February 19, 1985

TO: Ken & Jennifer Young, NRDC
Bill Noel, New York Road Runners Club
David Katz

SUBJECT: 1981 & 1982 - 1983 New York City Marathon Validations

Here is the material from the validation measurements performed on the weekend of December 8,9 1984. First I wish to thank both David Katz and Bill Noel for their hospitality.

I'm not sure I understand why we found such large differences between our recent measurements and the original measurements done for certification. One thing is for sure however; we are all now measuring our courses better these day's, and our measurements are agreeing within 0.05% .At any rate we measured the shortest possible route trying to come within 0.30 meter from the inside edge on turns. The original certification paperwork mentions measuring 5 feet from the roadway's edge but cutting close to the apex of turns. Also one should note, Attachment A to the 1982 NYC Marathon Notes mentioned the course being 136 yards short of 26 yards long; 110 yards (100.58 meters) + 26 yards = 136 yards. If we take my estimated difference between measuring 1 meter & 0.30 meter out from the edge on turns of 45.31 meters we get: 100.58 meters + 45.31 meters = 145.89 meters; This is close to my measured value of 148.27 meters; hmm!
I measured a 1982,1981 difference of 89.5 meters (97.8 yards).
The NYRRC claims a measurement for 1982 of 22 yards long.
I measured the 1982 course at 58.79 meters (64.29 yards) short.
With the correction of 45.95 meters (50.25 yards) for the 1 meter, 0.30 meter on turns difference, I would have gotten 14.04 yards short. The difference between this and 22 yards long is 36.04 yards or 0.078% of the marathon distance (reasonably close).

At any rate, I would expect a good measurement of each marathon course (using the same shortest possible route & 0.30 meters from inside edge of turns) to differ from my measured value by no more than 0.05% or approximately 21 meters.

Summary of Results Enclosed: (Using Standard Day's Constant Method)

	As Measured (0.30 Meters) (inside edge) (of turns)		Estimated (1.0 Meters) (inside edge) (of turns)	
	Knight	Katz	Knight	Katz
1981 NYC Marathon (Meters Short)	148.3	152.4	103.0	107.1
1982 NYC Marathon (Meters Short)	58.8	-----	12.8	-----

Sincerely yours,
Tom Knight
Tom Knight

Certificate

Validation Check (Blue Start Only)

NAME OF THE COURSE 1981 NEW YORK CITY MARATHON ADVERTISED DISTANCE: 42,195 Meters

LOCATION: (state) NEW YORK (city) NEW YORK (park) _____

TYPE OF COURSE: [loop (no.), pt/pt, out/back, key hole] Pt/Pt

TYPE OF SURFACE: paved 99.9† % dirt ____ % gravel ____ % grass 0.1 % †Includes Bridge Metal Grating sections

TYPE OF COURSE: road race ☒ cross country ☐ calibration ☐ track ☐

TYPE OF TERRAIN: flat ☒ slightly rolling ☒ hilly ☐ total climb _____

Mostly Flat with exception of some tough bridge sections

STRAIGHT LINE DISTANCE BETWEEN THE START AND FINISH ≈24,000 Meters + (Approximate?) (optional)

ALTITUDE:

		START	HIGHEST	LOWEST	FINISH
(meters/feet above sea level)	Feet	100	282	10	85
	Meters	30	86	3	26

MEASURED BY: (name, address & phone) Tom Knight 307 Dartmouth Ave San Carlos, CA 94070 (415) 594-9406 // Also P.O. BOX 620460 Woodside, CA 94062

MEASURING METHOD: bike ☒ walking wheel ☐ steel tape ☐ electronic meter (EDM) ☐

NUMBER OF MEASUREMENTS OF THE ENTIRE COURSE: 1 by Tom Knight [David Katz also but not included here]

DATE (S) WHEN COURSE WAS MEASURED: 12/8/84 & 12/9/84 RACE DATE (if applicable) 10/ /81

DATE WHEN COURSE PAPERWORK, SENT FOR EVALUATION, WAS POSTMARKED: _____

~~STATED~~ MEASURED DISTANCE OF THE COURSE (including .1% safety factor) 42,046.7 Meters *

DIFFERENCE BETWEEN THE TWO BEST MEASUREMENTS OF THE FINAL ADJUSTED COURSE: _____

* Turns Measured to within 0.30 Meters of inside edges (curbs) NATIONAL REGISTRATION CODE: _____

42,046.7 Meters = 42,195 Meters − 148.3 Meters = 42,195 Meters [1 − 0.35%]

BE IT OFFICALLY NOTED THAT

Δ Estimated 1 Meter from inside edges (curbs) on turns: 42,092.0 Meters = 42,195 Meters − 103.0 Meters

The course described above and defined by the attached map is hereby Nationally Certified as reasonably accurate in measurement according to the standards adopted by TAC/RRTC subcommittee on Certification (Ted Corbitt - Chairman). It will also be so recognized by the Road Runners Club of America. A copy of this certificate and map should accompany your Race Results mailed to the National Running Data Center (NRDC) P.O. Box 42888 Tucson, AZ. 85733. In the event a National Open Record is set on this course, a Validation Remeasurement will be required. Such a remeasurement must show the course to be at least the advertised race distance in order for the record to be accepted.

= 42,195 Meters × [1 − 0.24%]

RACE DIRECTORS PLEASE NOTE: If this course is changed in any way from the above Certified Route, it invalidates this Certification. The course must then be Recertified using the current National Standards.

AS NATIONALLY CERTIFIED BY:

Tom Knight. January 16, 1985

DATE: 1/16/85

-- Member: TAC/RRTC National Certification Committee

As Authorized by Ted Corbitt, National Chairman

Δ ≈ 3,709° Turns for ΔR = 0.7 Meters [1.0 Meter − 0.3 Meters]; ∴ Δ Distance = $2\pi\left(\frac{3709^\circ}{360^\circ}\right)(0.7) = 45.31$ Meters

Validation Check

APPLICATION FOR CERTIFICATION OF ACCURACY

Name of course: 1981 NEW YORK CITY MARATHON Date: 1/16/85

Location (place, city, state): NEW YORK CITY, NEW YORK

Measuring method used: Bicycle? Walking wheel? Steel tape? Electronic meter?

Describe the measuring device (make, model, dimensions, etc.):
JONES COUNTER (415)594-9406 (415)854-3300X2065 P.O. Box 620460 Woodside, CA 9406.

Who was responsible for measuring the course? Name: TOM KNIGHT Address: 307 Dartmouth Ave, San Carlos, CA 9407

Who will be responsible for locating the start/finish points, marking the course, measuring future changes and reporting them to the National Standards Committee:

Name: Address:

DESCRIPTION OF THE COURSE Mostly flat except for 2 hills on Verrazano Narrows & Queensboro Bridges

1. Is the course flat? rolling? hilly? mountainous? uphill? downhill?
   Elevation (feet above sea level): START____ Highest____ Lowest____ FINISH____
2. How much of the course is paved? 99.9%† grass? 0.1% dirt?____
   †Includes Bridge Metal Grating sections
3. Straight-line distance between the START and FINISH: ≈24,000 Meters
4. Describe exactly where the START, FINISH, TURNAROUND, and MILE/KM points are located with reference to unique permanent landmarks (e.g. 17 yds N of 934 Beach St. mailbox):
   START: (Blue) 163'9" S.E. of Post GG16 on the Bridge Plaza.
   FINISH: 12'3" N. of Lamp ole W 6702
5. Submit a complete, detailed map of the course with names of all streets/trails, showing all dirt/grass stretches, and including a north arrow. Indicate which side/half of each road was measured, and how all turns were taken. Use additional sketches or writeups to clearly communicate the running/measured route.

COMPARISONS WITH A KNOWN STANDARD DISTANCE. Certification requires two comparisons of each measuring device with a known standard distance. If steel tape is used, the standard must have been created with utmost accuracy by other survey instruments. If a wheel is used, the standard must have been created via steel tape or electronic meter, and must be at least 880 yards long on a straight, flat, paved surface.

6. Describe the known standard distance:
   Name: Central Park 2,000 Foot Calibration Course
   Location:____
   Length: 2,000.00 Feet [609.600 Meters]
   How measured: Steel Tape by David Katz (Lead) & Tom Knight (Tail) 12/8/84
   Certified?____

If the known standard distance is not certified, apply now by answering all appropriate questions on another APPLICATION FOR CERTIFICATION OF ACCURACY for the known standard distance.

All by Tom Kn.

7. Describe how each measuring device was compared with the known standard distance. List the date, time, and raw data for each comparison: S≡Start 2≡2,000' H≡Old 1/2 Mile

Calibration: 12/8/84 2:30PM Watch: 44.1°F Tape: 40°F
5 893,000 >5695.5 ①
2 898,695.5 >5696 ②
5 904,391.5 >5696 ③
2 910,087.5
H 911,913.5
2 913,741 >~~5697.5~~ stopped so ignore
5 919,438.5 >5696.5 ④
2 925,135
[①+②+③+④]/4 = 5,696

Recalibration: 12/8/84 5:38-5:45PM Watch: 41°F Tape: 41.5°F Bldg: 39°F
5 167,000 >5698 ⑤
2 172,698 >5698 ⑥
5 178,396 >5697 ⑦
2 184,093
H 185,920.5
2 187,746.5 >5699 ⑧
5 193,445.5
[⑤+⑥+⑦+⑧]/4 = 5,698

Calibration: 12/9/84 7:35-7:50A Watch: 42 Tape: 39°
5 228,000 >5697
2 233,697 >5697
5 239,394 >5697
2 245,091 >5697
5 250,788
5,697

Recalibration: 12/9/84 12:00N 12:17P Watch: 53 Tape: 50+
5 529,000 >5694.5
2 534,694.5 >5695.5
5 540,390 >5695.5
2 546,085.5 >5695.5
5 551,781
5,695

8. If steel tape or walking wheel was compared, what is the average correction factor?

9. If a bicycle was compared, what is the average digits/mile for all of the comparisons for each person for each day:

Date: 12/8/84 Name: Tom Knight Average digits/mile: 15,040.08 = 5,697/2,000 Feet

Date: 12/9/84 Name: Tom Knight Average digits/mile: 15,037.77 = 5,696.125/2,000 Feet

COURSE MEASUREMENTS. Certification requires two measurements. If a bicycle is used, the known standard distance and the race course must both be ridden during the same day by the same person for each measurement. (comparisons from a previous day are not acceptable).

