tuesday, December 3	Number	Set-up
8 a.m. - 6 p.m.	Registration Desk		
	National Convention Office		
	Typing Room		
	Press Room		
	U.S. Athletics Calendar Office		
a.m.			
9-11	First-Timers Orientation	200	T
9-12 Noon	Membership Committee	42	S
	Officials Executive Committee	30	S-T
	Associations Committee Seminars	150	T
	Athletes Advisory Committee	150	T
	U.S. Women's Track Coaches Association Advisory Board	20	C-T
	SSC Executive Committees		
	Men's & Women's Racewalking	30	C-T
	Youth Athletics	20	C-T
	Masters Long Distance Running	20	C-T
	Men's Track & Field	20	C-T
	Women's Track & Field	20	C-T
10:30-12 Noon	Men's LDR Championships Subcommittee	20	C-T
p.m.			
1-5	TAC Board of Directors	Special	
6-8	Masters Track & Field Executive Committee	20	C-T
6-9	Athletics for the Disabled Committee	30	S-T

* Room set-up Conference-style for number of people indicated; chairs theatre-style around perimeter of room.

** Room set-up Schoolroom-style for number of people indicated; chairs theatre-style around perimeter of room.

2-2-2

Time	Tuesday, December 3	Number	Set-up
6-9	Men's Track & Field Committee	150	T
	Women's Track & Field Committee	125	T
	Athletics Business Standards Committee	20	C-T
	National Team Uniform Committee	20	C-T
	Men's Long Distance Running Executive Committee	20	C-T
	Strategic Planning Faculty	20	C-T
	Officials Committee	100	T
	Youth Athletics Committee	200	T
6-11	Masters Long Distance Running Committee	100	T
	Men's & Women's Racewalking Committee	150	T
	Law and Legislation Committee	20	C-T
8:30-11	Masters Track & Field Committee	75	T
9:30-11	Men's Long Distance Running Associations Workshop	150	T
	Women's Awards Subcommittee	20	C-T
	Youth Athletics Regional Coordinators	20	C-T
	Grand Prix Committee	20	C-T
	Joint Men's & Women's Cross Country Subcommittee	20	C-T
	Coaching Education Committee	200	T

Time	Wednesday, December 4	Number	Set-up
7:30 a.m. - 6 p.m.	Registration Desk		
	National Convention Office		
	Typing Room		
	Press Room		
	U.S. Athletics Calendar Office		
a.m.			
7-8	Emerging Elite Committee	30	S-T
8-12 Noon	The Athletics Congress-General Meeting	900	T
p.m.			
1-3	Membership Committee	42	S
	Marketing & Media Committee	75	T
	Men's Awards Subcommittee	20	C-T
	Joint Men's & Women's Development Committees	250	T
	First-Timers Orientation	200	T
1-5	International Competition Committee	150	T
	Officials Committee	150	T
1-5:30	Budget & Audit Committee	100	T
	U.S. Women's Track Coaches Association	125	T
	Standards - Men's & Women's Subcommittee	20	C-T
	Race Walking Site Selection Subcommittee	20	C-T
	Law & Legislation Committee	20	C-T
3:30-5:30	Revitalizing Interest in Athletics Committee	20	C-T
	Women's Long Distance Running Executive Committee	20	C-T
	Ultra Distance Subcommittee	20	C-T
	Public Relations Task Group	15	C-T

Time	Wednesday, December 4	Number	Set-up
3:30-5:30	Race Walking National Team Subcommittee	20	C-T
	Men's Development Committee	250	T
	Associations Committee	200	T
6:30-8:00	CAJUN HOSPITALITY	900+	
8:30-11	Road Running Technical Committee	42	S
	Masters Track & Field Committee	100	T
	U.S. Women's Track Coaches Association	125	T
	Youth Athletics Committee	150	T
	Awards, Logos & Medals Committee	20	C-T
	Women's Track & Field Schedule Subcommittee	20	C-T
	Women's Heptathlon Subcommittee	20	C-T
	Ultra Distance Subcommittee	20	C-T
	Law & Legislation Committee	20	C-T
	Restructuring Group	20	C-T
	Men's Development/A	100	T
	Men's Development/B	250	T
	Men's Development/C	100	T
	Men's Development/D	200	T
9-11:30	Athletes Advisory Committee	150	T

