MEASUREMENT NEWS

NOVEMBER 1991 - ISSUE #50

Jean-Paul Delasalle (above, in striped tights) has been extremely active in establishing accurate course measurement in France. See his article inside:

COMPARATIVE PAPER OF THE MEASURES OF A COURSE MADE BY OFFICIALS TRAINED TO THE METHOD OF THE CALIBRATED BICYCLE

Support the Tampa Compromise!

by Bob Baumel

I am writing this just a few days after Clarence Thomas was confirmed as a Justice of the US Supreme Court by a 52–48 vote in the Senate. Although that spectacle may have had a beneficial side effect (by increasing public awareness of sexual harassment), it's clear that the process of selecting Supreme Court judges in this country has sunk to a sorry state, as indicated by that "squeaker" Senate vote.

In the meantime, we in TAC have been struggling with our own controversy which has been almost as acrimonious as the Thomas confirmation. We even had our own "squeaker" vote of 23–20 (although it didn't settle anything in this case) at last year's TAC Convention.

I refer, of course, to the debate on Rule 185.5. The 23–20 vote occurred in Men's LDR. (The scant 3-vote margin was in favor of keeping 185.5). This vote was taken in response to one of two proposed amendments aimed at dismantling the 1989-amended rule. We'll never know how Men's LDR would have voted on the *other* proposed amendment, or how Women's LDR would have voted. Happily, a scheme conceived by Jeff Darman cut off this extremely divisive debate (which was surely heading for a floor fight at the final general meeting, no matter which side had squeaked out a narrow victory in the committees).

Darman's idea was to appoint a special committee to search for a compromise acceptable to a majority on both sides. The principle of such a compromise would be to recognize performances of historic importance while also maintaining meaningful technical standards for record-keeping. Once Darman proposed this idea, it was quickly accepted by the LDR committees. Discussions became cordial again, and the two amendments aimed at dismantling 185.5 were tabled, to be resolved at the 1991 Convention.

The proposed special committee was appointed by the LDR chairmen and consisted of eight people (including myself to represent the technical community). This committee met in Tampa on Feb 10, 1991 and, after some additional correspondence, released a statement on June 12, 1991 (reprinted in July 1991 *Measurement News*, page 41). The final part of the committee's recommendation, namely a proposed rewording for 185.5(b), was published by Basil Honikman in Sept/Oct 1991 *TacTimes*.

I believe that this "Tampa compromise" provides a reasonable way to settle the 185.5 controversy. The present article is a plea to RRTC members (and all other TAC delegates) to support this compromise.

In Sept 1991 Measurement News (pp. 7–8), Pete Riegel, with endorsements from Norm Green and Wayne Nicoll, proposed an alternate solution. Unfortunately, Pete's proposal tends to repolarize the issue by moving in precisely the opposite direction from the Tampa compromise. Whereas the Tampa committee proposes a relaxation of 185.5(b), making it somewhat *easier* to set records on courses with separation exceeding 30%, Pete would make it **impossible** to ever set records on such courses.

Pete's proposal does have a certain elegant simplicity. And it has several other attractive features: (1) It avoids the technical uncertainties of wind measurement

by eliminating wind measurement entirely; (2) It allows runners to know for sure, as they toe the starting line, whether times from the course will be acceptable as records; (3) It avoids the negative publicity that may result when records are denied because they are found to be wind-aided.

But this is the real world, and Pete's simple, elegant proposal is not a viable solution to the controversy. Let's not forget that the two amendments aimed at dismantling 185.5 are still on the table for this year's Convention. Those amendments will still have some vocal supporters (including some major race organizations). If we come in on the other side backing Pete's proposal, the debate will be just as polarized as last year, and the effort at compromise will have been for naught. In such an atmosphere, I assure you, it won't be Pete's proposal that emerges victorious.

One of the greatest dangers of Pete's proposal is that people may be convinced by only *part* of his argument. Specifically, they may be convinced that wind gauging is a bad idea, while not buying Pete's arguments for retention of the separation limit. If we throw out both wind gauging **and** the separation limit, we completely eliminate part (b) of the rule, throwing the record system wide open for performances with any amount of wind aid—which was precisely the intent of one of the proposed amendments from last year that's still on the table. (This was the proposed amendment on the short side of the 23–20 vote in Men's LDR.)

In fact, it's interesting to note that all of the advantages I listed above for Pete's proposal apply equally to this notion of completely eliminating part (b). There's actually a lot of support for this notion of eliminating all attempts to control wind aid. So if the Tampa compromise breaks down, it's very likely that the amendment aimed at eliminating part (b) will succeed.

Of course, we on the technical side know that throwing out part (b) would make a complete mockery of the record system. It would certainly make a farce of the accuracy we try to maintain in course measurement. We'll deny a marathon record if we find the course to be short by more than 21 meters. But without part (b) of the rule, we'd sometimes be forced to accept records aided by tailwinds whose effects may be a hundred times greater!

So if we want to maintain any sort of credible record system, we **must** preserve a means of excluding performances that are clearly wind aided. I believe that the Tampa compromise, including Basil's amendment to 185.5(b) as stated in Sept/Oct *TacTimes*, provides a reasonable way to accomplish this.

Pete's proposal, as stated in Sept *Measurement News*, provides a different means of excluding wind-aided performances, but at the cost of forever excluding **all** performances on courses with separation exceeding 30% (even on days when there's no tailwind and the performances aren't aided at all). Let's remember that one of the "selling points" of our 1989 revamping of the rule was the opportunity to set genuine records on courses with large separations in case there's no tailwind.

Any attempt now to remove that opportunity will be widely viewed as heavy-handed and unfair—even "fascistic" in the words of some. (Recall that our 1989 changes were called "fascistic" by some runners. Adoption of Pete's proposal would make the rule appear even more so.)

Given the present political climate, there's **no way** that Pete's proposal could win approval. But if we go into the Convention backing that idea, the debate will be as

divisive as last year; the Tampa compromise will break down; and we run the risk of losing part (b) entirely, turning the record system into a complete farce.

I don't want to see the same sort of bitter debate as we had at last year's Convention. I don't want to see a floor fight at the final general meeting. As indicated earlier, the amendments proposed last year (aimed at dismantling 185.5) will probably still have supporters. But I hope they can be kept to a small minority. I am hoping that RRTC, along with the bulk of the LDR committees, will enter the Convention united in support of the Tampa committee's recommendations.

The Tampa compromise is a solution we can live with. (And the alternative is not really Pete's proposal, but rather, in all likelihood, a complete loss of meaningful standards for road record keeping.) So let's support the compromise!

I should mention, by the way, that this essay has concentrated on only the 2nd half of the Tampa committee's recommendation, i.e. part (b) of the rule, because that's the area in which Pete Riegel published an opinion that could break down the compromise. I haven't discussed the other portion of the compromise because I think RRTC is *already* united with the Tampa committee in that area.

During the Convention, it will be important to display broad agreement on *all* aspects of the compromise. The principles are: No change to part (a) of the rule. List "Best" performances to recognize marks set on courses ineligible for records. Change part (b) only in accordance with the spirit of Basil's proposed amendment in Sept/Oct *TacTimes*. If we are united, the compromise will prevail.

Bob Baumel

THE ATHLETICS CONGRESS
OF THE USA

Road Running Technical Committee
Peter S. Riegel, Chairman

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October 23, 1991

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

Dear Bob,

I like your article "Support the Tampa Compromise." I hope people do. My letter that appeared in September MN was written to the Tampa Committee in the hope that the compromise would take the direction I outlined, not to urge people outside that committee to oppose it. I felt that it was my right to inform the committee of certain facts and consequences, and I did so. For all I know, others may have offered their own inputs as well.

At this time I don't know the final form the compromise will take, although I did see the proposed rewording in TacTimes. If it turns out to be like the TacTimes specimen, I intend no opposition.

Best regards, Pete

2455 UNION STREET
APT. 412
SAN FRANCISCO, CA 94123

October 28, 1991

Mr. Pete Riegel
Columbus, Ohio

Dear Pete:

We are now ready to go into full production of the new "Jones Counter." From now on it will be called "THE 'JO' COUNTER!" "JO" stands for Jones/Oerth. The basic design was, and always will be, Alan Jones' concept.

The new models will be available as of January 1st, 1992. We will have both five digit and six digit counters ready to send out. The cost of each will be $45.00 for the five digit counter; and $55.00 for the six digit counters.

The wires are gone forever.

The basic design that Alan Jones conceived will be preserved for ever.

Paul

Paul Oerth

MEASUREMENT NEWS

#50 - November 1991

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NEW APPOINTMENT

Karl Ungurean has been appointed TAC/RRTC National Certifier (Final Signatory) for the State of Nebraska, by Bob Baumel. Welcome, Karl.

LAST MONTH'S PUZZLE

Brian Smith wins the cigar this time, with Bob Harrison's correct answer only a day behind. Bob said he prefers Jean-Paul Delasalle's puzzles to mine.

Later correct answers were sent in by Bill Grass, Mike Wickiser, and Tadeusz Dziekonski.

I'm running out of inspiration, and would dearly welcome more puzzles. Send in a knotty problem of your own. Odds are we can use it as the month's brain-teaser.

THE RACE TO THE MILLENIUM - THIS MONTH'S PUZZLE

We are approaching the end of the 20th century and the millenium. In celebration of this achievement I'm certain there will be many midnight footraces scheduled to bridge the instant between the second and third millenia.

Since it has never been particularly important to me that I know the date and time of the millenium, I have never given the subject a lot of thought. Maybe a reader has. The birth of Christ begins our modern era - of that I'm reasonably sure. I also know there was an adjustment period - a couple of weeks in the middle ages - during which we (retroactively) switched from the Julian calendar to the Gregorian, the one we use now. In any case, to help establish the date and time for these important footraces, does anyone know:

1) When was Christ's birthday, as reckoned by today's calendar?

   a) January 1, year 0 AD?
   b) January 1, year 1 AD?
   c) December 25, year 0 AD?
   d) December 25, year 1 AD?
   e) Something else?

2) At what date and time does the millenium occur? Many of us are ready to celebrate it on December 31, 1999, to ring in year 2000. Is that right? Should it be 2001? Perhaps on Christmas Eve?

I'm sure the millenium ties in with Christ's birthday, traditionally considered to be December 25. Does the first year AD have only 6 days in it? When Christ was six months old, what year was it? 0? 1? Please, someone who knows - explain. Anxious race directors await the definitive word.

Best answer will be published as the winner of this month's puzzle!

LAST MONTH'S PUZZLE - CALCULATION SUMMARY

You measure a loop that is just short of 5 km. The race director wants to use it for a 20 km race, and wants split points each 5 km. Start is fixed. Calculate distances from start to split points.

Pre-measurement constant = 9663 counts per km including 1.001.
Post-measurement constant = 9669 counts per km including 1.001.

Average constant = 9666 counts per km including 1.001. (Since this was an IAAF measurement, average constant is used.)

First loop measurement = 46300 counts

Initial estimate of distance, based on precal = 4791.473 meters

Counter reading at start of split layout = 47000

End of Lap	Meters Elapsed Distance	Meters Next Split	Desired Amount to Add, m	Desired Counts to Add	Counter Reading at Split	
0	0	1000	1000.00	9663	56663	These values are
1	4791.47	5000	208.53	2015	49015	based on precal
2	9582.95	10000	417.05	4030	51030	constant
3	14374.42	15000	625.58	6045	53045	
4	19165.89	20000	834.11	8060	55060	

For final adjustments, the following is calculated after postcalibration, using average constant:

Final measured distance = 4789.986 meters

End of Lap	Distance	Next Split	Desired Amount to Add, m	Amount Actually Added, m	Final Adjustment to add, m	
0	0	1000	1000.00	999.69	0.31	These values are
1	4789.99	5000	210.01	208.46	1.55	based on average
2	9579.97	10000	420.03	416.93	3.10	constant
3	14369.96	15000	630.04	625.39	4.66	
4	19159.94	20000	840.06	833.85	6.21	

Note:
Here's this senile citizen's puny stab at the current puzzle:

Counter will show these counts at the respt. tentative marks:

SPLITS	COUNTS
5	49015
10	51030
15	53045
20	55060
1	56663

After the post calibration all marks to be moved forward i.e. course made longer, by the following distances in meters

SPLITS	METERS INCREASE
5	1.551831161
10	3.10366232
15	4.655493482
20	6.20732464
1	0.310366232

Now how about a cigar ?

Brian

BRIAN SMITH S CAROLINA 8.30.91

SINCE 1963
NOTC
New Orleans Track Club, Inc.
P.O. BOX 52003, NEW ORLEANS, LA 70152-2003
(504) 482-NOTC

Pete Riegel
Measurement News
3354 Kirkham Road
Columbus,Ohio 43221

9-3-91

Dear Pete,

The article regarding the "Mardi Gras Marathon" on page 10 of the Sept 91 issue.

We take exception to the manner in which this article was presented.

While the marathon's ("Perrier Mardi Gras Marathon") course on the Lake Pontchartrain Causeway has not been used since 1985, the current "Bud Light MARDI GRAS MARATHON" (as it is now called) is one of the oldest marathon's in the country and will celebrate it's 27th year in 1992. Not to many races of any distances can boast that many years running. It is far from gone....

Yes, in 1979 and even more in 1980 there were tailwinds to "benefit the participants".
In the 1980 race, 66% of the men and 44% of the women ran personnel records. Over 300 qualified for Boston and 36 men qualified for the Olympic Trials. ON A CERTIFIED COURSE... at that time.

Please consult someone of official status before making ridiculous statements (i.e."Runner who was actually blown off the bridge and was hauled from the water by a fisherman" "What a Fish story"
This is completely FALSE.
We did however have one of the water tables accidentally fall from the water truck into the water. It sank!

Stellar Field.....
In 1980 Ron Tabb's winning time was 2:11:00, he was followed by Rick Calison at 2:11:22 and Don Howieson at 2:12:18. Gayle Olinek ran a 2:35:12 to win the womens division. If you don't consider this a stellar field, compare these

finish times with recent Boston and New York results.
In 1980, 24 runners finished in under 2:20:00. Some were skeptical about Tabb's winning time of 2:11:00 as perhaps being a fluke, yet he later ran 2:09:00 on another course (I believe the 1980 U.S. Marathon Olympic Trials?)
I don't recall how much/if any prize money was given in 1979/80/81, however in 1985 the total purse was $20,000.00

I hope that you will correct your article in the next issue.

sincerely,

Chuck George
Executive Director, NOTC

THE ATHLETICS CONGRESS
OF THE USA

3354 Kirkham Road
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September 9, 1991

Chuck George - New Orleans Track Club - PO Box 52003
New Orleans, LA 70152-2003

Dear Chuck,

My paragraph "Gone but not Forgotten" was intended to show a real-world example of the effect of a tailwind acting on runners on a straight-line course. The "fish story" may be incorrect, but it was told to me, as I said. I did not invent it. Rightly or wrongly, it's part of the Ponchartrain course's considerable folklore.

As for the "stellar field" and "substantial prize money" statements, it was my intent to speculate on what sort of finish times we might expect from such a course, on a windy day, if it were ever combined with the sort of field we usually see when large appearance fees, expensive automobiles, TV and really huge prize money are used to assure appearance of the world's top marathoners.

