
# Course Measurement Seminar and Training

# Thanks and Recognition Go To…

This presentation is intended as a guide for experienced measurers who would like to teach seminars on course measuring. It is also intended to go hand in hand with the Course Measurement Procedures Manual, and may be used by new measurers as a resource for learning measuring techniques. The following persons have directly contributed to the creation of this seminar presentation:

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# Hosts should provide:

**1) The venue** The seminar should have 5 km of traffic-free roads for use by the students. If 5 km is not available, we can do with less. Consult with me on this if you have questions. Near to the seminar should be shelter from the weather, with tables. The students will use the tables for paper work and calculations. I will use the shelter as a place to instruct the students. The students should be prepared to ride bicycles even if it is raining.

**2) Two steel tapes** of at least 30 metres length.

**3) Bicycles** for students (and instructor) to use. There should be at least one bicycle for each two students, plus one for the instructor. If you have 16 students, you will need nine bicycles at a minimum. Be sure the front forks can accommodate a Jones Counter. Some mountain bikes have fat front forks. It is difficult to mount a counter on such forks.

**4) Plenty of paper and pencils** for the students.

**5) A calculator for each student** (have them each bring one).

**6) A hammer and PK Nails.** These are used for marking the course. Nail size is 1½ × ¼. May be obtained at http://www.tigersupplies.com/Departments/Surveying-Equipment/Field-Supplies-and-Miscellaneous/Hubs-and-Nails.aspx . Choose the Magna MAX Masonry Nails from CST/Berger. Or go to a local store with surveyor supplies.

**7) Paint** (Florescent Marking Paint) for marking the pavement.

**8) Safety vests** and **helmets** for instructor and each student

**9) A classroom area with a blackboard, white board, or projector that can be connected to a computer**. This may be outside depending on the equipment you are obtaining - it may be more pleasant than inside - I do not know.

# Students should before they arrive:

**1) Know how to ride a bike.** Since long distance running courses are measured using the calibrated bicycle method, a measurer should be confident on a bicycle. Practice riding a straight line.

**2) Download and read the "Course Measurement and Certification Procedures Manual"**. There is a link to the manual on the Road Running Technical Council Website, rrtc.net. Students should be familiar with what will be covered in the session. The instructor helps the student understand, practice and become proficient at the skills outlined in the manual.

**3) Bring whatever the host asks them to bring.** The host may ask you to bring your own bicycle, helmet, vests, calculators. If you do not have any of the equipment that the host asks you to bring, please indicate so to the host, so that provisions can be made.

# Instructors will provide:

**1) Jones Counters-**enough for 14 students. Should more be needed, then host should be instructed to obtain them before the seminar

**2) Washers**- to work with the PK Nails that the host will bring. These will mark the calibration course and mark the start/finish/splits of practice course.

**3) Chalk or lumber crayon**-for marking the road.

**4) 3" wide masking tape**- for laying out the calibration course. Also to mark the distance from the curb that the bikes should be when measuring a course.

**5) Paper Copy of Slideshow,** enough for each student to have one, if the venue does not have access to electronic display from a computer.

**6) A Paper Copy (or electronic copy) of the "Course Measurement and Certification Procedures Manual".**

**7) A Spring Balance** to help pull tension on the steel tape measures.

**Session 1-** Introductions, Sanctioning vs. Certifying, General Principles of Measuring, Math Exercises, Layout a Calibration Course

**Session 2-** Introduction to Jones Counter, Mounting the Jones Counter, Calibrating Bicycle Demo/Practice, Laying out a Test Course to Measure

**Session 3-** Measuring the Course, Calculating Splits, Note Taking for Measuring, Understanding SPR, Off-setting, Turnarounds, Physical Measurement, Doing Calculations, Making Adjustments

**Session 4-** Completing the Application, Filling out the Application, Drawing the Course Map, Sending Applications to Certifier, Measurement Certificate, GPS


# Session 1

# So, what should I get out of this session?

Objectives

# Objectives…

- Introduction of Participants
- Understand the difference between USATF ***SANCTIONING*** and USATF ***CERTIFICATION***
- Understand the benefits of USATF sanctioning
- Learn the General Principles of Bicycle Calibration Measuring
- For you to determine whether or not you want to try to measure your course yourself
- If you don't measure your course yourself, give you a feel for what the measurer will be doing, and how he or she will do it
- Exercise your math skills
- Laying out a calibration course and filling out the application

# Introduction of Participants

***Name***
***Association***
***Credentials***


# Sanctioning

# Course Measurement and Certification

# Sanctioning vs. Certification

- **A USATF sanction is an official designation issued by USATF, through a local Association, which approves and licenses the holding of a competitive track & field, long distance running or race walking event in the United States.** The sanction is also a contract, which evidences the event's commitment to follow national and international rules and regulations of the sport and to provide a safe environment for the participants and spectators. Once the event has satisfied the sanction requirements, the event's application for sanction is approved.

# Sanctioning vs. Certification

- A USATF sanction is an official designation issued by USATF, through a local Association, which approves and licenses the holding of a competitive track & field, long distance running or race walking event in the United States.
- A USATF certified course is one that is measured in accordance with USATF methods and procedures. The purpose of the USATF course certification program is to produce road race courses of accurately measured distances.

# Sanctioning & Certification

- For any road running performance to be accepted as a record or be nationally ranked, it must be run on a USATF-certified course at a sanctioned event. In addition, the certification program is very important to the average road racer, as well as those of exceptional speed. Most runners like to compare performances run on different courses, and such comparisons are difficult if course distances are not reliable. No one can truly establish a personal best if the course distance is not accurate.


# SANCTIONING

# Advantages of Sanctioning

- Increased Prestige
- For many events, the USATF sanction improves the event's public perception. A sanction tells athletes that an event is being run according to applicable competition rules. Sanctioned events have the ability to use the USATF event designation logo to promote the fact that the governing body has sanctioned the event.

# Advantages of Sanctioning

- Liability Insurance
- Most governmental entities including cities, counties, state highway departments, parks and community centers require general liability insurance for all events. The cost of a sanction is very inexpensive compared to the prices of most event insurance policies. It is important to know that events that are already insured may choose to waive the insurance coverage and pay a lower sanction fee.

# Advantages of Sanctioning

- Sports Accident Insurance for Athletes
- Any athlete who is a USATF member and is injured while participating in a sanctioned event will be eligible for secondary medical insurance coverage for the injury. This insurance not only provides valuable coverage to USATF members, but it serves as a valuable deterrent to lawsuits.

# Advantages of Sanctioning

- Volunteer Event Medical Coverage (Optional)
- This add-on insurance coverage is available to USATF sanctioned events to provide medical liability coverage for volunteer physicians and all other volunteer healthcare providers providing support to participants, volunteers and spectators during sanctioned events.

# Advantages of Sanctioning

- Calendar Promotion
- Sanctioned events will be included in the USATF online calendar and be highlighted to distinguish them from non-sanctioned events.

# Advantages of Sanctioning

- Records, Dispute Resolution, Other
- In general, a sanction is required for a record to be set.
- If requested, USATF will act as an arbiter in disputes between athletes and sanctioned events.
- Each Association may provide additional benefits to its sanctioned events. Please contact your local Association for more details.

# For more on USATF sanctioning…

- Beginning September 1, 2013, all sanction applications will be completed online. Visit the USATF Sanctions Help page to learn more about the USATF online process and access webinar tutorials, FAQs and other tools to help you process your sanction successfully.
- Go to USATF.org, click on the PRODUCTS/ SERVICES tab, then click on EVENT SANCTIONS


# COURSE MEASUREMENT and CERTIFICATION

# Measurement vs Certification

- A course measurement is the act of measuring the long distance running course accurately, usually using the Calibrated Bicycle Method of measuring.
- A course certification is the review of an application from a measurer and approval that the measurer satisfied the standards for submitting the application for measuring the long distance running course.

# Measurement Myths

…what you might have heard about course measurement…

# Measurement Myths

- 1. Course measurement is time-consuming

- REALITY: An “experienced” measurer can measure and document a 5 km course in a morning.

# Measurement Myths

- 2. Course measurement is complicated.

- REALITY: There's nothing here more complicated here than addition, subtraction, multiplication, and division. You measure the course by riding the bike, then fill out the forms, draw the map, and send it all to the certifier.

# Measurement Myths

- 3. Course Measurement is expensive.

- REALITY: You can probably have a 5K course measured by an experienced measurer for $400 or less. If you want to measure the course yourself, that's about what your equipment will cost. This equals $40 per year for a 10 year Certification.

# Measurement Myths

- 4.  Nobody's going to set a record at my race, anyway…

- REALITY: You may be right—but your participants now expect your course to be the correct length—and all of the intermediate points to be the right distance from the start, finish, and each other. What about age-group records? What about PR's?

# Measurement Myths

- 5. Certified Courses are LONG.

- REALITY: Maybe. It's true that USATF requires a short course prevention factor (SCPF) to be added to each course. The SCPF *usually* compensates for errors in the measurement process that tend to yield a short course. Also, the SPCF is very small, a factor of 1 part per thousand. This equals only one meter per kilometer or 1 foot per 1000 feet. The overall distance in 5 km is about 16 feet, or a couple of steps for most runners.

# Measurement Myths

- 6. A measuring wheel is just as good.

- REALITY: NO. Measuring wheels are calibrated only once—at the factory—and seldom if ever again. As they wear, they get smaller, making them measure short. They're also susceptible to spinning when they bump. And walking behind one is SLOW.

# Measurement Myths

- 7. Only a certifier can measure a course for certification

- REALITY: ANYONE can measure a course. The measurement must be in accordance with USATF procedures and submitted on USATF's forms. The state certifier reviews the application and issues the certificate.


# General Principles of Measuring

# The Calibrated Bicycle Method

Used to measure race courses in the USA—and most of the world.

# What do you need?

- Bicycle
- Jones Counter
- Steel Measuring Tape
- Lumber crayon or chalk
- Calculator
- Safety Vest
- Spring Balance (fish scale)
- Masking tape
- Paint
- Hammer
- Nails and Washers
- Surveyor’s Tape
- Pencil
- Notebook

# Measurement Steps

- Define the road race course
- Select and Measure a calibration course
- Calibrate bicycle
- Measure course twice
- Re-calibrate bicycle
- Calculate the length of the course
- Make final Adjustments
- Document the course measurement
- Complete forms and draw course map
- Submit  the application to certifier


# When Measuring with the Calibrated Bicycle Method,

# Things a Measurer should…

# A measurer should

- **Be proficient at riding a bicycle**

Practice Riding a straight line. Some wobble is expected, even the best riders can have some wobble, but your rides must be consistent.