RRTC

Time	Thursday, December 5	Number	Set-up
8 a.m. - 6 p.m.	Registration Desk		
	National Convention Office		
	Typing Room		
	Press Room		
	U.S. Athletics Calendar Office		
8:30 - 11:30 a.m.	Joint Site Selection Subcommittee	42	S
	Women's Long Distance Running Committee	100	T
	Substance Abuse, Education & Testing Committee	150	T
	Masters Long Distance Running Committee	150	T
	ARRA Race Directors	125	T
	Youth Athletics Committee	150	T
	Women's Cross Country Subcommittee	20	C-T
	Travel Oversight Committee	20	C-T
	American Plan Advisory Committee	20	C-T
	Rules Committee	20	C-T
	Records Committee	20	C-T
	Masters Track & Field Committee	100	T
	Women's Development Committee	200	T
12 Noon - 2 p.m.	AWARDS LUNCHEON	900+	
p.m. 2:30-6	Women's Long Distance Running Committee	100	T
	Joint Masters Track & Field & Long Distance Running Committees	150	T
	Officials Committee	150	T

Time	Thursday, December 5	Number	Set-up
2:30-6	Men's & Women's Racewalking Committee	125	T
	Youth Athletics Committee	150	T
	Law & Legislation Committee	20	C-T
	Records Committee	20	C-T
	Men's Long Distance Running Committee	100	T
	Women's Development Committee	200	T
3-6:30	Men's Development Committee	150	T
8-11	Joint Law & Legislation & Rules Committees	42	S
	U.S. Olympic Festival Committee	100	T
	Road Running Technical Committee	150	T
	Athletes Advisory Committee	150	T
	Men's & Women's Racewalking Committee	125	T
	Cultural Exchange Committee	30	S-T
	Officials Executive Committee	20	C-T
	National Training Center	20	C-T
	Men's Decathlon Subcommittee	20	C-T
	Restructuring Group	20	C-T
	Sports Medicine & Sports Science Committee	150	T
	Associations Committee	200	T

RRTC

Time	Friday, December 6	Number	Set-up
8 a.m. - 6 p.m.	Registration Desk		
	National Convention Office		
	Typing Room		
	Press Room		
	U.S. Athletics Calendar Office		
a.m. 9-12 Noon	Women's Long Distance Running Committee	100	T
	Men's Track & Field Committee	150	T
	Women's Track & Field Committee	150	T
	Men's & Women's Racewalking Committee	125	T
	Youth Athletics Committee	150	T
	Rules Committee	20	C-T
	Masters Track & Field Committee	150	T
	Masters Long Distance Running Committee	250	T
	Men's Long Distance Running Committee	100	T
	Sports Medicine/Development Coaching Symposium	200	T
p.m. 1-3	Women's Long Distance Running Committee	100	T
	Men's Track & Field Committee	250	T
	Athletes Advisory Committee	250	T
	Women's Track & Field Committee	150	T
	Men's Long Distance Running Committee	125	T
1-5	Associations Committee Zone Meetings	150	T
	Television Review Advisory Committee	20	C-T
	Law & Legislation Committee	20	C-T
3:30-5:30	Joint Men's & Women's Track & Field Committees	250	T

5-5-5

Time		Number	Set-up
3:30-5:30	Friday, December 6 Joint Men's & Women's Long Distance Running Committees	250	T
6:30-7:30	RECEPTION	900+	
7:30-???	BANQUET		

Time		Number	Set-up
8 a.m. - 3 p.m.	Saturday, December 7 Registration Desk National Convention Office Typing Room Press Room U.S. Athletics Calendar		
7 a.m. - Finish	Delegates Race		
a.m.			
7-8:30	Convention Committee	20	C
8:30-10	Hall Of Fame Library Advisory Board	20	C-T
9-11:30	Joint Law & Legislation & Rules Committees	42	S
	Emerging Elite Committee	30	S-T
	Masters Long Distance Running Committee	125	T
	Athletics for the Disabled Committee	30	S-T
	Youth Athletics Committee	150	T
	Track & Field Junior Commission	20	C-T
	Women's Long Distance Running Committee	100	T
	Men's Long Distance Running Committee	100	T
12 Noon-Conclusion*	The Athletics Congress-General Meeting	900	T
p.m. 5-6**	SATURDAY AFTERNOON MASS	125	T

50

* Estimated conclusion of General Meeting is 4:00 p.m.