It was never my intent to denigrate the Mardi Gras Marathon, past or present, nor any of the athletes.

Since it obviously did offend, I owe those offended an apology, and I hereby offer it.

Best regards, Pete

HEARTWATCHER'S MARATHON

THE COURSE: The race is scheduled to start on Ridge Street by Bowling Green State University's Women's gym (across from the cemetery) and finish at the University of Toledo's Health Building. The course is flat and fast. With prevailing winds pushing the runners' backs, predictions are that a large percentage of the runners will establish personal records. If the forecast is for winds from the north, the race will start at the University of Toledo's Health Building and finish at B.G.S.U.

SUNDAY, MARCH 20, 1977

This was always a nice friendly race. They did all they could for the runners, including the possibility of running the race in the reverse direction, to take advantage of a tailwind. It was a mixed blessing. I ran it in 1975. Since I was driving up from Columbus, I was in some doubt as to where to go for the start. They started in Bowling Green that year. I don't remember whether they ever did actually switch ends in response to an adverse wind.

DeLand is due for first national road race record

John Boyle

RUNNING

Norm Green's time of 16 minutes, 38 seconds in the 5 kilometer road race is to be considered for acceptance as a national record for a male runner between the ages of 55 and 59.

Green, of Wayne, Pa., recorded the time in 1990 at the National TAC Masters Championship Race hosted in DeLand. He was 56 at the time.

The Athletics Congress will make the decision at its annual convention in New Orleans in December. TAC's Road Race Technical Committee will recommend its acceptance after verifying the course just last week.

Some race officials think they have measured a course when they really haven't. "Oh, we measured it with a wheel" or "it must be right, it's the same course we've used for years" are just some of the statements of folks who put on races. Because the high school coach measured it in 1975, and each year the miles came up fairly close on someone's car odometer, a course can become generally accepted as accurate — when this is hardly the case.

Here's some of what went into Green's record. Many years ago, I measured a straightaway on Hazen Road for one half mile. This was done by stretching a steel 100-foot cable 26 times with one 40 foot section at the end. Each time the tape was pulled to a tautness gauged by a seven pound scale.

This process was completed two times with several counterchecks. Six pages of information on the process were then filled out and submitted to the Road Race Technical Committee for certification. This was all just for the calibration of the course.

With a certified calibration established, the next process was to calibrate a bicycle using a special device on the front wheel that showed a number of counts relative to the half mile calibration course. With that number determined, we then rode the race course four times designating start, finish and mile marks. This was done by extrapolating the half-mile counts to one mile and five kilometer distances.

The paperwork on this process was another eight pages accompanied by a detailed map, which were again sent to the Road Race Technical Committee for certification.

Once accepted, a course is permanent — unless there's a world or national record. Then the measurement must be validated.

After Green's mark was submitted for consideration, another series of paperwork was undertaken to assure that proper timing techniques were used. After all other elements were checked, validation of the course remained.

When Wayne Nichols of New Hampshire, the verifier, and I scheduled time to do this early this summer, everything looked OK. A short time later, everything had changed.

A road was under construction through the middle of the shopping center where the race had been hosted. A ditch now existed through two course crossings. An expansion of the Wal-Mart store and the subsequent construction also crossed the course. I contacted Nichols to say things looked grim. It would be impossible to ride a measuring bike over the route.

Two days before he arrived just on the remote possibility of being able to remeasure, things were still torn up. Never had this veteran course checker experienced such a strange set of circumstances. Just how often is a major road built through a relatively new shopping center?

As if by miracle, however, on his arrival and our checking, the new road had been paved and Wal-Mart construction completed enough to remeasure. The course checked out to be 5,004 meters — well within the record qualifying criteria.

Green, a minister who holds many other marks, is on his way to the 5K record, and DeLand is on its way to its first national road race record.

Jean François Delasalle
B.P. 25
80800 CORBIE FRANCE

Corbie, September 1, 1991

Dear Peter,

At long last this is an account or our measurement work with my French measurement friends when you were here.
I am awfully sorry not to have sent it earlier and I hope you will forgive me.
This year, we have organized 6 seminars in France, each of them lasting 2 days with about 80 judges, who are at the time being, able to measure courses correctly in France.

The last seminar will take place next weekend in Amiens with 15 beginner judges.

This year, I have measured 15 courses in France and one in Belgium (on request of the Belgian Federation Board).

The 3 main ones were the official France Championships on 25 K (Avignon), marathon (Rouen) and 100 K (Millau). When measuring the Rouen marathon I was pleased to work again with M. Voiriot (who was with us in Salouel) and our results were similar (42 126 for me and 42 133 for M. Voiriot for the course we had to check and to which we added 69 m so as to ratify it to 42 195 before the race took place.

In Millau, we were 3 on bikes with Jones counters for the 100 K : we worked on 2 days. Our results were satisfying but there as well we had to add 456 metres to the course.

On the marathon line I only had 0,10 m difference with one of the 2 other judges !! but 28,0 metres with the other one who was not good at cycling and who sometimes showed hezitations : he retired during the second part of the course which was much more difficult with a few uphill slopes!!

At the end of the 100 K I had a 65 metre difference with the other judge.

With very best wishes.

FFA/CNCHS TECHNICAL COMMITTEE FOR MEASUREMENT

COMPARATIVE PAPER OF THE MEASURES OF A COURSE MADE BY OFFICIALS TRAINED TO THE METHOD OF THE CALIBRATED BICYCLE

(under the control of two I.A.A.F experts)

by J.F Delasalle

Summary

This report states a comparative paper of the measures of the course of a road race done in Salouel (France) on april 17th 91

Several aspects of the method will be dealt with ,allowing a very good approach of the reliability of the method brought in France only a year ago and used for the races in the IAAF international calendar (as well as for the marathons of the AIMS)

The whole work was supervised by M.Peter RIEGEL,
- international expert for measurements in the IAAF
- chairman of the RRTC (road races technical committee) in the American federation board (TAC)

A clarification also brought a harmonisation of the concepts on the measuring of courses in the way it is developing in France at the moment thanks to the creation of a new brigade of officials specialized in road races and also a technical committee of measuring at the national FFA road races national commission.

GENERAL POINTS

Eight measurement officials met in Salouel (France) on apri 17th 1991 on the occasion of the coming in France of an IAA international expert,the american Pete Riegel,whose experie concerning the measurement of road races is universally renowned.
There were two aims to that meeting :
- make a comparison between several measurers on several kn courses so as to judge the reliability of each person as we as the group
- take a benefit from Pete Riegel´s international experienc

The protocole had been set by J.F.Delasalle according to th shortness of Mr Riegel´stay in France.
It had 3 steps :
- measurement statement on the course from 7 to 9 p.m.
- calculations and conclusions for each measurer from 9 to
- discussion

In order to do that the experience was set in the condition a real expertise of a race which had taken place there on A 7th 1991.
All the measurers included in their calculations the recommandations of the CTM for the method of the calibrate bicycle :
- 4 precalibration rides and 4 postcalibration rides
- largest of the constants of pre and post calibration
- 1ØØ1 safety factor applied to the constant for the day
- smallest of the 2 measures for the parts of the course wh had been measured twice by the same judge.

Two protective vehicles were used so that the measurement statements were done in excellent material conditions.
Despite the bad weather conditions (windy and cold), a work calculations sometimes difficult and a little anxiety ,when one gave out his conclusion before the release of the resul all the measurement judges said they were pleased with that confrontation,the seriousness of the work done having not prevented a warm and friendly atmosphere.
If being physically fit and technical nature are two compul qualities for a good measurer of road races,a good sense of humour and humility will probably achieve the four conditio required for a better approach of the "perfect measurer".

STUDY OF THE COURSES TO BE EXPERTISED

The place of the courses to be expertised is in Salouel.
It is an event having really, taken place on the suggested courses on April 7 th 1991.
Two races took place and have to be checked.

1. Short race - 3 K

That race takes place around a park, on an asphalted road. The authorised race line is the line of kerbstones, gates fixed on the day of the event at that level forbidding the use of the sidewalks and gutters, in particular in the 3 bends of the course. The departure line is painted on the ground and is marked with a nail.
The measurement of the race was done by the local organizer with the help of an odometer (without any pre-calibration) that is to say a technical measurement file classified R4 according to the BRO classification.

The race consists of the distance Start.Finish + 4 full laps.
Each judge is asked to :
- measure the distance Dep.Arr (with 2 measurements)
- measure the distance of a full lap (with 2 measurements)
- expertise the race.

2. 20 K Race

It is a double back race on the same road between the two villages Salouel and Neuville les Loeuilly.

The departure line and the U-Turn are painted and marked with a nail. All intermediary kilometers are clearly indicated by a painted line on the road.
The runners are allowed to run right across the road, using the shortest line possible (except for the 300 metres before the U-turn where the road is divided into 2 parts).
A detailed map of the course has been given by the organizer.
The first measurement was previously done by the organizer with the use of a non calibrated odometre (classified R4).

A local measurer, Gérard RIMBAULT, checked the measurement of the race before it took place, using the method of the calibrate bicycle : that check measurement was followed by the addition of 140 metres to the initial course so as to obtain the definitive course for the race in April 7 1991 which has to be expertised. These 140 metres represent 0.7 % of the whole distance (which is quite a normal percentage with the use of an odometre).

Here is the data of the initial measurement certificate (G.Rimbault)

Data made on March 16 1991
Calibration Course : Amiens - la Hotoie - 55Ø m (ref : 8Ø/53)
Pre-calibration (Ø9hØ5 - 9 °C), 5273 - 5271 - 5272 - 5272 -
Average = 5272
Post Calibration (12h1Ø - 14°C) 5268 - 5268 - 5266 - 5262
Average = 5265.2
Constant for the day (5272 / 55Ø) x 1ØØ1 = 9595.Ø4Ø
Course Statements 1) 95950 pulses 2) 95993 pulses
Course distance ..... 95950/9595.Ø = 1Ø ØØØ m for 1 way
..... double back = 2Ø k

File registered at CTM under n°8Ø / 1Ø64.

Therefore, it is a race whose measurement data sheet was done according to the method of the calibrated bicycle and whose registration was accepted by the CTM.
The registered measurement data sheet is classified B3 according to the BRO Classification of the CTM (because that was the first real race measured by G. Rimbaut who had only be given a theoretical and technical training and had only performed small Ficticious courses).

The 8 measurement judges are asked to work out the distances between the departure spot and the lines marked on the road at 3,5,8,1Ø,15 and 2Ø K.

The return rides will also allow a comparison of the individual measures of the identical parts of the course that have been measured twice (between Ø - 5 K and between 5 and 1Ø K).

Let´s point out that the calibration course used by G.Rimbaut was 5 K away from the course to be measured (acceptable distance) but because we had very little time for our checking, a 5ØØ m calibration course was done on the spot on April 15 th, 1991 by Gérald CARON and Jean François DELASALLE with a steel tape. (Salouel calibration course n° 8Ø / 145 - d = 5ØØ m)

Common conditions to all the measurers :
- personal bicycle with personal Jones counter (except for Pete Riegel : bicycle with Jones counter were borrowed)
All the bicycles had inflatable tyres
- pre-calibration 7 pm temp = 11°2 C
- Back wind for the first 1Ø K of the 2Ø K course
Front wind on the way back
- post calibration 9 pm temp = 6 °3 C

MEASUREMENT EXERCICES IN A REAL SITUATION

Place : SALOUEL (AMIENS - 80 - France)

Calibration course : 500 meters in Salouel (ref:80/145)

1. 3 k course

consists of - the distance departure - arrival
- plus 4 full laps around the park

marking out : iron gates forbidding the use of sidewalks in the 3 curbs along the lap around the park

markers : a line is drawn on the ground (no nail)
Must be used as indicators the beginning of the departure and arrival lines painted on the ground

clockwise rotation (righthand cord)

Questions :
1. Measurement of the distance departure - arrival
2. Measurement of a full lap around the park
3. Expertise of the 3 K race of April 7 th 1991
4. Eventually put in accordance with the pattern :

whether any alteration : see departure line.

2) 20 K Course : return from Salouel to Neuville (going one way and back)

Follow pointed directing arrows on the road and use the map.

markers : nails indicated on the measurement map (departure and turn around point)

Marking out (iron gates) only around the park (as for the 3 K)

Questions :
1. Expertise of the 20 K race on April 7 th 1991.
2. Estimation of in between distances on the marker lines at 3 K, 5 K, 8 K, 10 K, 15 K, 20 K.

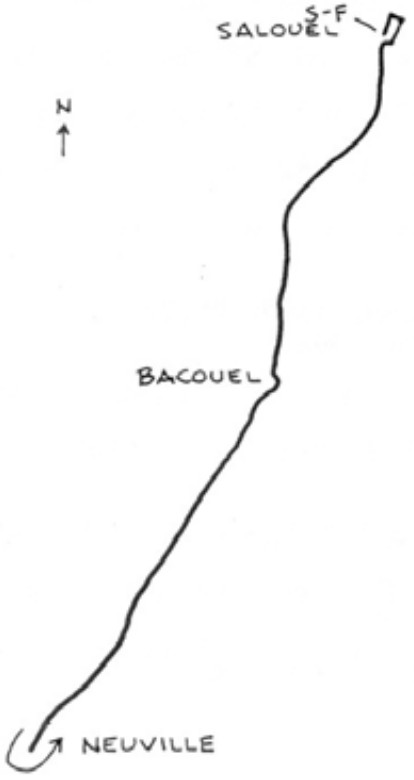
STUDY OF THE SALOUEL 20 K COURSE (FRANCE)

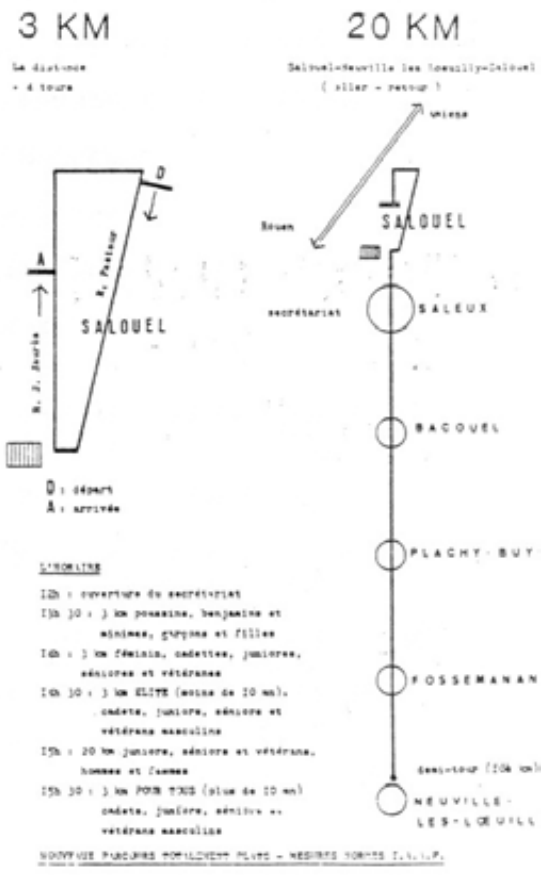
Overall confrontation of the results (in meters)

MES	3 km	5 km	8 km	10 km	15 km	20 km
PR	2996,95	4994,85	7994,80	9995,18	14996,03	19991,39
JFD	2997,05	4994,85	7994,71	9994,90	14995,47	19990,32
MT	2997,05	4994,85	7994,00	9994,43	14994,11	19988,75
AV	2996,98	4995,34	7994,43	9994,80	14996,23	19990,53
DC	2997,36	4995,62	7996,66	9997,98	14999,40	19995,54
GC	2997,45	4995,82	7996,74	9997,73	14999,23	19995,68
JPL	2997,21	4995,22	7995,70	9996,03	14998,53	19995,01
AVE	2997,15	4995,22	7995,29	9995,86	14997,00	19992,46
D.MAX						
m	0,50	0,97	2,74	3,55	5,29	6,93
m/km	0,16	0,19	0,34	0,35	0,35	0,35

This strengthens the idea that the method of the calibrate bicycle has,for a group of experimented measurers,a reliability better than 1 m/km.