10. Was the measuring route identical to the shortest route that can be permitted to be run by the winner of the race? 12 Inches Curbed [redacted]

11. Were all left/right turns measured to within [redacted] of the inside edge of all turns? If not, explain. YES 0.30 Meters Δ

12. If part of the race course is on dirt or grass, how were these stretches measured? YES ~ 0.1% Measured with the bicycle

14. If steel tape was used, answer the following questions:

a. How many people were in the survey party? List their specific duties:

b. How was the tape tension maintained during measuring?

c. How was the tape increments count maintained?

d. How were the curves measured?

15. If a bicycle was used, answer the following questions:

a. Was the bicycle ridden over the known standard distance and over the race course both during the same day by the same person for each measuring occasion? YES

b. Was the known standard distance compared before and after measuring the race course? If not, explain. YES

16. List the date, time, and raw data for each measurement of the course: All by Tom Knight

12/8/84 3:00-5:00 PM Bad Traffic; Many Stops

167,793
- 979,000 Old 15 Mile Mark [4 Yds. W. of #48 Yellow Box]
- 097,154 Stoplight Pole N.W. Corner 5th Ave. & 102nd
- 1141,731 Beginning of Grass Portion
- 1146,793 Men's Finish Marathon

12/9/84 9:25-11:40 AM

225,119
- 256,000 Start: 163' 9" S.E. of Post + GG16 Steel Taped
- 374,257 Nub at Atlantic
- 376,857 Right Turn at Lafayette
- 395,128 1st X walk line at Bedford
- 436,590 X walk Manhatten
- 481,119 old 15 Mile Mark [4 Yds. W. of #48 Yellow Box]

17. Describe any adjustments (calculations, measurements) made to create an exact length:
Δ Estimate for 1 Meter from inside edge of turns: ≈ 3709° of Turn = ∠
$\Delta R = (1 - .3) = .7$ Meter; $2\pi\left(\frac{\angle}{360^\circ}\right)\Delta R = 2\pi\left(\frac{3709}{360}\right)(.7) = 45.31$ Meters

18. What is the [redacted] length of the final course? 42,046.73 Meters = 42,195 Meters − 148.27 Meters

19. What is the difference between all of the measurements?

COURSE DISTANCE: (AS MEASURED)

$$= \frac{167{,}793 \text{ Counts}}{(5{,}697 \text{ Counts}/609.600 \text{ Meters})} + \frac{225{,}119 \text{ Counts}}{(5{,}696.125 \text{ Counts}/609.600 \text{ Meters})}$$

$$= 17{,}954.47 \text{ Meters} + 24{,}092.26 \text{ Meters}$$

$$= [11 \text{ Miles} + 275.25 \text{ Yards}] + [15 \text{ Miles} - 52.38 \text{ Yards}]$$

$$= 42{,}046.73 \text{ Meters} = 26 \text{ Miles} + 222.87 \text{ Yards}$$

$$= 42{,}195 \text{ Meters} - 148.27 \text{ Meters} = 26 \text{ Miles} + 385 \text{ Yards} - 162.13 \text{ Yards}$$

Angles of Turn for 1981
New York City Marathon
[Approximations from Maps and Course Measurement]

1	180°	$= \underline{180^\circ}$	
23	78° ↕ 106°	$= \underline{2{,}086^\circ}$	$\{78^\circ, 85^\circ, 88^\circ, 94^\circ, 105^\circ, 106^\circ, 17 \times 90^\circ\}$
6	41° ↕ 48°	$= \underline{266^\circ}$	$\{41^\circ, 43^\circ, 44^\circ, 45^\circ, 45^\circ, 48^\circ\}$
10	50° ↕ 70°	$= \underline{622^\circ}$	$\{50^\circ, 54^\circ, 55^\circ, 60^\circ, 63^\circ, 63^\circ, 67^\circ, 70^\circ, 70^\circ, 70^\circ\}$
14	20° ↕ 40°	$= \underline{434^\circ}$	$\{20^\circ, 24^\circ, 25^\circ, 27^\circ, 30^\circ, 30^\circ, 31^\circ, 32^\circ, 33^\circ, 33^\circ, 36^\circ, 36^\circ, 37^\circ, 40^\circ\}$
10	Less than 20°	$= \underline{121^\circ}$	$\{05^\circ, 06^\circ, 09^\circ, 12^\circ, 13^\circ, 14^\circ, 15^\circ, 15^\circ, 15^\circ, 17^\circ\}$

Total = $3{,}709^\circ$ Approximate total Angles of Turn 1981 New York City Marathon

Note: 1982 Course

$30^\circ \rightarrow 55^\circ \quad +25^\circ$
$85^\circ \rightarrow 112^\circ \quad +27^\circ$
$\} +\underline{52^\circ}$ Gain

$\therefore$ 1982 Course = $3{,}709^\circ + 52^\circ$

1982 Course = $3{,}761^\circ$ Approximate Angles of Turn 1982 New York City Marathon

1981 New York City Marathon

Error Corrections to Measured Distance:

(1) 92nd Street (Barricade Doesn't Appear on B1 or B2 Videotape)	−2.9	Meters	
(2) 44th Drive (Runners Possibly Forced to Right of Median)	+0.96	Meters	
(3) Use of 2,000 Foot Calibration Course (Short Baseline)	+4.08	Meters	*
(4) Stopping in Route Due to Traffic Etc. (During Measurement)	−3.36	Meters	**
(5) Measurement on Grass (~0.1% of Course)	+0.54	Meters	†
(6) Measurement to East of Tree Stump (Knight only)	−0.9⁻	Meters	††
(7) Small Crowd Impediment During Race Minus Small Traffic Impediment During Measurement	≅ 0.0	Meters	
TOTAL (1) → (7) [Negligible and Approximate]	−1.58	Meters	

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* $\left[\left(\frac{\text{Course Distance (Feet)}}{2{,}000 \text{ Feet}}\right)_{\text{Integer Above}} - 1\right] \text{Wobble} \cong \left[\left(\frac{137{,}949'}{3{,}000'}\right)_{\text{Int. Above}} - 1\right](.06 \text{ Meters}) = 68(.06 \text{ Meters}) = \underline{4.08 \text{ Meters}}$

** [# Stops Extra] Wobble ≅ (56)(.06 Meters) ≅ 3.36 Meters

† Letson Factor $\left[\frac{1{,}000}{987.3} - 1\right][42.0457] \cong \underline{0.54 \text{ Meters}}$

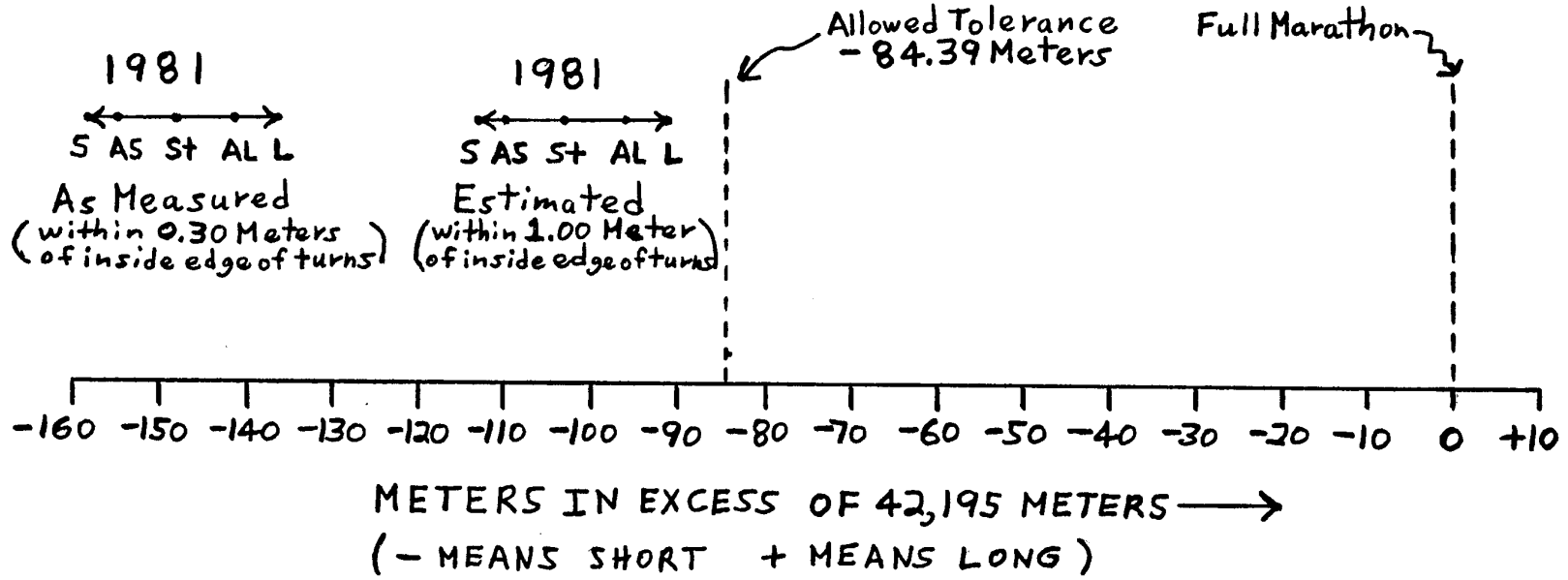
†† Videotape showed Runners Could Go West of Tree (Rough Approximation ~−0.9⁻ Meters)