**Exercise**: Mark a road in two places, especially one with twists and turns. Measure between the marks with a bike and Jones Counter. Then measure again. How close are the counts? Can you do this over and over again with similar results? Can you ride it backwards and see similar results? When you can ride a path multiple times and achieve results with only one or two counts difference, you are riding consistently.

# A measurer should

- **Understand Shortest Possible Route**
  - Defined as “the shortest possible route a runner can take and not be disqualified”
  - Measure no more than 30 cm (1 ft) from the curb or the side of the road
  - Measurement should be done at the 30 cm from curb or side of the road.

Since most courses are not a straight line, a measurer must be able to determine what is the route a runner might take to use the least amount of steps to run the race.

Some paths will be ***coned***, and it is imperative that a measurer take that into consideration when measuring and that all coning is noted in detail on the Certification Map.

# A measurer should

- **Know the route that is to be measured**

A Measurer should be prepared when they go out to measure a route. SPR can only be followed if the measurer knows where the turns are. A simple Google Map will do.

Talk with your Race Director about Start/Finishes/ Turnarounds and road restrictions.

# A measurer should

- **Be detail oriented**

A good measurement is in the details. Taking good notes, so that filling out the application is easy. Good notes also help to create good maps. Creating complete maps helps any user set up and run the course. Good notes also help you to adjust the course should there be a need in the future.

Always assume that it will be someone new from year to year who is the Race Director, and that they have no knowledge of setting up a course. Let that be your guide to notes and maps and your end users will be happy with your work.

# A measurer should

- **Be informed and have access to tools and information when they have questions**

All measurers are encouraged to go to the Road Running Technical Council Website rrtc.net. This website has information and tools to help you complete a course measurement and access to the pros.

**You can:**

**Download the Course Measurement Manual**
**Access forms for the application**
**Find places to buy equipment**
**Use the Bulletin Board to have questions answered**
**Get information on where to send your application**

# A measurer should

- **Be able to do simple math calculations**

A measurer must be able to Add, Subtract, Multiply, and Divide. You will be converting Jones Counts to miles or kilometers. You will be adjusting courses by feet or meters. Become comfortable moving between measurements and know the conversion factors.

The Bicycle Calibration Data Sheet has the conversion on it for your edification, but all conversions may be found in the USATF Measurement Manual.

# Math Exercises for Measuring with a Jones Counter

# Math Exercises

You have a 300 meter Calibration Course.

Your Jones counter reads 78000 at the beginning of the course. You ride your bike to the other end and your Jones counter reads 81312.

What are the total counts for 1 ride of the calibration course?

***Answer:*** *81312 – 78000 = 3312 counts for 300 meters*

# Math Exercises

A kilometer has 1000 meters

Using the counts of 3312 counts per 300 meters, how many counts would be needed to ride a kilometer?

***Answer:*** *3312/300 = 11.04 counts per meter.*
*11.04 x 1000 = 11040 counts per kilometer**

*At this time, we have not included the Short Course Prevention Factor (SCPF), which must be included in all measurements. We will discuss that later and explain why we use it.

# Math Exercises

If a kilometer is 11040 counts, how many counts for a 5 km course?

***Answer:*** *11040 x 5 = 55200**

*At this time, we have not included the Short Course Prevention Factor (SCPF), which must be included in all measurements. We will discuss that later and explain why we use it.

# Math Exercises

Now you go to the Finish point of your course. Your Jones counter now reads 61000.

What will your Jones Counter read when you get to the Start Point of the course?

***Answer:*** *61000 + 55200 = 16200*

Some Jones Counters have only 5 digits. The Jones counter is like an odometer on a car. It rolls over and starts again when it reaches 99999. Since the Jones counter has only 5 digits you will only see the 16200. But your paperwork should note the 1 digit in front, since it rolled over, making your paperwork state that the Jones Count was 116200.

A six-digit Jones Counter works the same way, only you will need to add the extra digit when you roll over at 999999.

# Math Exercises

You begin riding at a count of 86500. 15 minutes later you stop at a point to be measured. The counter now reads 12533. How many counts have elapsed?

***Answer:*** *Your Jones counter has rolled over and you must mentally add the 100000 before calculating the total counts elapsed.*

*(1)12533 – 86500 = 26033 counts*

# Math Exercises

You begin a ride at 11600 counts and ride approximately 5 km. When you reach the end of the ride your counter reads 66787.

1) How many counts did you use to complete the ride?

***Answer:*** *66787 – 11600 = 55187*

2) What distance was covered?

***Answer:*** *55187 counts/11040 counts per km = 4.99882246 km*

3) What distance needs to be added to the course to make it 5 km?

***Answer:*** *5.0 - 4.99882246 = 0.00117754 km (or 1.17754 meters)*


# Setting up a Calibration Course

# What is a Calibration Course

A calibration course is an accurately measured baseline used to calibrate the bicycle.

The effectiveness of the calibrated bicycle method of measurement depends on good calibration procedure, which demands quick access from the calibration course to the race course and vice-versa. Calibrations are best used when “fresh,” before conditions can change much.

# The Calibrated Bicycle Method

The Calibrated Bicycle Method uses a Calibration Course, in order to Calibrate the Bicycle before and after each measurement.

## The Calibration Course

Must be:

- Straight
- Paved
- As flat as possible
- At least 300 meters in length

# The Calibration Course

May be:

- Measured with Steel measuring tape (this is the usual method). Look for tapes made by well-known manufacturers of surveying and construction equipment with temp and tension specifications (usually 20°C, 50 N) on the blade of the tape
- Measured with Nylon Coated (“Nyclad”) steel tape measure.
- A Calibration Course may be a temporary course for one measurement, but paperwork must still be filled out and submitted with your course measurement

Measure the course twice, and AVERAGE the measurements

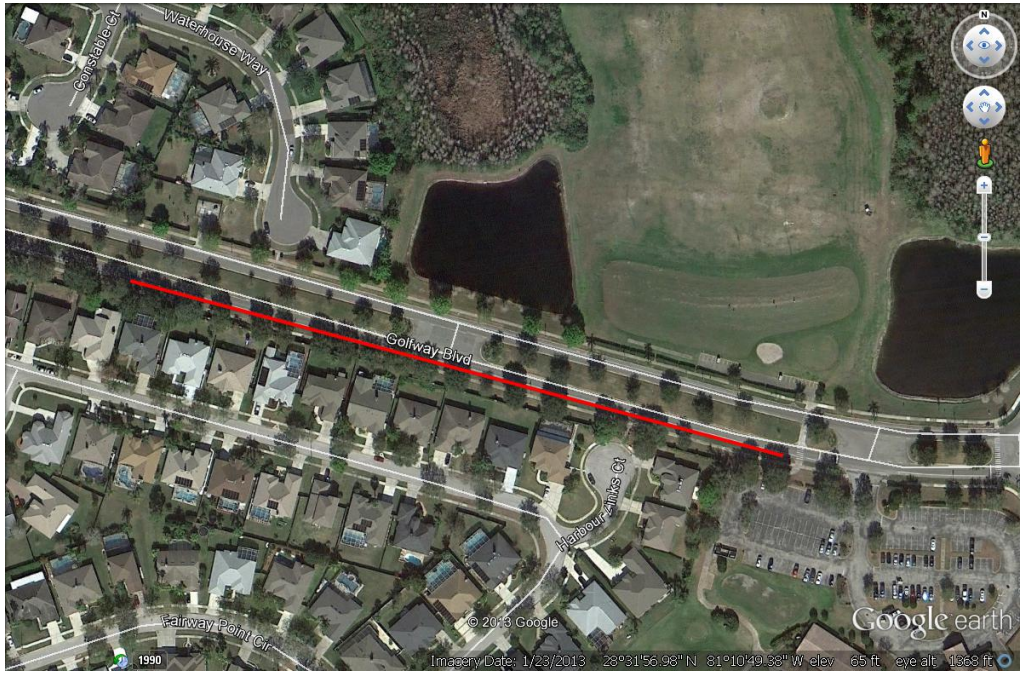
The two measurement cannot differ by more than 0.01% (e.g., 3 cm for a 300 m course, or 1.2" for a 1000' course).
If there is a greater difference between the two measurements, there is a problem and the course needs to be measured again.

# The Calibration Course

- A certified calibration course can be used to measure many courses.
- A certified calibration course may be any length, as long as it is at least 300 meters.
- Calculations will need to be made using your calibration course and the number of counts elapsed on your Jones Counter over the distance of your course.
- A calibration of your bicycle will be done before and after each measurement over a maximum time of 24 hours. (If there is a dramatic temperature change, you should calibrate more often)
- **Best Practice** is to **CALIBRATE RIGHT BEFORE and AFTER** a measurement, don't let time go by.
- **Best Practice** is to **Calibrate often** when measuring over long distances, you never know when a flat is coming on, and a slow leak is very hard to detect without the calibrating.

# The Calibration Course

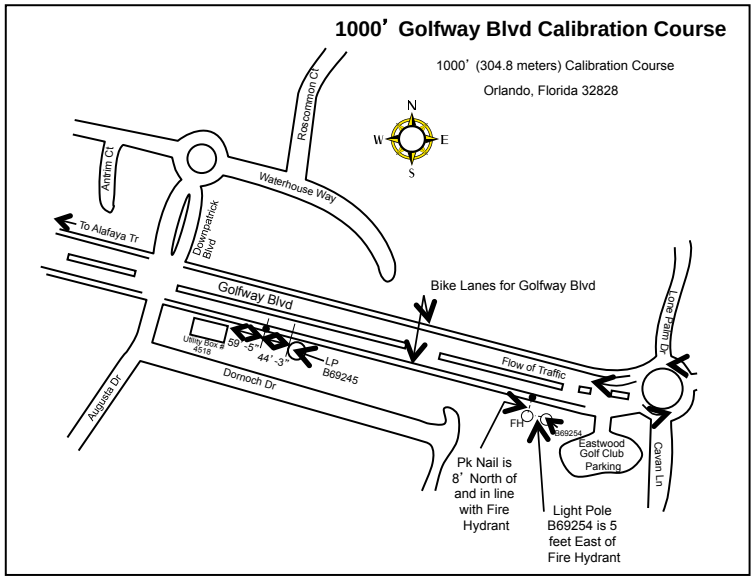
- Locate a straight segment of road
  - Bike lane is preferable
  - Straight with no cross streets is preferable




This is a Google Earth Picture of a current calibration course (FL06037DL). The actual course is 1000 feet (304.8 meters). Your calibration course should be at least 300 meters. Many of today's neighborhoods aren't straight streets. Do your best to find the distance needed.

# The Calibration Course

- Document your two end points thoroughly. It is best to use permanent objects as your end points.
- This course is good for 10 years, repaving may happen and you will want to know where your points are.
- Plan to repaint these points often.
- A well documented calibration course may be used by many measurers.