It is 0,35 m/km in our example.





STUDY OF THE 3 K COURSE

That race consisted of four laps of the park, plus a fraction of a lap (start-finish)

The distance had not been checked by a judge with a calibrate bicycle before the race,but merely estimated by the organizer with the help of an odometer (surveyor wheel) in good state but without any prior calibration.

Overall Confrontation of the results (in meters)

MES	LAP	S-F	race (4L+SF)	minor/3km
PR	653.73	363.72	2978.64	21.36
JFD	653.16	363.47	2976.11	23.89
MT	653.64	363.39	2977.95	22.Ø5
AV	653.95	363.92	2979.72	2Ø.28
DC	653.47	363.52	2977.4Ø	22.6Ø
GC	654.1Ø	363.77	298Ø.17	19.83
JPL	653.Ø4	363.37	2975.53	24.47
AVE	653.44	363.52	2977.5Ø	22.49
D.MAX				
m	1.Ø6	Ø.55	4.64	4.64
m/km	1,62	1.51	1.55	1.55

This example shows that for very short courses (less than 1 k) the reliability between measurers is not as good as for direct line measurements on longer courses (more than 5 k) : about 1,50 m/km vs Ø,35 m/km

The lap around the park (653 m) consisted of 3 plain curbs but, paradoxically it is more difficult to measure than a longer course in a line . For long length events (12 hrs or 24 hrs for example) you will have to round down the result of the measurement of a lap to the inferior meter in order not to multiply an eventual little mistake by the number of laps and take the risk of having a final estimation of the distance done that would be wrong.

Therefore the 3 k race of Salouel was to short by 22,5 m.

STUDY OF THE CALIBRATION WITH THE JONES COUNTER

1. INDIVIDUAL VARIATIONS WHEN CALIBRATING

						AVERAGE	VAR	*
PR	4829	4830	4829.5	4829.5	=	4829.500	1	0,207
	4831	4831.5	4831	4831.5	=	4831.250	0.5	0,103
JFD	4797	4798	4797.5	4798	=	4797.625	1	0,208
	4800	4800	4801	4800	=	4800.250	1	0,208
MT	4748	4749	4749	4748	=	4748.500	1	0,210
	4750	4749	4750	4750	=	4749.750	1	0,210
AV	4845	4844	4845	4845	=	4844.750	1	0,206
	4846	4846.5	4846.5	4846.5	=	4846.375	0.5	0,103
DC	4827	4827	4827	4827	=	4827.000	0	0
	4827	4827	4827	4827	=	4827.000	0	0
GC	4753	4752	4753	4753	=	4752.750	1	0,210
	4753	4753.5	4753	4755	=	4753.625	2	0,420
JPL	4728	4729	4728	4728.5	=	4728.375	1	0,211
	4730	4730	4731	4729	=	4730.000	2	0,422
BL	6228	6228	6230	6227	=	6228.250	3	0,481
	6235	6235	6235	6227	=	6233.000	8	1,283

Only, the post calibration of the measurer BL did not match the reliability standards. Therefore his results will be studied apart from those of the 7 other measurers.

<u>Calculation of the constant for the day :</u>

Let's point out that all the measurers used the 1001 safety factor and the biggest of the 2 constants according to the CTM instructions.
No mistake was found after checking all the calculations.

PR	9672.163	pulses/km	ou	9.672 163	pulses/mètre
JFD	9610.100			9.610 100	
MT	9508.999			9.508 999	
AV	9702.442			9.702 442	
DC	9663.654			9.663 654	
GC	9516.757			9.516 757	
JPL	9469.460			9.469 460	
BL	12478.466			12.478 466	

2. RESULT OF THE TEMPERATURE VARIATION ON THE PRE AND POST CALIBRATION

The temperature having fallen from 11°2 to 6°3 C in the lapse of 2 hours between the pre and post calibrations, it is logical that the constants have raised slightly when doing the post calibration.

	PRE	POST	VAR/T°	p/km	m/km
PR	4829,500	4831,250	+ 1.750	+ 3,50	0,362
JFD	4797,625	4800,250	+ 2,625	+ 5,25	0,546
MT	4748,500	4749,750	+ 1,250	+ 2,50	0,263
AV	4844,750	4846,375	+ 1,625	+ 3,25	0,335
DC	4827,000	4827,000	+ 0	+ 0	0
GC	4752,750	4753,625	+ 0,875	+ 1,75	0,184
JPL	4728,375	4730,000	+ 1,625	+ 3,25	0,343

LIST OF THE PEOPLE TAKING PART

PR Pete RIEGEL (U.S.A.) IAAF expert in course measurements

JFD J.F DELASALLE (F.F.A) IAAF expert in course measurements

MT Michel TRANCHANT (Nord Pas de Calais) official C.T.M / FFA

AV André VOIRIOT (Haute Normandie) official C.T.M / FFA

DC Daniel CADET (Picardie) official C.T.M

GC Gérald CARON (Picardie) official C.T.M / FFA

JPL J.Pierre LEROY (Picardie) official CDCR80

BL Benito LOPEZ (Picardie/Espagne) Trainee official CDCR 80

COMPARISON BETWEEN THE TWO MEASUREMENTS OF EACH MEASURER ON PARTS OF THE COURSE

It is interesting to compare 2 measurement statements of a same course by the same measurer.

The parts that are measured twice are as follows :

MEAS 1... Ø to 5 k (one way) and 15 to 20 K (back)
MEAS 2... 5 to 1Ø k (one way) and 1Ø to 15 K (back)
MEAS 3... Ø to 1Ø k (one way) and 1Ø to 2Ø K (back)
MEAS 4... lap around the park
MEAS 5... distance start/finish on the lap around the park

(results in meters)

MEAS 1	A	B	diff.	%
PR	4994.85	4995.36	+ Ø.51	Ø.Ø1Ø2
JFD	4994.85	4994.85	Ø	Ø
MT	4994.85	4994.64	- Ø.21	Ø.ØØ42
AV	4995.34	4994.3Ø	- 1.Ø4	Ø.Ø2Ø8
DC	4995.62	4996.14	+ Ø.52	Ø.Ø1Ø4
GC	4995.82	4996.45	+ Ø.63	Ø.Ø126
JPL	4995.22	4996.48	+ 1.26	Ø.Ø252

MEAS 2	A	B	diff.	%
PR	5ØØØ.33	5ØØØ.85	+ Ø.52	Ø.Ø1Ø3
JFD	5ØØØ.Ø5	5ØØØ.57	+ Ø.52	Ø.Ø1Ø3
MT	4999.58	4999.68	+ Ø.1Ø	Ø.ØØ2Ø
AV	4999.46	5ØØ1.43	+ 1.97	Ø.Ø393
DC	5ØØ2.36	5ØØ1.42	- Ø.94	Ø.Ø187
GC	5ØØ1.91	5ØØ1.5Ø	- Ø.41	Ø.ØØ81
JPL	5ØØØ.81	5ØØ2.5Ø	+ 1.69	Ø.Ø337

MEAS 3	A	B	diff.	%
PR	9995.18	9996.21	+ 1.Ø3	Ø.Ø1Ø3
JFD	9994.9Ø	9995.42	+ Ø.52	Ø.ØØ52
MT	9994.43	9994.32	- Ø.11	Ø.ØØ11
AV	9994.8Ø	9995.73	+ Ø.93	Ø.ØØ93
DC	9997.98	9997.56	- Ø.42	Ø.ØØ42
GC	9997.73	9997.95	+ Ø.22	Ø.ØØ22
JPL	9996.Ø3	9998.98	+ 2.95	Ø.Ø295

MEAS 4	A	B	diff.	%
PR	653.73	653.83	+ Ø.1Ø	Ø.Ø146
JFD	653.37	653.16	- Ø.21	Ø.Ø321
MT	653.85	653.64	- Ø.21	Ø.Ø321
AV	653.95	654.31	+ Ø.36	Ø.Ø55Ø
DC	653.47	653.58	+ Ø.11	Ø.Ø168
GC	654.1Ø	654.21	+ Ø.11	Ø.Ø168
JPL	653.25	653.Ø4	- Ø.21	Ø.Ø321

MEAS 5	A	B	diff.	%
PR	363.72	363.72	Ø	Ø
JFD	363.57	363.47	- Ø.1Ø	Ø.O275
MT	363.6Ø	363.39	- Ø.21	Ø.Ø577
AV	363.92	364.13	+ O.21	Ø.Ø576
DC	363.52	363.63	+ Ø.11	Ø.Ø3Ø2
GC	363.77	363.77	Ø	Ø
JPL	363.37	363.48	+ Ø.11	Ø.Ø3Ø2

On the whole, it is noticeable that all the measurers have an excellent reproductivity coefficient, but this one is not as good on small distances (measure 4 and measure 5) as on longer distances (measures 1 - 2 - 3).

All were quite below the normal threshold of the reproductivity coefficient (Ø.Ø8ØØ), proving a top quality .

PARTICULAR CASE OF THE MEASURER B.L (SPAIN)

The measurement statements of BL did not appear in the comparative study because his post calibration constant was not good enough for the reliability standard.

pre calibration 6228 6228 623Ø 6227 / average = 6228.25Ø
with a coeff of Ø.481 (différence of 3 pulses for 623Ø)

post calibration 6235 6235 6235 6227 / average = 6233.ØØØ
with a coeff of 1.283 (différence of 8 pulses for 6235)

The post calibration constant being bigger than the pre calibration, it should have been kept, but it is not reliable. However, the calculations that have been done with that constant give results similar to those of the 7 other measurement judges.

1. 2Ø K Course

MEAS	3KM	5KM	8KM	1ØKM	15KM	2ØKM
BL	2995.72	4993.Ø8	7992.16	9992.33	14994.55	19990.Ø3

2. 3 K Course

MEAS	LAP	S-F	COURSE (4L+SF)	LESS/ 3 KM
BL	653.92	363.9Ø	2979.58	2Ø.42

3. Comparison between 2 measures of B.L

	A	B	diff.	%
MEAS 1	4993.Ø8	4995.48	+ 2.4Ø	Ø.Ø48Ø
MEAS 2	4999.25	5ØØ2.21	+ 2.96	Ø.Ø591
MEAS 3	9992.33	9997.69	+ 5.36	Ø.Ø536
MEAS 4	653.92	653.92	Ø	Ø
MEAS 5	363.9Ø	363.9Ø	Ø	Ø

It is to be noticed that on longer measurement portions (1.2.3) the reproductivity coefficients are a little less good as for the other measures (wobbling or trajectory ?)
Therefore there seems to be a problem in the measurement technic of BL who is a beginner and who has learned on the field, without any previous training course.
A minimum of experience will probably allow him to have excellent results soon.

This example shows that if there is too much wobbling on calibrating and measuring, the final result can be O.K.
One must measure the same way as one calibrates.
However, if the reliability coefficients are not correct, one must always check the measurement again, before coming to a conclusion.

Tue Sep 17, 1991 9:22 am

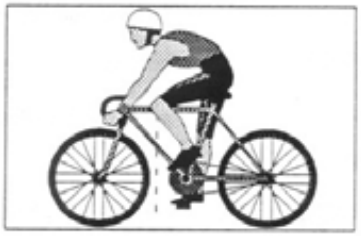
Pete Riegel, editor
Measurement News
3354 Kirkham Road
Columbus, OH 43221

A better mousetrap?

"Centering the bike's front axle over the mark" has always bugged me when doing course measurement procedures. The axle is more than a foot above the road surface and "parallax" enters the picture when trying to sight down the front axle - plus it's in a less than ideal viewing location. Here is a possible "better mousetrap" idea.

While experimenting one day I temporarily strapped to the top/down-tube a "sighting rod" on my bike, a wood 3/8" rod, about 32" in length. This was placed vertically extending to within 1 1/2" of the ground. It was located in a front-to-back position where I was sighting down the rod when in my normal riding position. The idea worked well.

Taking the idea a step farther (and more permanent): my touring bike has dual water bottle holders. The leading edge of the bottom one beneath the down tube happens to be in a near-perfect position beneath my line of sight. This time I jury-rigged a vertical sight rod made from wire, and taped it to the bottom water-bottle bracket.



The few times I've used it, it seems very functional . . . not only quicker to use, but more accurate.

Now if we could only get that darn little digit counter up on the handlebars, and horizontally, where my bifocals would work a whole lot better.

Sincerely,

Ed Okie

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

Editor's note: Mike Wickiser uses a piece of coathanger wire for this. It is mounted on his front wheel hub, next to his Jones Counter, and points straight down to within an inch of the ground.

Perceptive students of the graphic arts will notice that Ed's bike rider is the same as the one on this month's cover. Ed sent me an assortment of computerized cover art, and his is what you see this month.

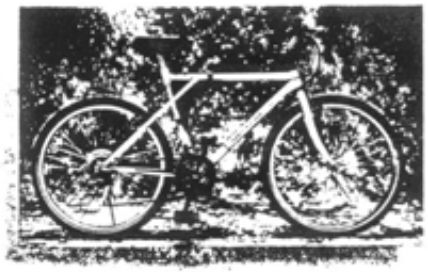
Mountain Gold Specifications

FRAME:	20½" Chromoly
SEAT POST:	Light Alloy
SADDLE:	ATB Gel with Lycra Top
GRIPS:	ATB Rubber
PEDAL:	Dahon Patented Folding Design
RIMS:	26 x 1.5 Aluminum
TIRES:	26 x 1.6 Skinwall, ATB Tread
CHAINWHEEL:	Shimano 200 GS Biopace
REAR DERAILLEUR:	Shimano 200-GS SIS, 21-Speed
BRAKE:	Shimano Cantilever
BRAKE LEVER:	Shimano
HUBS:	Front and Rear Alloy
WEIGHT:	33 Pounds
DIMENSIONS, OPEN:	66¾" x 23¼" x 37¾"
DIMENSIONS, FOLDED:	34¼" x 13¾" x 33¾"

All specifications subject to change without notice. Meets or exceeds all Consumer Product Safety Commission standards. Designed and engineered in U.S.A.

SENT BY TOM KNIGHT

1.

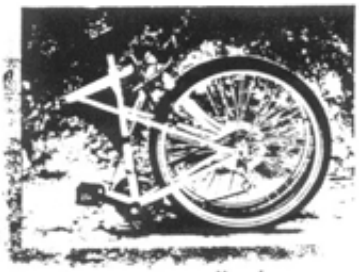


Release three sturdy connectors.

2.

Fold handlebar down; fold pedal up; fold frame in half.

3.