1981 NEW YORK CITY MARATHON

as measured by
Tom Knight
12/8/84 & 12/9/84

METERS IN EXCESS OF 42,195 METERS
(− MEANS SHORT + MEANS LONG)

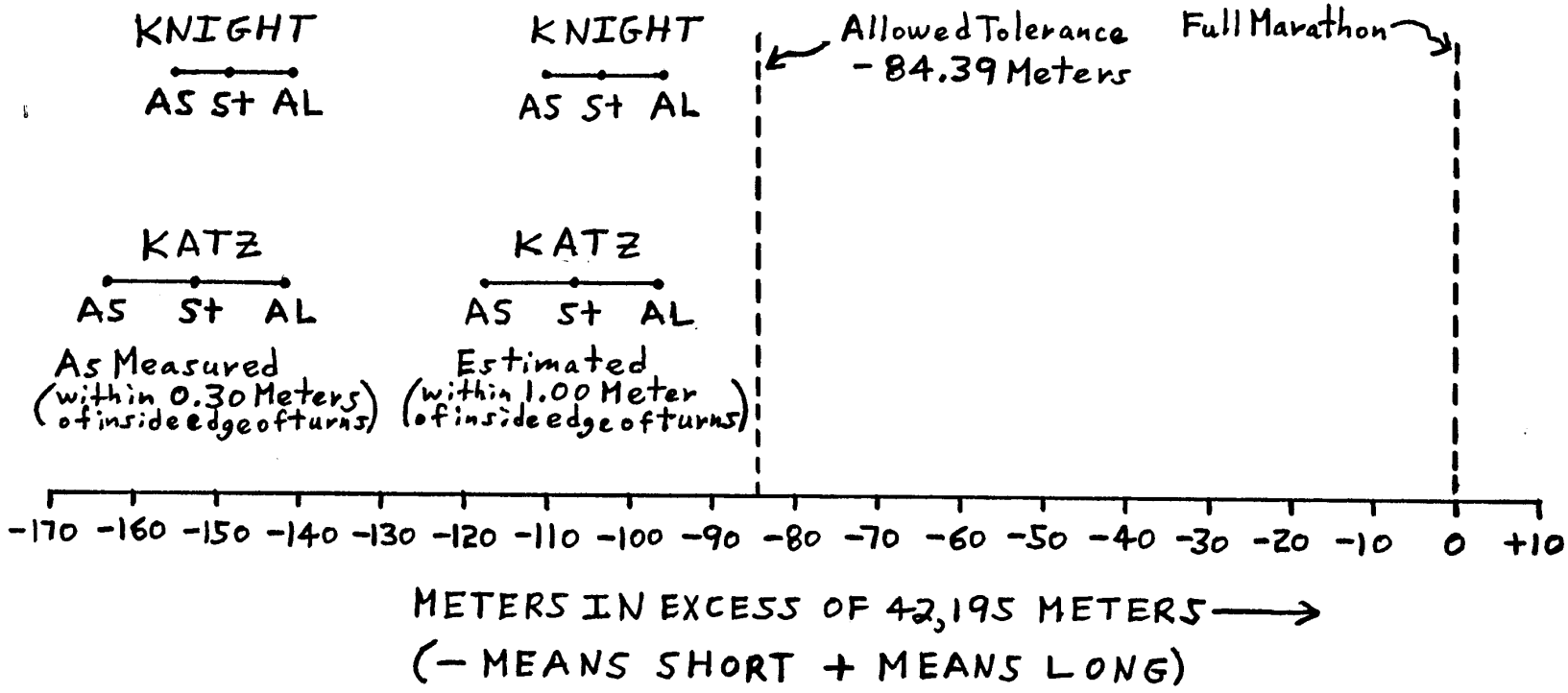
	As Measured (within 0.30 Meters of inside edge of turns)	Estimated (within 1.00 Meter of inside edge of turns)	
S	−158.3	−113.0	S ≡ Using Largest Individual Calibration # for Each Day
AS	−155.1	−109.8	AS ≡ Using Larger Adjacent Calibration or Recalibration
St	−148.3	−103.0	St ≡ Using Days' Constants (Average of Cal. + Recal.)
AL	−141.4	−96.1	AL ≡ Using Smaller Adjacent Calibration or Recalibration
L	−136.7	−91.4	L ≡ Using Smallest Individual Calibration # for Each Day

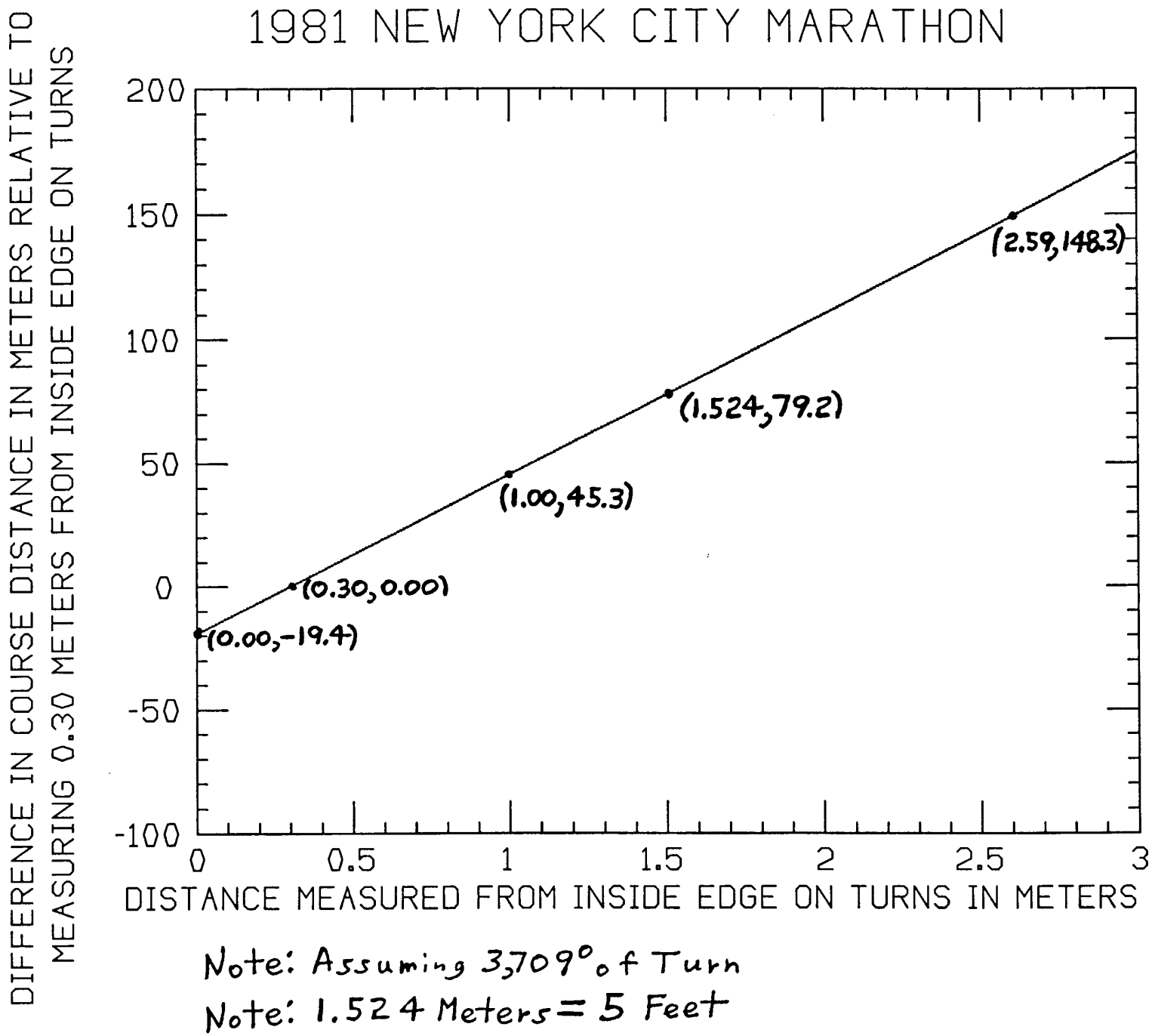


METERS IN EXCESS OF 42,195 METERS (− MEANS SHORT + MEANS LONG)

	As Measured (within 0.30 Meters of inside edge of turns)			Estimated (within 1.00 Meter of inside edge of turns)		
	KNIGHT	KATZ	KNIGHT MINUS KATZ	KNIGHT	KATZ	
AS	−155.1	−162.7	+7.6	−109.8	−117.4	AS ≡ Using Larger Adjacent Calibration or Recalibration
S+	−148.3	−152.4	+4.1	−103.0	−107.1	S+ ≡ Using Days' Constants (Average of Cal + Recal)
AL	−141.4	−142.1	+0.7	−96.1	−96.8	AL ≡ Using Smaller Adjacent Calibration or Recalibration