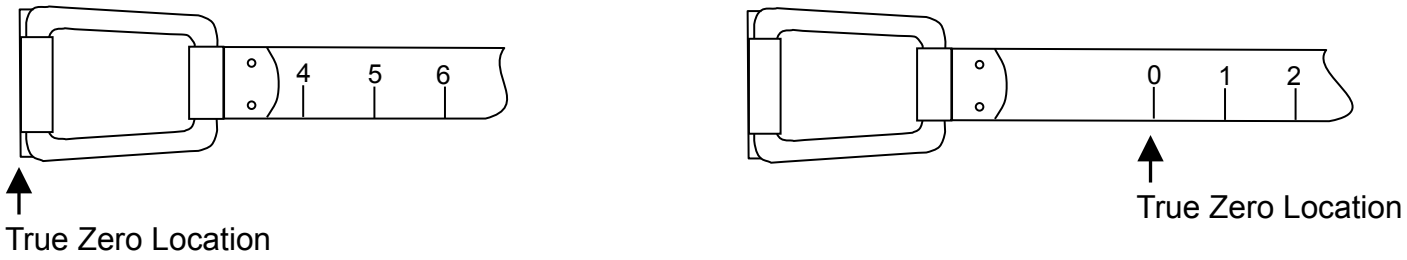

This course is well documented with reference to side streets and main roads that are near by. One end uses a fire hydrant as a key point. Another measurer could find this using the zip code and name of streets. You could find these points again if the road was repaved. “**Best Practice**” is to also paint the curb, which may not be repaved as often.

# The Calibration Course

- Once a location is found, a steel tape measure should be used to measure the course.

- Steel tapes are best, may use Nylon-clad steel tapes, never use a fiberglass tape measure. Ideally, it should be at least 25 to 30 meters long. It must be free of splices and crimps. Know what **ZERO** is on your tape measure.

**Construction Style Hook and Ring**

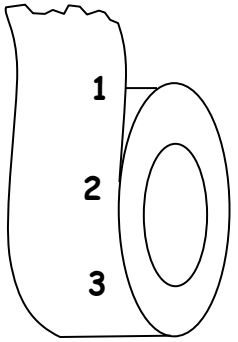



- You will need at least one other person to help hold the other end of the tape.
- The temperature should be taken of the asphalt (away from direct sun) and time noted.

# The Calibration Course

- Lay tape at the end of the Calibration Course and mark the beginning.

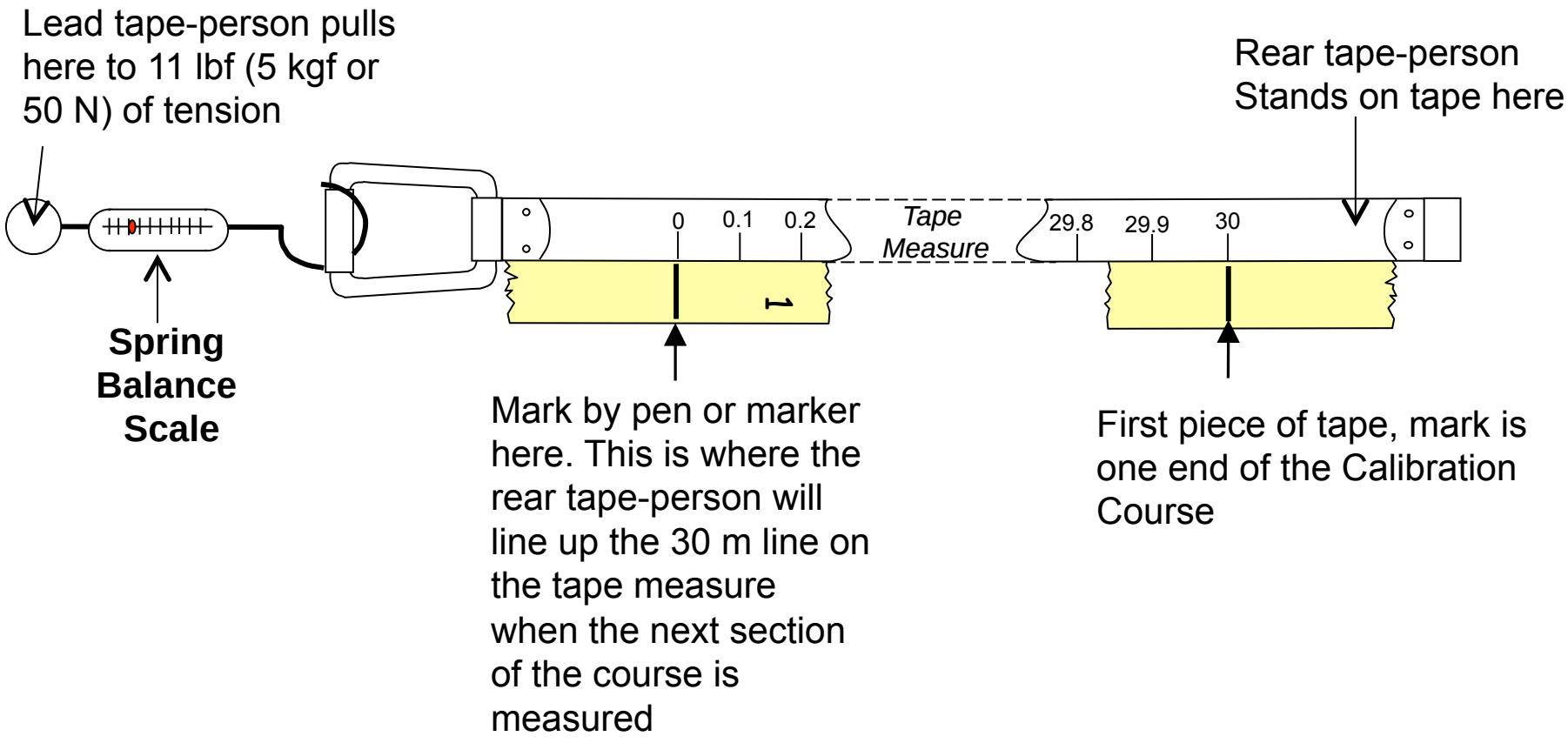
***Once the first piece of tape is laid, it is a good idea to label the rest of your masking tape before you begin with the number of lengths you will be laying down – a 300 meter course laid out with a 30 meter tape measure will need 10 pieces of tape labeled 1-10. This is to help ensure that you measure enough lengths.***




- Walk your tape measure out and lay a piece of masking tape with the number 1 down where the tape measure ends.
- With a fish scale or some other spring balance, connect it to the end of the tape measure and pull with approximately 11 lbf (5 kgf or 50 N) of tension. This step can be done by feel once you become accustomed to the tension needed.

# The Calibration Course

- At the second piece of tape (with the number 1 on it), draw a line to show the end of the tape measurement. Use a thin pen or marker. Leave all tape pieces on the ground.



# The Calibration Course

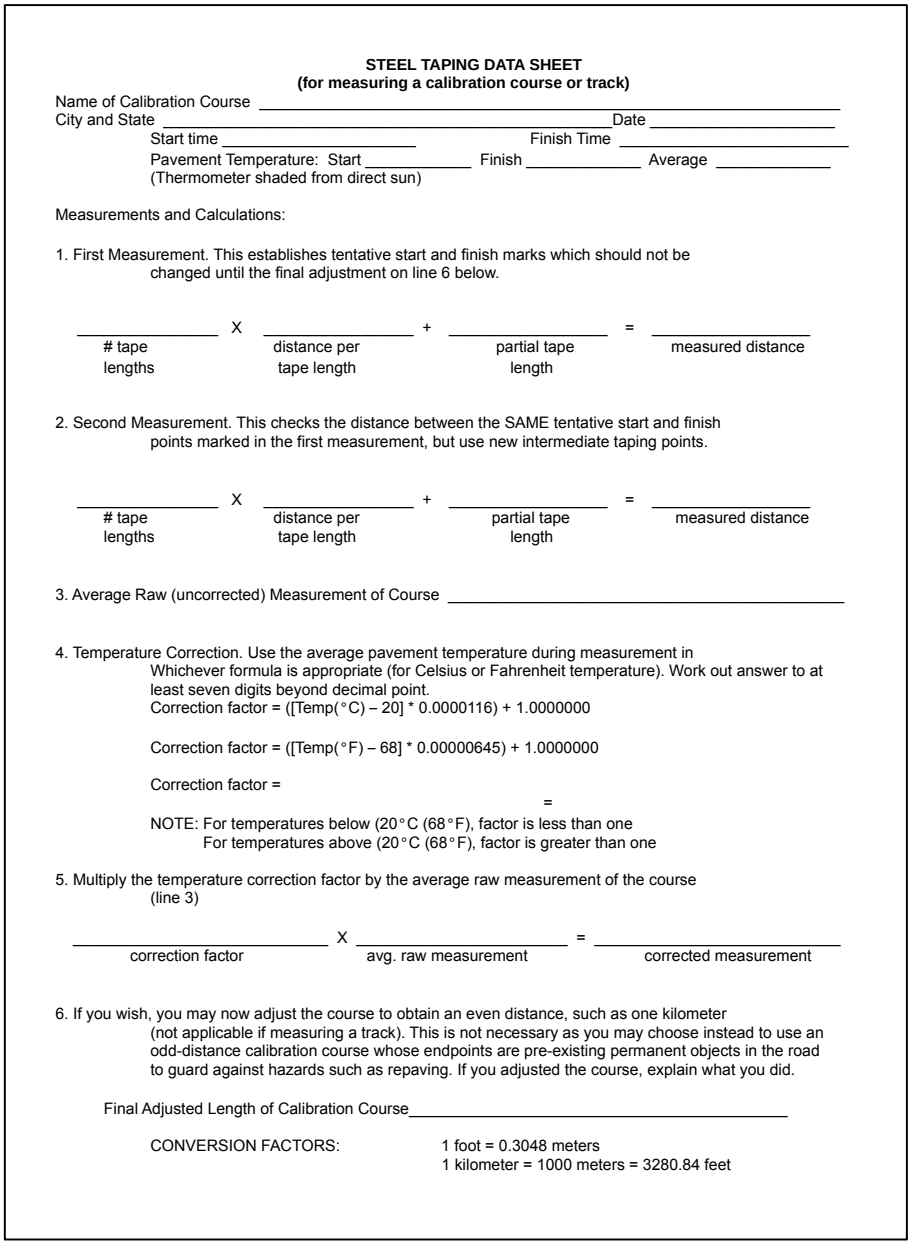
- Continue to tape along in this same fashion, until the end of the calibration course.
- If using permanent landmarks as the ends of your course, make a note of the total tape lengths and the partial required for the distance. If using a predetermined distance, measure to that point and lay a final piece of tape.
- Using the end points, measure the calibration course again, going the opposite way. Lay new tape down at each measured point and mark with pen.
- **If there is a significant difference in the measurements, then the course needs to be measured again. Your measurements should not differ by more than 0.01% (e.g., 3 cm in 300 m,  1.2" in 1000').**
- Take another temperature reading of the asphalt, away from direct sun and note the time.