Bicycle is ready to store or to roll wherever you want to take it.

INFO ON A FULL-SIZE, 26 INCH WHEELS, FOLDING BIKE. LOOKS LIKE A NICE MEASURING BIKE. I HAVE A DAHON FOLDER WITH 16 INCH WHEELS. IT'S AWFUL FOR MEASURING, BUT GOOD QUALITY AND FUN TO RIDE. Pete

DAHON
California, Inc.
The Folding Bicycle Experts

September 4, 1991

Dear Pete,

I am writing for three reasons.

First, to support your position re Rule 185.5. I realize that I have remained silent on this issue, but it seemed the wisest thing to do since the issue needed to be debated and a modicum of reason seems to have taken over.

Second, to thank you for keeping me on the mailing list of Measurement News. I appreciate, very much, being kept informed of this area of the sport.

And, third, to announce my engagement to Enrique Aviles, my running partner and best friend for the past three years. I plan to remain in Tucson and ask that you print my new address in Measurement News so that I will not lose touch with the many people who have corresponded from time to time with the PO Box. My address is: 10061 E. Sarah Ann Place, Tucson, AZ 85748. My son is to be a junior at Georgetown this fall and my daughter is entering the University of California at Santa Cruz. So, we made it, I am still running, and am hoping to occasionally see some of the many friends I made while with the National Running Data Center.

My very best to you and Joan.

Sincerely,

Jennifer

Jennifer Hesketh

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.

SALLY H. NICOLL
Ragged Mountain Club
Potter Place, New Hampshire 03265
(603) 735-5721

September 19, 1991

TO: Peter S. Riegel, Chairman, Road Running Technical Committee
3354 Kirkham Road, Columbus, Ohio 43221

SUMMARY REPORT - WOMEN'S TEAM MEASUREMENT OF THE HOUSTON TENNECO MARATHON FOR WOMEN'S 1992 OLYMPIC TRIALS

Attached you will find copies of all data collected during the measurement verification of the Houston Tenneco Marathon course. It was my very great pleasure to serve as leader of this team and to submit the following report. It is intended to summarize our activities for you and to provide some additional details not covered by the attachments.

Tom and Mary Anne McBrayer served our hosts and made all the local arrangements for our visit to Houston. Both Tom and Mary Anne serve on the Marathon Committee, Tom is the current course measurer and Mary Anne is coordinator for the qualified athletes. The Marathon Committee and Race Director David Hannah agreed to provide in-town costs for the measurement to include meals and hotel accommodations, local transportation, police and medic support, recorders during course work, and the bicycles.

The selected riders were RRTC National Certifiers Amy Morss (NY) and Elizabeth Longton (TN) joined by Pittsburgh '88 veterans Betsy Hughes (FL) and Carole Langenbach (WA). Carol McLatchie, TAC Athletes Advisory member of RRTC also joined the Team for the ride. Carol's participation was significant step forward as a Trials Qualified athlete shared the work of the technicians within the sport. Carol gained the Team members respect and devotion for her efforts. She added a very special perspective to both the work and pursuant conversations.

The measurement took place on the weekend of September 13 - 15, 1991. This date was chosen as it coincided with the annual Marathon Kickoff celebration. During the weekend the people's marathon held early sign-up and by Monday over 1000 early registrations had been accepted for the January 26, 1992 event.

The Measurement Team arrived on Friday afternoon. Members were met at the various airports by the McBrayers. We assembled at The Four Seasons, our host hotel, where splendid accommodations and service were provided. The evening meal was graciously hosted at the home of the McBrayers where we were joined by David Hannah, Race Director, and special guest Al Becken, former RRCA Southern Region Director, who happened to be in town on business. Mary Anne served a delicious meal and introduced us to Bluebonnet Ice Cream (fearfully addictive). Following the meal, Tom reviewed the agenda for the weekend and presented us with T shirts

designed especially for the occasion. The warm welcome introduced us quickly to Texas hospitality.

On Saturday morning Mary Anne took us to Butera's on Montrose, a local restaurant, where we enjoyed a delicious breakfast. Next stop was Boone's Cycles for a careful and expert fitting to the bicycles which had been selected according to our requests. During the fittings we were joined by running columnist Gwen Lewis, the photographer from a local newspaper,and the McBrayer's daughter Carol, our official photographer. Jones Counters were carefully installed and when all bicycles were completely adjusted the Team tested them on a ride back to the hotel.

Next on the agenda was a tour of the course in a van rented especially for our stay. We were first shown the calibration course located in front of the George Brown Convention Center adjacent to the start lines, then we drove over the course. Tom shared details of his measurement and explained areas where we would have to follow special instructions. In accord with police requests we agreed to ride in the direction of traffic. This would involve riding one segment separately. We visited that site as well as the dual starts and merge point. The balance of the afternoon was free time and rest in preparation for the 2 AM calibration.

The McBrayers called for us at 5:40 PM for Saturday evening dinner at the XIT in River Oaks Shopping Center. We were joined there by Pete League (Marathon Founder), Pete's wife Lynn, and Carol and Jim McLatchie. We enjoyed good fellowship and tasty meals featuring local specialities. I was especially pleased to meet Pete League. He was the measurer of the Elby's course in Wheeling, West Virginia, validated in 1990 by Mike Wickiser. Pete has since moved from that area back to Houston.

A few hours of rest and it was measurement time. The group assembled at the George Brown Convention Center calibration course where we were met by the support crew which included the police escort, the Course Coordinator, an EMT Team, recorders Pete League and Will Vanderbrink, and Michael Fred with a supply van. (Michael was director of the '91 Bear Creek Loop 50 Mile recently validated by Felix Cichocki). Tom McBrayer and Carol McLatchie joined the bicyclists with Mary Anne McBrayer and I completing the group. Ride order was confirmed as Amy, Elizabeth, Betsy, Carole and Carol with Tom serving as a guide. Radios were mounted on Tom and Amy's bicycles to provide on-course communication and guidance during the rides. Four calibration rides were made with Will and Pete recording on one end and Mary Anne and I on the other. Start time was 2:25 AM with a temperature of 78 degrees F.

We first rode the predetermined segment from the finish point to a reference point at the Shepherd Bridge to accommodate the request we stay with the flow of traffic. The bicycles were then transported back

to the Crawford start line on a truck rigged with racks our hosts designed to transport six bicycles. The course was negotiated from Crawford to the Shepherd Bridge point (approximately 23 miles) with a break at the 15 mile point where we enjoyed the hospitality of the police station. During the measurement, support vehicles blocked intersections and closed lanes to insure a secure ride.

The Crawford (Trials course) course ride was completed when we arrived back at the Shepherd Bridge reference point. During that ride at the section from the merge to the 5K point the riders had been required to use the right lanes rather than the SPR. Although there had been some off-setting the Team members were not comfortable with that portion of the ride. The bicycles were transported back to the 5K point. It was decided to ride from the 5K point back to the LaBranche start line using the SPR from the 5K to the merge and to substitute those figures in the earlier data. This completed the course riding and we returned the bicycles by truck to the George Brown Convention Center and recalibrated The temperature remained at 78 degrees throughout the measurement and riding was completed shortly after 7 AM (approximately 5 hours total measurement time).

Following a short break, we gathered at Pete League's home for a delicious home cooked breakfast, wonderful Texas hospitality and good fellowship. Tom and Mary Anne presented special plaques to the Team members. They are the first items to display the 1992 Women's Trials logo and we felt especially honored to receive them. Next came the serious calculating time. After the first set of potential findings were determined it was obvious a problem existed. Our very consistent data showed the course to be unreasonably overlength. Checks and double checks only served to confirm the calculations. This pointed to an immediate need to remeasure the calibration course. Scheduled departure times did not allow members of the Team to do this and we had to leave the problem with Tom McBrayer for solution. In retrospect we realize we should have accomplished a calibration course check on Saturday afternoon and will certainly do so in any future remeasurement activity. Though it temporarily placed a damper on an otherwise perfect weekend by leaving the question of course length unanswered, we did know it was "at least the marathon distance". Tom's measurement of the calibration course was originally reported to us as 309.93 meters but proved on remeasurement to be 307.857 meters. The data reflecting the revisions is attached. Tom had predicted we would find overage. It is consistent with his own original measurement data.

The completion of this project represents another significant advance in the technical role of women in the sport. In 1988 the Team activity was a first. For the '92 Trials we not only have women doing the work, but this time the riders included two women certifiers both of whom

are very active Final Signatories. Additionally we had a qualified woman athlete joining the ride for a mutual sharing of experiences and roles in the sport. That is a first!

Heartfelt thanks are extended to everyone who made this possible: Team members Amy Morss, Elizabeth Longton, Betsy Hughes, Carole Langenbach and athlete Carol Mc Latchie, our in-town sponsors Tom and Mary Anne McBrayer, The Houston Tenneco Marathon Committee represented by David Hannah (Director) with Pete, Mac, Michael, and Will, the Houston police, the EMT's, Joy Boone, Lynn League, and several others. Last but not least, our grateful thanks to Pete Riegel without whose encouragement and support our goals would not have been realized.

Respectively submitted,

Sally H. Nicoll

Sally H. Nicoll, Team Leader
Validations Chairman, RRTC

Women's Olympic Trials Marathon Measurement Team assembled outside Boone's bicycle shop - l-r: Betsy Hughes, Sally Nicoll, Amy Morss, Tom McBrayer, Elizabeth Longton, Mary Anne McBrayer, Carole Langenbach

WOMEN'S OLYMPIC TRIALS MARATHON MEASUREMENT

HOUSTON, TEXAS - SEPTEMBER 15, 1991

ALL CALCULATIONS USE AVERAGE CONSTANT WITHOUT 1.001

CALIBRATION DATA

CALIBRATION COURSE LENGTH = 307.857 METERS

	ELIZABETH LONGTON		AMY MORSS		BETSY HUGHES		CAROLE LANGENBACH	
PRECAL	78687		70600		37700		23695	
	81583	2896	73695.5	3095.5	40763.5	3063.5	26591	2896
	84478	2895	76792	3096.5	43828	3064.5	29486	2895
	87373.5	2895.5	79888.5	3096.5	46893.5	3065.5	32381.5	2895.5
	90269.5	2896	82985	3096.5	49957.5	3064	35277.5	2896
AVG		2895.625		3096.25		3064.375		2895.625
CTS/KM		9405.746		10057.42		9953.890		9405.746
CTS/M		9.405746		10.05742		9.953890		9.405746
POSTCAL	39870		67320		26400		85790	
	42765	2895	70415	3095	29462.5	3062.5	88684.5	2894.5
	45660	2895	73509	3094	32524.5	3062	91578.5	2894
	48555	2895	76604.5	3095.5	35586.5	3062	94472.5	2894
	51450	2895	79699	3094.5	38650.5	3064	97367	2894.5
AVG		2895		3094.75		3062.625		2894.25
CTS/KM		9403.716		10052.55		9948.206		9401.280
CTS/M		9.403716		10.05255		9.948206		9.401280
DAY'S CONSTANT CTS/M		9.404731		10.05499		9.951048		9.403513

RECORDED MEASUREMENT DATA

	LONGTON		MORSS		HUGHES		LANGENBACH	
	OBSERVED COUNT	INTERVAL COUNT	OBSERVED COUNT	INTERVAL COUNT	OBSERVED COUNT	INTERVAL COUNT	OBSERVED COUNT	INTERVAL COUNT
CR START	44601		44836		8083		90165	
MERGE	79067	34466	81690	36854	44564	36481	124635	34470
5 KM	91698	12631	95199	13509	57936	13372	137248	12613
10 KM	138762	47064	145520	50321	107743	49807	184322	47074
15 KM	185862	47100	195875	50355	157585	49842	231430	47108
20 KM	232923	47061	246196	50321	207403	49818	278499	47069
HMAR	243245	10322	257234	11038	218325	10922	288819	10320
25 KM	280025	36780	296566	39332	257238	38913	325610	36791
30 KM	328072	48047	347933	51367	308086	50848	373664	48054
35 KM	374207	46135	397263	49330	356915	48829	419814	46150
MEM/SHEP	389512	15305	413626	16363	373115	16200	435126	15312
MEM SHEP	144601		144836		108083		90165	
40 KM	112829	31772	110871	33965	74455	33628	58387	31778
FINISH	92180	20649	88800	22071	52600	21855	37735	20652
START LAB	136766		64223		123265		82845	
MERGE	102298	34468	27363	36860	86781	36484	48371	34474
5 KM	89690	12608	13880	13483	73440	13341	35758	12613

CALCULATED INTERVALS

	LONGTON	MORSS	HUGHES	LANGENBACH
	INTERVAL METERS	INTERVAL METERS	INTERVAL METERS	INTERVAL METERS
CR START				
MERGE	3664.8	3665.2	3666.0	3665.7
5 KM	1343.0	1343.5	1343.8	1341.3
10 KM	5004.3	5004.6	5005.2	5006.0
15 KM	5008.1	5008.0	5008.7	5009.6
20 KM	5004.0	5004.6	5006.3	5005.5
HMAR	1097.5	1097.8	1097.6	1097.5
25 KM	3910.8	3911.7	3910.4	3912.5
30 KM	5108.8	5108.6	5109.8	5110.2
35 KM	4905.5	4906.0	4906.9	4907.7
MEM/SHEP	1627.4	1627.4	1628.0	1628.3
MEM SHEP				
40 KM	3378.3	3377.9	3379.3	3379.4
FINISH	2195.6	2195.0	2196.3	2196.2
START LAB				
MERGE	3665.0	3665.8	3666.3	3666.1
5 KM	1340.6	1340.9	1340.7	1341.3

LENGTHS OF 5 KM SPLITS

	LONGTON	MORSS	HUGHES	LANGENBACH	
	INTERVAL METERS	INTERVAL METERS	INTERVAL METERS	INTERVAL METERS	SOSS
WOM START					
5 KM	5007.8	5008.8	5009.8	5007.0	5007.0
10 KM	5004.3	5004.6	5005.2	5006.0	5004.3
15 KM	5008.1	5008.0	5008.7	5009.6	5008.0
20 KM	5004.0	5004.6	5006.3	5005.5	5004.0
25 KM	5008.3	5009.5	5008.0	5009.9	5008.0
30 KM	5108.8	5108.6	5109.8	5110.2	5108.6
35 KM	4905.5	4906.0	4906.9	4907.7	4905.5
40 KM	5005.7	5005.3	5007.3	5007.7	5005.3
FINISH	2195.6	2195.0	2196.3	2196.2	2195.0
TOTAL	42248.1	42250.3	42258.4	42259.8	
MEN START					
5 KM	5005.6	5006.8	5007.0	5007.4	