1981 NEW YORK CITY MARATHON as measured by
Tom Knight & David Katz
12/8/84 & 12/9/84





Note: Assuming 3,709° of Turn

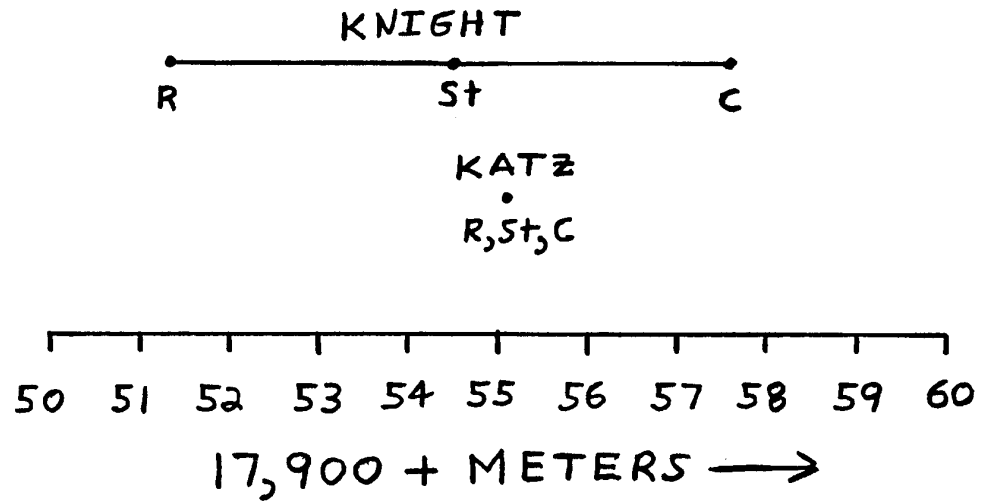
Note: 1.524 Meters = 5 Feet

1981 NEW YORK CITY MARATHON
[old 15 Mile Mark to Finish]
as measured by Tom Knight & David Katz 12/8/84

As Measured (within 0.30 Meters of inside edge of turns)*

*Note: ~2,393° Turns from old 15 Mile Mark to Finish
°° ~29.24 Meters (32.0 Yards)
0.30 Meter → 1.00 Meter from edge difference

	(METERS)		(MILES & YARDS)	
	KNIGHT	KATZ	KNIGHT	KATZ
Calibration C	17,957.6	17,955.1	11 MILES + 278.7 YARDS	11 MILES + 275.9 YARDS
Recalibration R	17,951.3	17,955.1	11 MILES + 271.8 YARDS	11 MILES + 275.9 YARDS
Day's Constant St	17,954.5	17,955.1	11 MILES + 275.2 YARDS	11 MILES + 275.9 YARDS



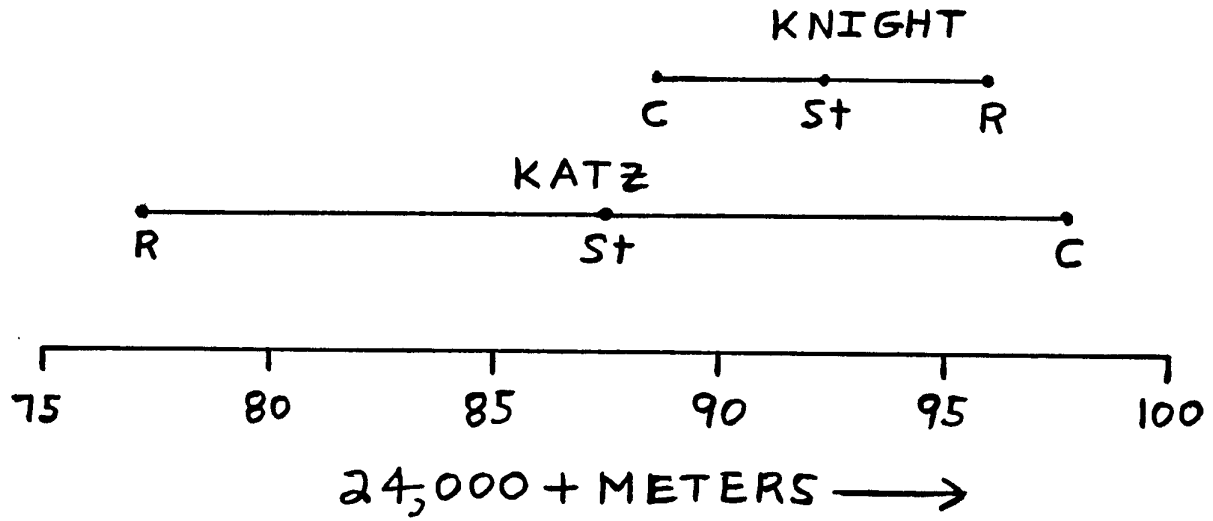
1981 NEW YORK CITY MARATHON

[start to old 15 Mile Mark]
as measured by Tom Knight & David Katz 12/9/84

As Measured
(within 0.30 Meters
of inside edge of turns)*

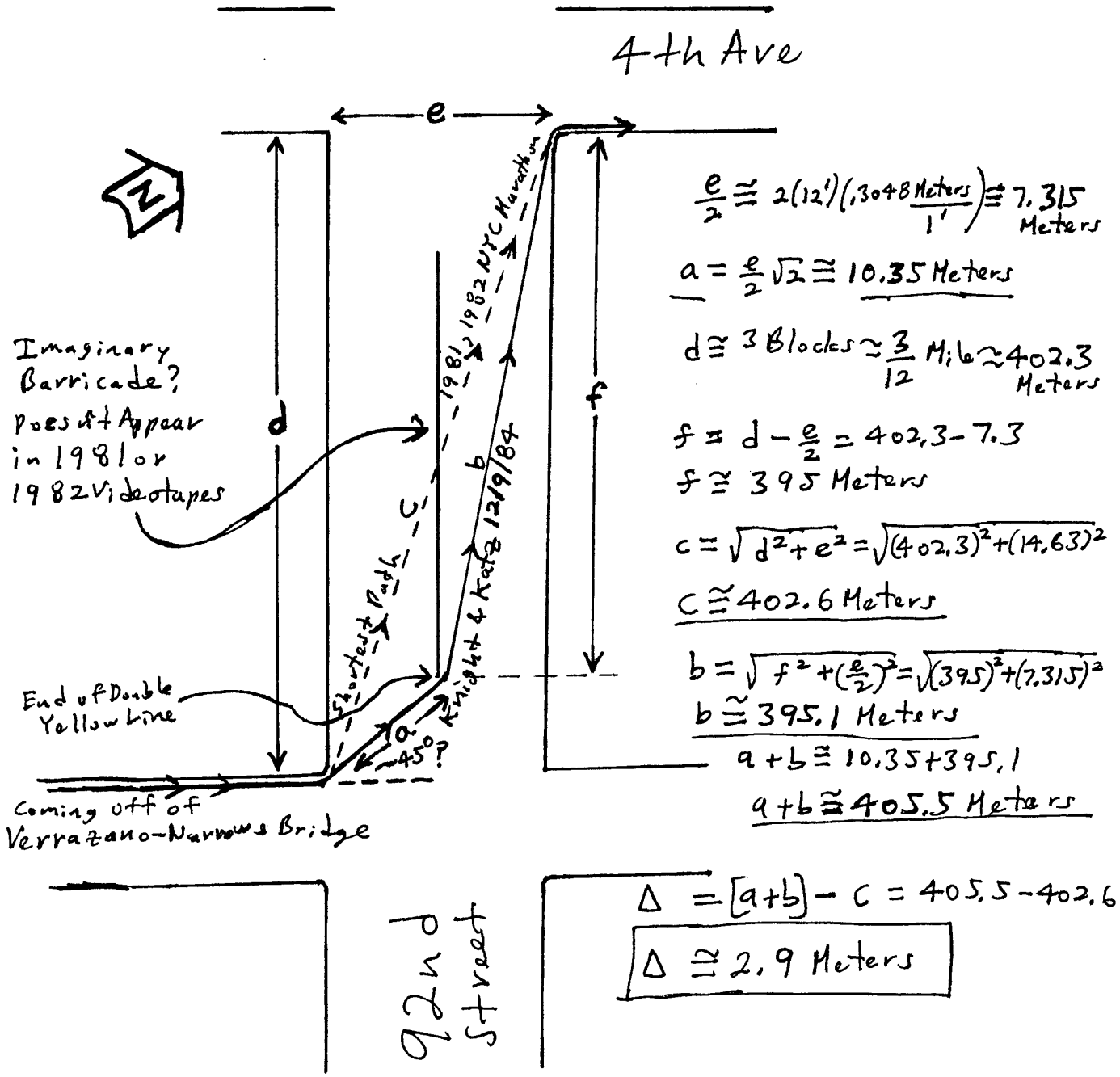
*Note: ~1316° Turns from start to old 15 Mile Mark
∴ ~16.08 Meters (17.6 Yards)
0.30 Meter → 1.00 Meter from edge difference

	(METERS)		(MILES & YARDS)	
	KNIGHT	KATZ	KNIGHT	KATZ
Calibration C	24,088.6	24,097.8	15 MILES - 56.4 YARDS	15 MILES - 46.3 YARDS
Recalibration R	24,096.0	24,077.2	15 MILES - 48.3 YARDS	15 MILES - 68.8 YARDS
Day's Constant St	24,092.3	24,087.5	15 MILES - 52.4 YARDS	15 MILES - 57.6 YARDS



Calculation of 92nd Street Correction

(Only Approximation is Possible)



$\frac{e}{2} \cong 2(12')\left(.3048 \frac{\text{Meters}}{1'}\right) \cong 7.315$ Meters