# The Calibration Course

- At this time, you may check your measurement, by using your bicycle with a Jones Counter.
  - Measure one tape length
  - Multiply the number of Jones counts for this section by the total number of tape lengths you measured
  - This number should be close to the total number of counts in one ride of the total calibration course.
- Before driving the nails, make sure the course is adjusted for the temperature.
- Document the course.

# The Calibration Course

- Whether your calibration course is permanent or temporary, you will need to fill out the **Steel Taping Data Sheet**. You will need to document what you measured, the temperature correction if any, and any adjustment to the course.
- **The temperature correction is especially important. When it is colder than 20°C (68°F), your course will be shorter than what you measured. Adjust your course accordingly.**



**STEEL TAPING DATA SHEET**
**(for measuring a calibration course or track)**

Name of Calibration Course _____
City and State _____ Date _____
Start time _____ Finish Time _____
Pavement Temperature: Start _____ Finish _____ Average _____
(Thermometer shaded from direct sun)

Measurements and Calculations:

1. First Measurement. This establishes tentative start and finish marks which should not be changed until the final adjustment on line 6 below.

_____ (# tape lengths) X _____ (distance per tape length) + _____ (partial tape length) = _____ (measured distance)

2. Second Measurement. This checks the distance between the SAME tentative start and finish points marked in the first measurement, but use new intermediate taping points.

_____ (# tape lengths) X _____ (distance per tape length) + _____ (partial tape length) = _____ (measured distance)

3. Average Raw (uncorrected) Measurement of Course _____

4. Temperature Correction. Use the average pavement temperature during measurement in Whichever formula is appropriate (for Celsius or Fahrenheit temperature). Work out answer to at least seven digits beyond decimal point.
Correction factor = ([Temp(°C) – 20] * 0.0000116) + 1.0000000

Correction factor = ([Temp(°F) – 68] * 0.00000645) + 1.0000000

Correction factor =
=

NOTE: For temperatures below (20°C (68°F), factor is less than one
For temperatures above (20°C (68°F), factor is greater than one

5. Multiply the temperature correction factor by the average raw measurement of the course (line 3)

_____ (correction factor) X _____ (avg. raw measurement) = _____ (corrected measurement)

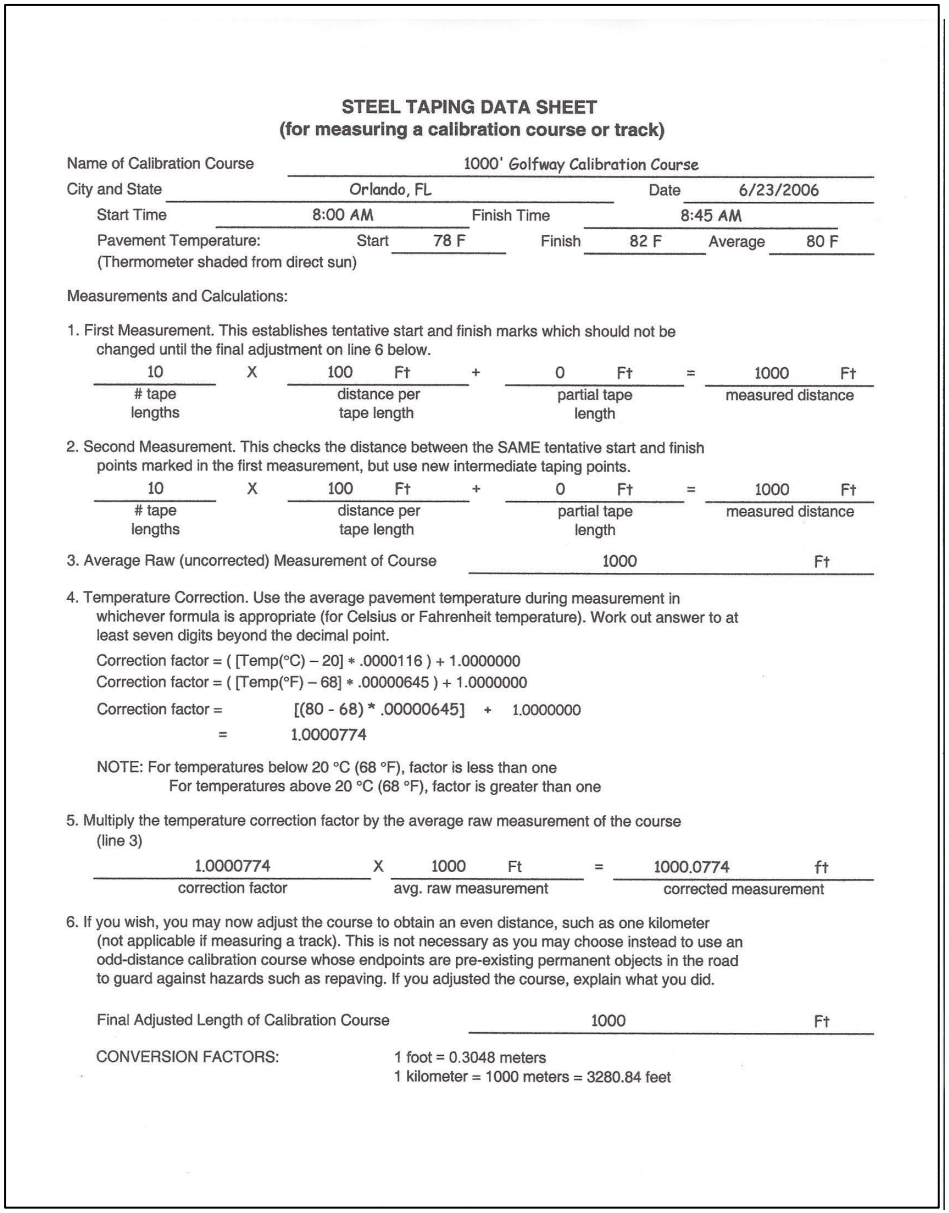
6. If you wish, you may now adjust the course to obtain an even distance, such as one kilometer (not applicable if measuring a track). This is not necessary as you may choose instead to use an odd-distance calibration course whose endpoints are pre-existing permanent objects in the road to guard against hazards such as repaving. If you adjusted the course, explain what you did.

Final Adjusted Length of Calibration Course_____

CONVERSION FACTORS: 1 foot = 0.3048 meters
1 kilometer = 1000 meters = 3280.84 feet

# The Calibration Course

- **Steel Taping Data Sheet** should be filled out completely, using units of measure. Notice that the temperature is noted with F for Fahrenheit and the distance is noted in feet since this is a 1000 foot course. Altitude is noted in meters, as that is the standard we use.



**STEEL TAPING DATA SHEET**
**(for measuring a calibration course or track)**

Name of Calibration Course: 1000' Golfway Calibration Course
City and State: Orlando, FL  Date: 6/23/2006
Start Time: 8:00 AM  Finish Time: 8:45 AM
Pavement Temperature: Start 78 F  Finish 82 F  Average 80 F
(Thermometer shaded from direct sun)

Measurements and Calculations:

1. First Measurement. This establishes tentative start and finish marks which should not be changed until the final adjustment on line 6 below.

| 10 | X | 100 Ft | + | 0 Ft | = | 1000 Ft |
|---|---|---|---|---|---|---|
| # tape lengths | | distance per tape length | | partial tape length | | measured distance |

2. Second Measurement. This checks the distance between the SAME tentative start and finish points marked in the first measurement, but use new intermediate taping points.

| 10 | X | 100 Ft | + | 0 Ft | = | 1000 Ft |
|---|---|---|---|---|---|---|
| # tape lengths | | distance per tape length | | partial tape length | | measured distance |

3. Average Raw (uncorrected) Measurement of Course: 1000 Ft

4. Temperature Correction. Use the average pavement temperature during measurement in whichever formula is appropriate (for Celsius or Fahrenheit temperature). Work out answer to at least seven digits beyond the decimal point.

Correction factor = ( [Temp(°C) – 20] * .0000116 ) + 1.0000000
Correction factor = ( [Temp(°F) – 68] * .00000645 ) + 1.0000000
Correction factor = [(80 - 68) * .00000645] + 1.0000000
= 1.0000774

NOTE: For temperatures below 20 °C (68 °F), factor is less than one
For temperatures above 20 °C (68 °F), factor is greater than one

5. Multiply the temperature correction factor by the average raw measurement of the course (line 3)

| 1.0000774 | X | 1000 Ft | = | 1000.0774 ft |
|---|---|---|---|---|
| correction factor | | avg. raw measurement | | corrected measurement |

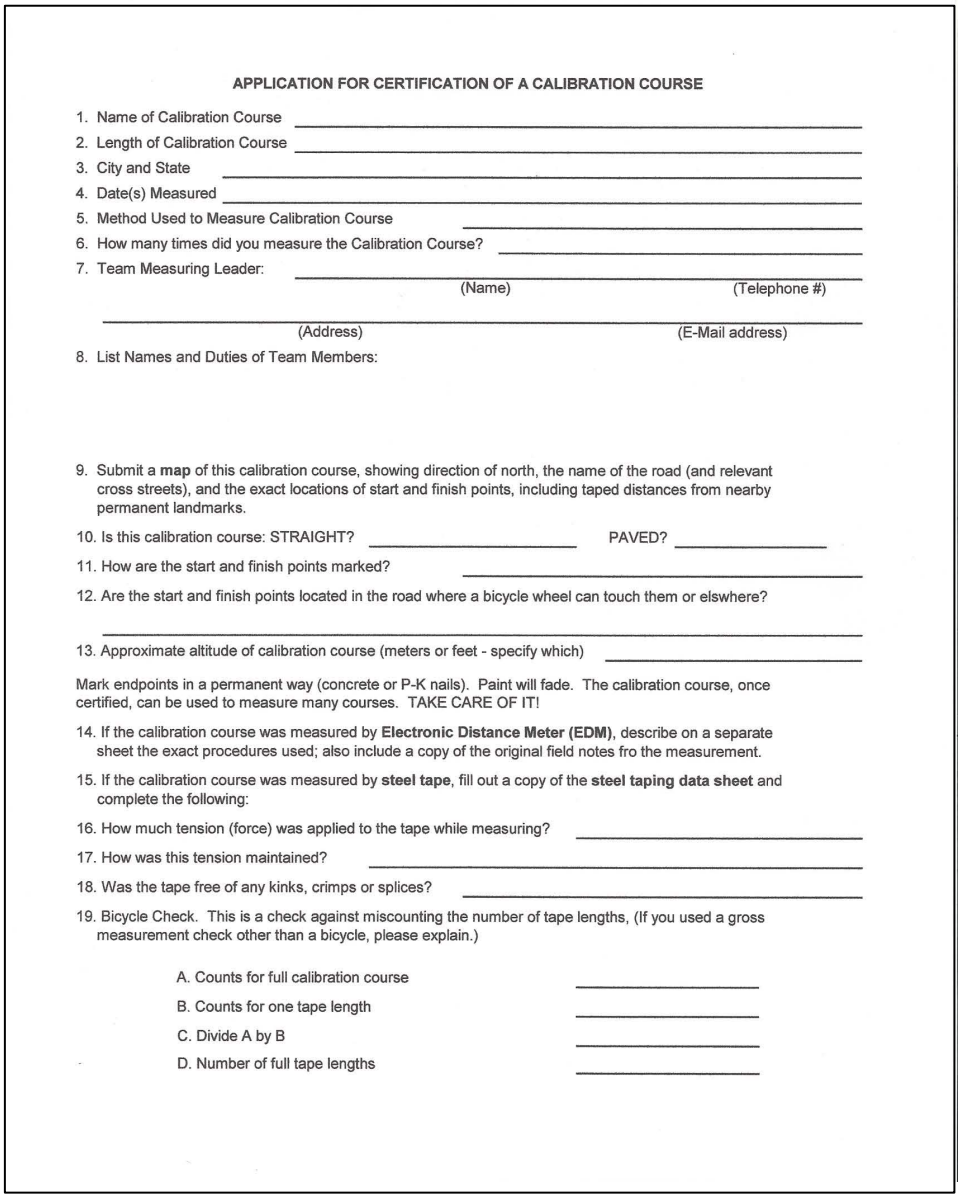
6. If you wish, you may now adjust the course to obtain an even distance, such as one kilometer (not applicable if measuring a track). This is not necessary as you may choose instead to use an odd-distance calibration course whose endpoints are pre-existing permanent objects in the road to guard against hazards such as repaving. If you adjusted the course, explain what you did.