MEASURED DISTANCES FROM WOMEN'S START

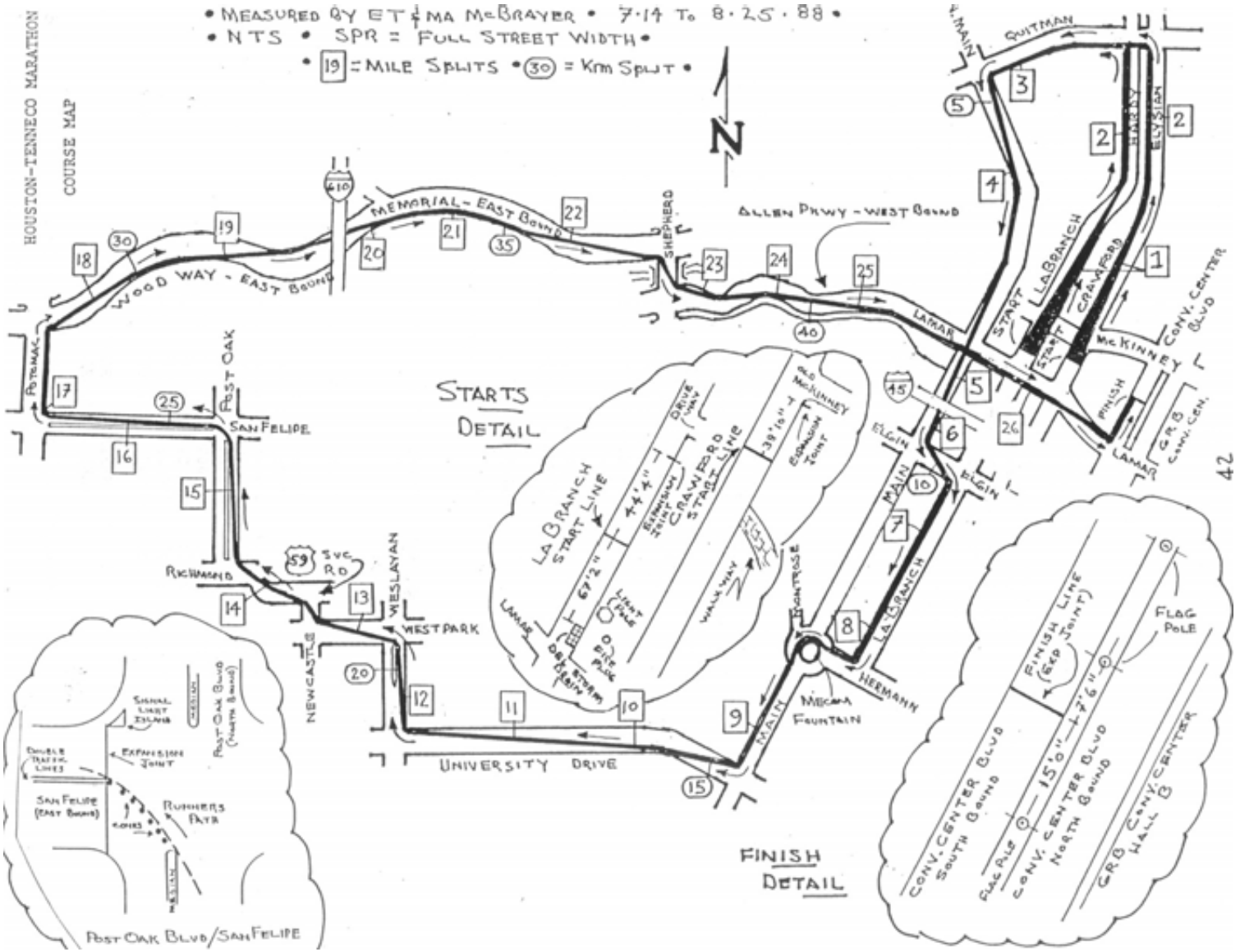
	LONGTON	MORSS	HUGHES	LANGENBACH			
	ELAPSED METERS	ELAPSED METERS	ELAPSED METERS	ELAPSED METERS	SOSS	DESIRED METERS	REQ'D ADJUST
WOM START							
5 KM	5007.8	5008.8	5009.8	5007.0	5007.0	5005.0	-2.0
10 KM	10012.1	10013.3	10015.0	10013.0	10011.2	10010.0	-1.2
15 KM	15020.2	15021.3	15023.7	15022.6	15019.2	15015.0	-4.2
20 KM	20024.2	20025.9	20030.0	20028.0	20023.2	20020.0	-3.2
25 KM	25032.5	25035.3	25038.1	25038.0	25031.2	25025.0	-6.2
30 KM	30141.3	30143.9	30147.9	30148.2	30139.8	30030.0	-109.8
35 KM	35046.8	35049.9	35054.8	35055.9	35045.3	35035.0	-10.3
40 KM	40052.5	40055.2	40062.1	40063.6	40050.6	40040.0	-10.6
FINISH	42248.1	42250.3	42258.4	42259.8	42245.6	42237.2	-8.4

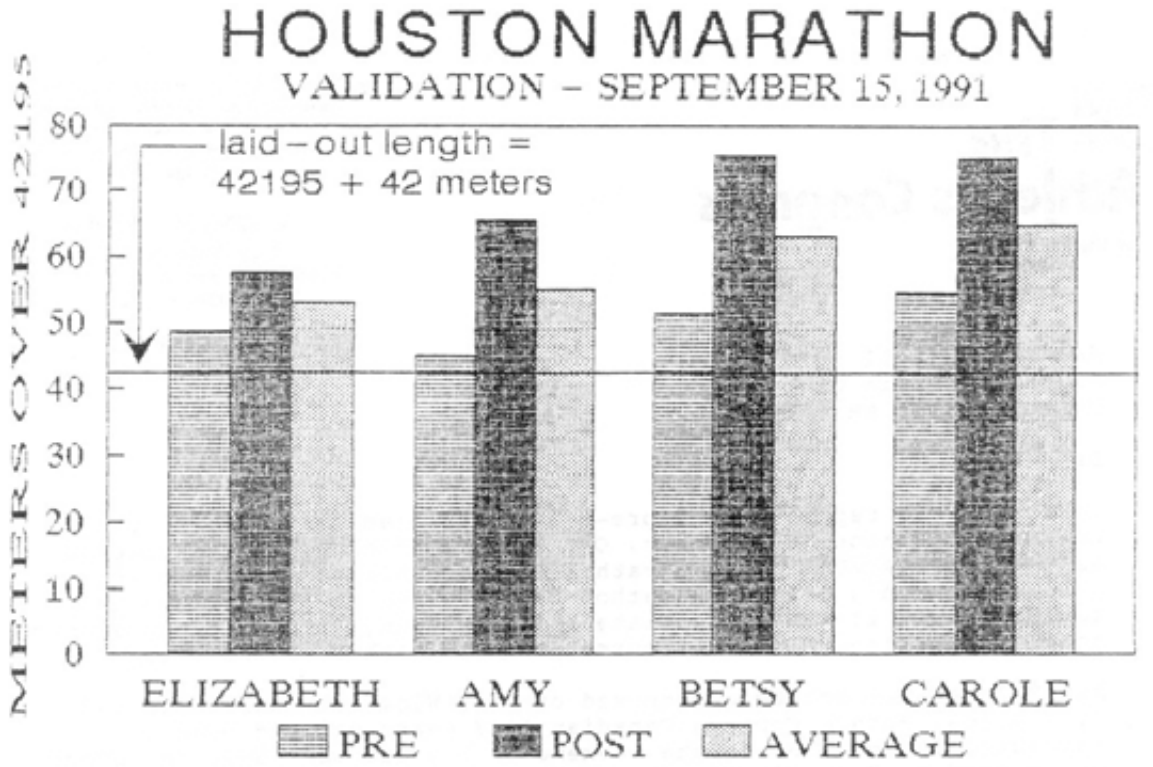
NOTE:

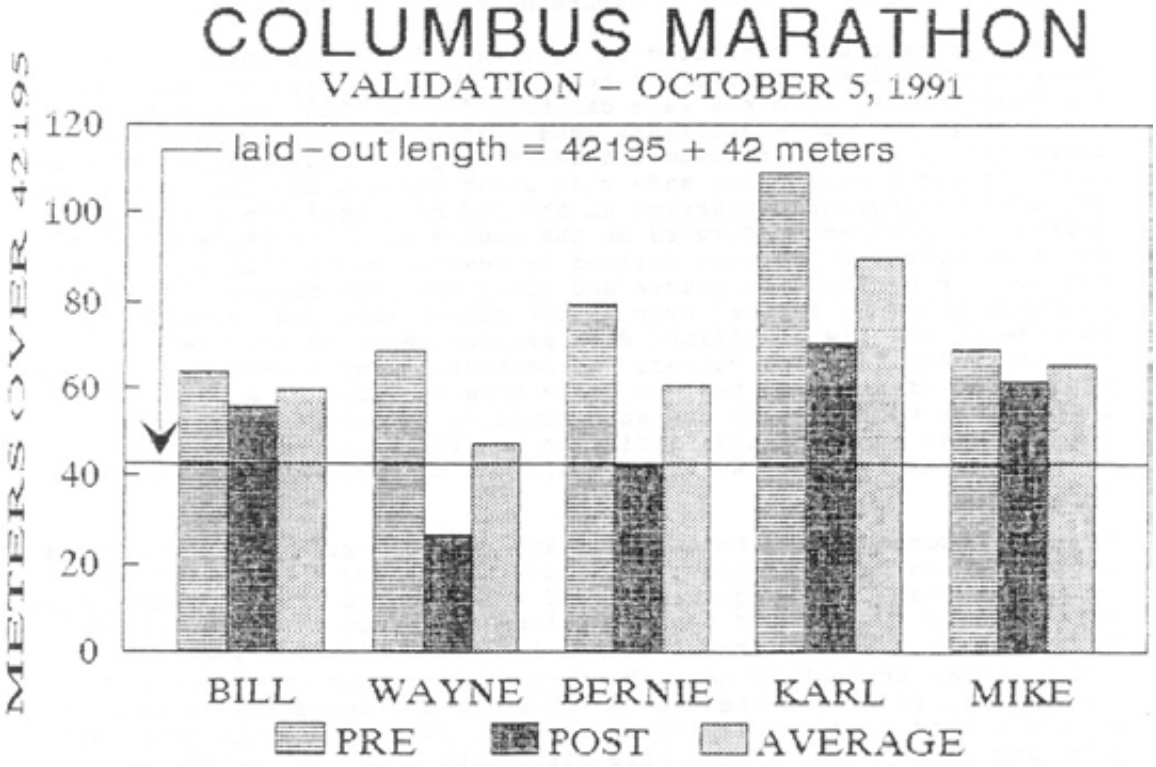
One section of the course between the merge point and the 5K mark was measured twice. After riding this part of the course and while measuring from the Crawford start, the Team was not satisfied they rode the shortest possible route. Late in the measurement when the merge to LaBranche start segment was being measured, the Team started at the 5K point and rode the 5K to merge segment a second time. Three of the riders had lower distances recorded of about 2 meters each. If the lower figures were substituted for the original merge to 5K data, the course length would be about 2 meters shorter in the data of three of the riders.

The data reveals a layout discrepancy in the location of the 30K mark. The point should be located about 100 meters before its recorded point.

Sally H. Nicoll


HOUSTON-TENNECO MARATHON
COURSE MAP
• MEASURED BY ET & MA McBRAYER • 7-14 TO 8-25-88 •
• NTS • SPR = FULL STREET WIDTH •
• 19 = MILE SPLITS • 30 = Km SPLIT •
N
MEMORIAL - EAST BOUND
WOOD WAY - EAST BOUND
ALLEN PKWY - WEST BOUND
SHEPHERD
POST OAK
SAN FELIPE
RICHMOND
SVC RD
WESTPARK
NEWCASTLE
UNIVERSITY DRIVE
MAIN
HERMANN
MECHA FOUNTAIN
LAMAR
ELGIN
QUITMAN
ELYSIAN
LA BRANCH
CRAWFORD
McKINNEY
CONV. CENTER BLVD
GRB CONV. CEN.
FINISH
START
STARTS DETAIL
LA BRANCH START LINE
CRAWFORD START LINE
EXPANSION JOINT
LIGHT POLE
WALK WAY
DRIVE WAY
FINISH LINE (EXP JOINT)
FLAG POLE
CONV. CENTER BLVD SOUTH BOUND
CONV. CENTER BLVD NORTH BOUND
GRB CONV. CENTER HALL G
FINISH DETAIL
POST OAK BLVD/SAN FELIPE
SIGNAL LIGHT ISLAND
DOUBLE TURNING LINES
SAN FELIPE (EAST BOUND)
RUNNERS PATH
POST OAK BLVD (NORTH BOUND)


HOUSTON MARATHON
VALIDATION – SEPTEMBER 15, 1991
METERS OVER 42195
80
70
60
50
40
30
20
10
0
laid–out length =
42195 + 42 meters
ELIZABETH
AMY
BETSY
CAROLE
PRE
POST
AVERAGE


COLUMBUS MARATHON
VALIDATION – OCTOBER 5, 1991
METERS OVER 42195
120
100
80
60
40
20
0
laid–out length = 42195 + 42 meters
BILL
WAYNE
BERNIE
KARL
MIKE
PRE
POST
AVERAGE

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.

WAYNE B. NICOLL
Ragged Mountain Club
Potter Place, New Hampshire 03265
(603) 735-5721

15 October 1991

Sally H. Nicoll
Ragged Mountain Club
Potter Place, NH 03265

Dear Sally,

Attached is a report of the pre-validation team measurement of the Columbus Marathon in Columbus, OH. This marathon has been selected as the 1991 TAC/USA Men's Marathon Championships in November 1991 and as the Men's Olympic Marathon Trials event in April 1992. Thus the RRTC felt it was appropriate and in keeping with past precedents to check the length of the course prior to either of the events.

An RRTC measurement team composed of Mike Wickiser, Karl Ungurean, Bill Grass, Bernie Conway (Canadian IAAF measurer) and myself assembled in Columbus on the weekend of 5-6 October 1991. The event was hosted by Pete Riegel, the course measurer/certifier, and Doug Thurston, the race director. The team was hosted at the Marriot Courtyard Motel in Dublin, a suburb northwest of Columbus.

The measurement was conducted on Saturday, 5 October under threatening skies and moderate temperatures. The team gathered at the Riegel home and bikes were calibrated on a 1000' course starting at the edge of Pete's driveway. Pete planned the measurement so there was no need to transport bikes during the measurement and also allowing for a reasonably safe ride along the course. The course was measured in segments, starting at the 10K mark near the calibration course and proceeding forward on the course to a reference point in downtown Columbus. We were visited by several media representatives both at the calibration course and along the race course. At the downtown point we shifted over to the finish line and proceeded in reverse to the new Ameriflora Park project. We were admitted to the park after signing waivers and restarting our measurement on the other side of a closed project fence gate we were not allowed to ride through. We continued to the same downtown reference point and shifted over to the start, riding to the 10K mark where we had begun the measurement. We recalibrated on the same calibration course.

We were accompanied by Pete Riegel and Doug Thurston who assisted us in keeping on the measured path. About two thirds through the ride we encountered rain, high winds, and a ten degree drop in temperature. We continued in spite of the conditions and gradually dried out and warmed up as we moved into the uphill portion of the course. The route passed through or near the Ohio State campus twice. On the return trip we encountered heavy vehicular and pedestrian traffic as football fans were proceeding to the Ohio State-Wisconsin game. Mike Wickiser experienced a flat tire with about eight kilometers to go and rode both the remaining course distance and the four rides of the calibration course on the flat tire! (REAR TIRE)

Following recalibration we returned to the hotel, cleaned up, and enjoyed a lunch where we calculated the results. That evening Doug Thurston hosted a dinner at the motel where we had a chance to relax and discuss the measurement in detail. Pete produced computer generated results which are included with this report. The group decided to accept the Sum of Shortest Splits as the official distance which was 42236 meters. The following morning we had breakfast together and departed for home.