$a = \frac{e}{2}\sqrt{2} \cong 10.35$ Meters

$d \cong 3$ Blocks $\simeq \frac{3}{12}$ Mile $\simeq 402.3$ Meters

$f \cong d - \frac{e}{2} = 402.3 - 7.3$

$f \cong 395$ Meters

$c = \sqrt{d^2 + e^2} = \sqrt{(402.3)^2 + (14.63)^2}$

$c \cong 402.6$ Meters

$b = \sqrt{f^2 + \left(\frac{e}{2}\right)^2} = \sqrt{(395)^2 + (7.315)^2}$

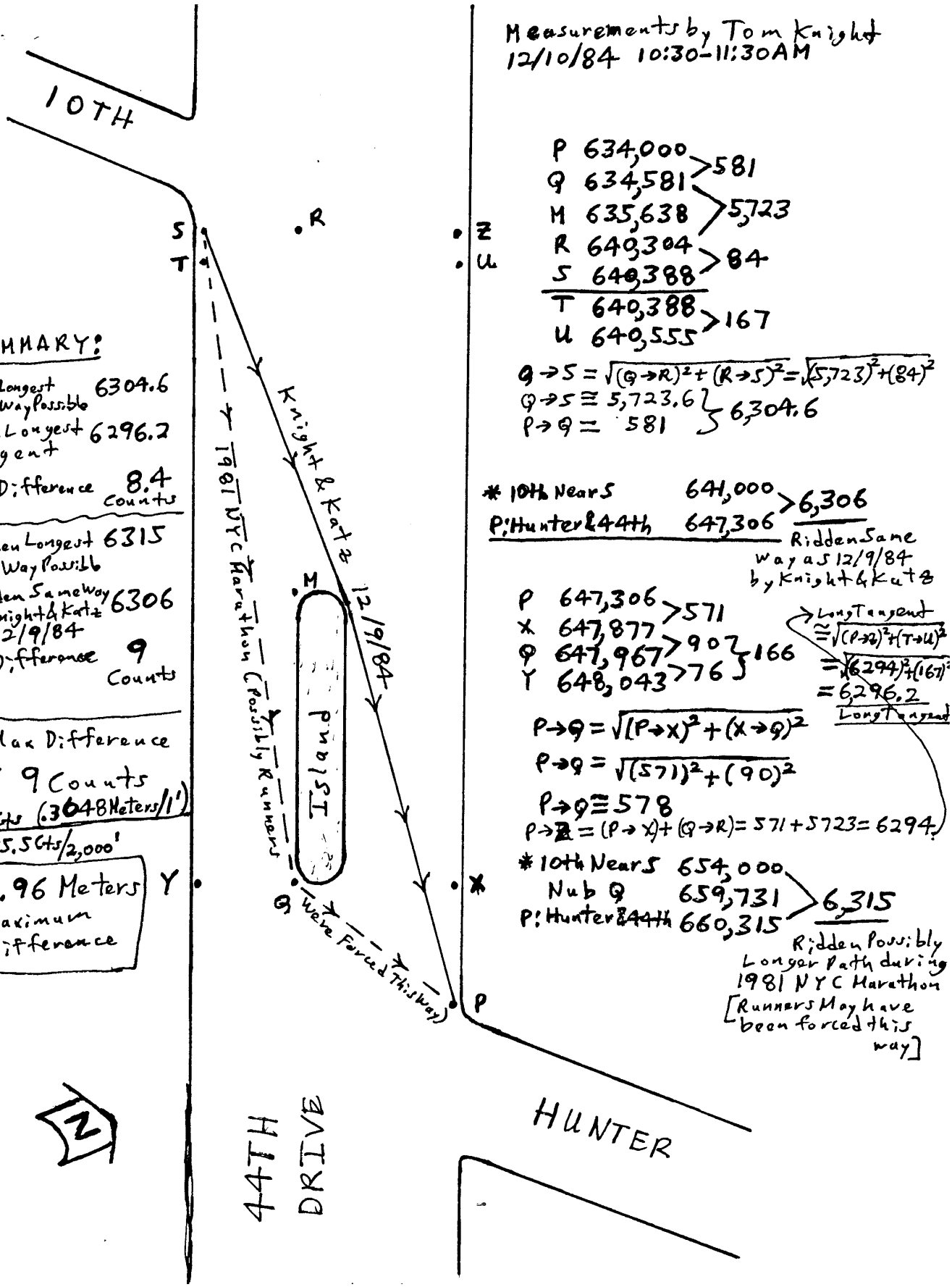
$b \cong 395.1$ Meters

$a + b \cong 10.35 + 395.1$

$a + b \cong 405.5$ Meters

$\Delta = [a+b] - c = 405.5 - 402.6$

$\boxed{\Delta \cong 2.9 \text{ Meters}}$



Measurements by Tom Knight
12/10/84 10:30-11:30AM

P 634,000
Q 634,581 > 581
M 635,638 > 5,723
R 640,304 > 84
S 640,388
T 640,388 > 167
U 640,555

$Q \to S = \sqrt{(Q \to R)^2 + (R \to S)^2} = \sqrt{(5{,}723)^2 + (84)^2}$
$Q \to S \cong 5{,}723.6$
$P \to Q = 581$
} 6,304.6

* 10th Near S 641,000 > 6,306
P: Hunter & 44th 647,306
Ridden Same way as 12/9/84 by Knight & Katz

P 647,306 > 571
X 647,877
Q 647,967 > 90
Y 648,043 > 76
} 166

$P \to Q = \sqrt{(P \to X)^2 + (X \to Q)^2}$
$P \to Q = \sqrt{(571)^2 + (90)^2}$
$P \to Q \cong 578$
$P \to R = (P \to X) + (Q \to R) = 571 + 5723 = 6294$

Long Tangent $\cong \sqrt{(P \to R)^2 + (T \to U)^2}$
$= \sqrt{(6294)^2 + (167)^2}$
$= 6{,}296.2$
Long Tangent

* 10th Near S 654,000
Nub Q 659,731 > 6,315
P: Hunter & 44th 660,315

Ridden Possibly Longer Path during 1981 NYC Marathon [Runners May have been forced this way]

SUMMARY:

Calc. Longest 1981 Way Possible 6304.6
Calc. Longest Tangent 6296.2
Δ Difference 8.4 Counts

Ridden Longest 1981 Way Possible 6315
Ridden Same Way as Knight & Katz on 12/9/84 6306
Δ Difference 9 Counts

∴ Max Difference
≅ 9 Counts
= 9 Cts (.3648 Meters/1')
= 5695.5 Cts/2,000'
= 0.96 Meters Maximum Difference

2

1981 New York City Marathon
David Katz's Measurements
12/8/84 & 12/9/84

12/8/84

PreCal: 5,852.5/2,000' > D.C. = 5,852.5/2,000'
PostCal: 5,852.5/2,000'

Old 15 Mile Mark 594,000 > 172,379
Men's Finish 766,379

12/9/84

PreCal: 5,857/2,000' > D.C. = 5,859.5/2,000'
PostCal: 5,862/2,000'

Start: 844,000 > 231,530
Old 15 Mile Mark: 1,075,530

Note: 2,000' = 609.600 Meters

Calculations:

1.) Standard Day's Constant Method

$$S+ = \frac{172{,}379 \text{ Counts}}{(5{,}852.5 \text{ Counts}/609.600 \text{ Meters})} + \frac{231{,}530 \text{ Counts}}{(5{,}859.5 \text{ Counts}/609.600 \text{ Meters})}$$

$$S+ = 42{,}042.6 \text{ Meters} = 42{,}195 \text{ Meters} - 152.4 \text{ Meters}$$

2.) Adjacent Shorter Method: (Using Larger Adjacent Calibration or Recalibration)

$$AS = \frac{172{,}379 \text{ Counts}}{(5{,}852.5 \text{ Counts}/609.600 \text{ Meters})} + \frac{231{,}530 \text{ Counts}}{(5{,}862 \text{ Counts}/609.600 \text{ Meters})}$$

$$AS = 42{,}032.3 \text{ Meters} = 42{,}195 \text{ Meters} - 162.7 \text{ Meters}$$

3.) Adjacent Longer Method: (Using Smaller Adjacent Calibration or Recalibration)

$$AL = \frac{172{,}379 \text{ Counts}}{(5{,}852.5 \text{ Counts}/609.600 \text{ Meters})} + \frac{231{,}530 \text{ Counts}}{(5{,}857 \text{ Counts}/609.600 \text{ Meters})}$$

$$AL = 42{,}052.9 \text{ Meters} = 42{,}195 \text{ Meters} - 142.1 \text{ Meters}$$

Add 45.31 Meters for 0.30 Meters → 1 Meter on Get: −107.1, −117.4, −96.8 Turns Difference