Final Adjusted Length of Calibration Course: 1000 Ft

CONVERSION FACTORS: 1 foot = 0.3048 meters
1 kilometer = 1000 meters = 3280.84 feet

# The Calibration Course

- The Calibration Course Application should be filled out if this will be a permanent course, used on a regular basis by you or by other measurers.



**APPLICATION FOR CERTIFICATION OF A CALIBRATION COURSE**

1. Name of Calibration Course _____
2. Length of Calibration Course _____
3. City and State _____
4. Date(s) Measured _____
5. Method Used to Measure Calibration Course _____
6. How many times did you measure the Calibration Course? _____
7. Team Measuring Leader: _____
   (Name) (Telephone #)
   _____
   (Address) (E-Mail address)
8. List Names and Duties of Team Members:

9. Submit a **map** of this calibration course, showing direction of north, the name of the road (and relevant cross streets), and the exact locations of start and finish points, including taped distances from nearby permanent landmarks.
10. Is this calibration course: STRAIGHT? _____ PAVED? _____
11. How are the start and finish points marked? _____
12. Are the start and finish points located in the road where a bicycle wheel can touch them or elswhere?
    _____
13. Approximate altitude of calibration course (meters or feet - specify which) _____

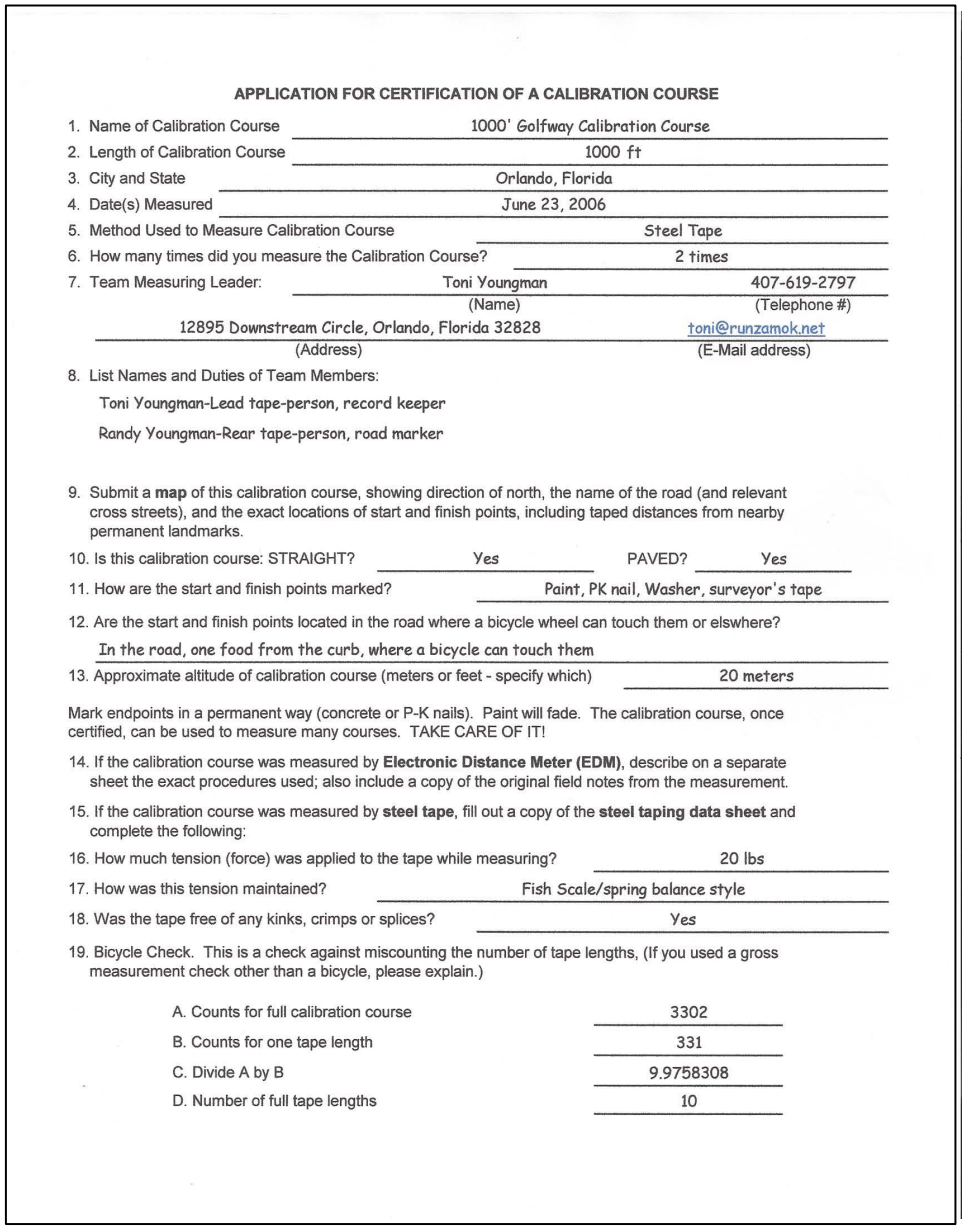
Mark endpoints in a permanent way (concrete or P-K nails). Paint will fade. The calibration course, once certified, can be used to measure many courses. TAKE CARE OF IT!

14. If the calibration course was measured by **Electronic Distance Meter (EDM)**, describe on a separate sheet the exact procedures used; also include a copy of the original field notes fro the measurement.
15. If the calibration course was measured by **steel tape**, fill out a copy of the **steel taping data sheet** and complete the following:
16. How much tension (force) was applied to the tape while measuring? _____
17. How was this tension maintained? _____
18. Was the tape free of any kinks, crimps or splices? _____
19. Bicycle Check. This is a check against miscounting the number of tape lengths, (If you used a gross measurement check other than a bicycle, please explain.)

    A. Counts for full calibration course _____
    B. Counts for one tape length _____
    C. Divide A by B _____
    D. Number of full tape lengths _____

# The Calibration Course

- The Calibration Course Application
  - Answer all questions completely
  - Make sure that the name of the Calibration Course matches the name used on the map



**APPLICATION FOR CERTIFICATION OF A CALIBRATION COURSE**

1. Name of Calibration Course: 1000' Golfway Calibration Course
2. Length of Calibration Course: 1000 ft
3. City and State: Orlando, Florida
4. Date(s) Measured: June 23, 2006
5. Method Used to Measure Calibration Course: Steel Tape
6. How many times did you measure the Calibration Course? 2 times
7. Team Measuring Leader: Toni Youngman (Name) 407-619-2797 (Telephone #)
   12895 Downstream Circle, Orlando, Florida 32828 (Address) toni@runzamok.net (E-Mail address)
8. List Names and Duties of Team Members:
   Toni Youngman-Lead tape-person, record keeper
   Randy Youngman-Rear tape-person, road marker
9. Submit a **map** of this calibration course, showing direction of north, the name of the road (and relevant cross streets), and the exact locations of start and finish points, including taped distances from nearby permanent landmarks.
10. Is this calibration course: STRAIGHT? Yes PAVED? Yes
11. How are the start and finish points marked? Paint, PK nail, Washer, surveyor's tape
12. Are the start and finish points located in the road where a bicycle wheel can touch them or elswhere?
    In the road, one food from the curb, where a bicycle can touch them
13. Approximate altitude of calibration course (meters or feet - specify which) 20 meters

Mark endpoints in a permanent way (concrete or P-K nails). Paint will fade. The calibration course, once certified, can be used to measure many courses. TAKE CARE OF IT!

14. If the calibration course was measured by **Electronic Distance Meter (EDM)**, describe on a separate sheet the exact procedures used; also include a copy of the original field notes from the measurement.
15. If the calibration course was measured by **steel tape**, fill out a copy of the **steel taping data sheet** and complete the following:
16. How much tension (force) was applied to the tape while measuring? 20 lbs
17. How was this tension maintained? Fish Scale/spring balance style
18. Was the tape free of any kinks, crimps or splices? Yes
19. Bicycle Check. This is a check against miscounting the number of tape lengths, (If you used a gross measurement check other than a bicycle, please explain.)

| | |
|---|---|
| A. Counts for full calibration course | 3302 |
| B. Counts for one tape length | 331 |
| C. Divide A by B | 9.9758308 |
| D. Number of full tape lengths | 10 |

# The Calibration Course

- **A Final Note of Warning**
  - Some Certifiers only accept metric measurements. Current standards are going metric with all but the Imperial Road Race Distances. Conversions are easily accomplished if Imperial is needed.
  - Please check with the Certifier to see if they prefer metric calibrations for metric courses.
  - Have a course set up near your home. Most measuring will be done within an hour of home, so it is good to have a course close. Anything further, and a new course should be set up closer to the Measurement. Adjustments must be made before the application and maps are sent in. Maps must be accurate.

# Let’s Lay Out Our Calibration Course

- This space intentionally left blank for Instructor’s use. Instructor should have a picture of area to be used for a calibration course and have students help measure and record the calibration course.