** Will commence one half-hour following conclusion of General Meeting in the event that conclusion is earlier than 4 p.m.

Meanwhile, all along the marathon route, neighborhood dogs fulfilled their role in nature by weeding out the weak and injured.

PHELPS SAUERKRAUT 20K
GEORGE TILLSON
WIBORN ROAD
SHORTSVILLE, N.Y. 14548
(716) 289-4250

May 13, 1991

Dear Pete

Many thanks for toting home for me from your long trip the waterproof notebook. I tried one out this am in a light rain after returning from a run. Between the light drizzle and the perspiration rolling off my fingers the notebook worked just fine.

I like your idea of laying out reference points along a marathon course, as you did with John Disley along the London course, when one can perhaps expect some construction prior to race day. Laying out a marathon course and measuring one is a huge undertaking for me and with a several reference points one can make some adjustments should construction change the route. That must have been quite an experience riding in the lead vehicle in London.

Reading Measurement News and Bernie Conway's measurement of a ice racing oval brought up a unique problem when chatting with a friend at a recent running race. Two weeks ago I was chatting with Diane Roth at a local race. Diane, a member of the US ski team, lives about 15 miles from me and occasionally joins a local running race. We chat as I used to be involved with skiing, as an instructor in Aspen, and two weeks ago she brought to the race another area US ski team member, "A.J." Kitt. AJ won the world downhill race this winter in Lake Louise. We were speaking about the length of the course and his time, translating it to mph. The course is <u>approximately</u> two miles long and he completed the run in 1 min 59 sec. He was impressed that he averaged 60 mph. I told him that I measure race courses and that I would check the course out on my bicycle. We had a good chuckle about that, all of the possible problems going down a snow covered slope on a bicycle. Have you any suggestions on how to? You had opinions on measuring speed skating ovals.

The May issue of Measurement News contains such a wonderful array of information. I really appreciate your superb efforts for all of us measurers, we can certainly benefit from the many articles.

Best Regards,

George

I am working almost full time this month on the Phelps race. This week I am sending out 1,200 registration forms to past participants.

THE ATHLETICS CONGRESS
OF THE USA

Road Running Technical Committee
Peter S. Riegel, Chairman

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May 22, 1991

George Tillson - 5120 Wiborn Rd - Shortsville, NY 14548

Dear George,

I'm glad your notebook arrived OK. I haven't had a chance to try m the rain yet. Maybe just possessing one is a talisman against show

As for measuring the ski course, the obvious thing is to measure it summer. I suppose one could lug a measuring wheel up the slope if to. If it was terribly important I'd tape it. It would be a good a mountain hike. Maybe I could talk them into a ride up on the lif wasn't for the crowds, one could always tape it on skis, using ski intermediate marks. Maybe do it after the area closes.

However, I don't think anybody is terribly picky as to exactly wher are set for the competition, which would affect the length of the m line. Gate positions may even vary from day to day, as snow condit change. I confess I don't know.

Given all the variables inherent in downhill ski racing, I doubt th need for any more than an approximate distance. If it was up to me out the course on a large-scale topographical map, and do a careful Then I'd figure out the slope distances from start to finish. Beca slopes are a lot steeper than road courses, the slope distances wil longer measured value than would simple map scaling.

I suspect people do use topographic maps for this, without the (pro unnecessary) added refinement of figuring the slope distances.

All in all, the most accurate and fun way to do the job would be to on skis, after hours, with a good guide to point out the proper pat

Good luck with the Sauerkraut 20km.

Best regards,

Pete