MAP 1st + 15 Miles

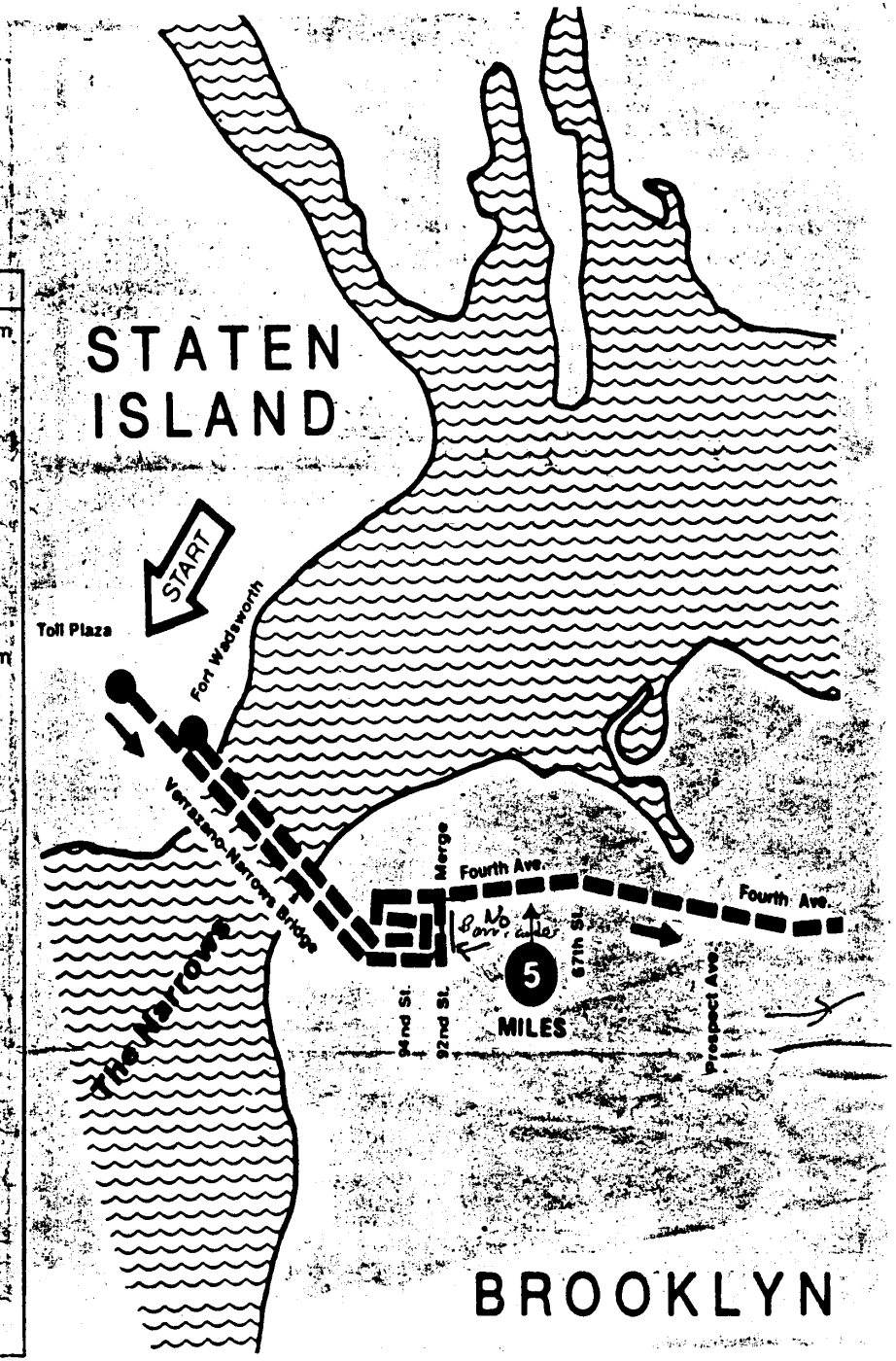
1st 15 Miles
1981 NYC Marathon


NEW JERSEY
Hudson River
26
FINISH
Tavern on the Green
West Drive at W. 66th, St.
Central Park
Enter Park
at 102nd St.
& Fifth Ave.
Madison Ave.
135th St.
Cent. Pk. So.
East Drive
90th St.
Marcus
Garvey Pk.
25
MANHATTAN
59th St.
First Ave.
135th St.
138th St.
Alexander Ave.
20
BRONX
Off of Bridge
RRC
East River
Vernon Blvd.
48th St.
Queensboro Br.
15
Manhattan Ave.
Greenpoint Ave.
McGuinness Blvd.
Pulaski Br.
Crescent St.
10
Ashland Pl.
Lafayette Ave.
Bedford Ave.
Flatbush Ave.
QUEENS

FOR 1982 NEW YORK CITY MARATHON™

Times are based on 10:30 a.m. start. Lead time is determined from the 1981 record year's winning time; slow time is somewhat faster than last year's. In case of record time, spectators should arrive at least 5 minutes ahead of time indicated.

	Mile	Location	Lead	Slow
Staten Island	0	Verrazano Toll Plaza	10:30am	10:30am
	1	Midpoint of Verrazano Bridge	10:34	10:40
Brooklyn	2	Verrazano Bridge exit to 92nd St.	10:39	10:50
	3	4th Ave. and 84th St.	10:43	11:00
	4	4th Ave. and 65th St.	10:48	11:10
	5	4th Ave. and 45th St.	10:53	11:20
	6	4th Ave. and 25th St.	10:58	11:30
	7	4th Ave. and 5th St.	11:03	11:40
	8	Flatbush Ave. and Ashland Pl.	11:08	11:50
	9	Lafayette between Classon and Grand	11:13	12:00pm
	10	Bedford Ave. and Flushing Ave.	11:18	12:10
	11	Bedford Ave. and S. 5th St.	11:23	12:20
	12	Bedford Ave. and Nassau St.	11:28	12:30
	13	McGuinness Blvd. at Start of Pulaski Br.	11:33	12:40
Queens	13.1	Pulaski Bridge (Half-Marathon)	11:34	12:42
	14	Vernon St. and 45th Ave.	11:38	12:50
	15	Queensboro Bridge (Queens side)	11:43	1:00
Manhattan	16	Queensboro Bridge (Manhattan side)	11:48	1:10
	17	1st Ave. and 76th St.	11:53	1:20
	18	1st Ave. and 95th St.	11:58	1:30
	19	1st Ave. and 115 St.	12:03pm	1:40
Bronx	20	Willis Ave. Bridge and 135th St.	12:08	1:50
Manhattan	21	Madison Ave. and 135th St.	12:13	2:00
	22	5th Ave. and 120th St.	12:18	2:10
	23	5th Ave. and 102nd St.	12:23	2:20
	24	Central Park: East Dr. and 84th St.	12:28	2:30
	25	Central Park: East Dr. and 66th	12:33	2:40
	26	Central Park: West 61st St.	12:38	2:50
	26.2	Central Park: West 66th St. and Tavern-on-the-Green	12:39	2:52



Certificate

Validation Check (Blue Start Only)

NAME OF THE COURSE 1982 1983 NEW YORK CITY MARATHON ADVERTISED DISTANCE: 42,195 Meters

LOCATION: (state) NEW YORK (city) NEW YORK (park) _____

TYPE OF COURSE: [loop (no.), pt/pt, out/back, key hole] Pt/Pt

TYPE OF SURFACE: paved 99.9+ % dirt ____ % gravel ____ % grass 0.1 % +Includes Bridge Metal Grating sections

TYPE OF COURSE: road race ☒ cross country ☐ calibration ☐ track ☐

TYPE OF TERRAIN: flat ☒ rolling ☒ (Slightly) hilly ☐ total climb _____

Mostly Flat with exception of some tough bridge sections (optional)

STRAIGHT LINE DISTANCE BETWEEN THE START AND FINISH ≈24,000 Meters + (Approx-imate?)

ALTITUDE: Feet START 100 HIGHEST 282 LOWEST 10 FINISH 85

(meters/feet above sea level) Meters START 30 HIGHEST 86 LOWEST 3 FINISH 26

MEASURED BY: (name, address & phone) Tom Knight 307 Dartmouth Ave

San Carlos, CA 94070 (415) 594-9406 || Also P.O. BOX 620460 Woodside, CA 94062

MEASURING METHOD: bike ☒ walking wheel ☐ steel tape ☐ electronic meter (EDM) ☐

NUMBER OF MEASUREMENTS OF THE ENTIRE COURSE: 1 by Tom Knight

DATE (S) WHEN COURSE WAS MEASURED: 12/8/84 & 12/9/84 RACE DATE (if applicable) _____

DATE WHEN COURSE PAPERWORK, SENT FOR EVALUATION, WAS POSTMARKED: _____

~~MEASURED~~ DISTANCE OF THE COURSE (including .1% safety factor) 42,136.2 Meters *

DIFFERENCE BETWEEN THE TWO BEST MEASUREMENTS OF THE FINAL ADJUSTED COURSE: _____

* Turns Measured within 0.30 Meters of inside edges (curbs)

NATIONAL REGISTRATION CODE: _____

42,136.2 Meters = 42,195 Meters − 58.8 Meters = 42,195 Meters [1 − 0.14%]

BE IT OFFICALLY NOTED THAT

Δ Estimated 1 Meter from inside edges (curbs) on turns: 42,182.2 Meters = 42,195 Meters − 12.8 Meters

The course described above and defined by the attached map is hereby Nationally Certified as reasonably accurate in measurement according to the standards adopted by TAC/RRTC subcommittee on Certification (Ted Corbitt - Chairman). It will also be so recognized by the Road Runners Club of America. A copy of this certificate and map should accompany your Race Results mailed to the National Running Data Center (NRDC) P.O. Box 42888 Tucson, AZ. 85733. In the event a National Open Record is set on this course, a Validation Remeasurement will be required. Such a remeasurement must show the course to be at least the advertised race distance in order for the record to be accepted.

= 42,195 Meters × [1 − .03%]

RACE DIRECTORS PLEASE NOTE: If this course is changed in any way from the above Certified Route, it invalidates this Certification. The course must then be Recertified using the current National Standards.

AS NATIONALLY CERTIFIED BY:

Tom Knight. DATE: 1/16/85 January 16, 1985

-- Member: TAC/RRTC National Certification Committee

As Authorized by Ted Corbitt, National Chairman

Δ ≈ 3,761° Turns for ΔR = 0.7 Meters; ∴ Δ Distance = $2\pi\left(\frac{3761^\circ}{360^\circ}\right)(0.7) = 45.95$ Meters

APPLICATION FOR CERTIFICATION OF ACCURACY

1982
Name of course: 1983 NEW YORK CITY MARATHON Date: 1/16/85

Location (place, city, state): NEW YORK CITY, NEW YORK

Measuring method used: [Bicycle?] Walking wheel? Steel tape? Electronic meter?

Describe the measuring device (make, model, dimensions, etc.):
JONES COUNTER (415)594-9406 (415)854-3300X2065

Who was responsible for measuring the course? P.O.Box 620460 Woodside, CA 94062
Name: TOM KNIGHT Address: 307 Dartmouth Ave, San Carlos, CA 94070

Who will be responsible for locating the start/finish points, marking the course, measuring future changes and reporting them to the National Standards Committee:
Name: Address:

DESCRIPTION OF THE COURSE Mostly flat except for 2 hills on Verrazano Narrows & Queensboro Bridges

1. Is the course [Flat?] rolling? hilly? mountainous? uphill? downhill?
   Elevation (feet above sea level): START____ Highest____ Lowest____ FINISH____
2. How much of the course is paved? 99.9%† grass? 0.1% dirt?____
   †Includes Bridge Metal Grating sections
3. Straight-line distance between the START and FINISH: ≈24,000 Meters
4. Describe exactly where the START, FINISH, TURNAROUND, and MILE/KM points are located with reference to unique permanent landmarks (e.g. 17 yds W of 934 Beach St. mailbox):
   START: (Blue) 163'9" S.E. of Post+GG16 on the Bridge Plaza
   FINISH: 12'3" N. of Lamp pole W 6702
5. Submit a complete, detailed map of the course with names of all streets/trails, showing all dirt/grass stretches, and including a north arrow. Indicate which side/half of each road was measured, and how all turns were taken. Use additional sketches or writeups to clearly communicate the running/measured route.