# Session 2

# So, what should I get out of this session?

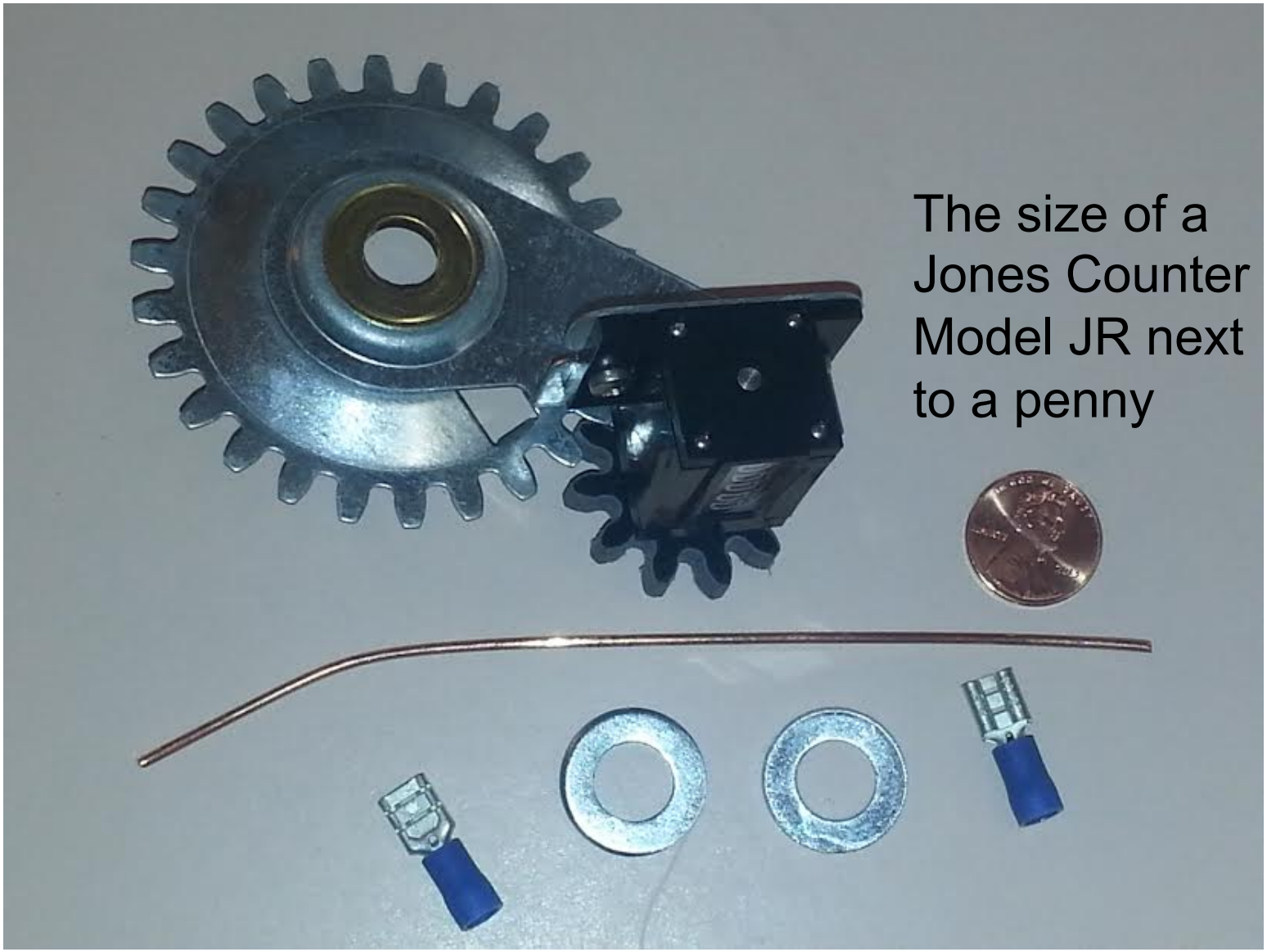
Objectives

# Objectives…

- Introduction to the Jones Counter
- Mount Jones Counter to Bicycles
- Demonstration of Riding by Instructor
- Lay out a Test Course by Instructor


# Introduction of The Jones Counter Model JR

# The Jones Counter



# The Jones Counter

The Jones Counter has been through a few modifications over the years. This is the latest version. The counter can be read by looking straight down the bike wheel. The parts next to the Jones counter are included when you order a new Jones Counter Model JR.

Jones Counters come in 5 digit and 6 digit models. There is also a right hand model (mounted on the right side of the bike wheel) for an additional cost.

# The Jones Counter

The Jones Counter may be ordered by going to the RRTC.net website and clicking on The “Jones Counter model JR”, this will take you to the JONESCOUNTER.COM website

Jones Counter Costs (US Dollars in the USA)

- $140 for a 5 digit
- $160 for a 6 digit
- $180 for a right hand Counter

- A PayPal account will be used to pay for the Counter.


# Mounting the Jones Counter

# Mounted on the bicycle…


This Jones Counter is a 6 digit model. It currently reads 608002. I round up when writing the count at the end of my first calibration ride, but the Jones Counter is locked and will start the second calibration ride on the partial count as shown.

# Mounting the Jones Counter

- The Jones Counter goes on the front hub of the bicycle.
- The Jones Counter should be on the left side of the wheel (unless a right hand counter was purchased).
- There are Instructions and mounting aids included in the Jones Counter package.
- The wheel should be able to move freely once the counter is installed.
- The measurer should be able to read the Jones counter over their handlebar.

# Calibrating the Bicycle Demonstration

# Calibrating the Bicycle

- Start riding at one end of the calibration course
- Turn around at the other end and ride back
- At least two rides in each direction (4 rides total)
- The rides on your Calibration Course must be within 2 counts of each other. If they are not, continue to ride until you get consistent rides. The difference between counts is between 3-4 inches. A 2 count difference could be as much as an 8 inch difference between rides.
- Determine your constant by averaging the counts from your rides, multiply by the factor that equals km or mile (established by your calibration course), and including a factor of 1.001

# Calibrating the Bicycle

## Notes should appear like following:

Name of Course: 1000' Golfway FL06037DL Date: 11-17-13
Time: 4:45 am Temp: 72 F
Rider – Toni Women's 5k in St. Pete

| | Counts | Difference |
|---|---|---|
| 1 | 979000 | |
| 2 | 982315 | 3315 |
| 3 | 985630 | 3315 |
| 4 | 988946 | 3316 |
| 5 | 992262 | 3316 |

*These Notes give counts in miles and kilometers. Here in the US we often note miles on the course, even for metric distances. This helps set up mile marks and the 5 km overall distance.*

992262 - 979000=13262/4=3315.50x(5280/1000)=17505.84x1.001*=
17523.34584=17524** counts per mile
17523.34584/1.609344=10888.5023=10889** counts per km

***A Short Course Prevention Factor (SCPF) of 1.001 is used in calculating your counts for both WORKING and FINISH constants.**

****Counts are ALWAYS rounded up at the end of calculations.**

# Calibrating the Bicycle

| | Counts | Difference |
|---|---|---|
| 1 | 979000 | |
| 2 | 982315 | 3315 |
| 3 | 985630 | 3315 |
| 4 | 988946 | 3316 |
| 5 | 992262 | 3316 |

Must be within 2 counts for all rides

Note that the counts are close. The distance per count is anywhere from 3-4 inches, depending on your wheel size and pressure. Much difference between the counts means you are not riding consistently. **Start on an even 1000 count (like above) and you can easily do the math in your head.** If your counts are not looking consistent, continue riding the calibration course until you get 4 rides in a row that are.

# Calibrating the Bicycle

## Why do we use a Short Course Prevention Factor (SCPF)?

A Short Course Prevention Factor (SCPF) is just as it sounds. It is to prevent creating a short course. We multiply the counts per mile or kilometer by a factor of 1.001. This is equal to one meter per kilometer (or one foot per thousand feet). By adding this small amount of distance, you make sure your course is at least as long as you say it is.

Think about how your second ride of the course is sometimes longer or shorter than the first ride. We cannot always ride exactly the same every time.

If a course is found short, and a runner breaks a record on it, the record does not stand. This is a huge disappointment for the runner and the race. Building in this factor helps to make sure it can stand the audit, if you're lucky to need one.


# Laying Out a Test Course

# Test Course for Participants

This space left blank for an instructor to add a picture or street by street directions of what is to be measured. Instructor should explain their process for planning a measurement and Demonstrate Measuring a Course.


# Session 3

# So, what should I get out of this session?

Objectives

# Objectives…

- Understand the Practical aspects of measuring the course
- Be able to calculate splits.
- Understand how to take good notes and create good Documentation of the measurement
- Understand Shortest Possible Route (SPR) and how to measure it
- Off-Setting techniques and knowing when to use them
- Laying out Turnarounds
- Do the Physical Measurement of a Course
- Do the Post Measurement Calculations and Adjustments to a Course


# Measuring the Course

# Measuring the Course

- Calculate the course length in counts: constant (counts/meter) x length (meters)
- Begin measuring at either the start or the finish
- Mark intermediate splits as you go
- Follow the SHORTEST POSSIBLE ROUTE (SPR)

# Measuring the Course

## Noting Key Points and Intermediate Splits on the Course

- **Start, Finish,** and **Turnaround** points **MUST** be noted in detail. A hand drawn map of these areas would also be prudent at this time

- Points should tell you where they are

- Points should be directional

- Points should reference permanent landmarks

# Measuring the Course

## Noting Key Points and Intermediate Splits on the Course

Example:

**START IS ON MAIN STREET, FACING NORTHEAST. POINT IS ACROSS FROM AND IN LINE WITH FIREHOUSE 72 DRIVEWAY.**

This shows Where, Direction, and a reference to a permanent landmark. But it is **NOT** complete. This is a certified point, so it must be very detailed. It must be found, even if the nail and paint are gone.