Deepest thanks go to Pete and Doug for the assistance rendered and hospitality shown during our stay, resulting in a highly successful team measurement. We are also grateful to the team members who sacrificed time, funds and energy to be part of this project.

Sincerely,

Wayne B.Nicoll
Vice Chair East, RRTC

Men's Olympic Trials Marathon Measurement Team assembled in front of the full-size replica of Columbus' ship Santa Maria, now moored in the Scioto River near the finish line - l-r: Wayne Nicoll, Bill Grass, Pete Riegel, Race Director Doug Thurston, Bernie Conway, Mike Wickiser, Karl Ungurean

Prevalidation of Columbus Marathon - US Men's Olympic Marathon Trials

October 5, 1991

Validators: Bill Grass, Wayne Nicoll, Bernie Conway, Karl Ungurean, Mike Wickiser

Calibrations done on Kirkham Road 1000 feet. Calibration course checked out at 999.99 Feet at 56 F. Corrected length = 999.92 feet. However, excess tension was used on tape. Therefore 1000 feet is used in these calculations.

Recorded Calibration Counts

Bill	Wayne	Bernie	Karl	Mike
38800	76000	90000	67000	12400
41636.5	79035	92868	70046	15267
44474	82071	95735	73093	18134
47312	85105	98603	76139	21001
50149	88139	101471	79185	23868
80000	47000	36000	40400	57800
82837	50038	38871	43449	60668.5
85675	53076	41741	46498	63536
88513.5	56113	44611	49547	66403.5
91351	59151	47481	52596	69270

Interval Calibration Counts

	2836.5	3035	2868	3046	2867
	2837.5	3036	2867	3047	2867
	2838	3034	2868	3046	2867
	2837	3034	2868	3046	2867
Avg	2837.25	3034.75	2867.75	3046.25	2867
Ct/km	9308.563	9956.529	9408.629	9994.259	9406.168
	2837	3038	2871	3049	2868.5
	2838	3038	2870	3049	2867.5
	2838.5	3037	2870	3049	2867.5
	2837.5	3038	2870	3049	2866.5
Avg	2837.75	3037.75	2870.25	3049	2867.5
Ct/km	9310.203	9966.371	9416.831	10003.28	9407.808
Av ct/km	9309.383	9961.45	9412.73	9998.77	9406.988

Recorded Counts

	Bill	Wayne	Bernie	Karl	Mike
10k	62500	1000	14000	92400	3600C
15k	109098	50834	61092	142449	83074
20k	155617	100593	108088	192443	130094
hydrant	168041	113880	120644	205796	142652
Finish	74500	21000	27000	12700	4900C
40k	94955	42880	47706	34681	6967E
35k	141549	92729	94841	84778	116791
30k	188131	142571	141955	134842	163883
fence	215243	171595	169363	163970	191281
fence	19900	76000	74000	68800	9590C
hydrant	73709	133533	128405	126656	15027E
Start	74200	34000	29000	27000	5100C
5k	120827	83887	76156	77139	98129
10k	167452	133769	123308	127252	145231

Interval Counts

	Bill	Wayne	Bernie	Karl	Mike
10k					
15k	46598	49834	47092	50049	47074
20k	46519	49759	46996	49994	47020
hydrant	12424	13287	12556	13353	12558
Finish					
40k	20455	21880	20706	21981	20678
35k	46594	49849	47135	50097	47113
30k	46582	49842	47114	50064	47092
fence	27112	29024	27408	29128	27398
fence					
hydrant	53809	57533	54405	57856	54376
Start					
5k	46627	49887	47156	50139	47129
10k	46625	49882	47152	50113	47102

Interval Meters - all distances calculated using average constant without extra 1.001.

	Bill	Wayne	Bernie	Karl	Mike	SOSS
10k						
15k	5005.5	5002.7	5003.0	5005.5	5004.2	5002.7
20K	4997.0	4995.2	4992.8	5000.0	4998.4	4992.8
hydrant	1334.6	1333.8	1333.9	1335.5	1335.0	1333.8
Finish						
40k	2197.2	2196.5	2199.8	2198.4	2198.2	2196.5
35K	5005.1	5004.2	5007.6	5010.3	5008.3	5004.2
30K	5003.8	5003.5	5005.3	5007.0	5006.1	5003.5
fence	2912.3	2913.6	2911.8	2913.2	2912.5	2911.8
fence						
hydrant	5780.1	5775.6	5779.9	5786.3	5780.4	5775.6
Start						
5k	5008.6	5008.0	5009.8	5014.5	5010.0	5008.0
10K	5008.4	5007.5	5009.4	5011.9	5007.1	5007.1
Total	42252.5	42240.5	42253.4	42282.6	42260.1	42236.0

Wickiser accounted for his bike length at fence. Others did not. 2 meters has been added in the 20 to 30 km range, below, which is calculated on the basis of SOSS:

	Interval Meters	Cum Meters	Desired Meters	Adjust Meters
Start		0	0	0.0
5 Km	5008.0	5008.0	5005.0	-3.0
10 Km	5007.1	10015.1	10010.0	-5.1
15 Km	5002.7	15017.8	15015.0	-2.8
20 Km	4992.8	20010.6	20020.0	9.4
30 Km	10023.2	30033.8	30030.0	-3.8
35 Km	5003.5	35037.3	35035.0	-2.3
40 Km	5004.2	40041.5	40040.0	-1.5
Finish	2196.5	42238.0	42237.2	-0.8

1991 Columbus Marathon

Columbus, Ohio

Site of 1992 US Olympic Trials Marathon

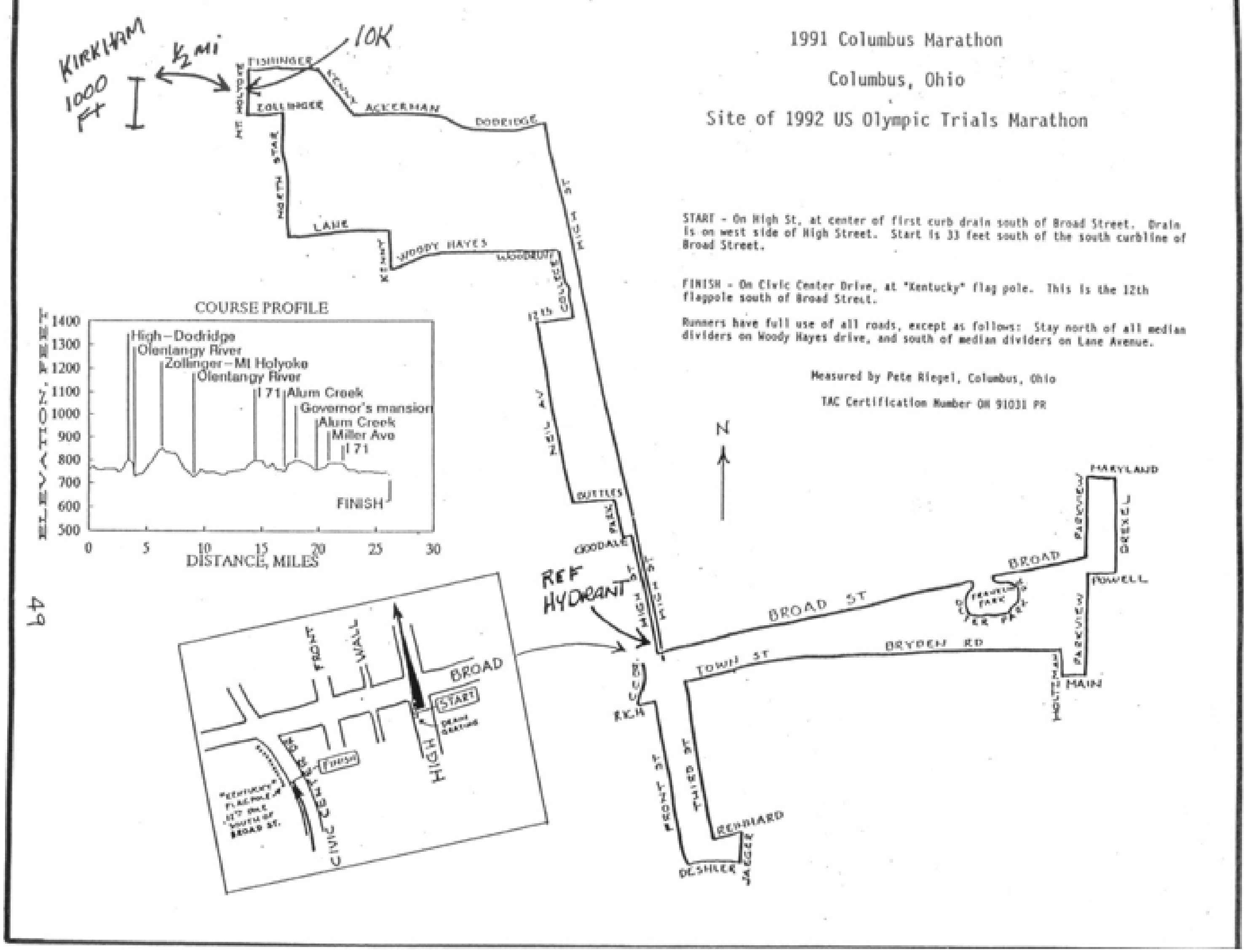
START - On High St, at center of first curb drain south of Broad Street. Drain is on west side of High Street. Start is 33 feet south of the south curbline of Broad Street.

FINISH - On Civic Center Drive, at "Kentucky" flag pole. This is the 12th flagpole south of Broad Street.

Runners have full use of all roads, except as follows: Stay north of all median dividers on Woody Hayes drive, and south of median dividers on Lane Avenue.

Measured by Pete Riegel, Columbus, Ohio

TAC Certification Number OH 91031 PR



BOB BAUMEL'S MEASUREMENT CALCULATION PROGRAM - A USER EVALUATION

Bob sent me a copy of his measurement program, and I stuck the disk in my machine to see how it worked. It has several different programs on it. There's a set of instructions, to tell you how it works. There's a word-processing program too, in case you don't have one. I used this to print the instructions so as to have them before me as I worked. Because I am not very computer-literate, I thought this would help me.

I could have saved this step, because once I started up the measurement program, it told me, step by step, what to do. First it asks you for the name of the course, the measurer(s) and the date of measurement, and you type in the data after each question is asked.

It asks for calibration information. Length of calibration course, and the counts you got. You don't have to think - the program asks you for what it needs to know. This made it easy for me - I have a hard time learning to use new programs.

It asks whether you want to use larger constant or average constant. It asks whether you want the calculation to include the 1.001 short course prevention factor.

The program asks you to list, in order, the names of the places where data was taken. Once this is done, it asks for counts obtained at those points. Once you have given the last bit of information, the program tells you you are done, and tells you the file name where you can retrieve the output for printing. You can also retrieve the data, and can change it and re-run the calculation in case you made a mistake.

You have seen the resulting printouts, and they very nicely organize all the measurement information. I think this program is a valuable tool for those measurers who have computers, and I'm glad to have it.

Try it. You'll like it. Send Bob a disk.

RRTC MEETINGS AT THE TAC CONVENTION

There will be two RRTC meetings at the TAC Convention. Both are open to all who choose to come. They will be held:

1) Wednesday, December 4, 8:30 to 11 PM

2) Thursday, December 5, 8 to 11 PM

At past years' meetings I have discovered that a measurer or certifier I did not know was at the meeting, but hesitated to introduce him/herself. Please introduce yourself this time - I want to meet you.

The rundown

By Wayne Nicoll

Getting Certified

Our TAC expert on freqent concerns

In the masthead of this publication is a list of the people who serve the South as volunteers on the Road Running Technical Committee (RRTC) of TAC/USA. They are the course certifiers who manage the course certification program in each state.

As the Vice Chair East I supervise the road race course certifiers in the eastern U.S. In addition, I personally serve as a certifier for four states – Georgia, Delaware, Massachusetts, and Rhode Island. The road course certificates issued by your certifier cross my desk en route to their inclusion on the national list of certified courses. There is frequent communication among us regarding measurement problems and policies.

Most of us have a few concerns regarding the way some race staffs and measurers function within the program. Here are a few examples and some thoughts on how to alleviate the problems.

The rising expense of course measurement

I have been hearing this a lot lately. The program is designed so that any individual who wants to measure a road race course can do so with minimal cash expenditure. One needs a copy of the TAC Course Measurement Procedures Manual ($4), a Jones Counter ($45), a bike, a steel tape, and a few miscellaneous supplies for recording points and marking the course.

You may be able to borrow many of the items from a local running club or a TAC or RRCA official. The greatest cost to an individual or group doing their own measuring is the expenditure of time. Many race organizers, who do not want to divert their valuable time to measuring, turn to expert measurers who contract to accomplish the measurements and apply for the certificate.

Most figures I hear quoted by measurers and certifiers seem very reasonable to me. When you consider the measurer's expertise, his inventory of proper equipment, and the time and travel involved, most contract measurers are offering a bargain deal. What most clients do not see is the hours spent after the measurement in marking and recording all point locations and preparing the application, data sheets, course map, and other diagrams.

Do not expect a certifier to volunteer to measure for you. The certifier has a big enough job processing applications and guiding measurers through the process. Most of them are expert measurers and some do agree to measure on a volunteer or contract basis, depending on their affiliation with the sponsoring organization and the availability of experienced contract measurers.

Last minute application submissions

The TAC rule requires that applications submissions be postmarked prior to the day of the race. An application postmarked before race day can be processed after race day and if there are no errors in preparation that would indicate a short course, the course can be certified retroactive to race day. Any application mailed on race day or later is rejected.

Many groups planning a race underestimate the time needed to conduct the measurement and submit the paperwork. A late submission puts unnecessary pressure on the certifier to press forward with the review in hopes he can approve the paperwork and issue a certificate and a race identification number prior to race time.

A last-minute submission runs the risk of the certifier not being available to process the paperwork, and thus not able to inform the race director his course was okay on race day.

Planning the measurement should start months ahead of race day so any problems with the application can be resolved long before race time. A lot of measurers lightly scan the manual and charge out onto the course without consulting their certifier. Get to know your certifier. He may be able to save you hours of unnecessary work.

Entry forms with false statements regarding course certification

This is an ever lessening problem but some races are still preparing and releasing entry forms that declare the race course is certified when it has not been measured. Some manage to have it measured and certified by race day but many do not ever get it done.

Serious runners vying for state and national records should ask the race director for a copy of the certificate. If you are still suspicious, call the certifier and ask him if the course is certified.

Misuse of the terms "certify" and "certification"

Many measurers commonly state, "I certified the XYZ Run" when in fact they meant they measured the race course for certification. A measurer measures but only a certifier certifies. Many race staffs also confuse the term "certification" with the process of sanctioning the event. A sanction is an official permission from the issuing body, either TAC/USA or RRCA, to conduct the event.

The continued preparation of long calibration courses

Since the publication of the 1989 revised edition of the measurement manual, we have authorized the measurement and certification of short calibration courses. The course must be a minimum of 300 meters and the distance that is commonly laid is 1,000 feet (304.8 meters). The short calibration course can be tucked on quiet lanes and large parking lots, which makes the calibration process much faster, more convenient, and much safer for the measurer.