COMPARISONS WITH A KNOWN STANDARD DISTANCE. Certification requires two comparisons of each measuring device with a known standard distance. If steel tape is used, the standard must have been created with utmost accuracy by other survey instruments. If a wheel is used, the standard must have been created via steel tape or electronic meter, and must be at least 880 yards long on a straight, flat, paved surface.

6. Describe the known standard distance:
   Name: Central Park 2,000 Foot Calibration Course
   Location:____
   Length: 2,000.00 Feet [609.600 Meters]
   How measured: Steel Tape by David Katz (Lead) & Tom Knight (Tail) 12/8/84
   Certified?____

If the known standard distance is not certified, apply now by answering all appropriate questions on another APPLICATION FOR CERTIFICATION OF ACCURACY for the known standard distance.

All by Tom Knight

7. Describe how each measuring device was compared with the known standard distance. List the date, time, and raw data for each comparison: S≡Start 2≡2,000' H≡Old 1/2 Mile

Calibration: 12/8/84 2:30PM
S 893,000 >5695.5 ① Watch: 44.1°F Tape: 40°F
2 898,695.5 >5696 ②
S 904,391.5 >5696 ③
2 910,087.5
H 911,913.5
2 913,741 >5~~69~~7.5 stopped so ignore
S 919,438.5 >5696.5 ④
2 925,135
[①+②+③+④]/4 = 5,696

Recalibration: 12/8/84 5:38-5:45PM Watch: 41°F
S 167,000 >5698 ⑤ Tape: 41.5°F
2 172,698 >5698 ⑥ Bldg: 39°F
S 178,396 >5697 ⑦
2 184,093
H 185,920.5
2 187,746.5 >5698 ⑧
S 193,445.5
[⑤+⑥+⑦+⑧]/4 = 5698

Calibration: 12/9/84 7:35-7:50AM
S 228,000 >5697 Watch: 42°F Tape: 39°F
2 233,697 >5697
S 239,394 >5697
2 245,091 >5697
S 250,788 5,697

Recalibration: 12/9/84 12:00 Noon-12:17PM
S 529,000 >5694.5 Watch: 53→48° Tape: 50→45°
2 534,694.5 >5695.5
S 540,390 >5695.5
2 546,085.5 >5695.5 5,695.25
S 551,781

8. If steel tape or walking wheel was compared, what is the average correction factor?

9. If a bicycle was compared, what is the average digits/mile for all of the comparisons for each person for each day:

Date: 12/8/84 Name: Tom Knight Average digits/mile: 15,040.08 = 5,697/2,000 Feet

Date: 12/9/84 Name: Tom Knight Average digits/mile: 15,037.77 = 5,696.125/2,000 Feet

COURSE MEASUREMENTS. Certification requires two measurements. If a bicycle is used, the known standard distance and the race course must both be ridden during the same day by the same person for each measurement. (comparisons from a previous day are not acceptable).

10. Was the measuring route identical to the shortest route that can be permitted to be run by the winner of the race? 12 Inches Curbed [redacted]

11. Were all left/right turns measured to within [redacted] of the inside edge of all turns? If not, explain. YES 0.30 Meters Δ

12. If part of the race course is on dirt or grass, how were these stretches measured? YES ~ 0.1% Measured with the bicycle

14. If steel tape was used, answer the following questions:

a. How many people were in the survey party? List their specific duties:

b. How was the tape tension maintained during measuring?

c. How was the tape increments count maintained?

d. How were the curves measured?

15. If a bicycle was used, answer the following questions:

a. Was the bicycle ridden over the known standard distance and over the race course both during the same day by the same person for each measuring occasion? YES

b. Was the known standard distance compared before and after measuring the race course? If not, explain. YES

16. List the date, time, and raw data for each measurement of the course: All by Tom Knight

12/8/84 3:00-5:00 PM Bad Traffic; Many Stops

167,793
- 979,000 Old 15 Mile Mark [4 Yds. W. of #48 Yellow Box]
- 097,154 Stoplight Pole N.W. Corner 5th Ave. & 102nd
- 1 141,731 Beginning of Grass Portion
- 1 146,793 Men's Finish Marathon

12/9/84 9:25-11:40 AM

225,119
- 256,000 Start: 163.9" Steel Taped S.E. of Post + GG 16
- 374,257 Ⓔ Nub at Atlantic
- 376,857 Ⓗ Right Turn at Lafayette
- 395,128 1st X walk line at Bedford
- 436,590 X walk Manhatten
- 481,119 old 15 Mile Mark [4 Yds. W. of #48 Yellow Box]

1981 Way 2,600 Counts

12/9/84 5:20-6:30 PM T~44°F

A 559000	> 548	I 571,000
B 559548	> 115	C 571,767
C 559663	> 115	E 572,535
B 559778	> 549	H 574,368
A 560327		

2601

D 560388 ← 61 → C→A = √((C→B)² + (B→A)²) = 560.43

A 560448 > 60

D 560508 > 60

E 562446 > 1938

D 564383 > 1937

E 566320 > 1937

A→D = 60.33

D→F = √((D→E)² + (E→F)²) = 1944.66

F 566488 > 168

E 566657 > 169

F 566826 > 169

G 566883 > 57

H 567698 > 815

G 568511 > 813

F 568568 > 57

F→G = 57

G→H = 814

Total 1982 C→H 3436.42

1981 Total = (2600 + 2601)/2 = 2600.5

1982 Total − 1981 Total ≅ 3436.42 − 2600.5 = 835.92 Counts

17. Describe any adjustments (calculations, measurements) made to create an exact length:

Δ Estimate for 1 Meter from inside edge of turns: ≅ 3761° of Turn = ∠

ΔR = (1 − .3) = .7 Meter; $2\pi\left(\frac{\angle}{360^\circ}\right)\Delta R = 2\pi\left(\frac{3761}{360}\right)(.7) = 45.95$ Meters

18. What is the [redacted] length of the final course? 42,136.21 Meters = 42,195 Meters − 58.79 Meters

19. What is the difference between all of the measurements?

COURSE DISTANCE: (AS MEASURED)

$$= \frac{167{,}793 \text{ Counts}}{(5{,}697 \text{ Counts}/609.600 \text{ Meters})} + \frac{225{,}119 \text{ Counts}}{(5{,}696.125 \text{ Counts}/609.600 \text{ Meters})} + \frac{835.92 \text{ Counts}}{5{,}695.25 \text{ Counts}/609.600 \text{ Meters}}$$

$$= 42{,}136.21 \text{ Meters} = 26 \text{ Miles} + 320.72 \text{ Yards}$$

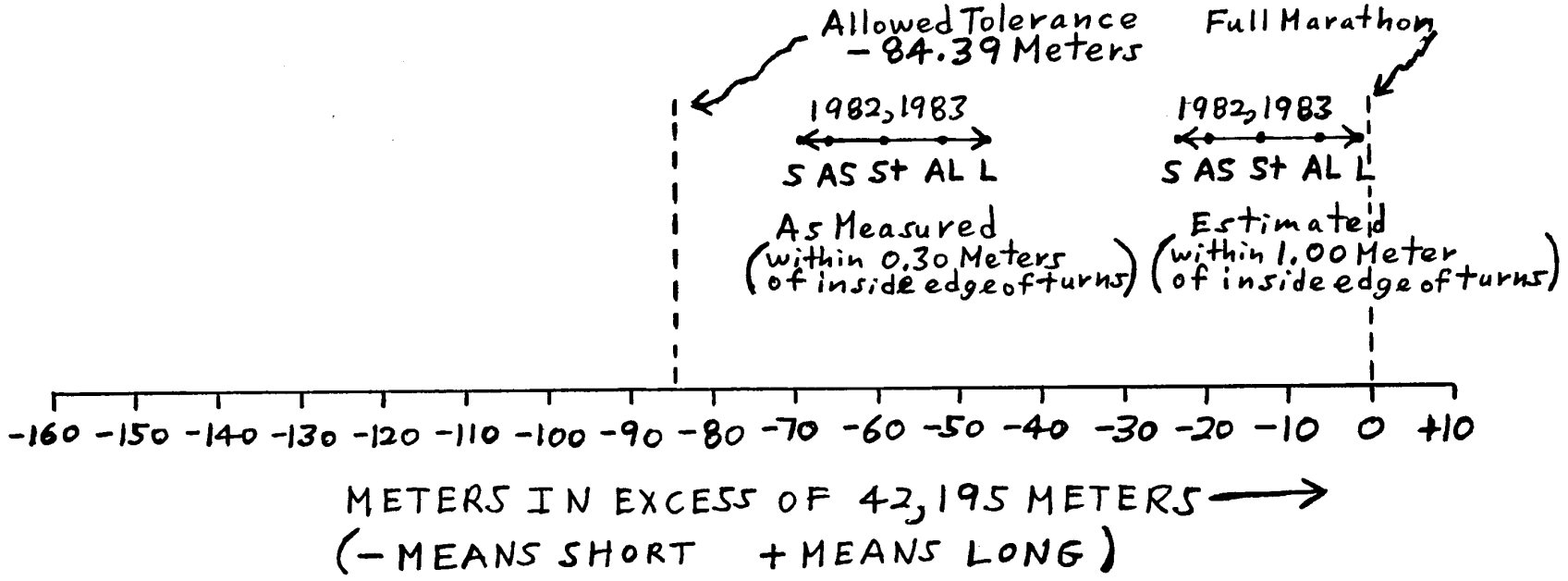
$$= 42{,}195 \text{ Meters} - 58.79 \text{ Meters} = 26 \text{ Miles} + 385 \text{ Yards} - 64.28 \text{ Yards}$$