# Measuring the Course

## Noting Key Points and Intermediate Splits on the Course

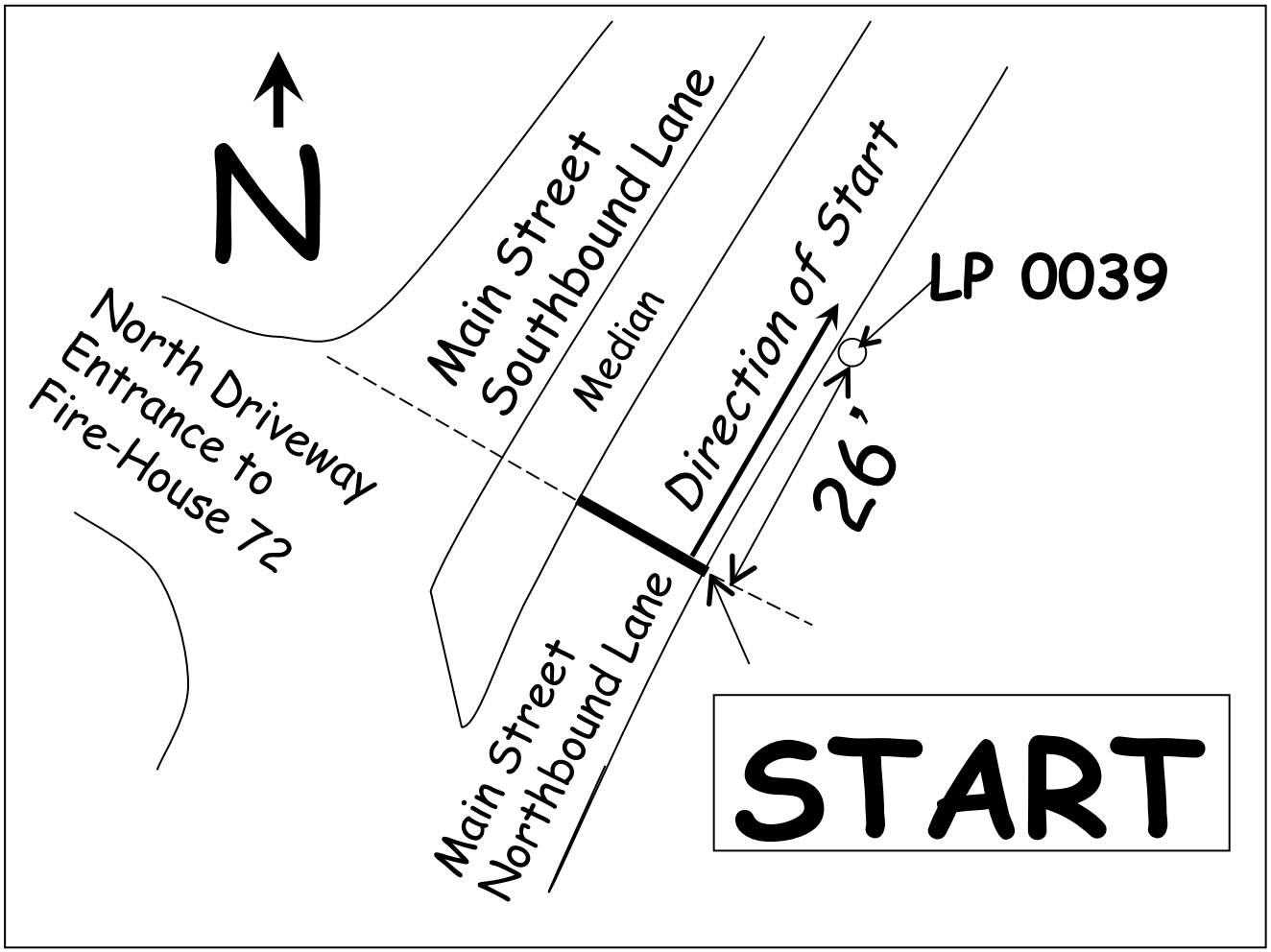
OR:

**START IS ON THE SOUTHEAST SIDE OF THE NORTHBOUND LANE OF MAIN STREET, FACING NORTHEAST. POINT IS 26 FEET SOUTHWEST OF LIGHT POLE 0039 AND ACROSS FROM AND IN LINE WITH THE NORTH SIDE OF THE FIREHOUSE 72 NORTH DRIVEWAY ENTRANCE**.

More details will help to find the point even if the nail and paint are gone. When a detail map is added, it becomes easy to find.

# Measuring the Course

## Noting Key Points and Intermediate Splits on the Course




Create a Detail Map of Starts, Finishes, and Turnarounds. These **MUST** be on the Certification Map Later.

# Measuring the Course

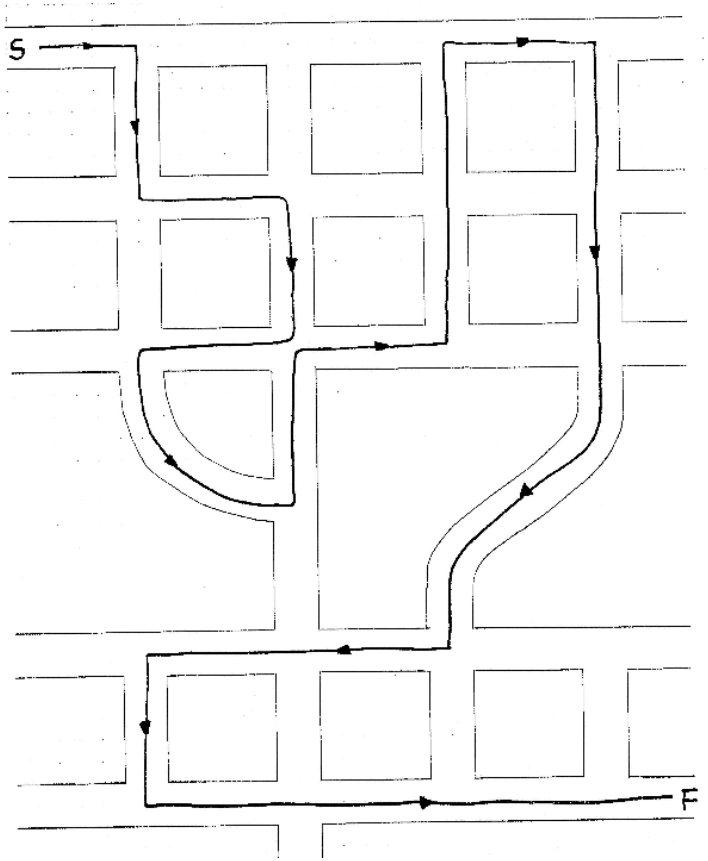
## The Shortest Possible Route

- Defined as “the shortest possible route a runner can take and not be disqualified”
- Measure no more than 30 cm (1 ft) from the curb or the side of the road, obstacles, or bends
- Try to stay at 30 cm from the edge of the road or curb when following bend or corners in the road.

# Measuring the Course

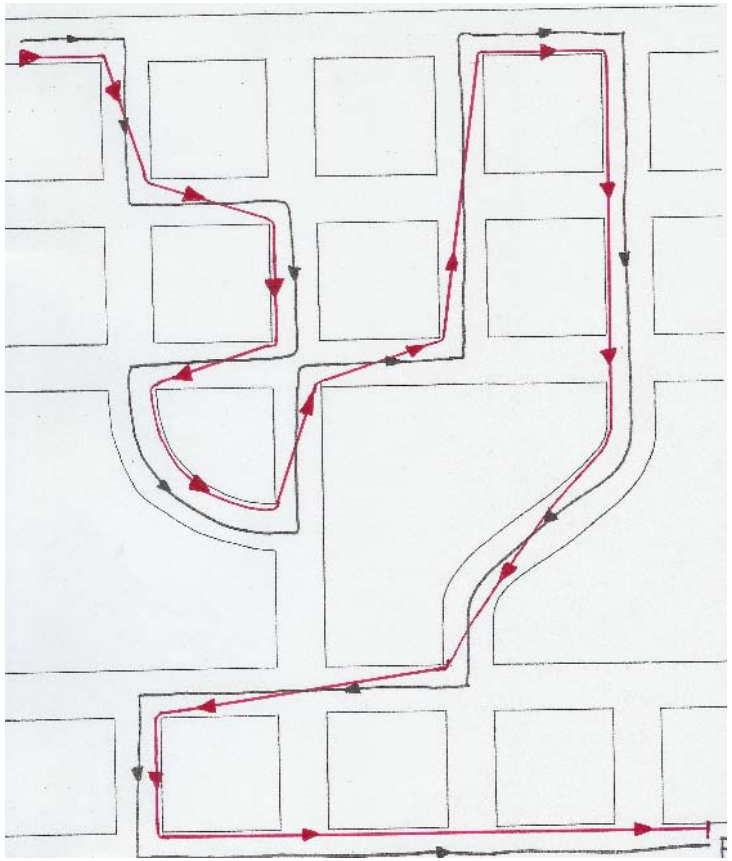
## The Shortest Possible Route

- This map shows the route from start to finish.  Is this the path you would follow when you measure?



# Measuring the Course

## The Shortest Possible Route



- Red line shows the route that should be measured
- Stay to the inside on curves
- Connect with diagonals if necessary
- “Running the Tangents”

# Measuring the Course
## Off-Setting Your Bike

**What is off-setting?**

Off-setting is when a measurer locks his Jones counter in the middle of the measurement, then moves his bicycle to another part of the road. This is done to prevent swerving around parked cars and sometimes to bring the bicycle to a safer side of the road during the measurement.

# Measuring the Course

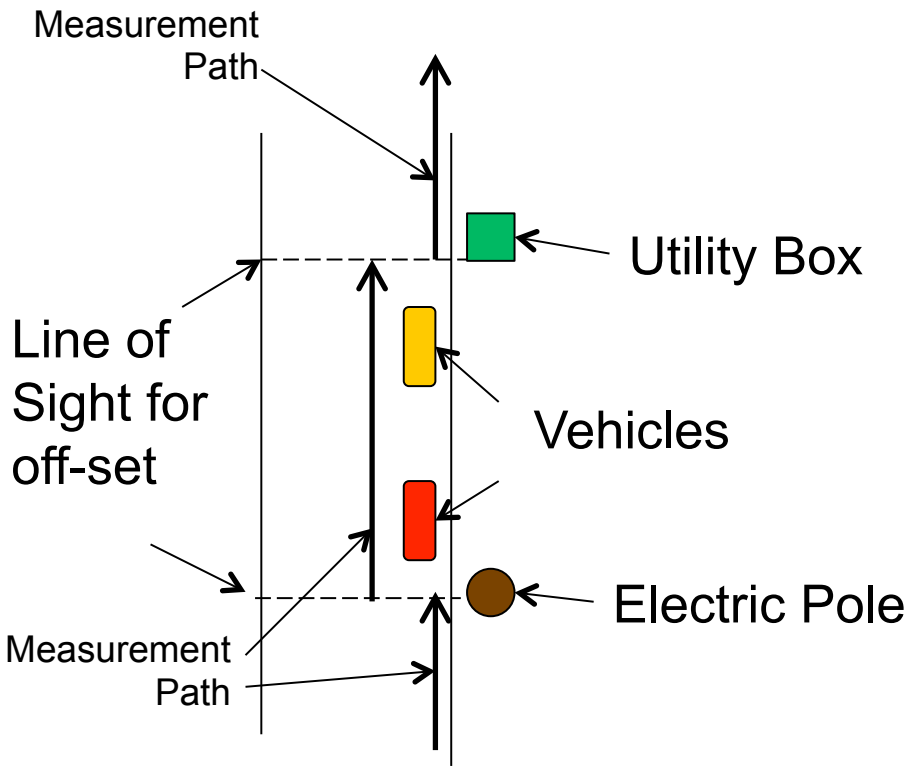
## Off-Setting Your Bike

**How is off-setting done?**

Off-setting is done by riding up to a point on the course just before you off-set. You lock the brake on the front wheel (Jones Counter cannot move now) and get off the bike. Keeping your hand on the brake, you pick up the bike and move it to another point on the course, and set it back down. Once you are back on the bike, you can let go of the brake and continue riding the course.