Despite our attempts to publicize this significant improvement in measurement procedure, we will see people who are using courses as long as a mile or a kilometer. I recently received an application from a measurer who calibrated on a one-mile course to measure a 5K race course. He rode six miles on the race course (two rides of 3.1 miles) but he rode eight miles on the calibration course!

An Analysis of Runner Performance
at Recent Boston Marathons

Introduction

Several years ago, the Road Race Technical Committee of TAC (The Athletics Congress) — the governing body for track and field competition in the United States — revised rule 185.5 to establish standards for elevation drop in road races. The TAC committee decided to measure only the elevation change between the start and finish of the race. If the elevation drop exceeded 0.1% (1 meter per kilometer) a race was deemed "aided" and, consequently, performances there were ineligible for consideration for national records.

The BAA Boston Marathon has a net drop of a bit over 100 meters between Hopkinton and Boston and, according to rule 185.5, is an "aided" course. Consequently, according to the proponents of the new TAC rule, a runner ought to perform better than an equally proficient runner on an unaided course.

This study examines the results of the last three years of the Boston Marathon (1989-1991) in an effort to see what runners *actually* do, as opposed to what the theory says they should do. Unlike most other marathons, Boston requires that runners qualify by running another marathon in the previous year under a particular time. Although this time does not necessarily reflect the runner's best previous time, it is a conservative estimate (the runners have done at least as well as their qualifying time) and, thus, a comparison of qualifying and finishing time should offer some insight as to whether Boston is indeed aided, as shown by the experiences of the runners who take part in it.

A number of tests were made to extract a useful subset of the data. This study includes only open male and female runners, and eliminates runners with no qualifying time, as well as those whose qualifying time was slower than the qualifying standard. (Runners with qualifying times exactly equal to the qualifying standard were also eliminated to avoid the risk that these were artificial times given to invited runners.)

Unfortunately, Boston does not record whether a runner started the race, so all runners who did not finish were eliminated from the study database. Note that this causes the results to be better (show less difference) than if dropouts were given an artificially slow time.

Specifically, each runner included in the study was under 40, not a wheelchair competitor, qualified with a time of under 3:10 (male) or 3:30 (female), and finished the race.

In addition to the open category, separate measurements were made for elite runners. These were men with qualifying times under 2:20:00 and women with qualifying times were under 2:50:00. These times are very close to the Olympic trial marathon qualifying standard.

Analysis

The following tables show the results of the study for the last three years.

Boston Marathon 1989	Open Male	Elite Male	Open Female	Elite Female
Total	1809	25	474	17
Median	905	13	237	8
Median Time	3:09:32	2:27:49	3:36:35	2:51:53
Median Difference	-11:37	-7:52	-12:46	-2:44
Average Difference	-16:09	-8:48	-12:54	-1:47
Standard Deviation	1:49	8:39	1:49	4:32
2-tailed T-test sig.	0.000	0.000	0.000	0.125
Faster than qualifying	262	1	82	5
Slower than qualifying	1547	24	392	12
% faster than qualifying	14%	4%	17%	29%

Boston Marathon 1990	Open Male	Elite Male	Open Female	Elite Female
Total	2457	30	437	18
Median	1228	15	219	9
Median Time	3:01:42	2:15:25	3:33:12	2:38:44
Median Difference	-12:58	-2:27	-12:10	-4:44
Average Difference	-15:15	-4:11	-14:27	-3:40
Standard Deviation	1:45	8:09	1:23	6:18
2-tailed T-test sig.	0.000	0.009	0.000	0.024
Faster than qualifying	361	9	69	3
Slower than qualifying	2096	21	368	15
% faster than qualifying	15%	30%	16%	17%

One of the "faster than qualifying" elite male runners was Rob deCastella, who ran slower than his Boston course record time of 2:07:51. The table does not include masters runner John Campbell, who set a masters world record 2:11:04 at this race.

Boston Marathon 1991	Open Male	Elite Male	Open Female	Elite Female
Total	2122	26	385	25
Median	1061	13	192	12
Median Time	3:01:18	2:23:27	3:31:07	2:47:49
Median Difference	-3:27	-3:34	-4:54	-2:20
Average Difference	-5:25	-2:51	-6:07	-4:45
Standard Deviation	1:03	4:20	1:10	13:28
2-tailed T-test sig.	0.000	0.003	0.000	0.090
Faster than qualifying	262	1	82	5
Slower than qualifying	1377	20	252	13
% faster than qualifying	35%	23%	35%	48%

One of the "faster than qualifying" elite female runners was Joan Benoit Samuelson, who ran slower than her previous Boston winning time of 2:22:43 and American record of 2:21:21 set at the flat Chicago marathon in 1985.

The median difference is the key value in the above tables. Using the 1989 Open Male runners for illustration, the median runner was 11:37 slower than his qualifying time. I.e., half of the runners were even slower, while half were faster, including 14% whose finishing time was faster than their qualifying time. The percentages of runners finishing faster and slower than their qualifying times is shown graphically in figure 1.

Interpretation

Using qualifying time as an unbiased predictor of runner capability can be criticized in many aspects. "Qualifying time" is not necessarily identical to the runner's best previous marathon. Also, some elite runners did not record qualifying times — and, consequently, were not included in the statistics. Here, it may be noted that two 1991 male runners without qualifying times finished under 2:20:00 and the study did not include John Campbell's world record Masters performance in 1990. One advantage of using qualifying time instead of "best previous marathon" is that it a *recent* result (from the previous year), and hence better represents the runner's current capability.

By not including dropouts, the median performance is better (faster) than it would be if dropouts were given an artificially slow time (or the runners were forced to complete the race no matter what). This is especially important in understanding the performance of the elite field as those runners may realize they were not competitive on this particular day and decide to drop out rather than risk injury. On the other hand, the "pack" may consider Boston as their goal and choose to finish, even though they do not better their qualifying time.

Even given possible errors in the data, it does not seem likely that the actual performance of runners at the Boston Marathon indicates that they experience it as "aided" or make effective use of any theoretical aid it might offer.

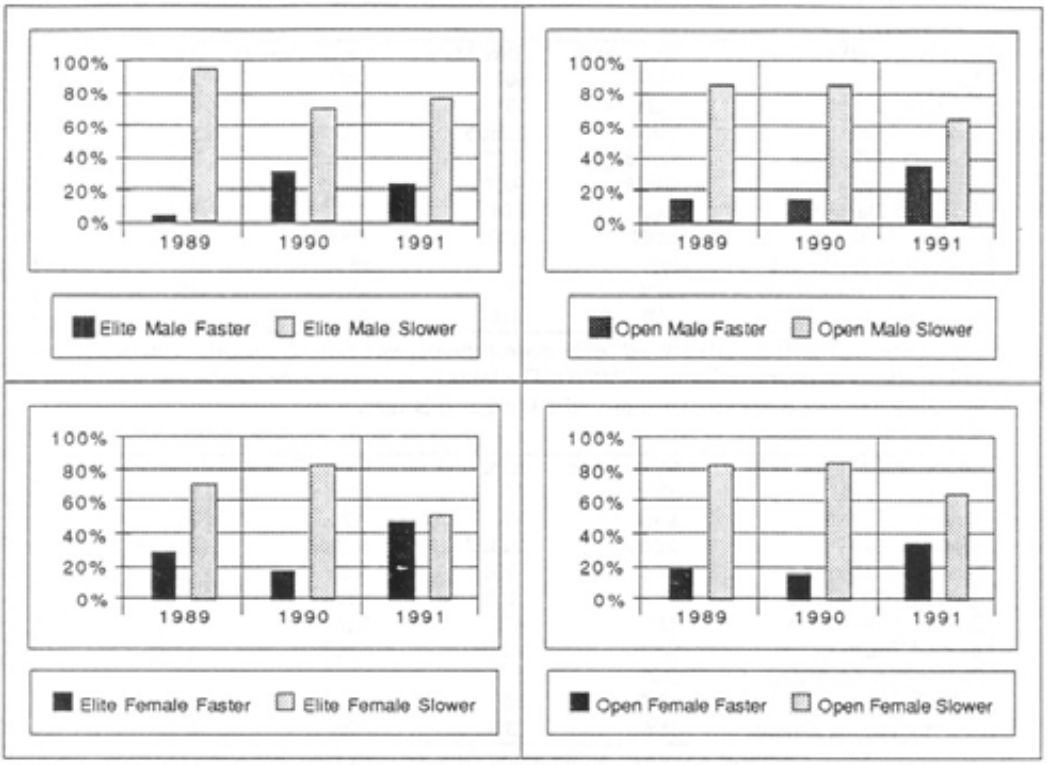


Figure1. Finishing time difference percentages

The TAC Argument

The "theory" behind the decision to eliminate records at Boston, as expressed in numerous articles in Measurement News and TAC Times, claims that runners ought to be able to improve on their best performances by 90 seconds at Boston, because of its downhill character:

> Boston may be a tough course, but it is an aided course because the 146 meter (over 400 foot) drop gives runners "a considerable advantage over standard courses, in terms of aid to the runner." [Pete Riegel, letter to TAC, 1-Feb-1990].
>
> "A person running a 2:10:00 marathon on a flat course can expect to run one minute and 32 seconds faster on the Boston course." [Alan Jones memo, undated.]
>
> "A 2:08:00 marathoner could ... expect to run 1 min 34 secs. faster than on a flat course." [TAC Times, April 1990, p. 11].
>
> "The effective length of the Boston Marathon course is about 500 meters short of the marathon distance." [Bob Baumel, Measurement News, March 1991]
>
> "Put Boston next to any standard course on any given day and its downhill alone will result in faster times." [Riegel, quoted in TacTimes/Minnesota, October 1990]
>
> "Runners achieve their best times by 90 seconds when they run Boston, as compared to running anywhere else." [Alan Jones, from TAC National Convention minutes, 28-Nov-1990, Measurement News, January, 1991]

The TAC Strategy

The TAC argument is predicated on the runner using a particular, non-obvious, strategy:

> In order to take advantage of the Boston course, the runner must use an "optimal pacing strategy" by "slow[ing] down on uphills and speed[ing] up on the downhills." [Baumel].

> Runners do not slow down enough on the uphills or speed up enough on the downhills to take full advantage of this theory and, consequently, run an uneven energy consumption race that "inevitably hurts performance." [Baumel]
>
> "The runner must attack the course hard. He ought to be almost a minute ahead of even pace by the time he hits five miles. This requires running that many runners consider suicidal ... The runner must back off on the hills or be destroyed, just as he must hit the hills hard or lose his chance." [Riegel, letter to Guy Morse, 16-Feb-1990].

The TAC theory is primarily based on interpretation by Baumel, Riegel, and Jones of a study of treadmill running published in 1963 (Margaria, Cerretelli, Aghemo, and Sassi, Energy Cost of Running, *J. Appl. Physiol* 18 (1963) 367-370). Baumel, Riegel, and Jones have published their theories in several articles in Measurement News (a newsletter published by the Road Race Technical Committee).

The Margaria study measured the energy consumption of two Olympic middle-distance runners who ran for 10 to 15 minutes at varying slopes and speeds. It did not attempt to measure the effects, if any, of hill running on longer distances (10 to 15 minutes corresponds to a maximum race length of roughly three to five kilometers).

There is, for example, no measurement in Margaria's study that would account for an observation made by elite marathoner Benji Durden that "the problem in marathons is not so much energy expenditure as loss of elasticity of the muscles." [TAC 1990 National Convention minutes.] If the effort of running to — and through — the Newton hills causes the athlete's muscles to tighten up, this may cause the stride to shorten which, in turn, will cause the same energy expenditure to result in less forward motion. I.e., the optimal pace after the hills may be slower than the optimal pace before the hills.

Attempting the TAC Strategy

By following the TAC strategy (assuming it is correct), a runner capable of equalling Densimo's world record of 2:06:50 (set on the flat Rotterdam course) should be able to run 2:05:20 (90 seconds better) at Boston. This would lower the course record by 2:30 and vindicate the TAC strategy. However, the TAC strategy is a self-fulfilling prophecy: if a runner fails to lower the course record, either the runner used the wrong strategy, or the runner lacked the ability to run a world best time on a flat course.

When the Boston Marathon was run in 1990, a number of runners appear to have attempted the TAC "attack the course hard" strategy. The first mile was run in 4:26, thirteen seconds under the course record for the first mile and almost identical to Pete Riegel's prediction for a 2:08:00 marathon (letter to Guy Morse, Feb 16, 1990). At 15 Km, the lead runners were 1:53 under the course record split at that distance (they were also about two minutes under Riegel's prediction). However, the runners who set that pace could not sustain it after the long descent to Newton Lower Falls, and the climb over Rt 128. The eventual winner ran a traditional race strategy passing the early leaders on the Heartbreak hills.

Seemingly aware of the problem of a fast first half, the lead pack ran the first half of the 1991 race at a surprisingly slow pace, so slow that the race winner ran the second half of the race in a course-record time that was faster than the first half. It should be noted that several runners were in the lead pack in both races. Having tried it, the TAC strategy no longer appears to be acceptable to the Boston elite runners. It isn't clear whether it may apply to the women's field: in 1991, almost half of the women's elite field improved on their qualifying times in an extremely competitive race.

Acknowledgement

The preparation of this study was made possible by access to the Boston Marathon results database with the permission of the Boston Athletic Association. The author is a volunteer in the pressroom of the Boston Marathon where he aids with statistical calculations during and after the marathon, but is not employed by, or otherwise connected to, the Boston Athletic Association.

THE ATHLETICS CONGRESS
OF THE USA

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October 28, 1991

Martin Minow - 160 Waverly St - Arlington, MA 02174

Dear Martin,

Looking at your data for the last three years shows me that roughly 20 to 30 percent of the Boston runners better their qualifying time. I wondered how it might apply to me, so I asked myself "how often is your first marathon of the year faster than your best for the previous year?" This seemed to me to mimic somewhat the Boston qualifying procedure, since most runners will report their year's best as the qualifier.

Over the years I've beaten my previous year's best about 30 percent of the time. I wonder how others do? A sample of one is hardly definitive of anything, but it reinforces my view that your study is inconclusive as regards whether Boston aid or lack of same exists, even for the ordinary runners, let alone the top ones. Given some variability between marathons, one wonders whether a 1.5 minute advantage on a given course would show up very clearly. Remember that the rough 1.5 minute Boston advantage represents only a 1 percent difference from a standard course. The difference is pretty difficult to spot statistically.

The fact that Margaria used a 15 minute test time period does not mean much. The purpose was to run the subjects until steady-state data conditions were reached, then record the data. This is routinely done in many disciplines. Automotive miles per gallon figures do not require that an entire gallon be burned. All that's needed is to take the data under steady state conditions.

A record-time long run is almost always done at close to steady state conditions. If data to contradict this exists, it's unknown to me.

Regarding the TAC strategy, I don't agree that it's non-obvious. It simply says what's been known for a very long time - the most effective way to run fast is to spend yourself at the maximum uniform rate you can tolerate, and collapse at the finish, but not before. Any variation from uniform effort will reduce performance.

This may not be the most effective way to race, but it is the best way to run a fast time. Pack psychology destroys a lot of potential fast times, because the guys spend too much time dawdling, eyeballing one another, checking each other out, expecting to go for it later - running the pack's race rather than their own.