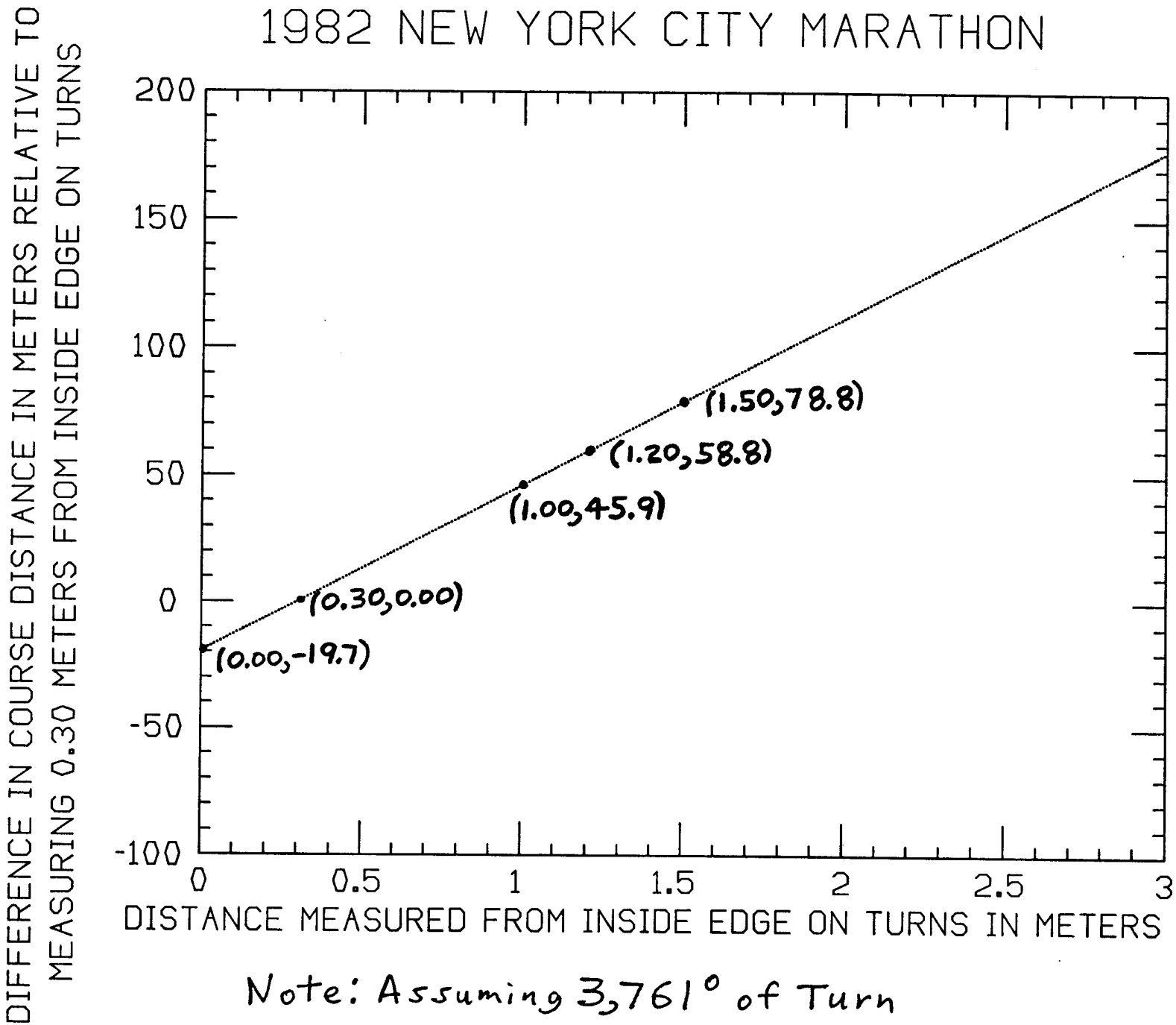
1982, 1983 NEW YORK CITY MARATHON

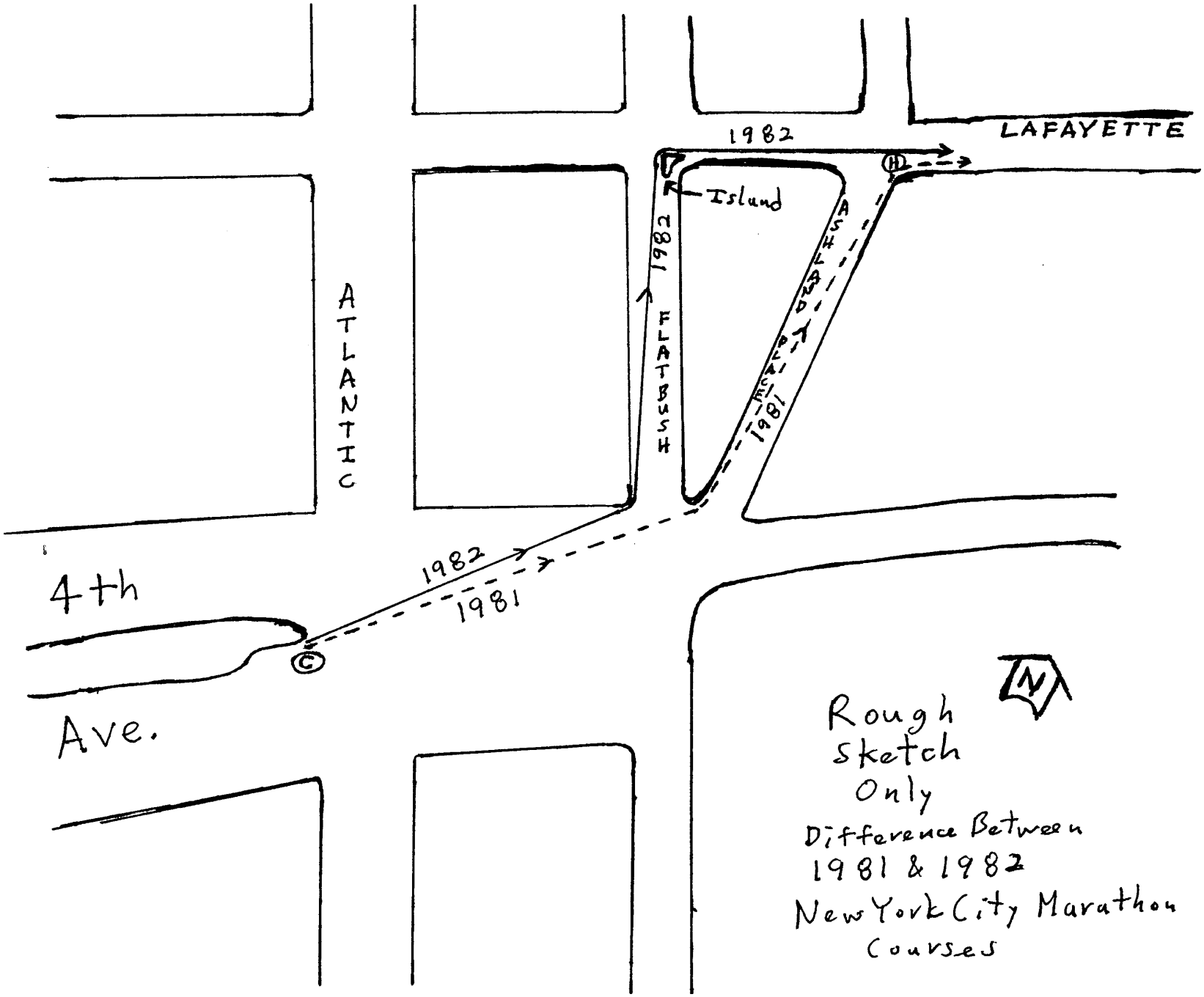
as measured by
Tom Knight
12/8/84 & 12/9/84

METERS IN EXCESS OF 42,195 METERS
(− MEANS SHORT + MEANS LONG)

	As Measured (within 0.30 Meters of inside edge of turns)	Estimated (within 1.00 Meter of inside edge of turns)	
S	−68.8	−22.8	S ≡ Using Largest Individual Calibration # for Each Day
AS	−65.6	−19.7	AS ≡ Using Larger Adjacent Calibration or Recalibration
S+	−58.8	−12.8	S+ ≡ Using Days' Constants (Average of Cal. + Recal.)
AL	−51.9	−6.0	AL ≡ Using Smaller Adjacent Calibration or Recalibration
L	−47.2	−1.2	L ≡ Using Smallest Individual Calibration # for Each Day




1982 NEW YORK CITY MARATHON
DIFFERENCE IN COURSE DISTANCE IN METERS RELATIVE TO MEASURING 0.30 METERS FROM INSIDE EDGE ON TURNS
200
150
100
50
0
-50
-100
0
0.5
1
1.5
2
2.5
3
DISTANCE MEASURED FROM INSIDE EDGE ON TURNS IN METERS
(1.50,78.8)
(1.20,58.8)
(1.00,45.9)
(0.30,0.00)
(0.00,-19.7)
Note: Assuming 3,761° of Turn


1982
LAFAYETTE
Island
1981
FLATBUSH
ASHLAND PL.
1981
ATLANTIC
1982
1981
4th
Ave.
N
Rough
sketch
Only
Difference Between
1981 & 1982
New York City Marathon
Courses