This may not be an optimum strategy for a record, but it often wins the race, and that's the primary goal, after all. Records come second to victory.

I look forward to readers' comments on your work.

Best regards,

Pete

ANNUAL REPORT -- VICE-CHAIRMAN WEST

It's been a relatively stable year in the West, as every state has the same certifier at year's end as it had at the beginning. There has, however, been one appointment, as Karl Ungurean was promoted to Final Signatory for Nebraska.

Much of my time was, once again, taken up by the contentious Rule 185.5. This time, I was a member of the special committee formed at last year's Convention to look for a compromise solution to the controversy. For more details, see my (blatantly political) essay on the "Tampa Compromise" elsewhere in this issue of MN. Hopefully, this compromise will result in a peaceful settlement, so that next year I'll be able to step back from the politics and return to the more normal technical functions of RRTC.

During the past year, I did conduct a few other projects, as indicated by articles I wrote for MN. As most of you know, one subject I consider inseparable from measurement (in just about any context) is use of the SI metric system--the simpler, superior language of measurement which is now standard just about everywhere on Earth except the United States. Unfortunately, Americans who want to measure metrically often have trouble obtaining suitable measuring tools. For race course measurement, the problem is to get long metric steel tapes. This year, I did some research on availability of metric steel tapes in the US, and wrote it up in the July 91 issue of MN. That article ought to help any US measurer who is so inclined to obtain such a device.

Another area I worked on this year was my computer program that helps measurers and certifiers check their course measurement calculations. I originally wrote this program (for the Apple Macintosh) in 1987. It became available to many more computer users in 1989 when Alan Jones adapted it to run on PCs as well as Macs. This year, particularly with help from Tom Knight, I made a few more changes to the program. And I wrote an article about it in the Sept 91 issue of MN. Since that article appeared, many more measurers have sent me requests for the program.

Bob Baumel

COURSE REGISTRAR'S ANNUAL REPORT.....Joan Riegel

Requests for information increased this year: 112 certificates were mailed; 22 course list disks; 37 individual state lists. With interest in qualifying for the Olympic Trials in mind, athletes have requested information regarding the certification status of marathons they plan to run. I field these questions from the Columbus Marathon office, as well as at home.

The course list is most up to date immediately after each issue of Measurement News. I hope certifiers will double check each state list periodically, deleting obsolete courses and noting other changes. I'll do my best to keep each state list current.

Joan

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.

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Annual Report - Vice Chairman East, RRTC

The following is a report on the activities of the Vice Chairman, East, Road Running Technical Committee, TAC/USA for the year 1991.

My close relationship to the Validations Chairman resulted in my appointment as validator for several road running and walking events. The Chubb Life 5K, New Haven 20K, the TAC/USA Mens 15K Racewalk Championship course in Portland, OR, the 1990 Rocket City Marathon in Huntsville, AL, (including a pre-validation of the 1991 course), the Lake Gertie 5K in Deland, FL, the Quinnipiac 5K Racewalk course in Hamden, CT. The Freihofers Run for Women 5K courses in Albany and Syracuse, NY were also prevalidated. Also, several races, which I had validated in the past, were currently validated based on videotapes and affidavits from course managers. The trip to Huntsville, AL to check the Rocket City Marathon was an especially rewarding trip since I was able to meet and work with John DeHaye, the AL certifier, whom I had appointed but had never met, despite the fact that I lived in neighboring Georgia for several years. On the trip to Portland, OR I was hosted by the OR certifier, Lee Barrett, who proved to be as good a host as he is a measurer and certifier.

Along with the Validations Chair, Sally Nicoll, we attended as officials the Red Lobster 10K, the Freihofer events (the Syracuse event was the 1991 TAC/USA Womens 5K Championships), and the Crescent City Classic 10K in New Orleans. At the New Orleans event I was given an opportunity to experiment with mounted streamers along the race course to determine if wind effects could be reliably evaluated. At the Red Lobster event I served as a member of the Jury of Appeals in investigating a protest by a wheelchair competitor that a fellow competitor's chair was illegally equipped. From the investigation I gained valuable information and insight into the rules and procedures in wheelchair racing.

Upon completion of apprenticeship as state reviewers, Elizabeth Longton (TN) and Bob Harrison (MS) were appointed as Final Signatories. Both of them have demonstrated they will be excellent certifiers in their respective states.

I continued to serve as a certifier for several states - GA, DE, MA, And RI. Recently I assumed temporarily the certifier duties for Maine during the one year absence of Greg Nelson.

Measurement clinics were conducted in Memphis, TN, Dedham, MA, and two towns in Vermont. The Memphis clinic produced several new measurers in western TN and has resulted in a sharp rise in the certified courses managed by the Memphis Runners.

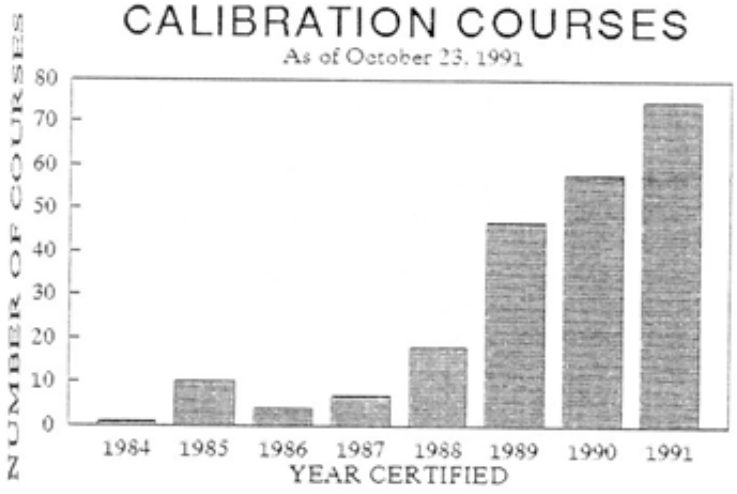
While attending the 1991 RRCA Convention Pete Riegel and I conducted a prevalidation measurement of the Hospital Hill Half Marathon. On 5-6 October I served as team leader for the pre-validation of the Columbus Marathon, which will be the 1991 TAC/USA Mens Marathon Championships (Nov '91) and the 1992 Mens Olympic Marathon Trials (Apr '92). The team included Bill Grass (WI), Mike Wickiser (IN), Karl Ungurean (NE), and Bernie Conway (Canada). The measurement was conducted on 5 October 1991 and resulted in an official distance of 42236 meters.

Goals for 1992 include the search for new certifier candidates for several Eastern states, increased education of race staffs of the importance of insuring their courses are records eligible, the education of measurers, certifiers,and racewalk directors of the proper guidelines in the design of racewalk courses, and the training of measurers in the New York City area.

My deepest thanks to all of the measurers, certifiers, and others associated with the RRTC who have contributed to the smooth operation of the course measurement and certification program.

Respectfully submitted,

Wayne B. Nicoll
Vice Chair East, RRTC



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.

SALLY H. NICOLL
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October 21, 1991

ANNUAL REPORT
Validations Chairman, RRTC

The table presented below reflects: (a) the course validation activity as of October 3, 1991, (b) 1990 validations completed after the 1990 report was prepared and (c) assignments currently in progress.

DISTANCE	ID#	NAME	MEASURER	VALIDATOR	DATE	LENGTH
2500	OR90002LB	TAC Race Wk	L. Barrett	W. Nicoll	9/8/91	2509.0885m
5K	CA86068PR	Carlsbad	J. Collias	W. Nicoll	8/17/91	*
5K	CT91015DR	Quinnipiac	Guido Bros	W. Nicoll	10/11/91	5015.457m
5K	FL89028BH	Edison Fest	L. Allshouse	D. Loeffler	4/8/91	*
5K	FL88005BH	Nat'l Masters	J. Boyle	W. Nicoll	9/19/91	5007.328m
5K	NH86001BT	Chubb Life	B. Teschek	W. Nicoll	4/9/91	5008.1988m
5K	NY90002WN	Freihofers Syr	D. Oja	W. Nicoll	9/29/91	5005.0776m
5K	NY83004TC	Onondaga Pk	N. White	W. Nicoll	8/25/87	5007.1m
8K	CA91002TK	Fifty Plus	D. Carpenter	T. Knight	8/19/91	8000.18m
8K	DC90001JS	Nike Women's	J. Sissala	B. Thurston	5/12/91	*
8K	IL90002JW	Shamrock Shuffle	C. Hinde	J. Wight	6/2/90	8015.18+m
8K	NY91032AM	Freihofers Open	W. Nicoll	A.Morss	9/29/91	8022.7735m
8K	OR87004LB	Spring Classic	L. Barrett	T. Knight	*	
10K	CA88047CW	Mulberry Grape Esc.	C. Wisser	F. Cichocki	9/28/91	10,006.67m
10K	FL90004WN	Red Lobster	W. Nicoll	D. Loeffler	*	
12K	WA86010TD	Bloomsday	M. Renner	B. Baumel	*	
15K	MN90012RR	MN Masters	J. Moran	M. Wickiser	7/28/91	15.017987K
10Mi	DC85007RT	Cherry Blossom	R. Thurston	W. Nicoll	*	
20K	CT86001WN	New Haven	A. Morss	W. Nicoll	8/4/91	20.0155035K
25K	MN90015RR	City of Lakes	R. Recker	M. Wickiser	7/27/91	25.044878K
Mar	AL90021JD	WZYP Rocket Cty	J. DeHaye	W. Nicoll	8/24/91	26.24832+Mi
Mar	AL91019JD	'91 Rocket City	J. DeHaye	W. Nicoll	8/24/91	26.25673Mi
Mar	MN90017RR	Twin Cities	R. Recker	M. Wickiser	7/26/91	42.233428K
Mar	OH91031PR	Columbus	P. Riegel	Men's Team	10/5/91	**42236.0m
Mar	TX88024ETM	Houston Tenneco	ET McBrayer	Wm's Team	9/15/91	**42245.6m
50Mi	TX91006ETM	Houston Ultra	T. McBrayer	F. Cichocki	4/27/91	50.132Mi

* indicates a previous validation applies to current year based on evidence submitted.

** indicates length determined by SOSS.

Currently assigned, not completed:

5K	MO91025BG	St. Louis Wms Race Wk	D. Sebben	B. Glaus
5K	CA87016CW	Foundation	C. Wisser	T. Knight
5K	IL89046JW	Chicago Walkers	J. Knoedel	J. Wight
10K	CA88047CW	Mulberry Grape Escape	C. Wisser	F. Cichocki
10K	IL 91033JW	Nat'l Masters Race Wk	J. Knoedel	J. Wight
20K	IL91034JW	Nat'l Masters Race Wk	J. Knoedel	J. Wight
30K	CA87015CW	Foundation	C. Wisser	T. Knight
40K	NJ86005GD	Ft. Monmouth Race Wk	D. Johnson	W. Nicoll
40K	NJ91020DB	Ft. Monmouth Race Wk	D. Johnson	W. Nicoll

Sally H. Nicoll

Sally H. Nicoll, Validations Chairman

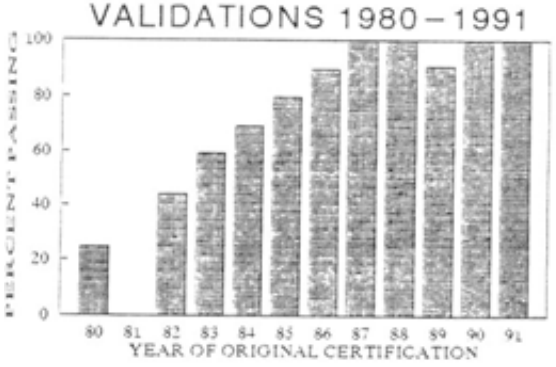
ANNUAL SUMMARY OF VALIDATIONS

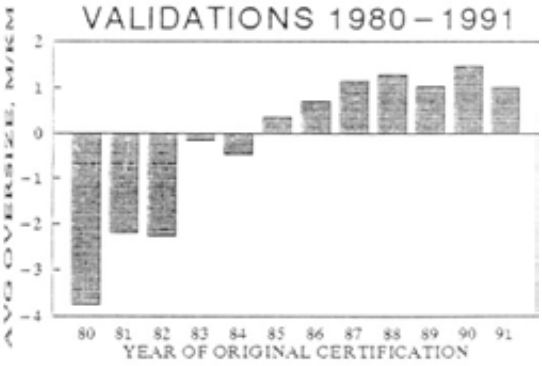
Validations continue to show the basic soundness of our present measurement method. The Short Course Prevention Factor (SCPF) was instituted in late 1982. Because we knew it would take a while for the word to get around, runs on slightly short courses were accepted as records until January, 1985. Since then no shortness has been accepted.

Rule 185 places the burden of proof on TAC to show that the course is short, if it is. We presently interpret this as meaning that an allowance for measurement error of 0.5 m/km (5 meters in 10 km) exists. Courses that fall between 9995 and 10,000 are considered to pass the test, but fall into what we call the "gray area."

Year	80	81	82	83	84	85	86	87	88	89	90	91
	Results of Validation Measurements, m/km											
Avg	-3.75	-2.19	-2.26	-0.14	-0.46	0.36	0.69	1.15	1.27	1.01	1.46	0.99
Low	-8.25	-3.51	-8.75	-7.70	-9.25	-5.93	-5.56	0.16	0.31	-1.03	0.01	-0.44
High	1.00	-0.40	1.00	6.33	1.68	5.58	2.55	3.78	1.89	4.09	3.64	2.65
StdDev	3.82	1.02	3.11	3.09	2.58	2.29	1.39	1.07	0.53	1.28	0.94	1.05
Number	4	6	16	22	29	29	29	16	8	11	14	5
Pass	1	0	1	13	20	22	25	16	8	9	14	4
Fail	3	6	9	9	9	6	3	0	0	1	0	0
Gray	0	0	6	0	0	1	1	0	0	1	0	1*
Pass+Gray	1	0	7	13	20	23	26	16	8	10	14	5
Pct Pass	25	0	44	59	69	79	90	100	100	91	100	100

* This "gray" happened on a pre-race validation, thus no question of post-run shortness was raised.





STEEL VS FIBERGLASS TAPES

While I was teaching a group of Malaysian measurers in September, the question of steel vs fiberglass tapes was raised. Fiberglass tapes are certainly more rugged than steel. They will take abuse, such as being run over by cars, while a steel tape may kink or break. They wondered why fiberglass was unacceptable.

I explained that fiberglass tapes were not as accurate, and that they stretched more than steel tapes did, making precision difficult.

At the end of the seminar we had some idle time, so we went to a balcony in the classroom building and stretched a steel tape and a fiberglass tape side by side over a 25 meter interval. Each was held down while varying tensions were applied. Below you can see a copy of the tape used to record the results. The fiberglass tape at 5 pounds tension showed the same length as the steel tape at 10 pounds tension. However, over the range from 0 to 10 pounds, the steel tape stretched 1 mm, while the fiberglass tape stretched 10 mm, ten times the stretch of the steel tape.

Using one's judgment on the tension of a steel tape thus will produce little error, but with fiberglass it's doubtful if most people can get it right.

US Government specifications for fiberglass tapes, used by almost all manufacturers, are far more lenient for fiberglass than for steel. Thus fiberglass tapes aren't used for highly accurate work.