# Measuring the Course

## Off-Setting Your Bike




When off-setting, pick objects close to where you want to off-set. Ride up to the objects, Line Jones Counter up with object, Lock your Brake, Move the Bike over, Ride as straight of a line as possible to the next object in the road, Line up your Jones Counter and Move bike back over. Continue on with measurement.

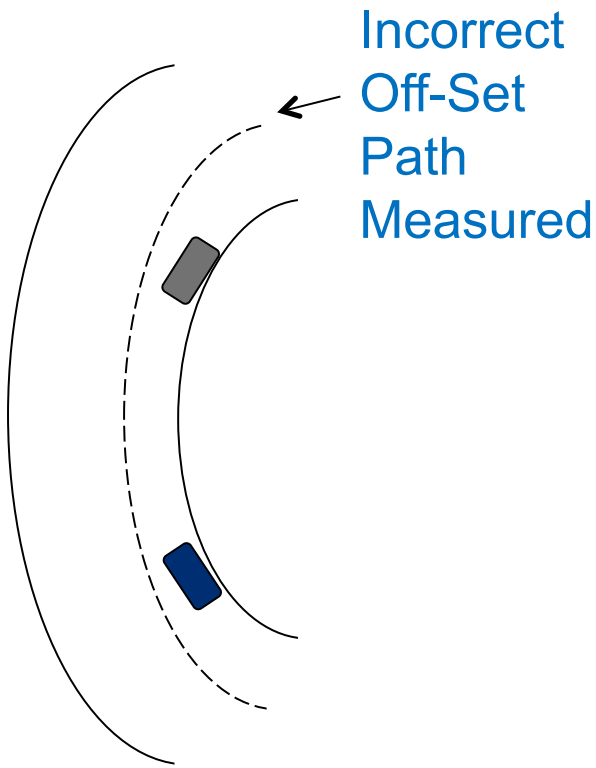
**Caution**: This should be done as little as possible, due to errors in off-setting. All points should be noted and added to your application report when submitting for certification.

# Measuring the Course

## Off-Setting Your Bike

## Never Off-Set on a Curve

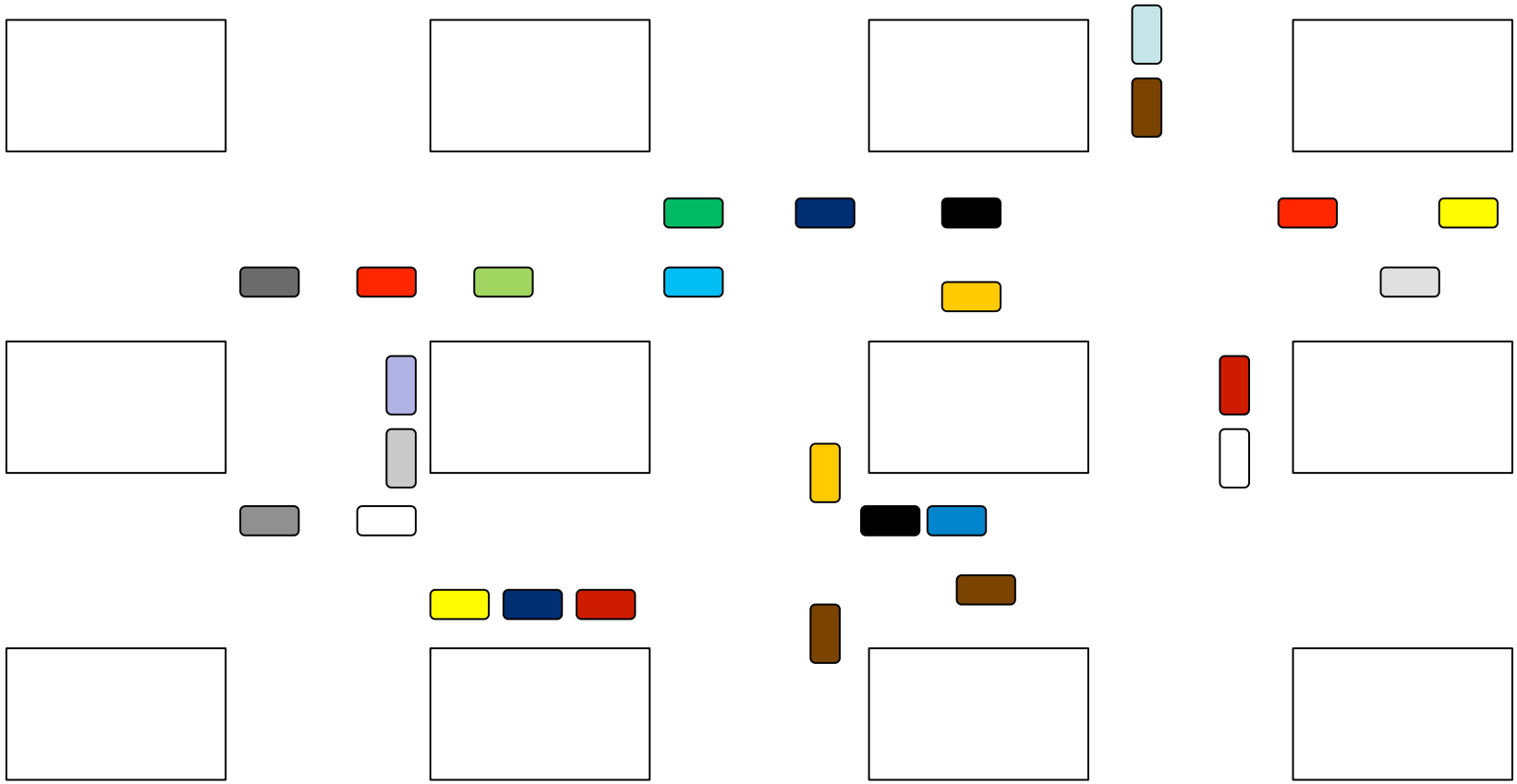
Off-Setting around the outside of these vehicles will cause your course to be short. You will be measuring a longer distance than SPR. Better to wait for no vehicles, or measure on the curb if absolutely necessary.



# Measuring the Course

## Off-Setting Your Bike

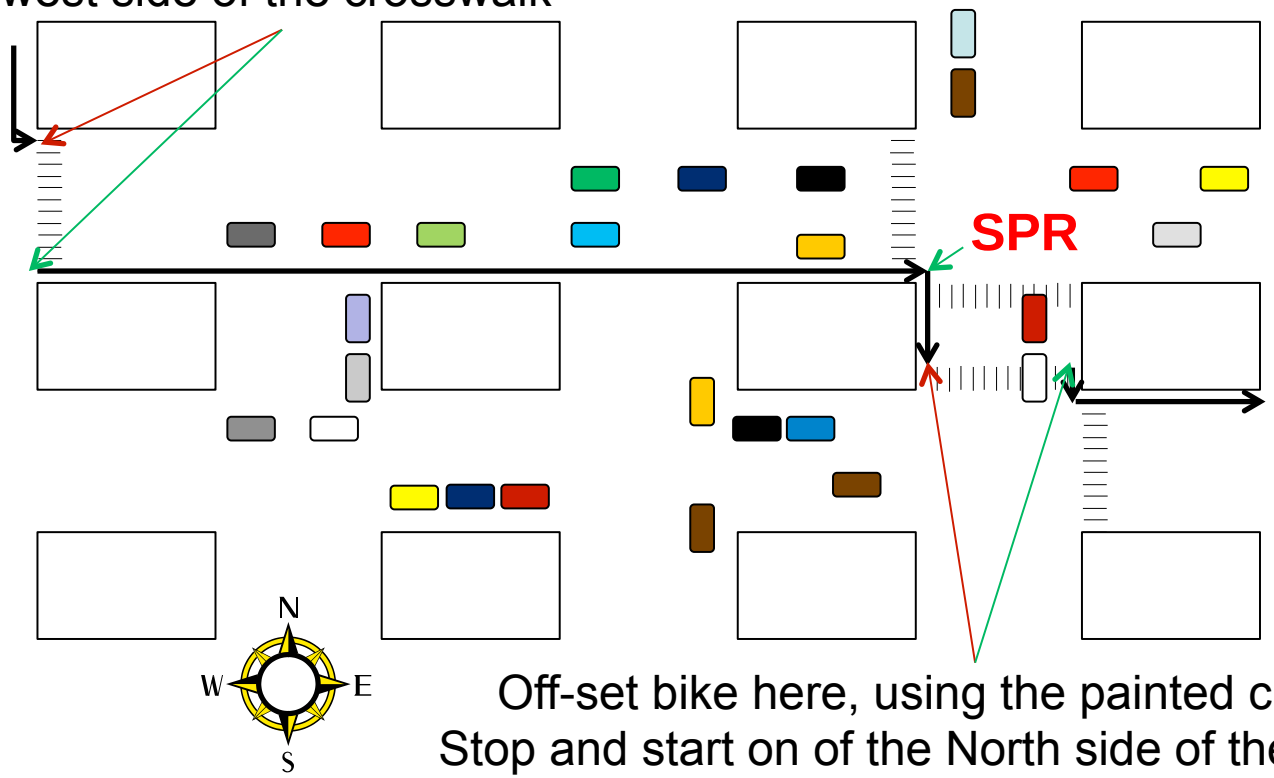
These streets are busy. A measurer cannot cross these lines of traffic. Off-setting should be done for the safety of the measurer and the drivers.



# Measuring the Course

## Off-Setting Your Bike

Off-set bike here, using the painted crosswalk. Stop and start on of the west side of the crosswalk




*Use your Jones Counter as the point of starting and stopping. When the Jones counter is at the west side of the crosswalk, stop the wheel. Place the Jones counter on the west side of the crosswalk on the south side of the intersection and start the wheel again.*

Off-set bike here, using the painted crosswalk. Stop and start on of the North side of the crosswalk

# Measuring the Course

## Off-Setting Your Bike

**Some final notes on Off-Setting:**

**Plan your measurement**. Know when and where you want to off-set before getting there. Sometimes it's too late once you get into the middle of the area that may need off-setting.

**Use this as sparingly as possible**. Measure when the roads are clear of traffic and debris (even in the middle of the night if it helps).

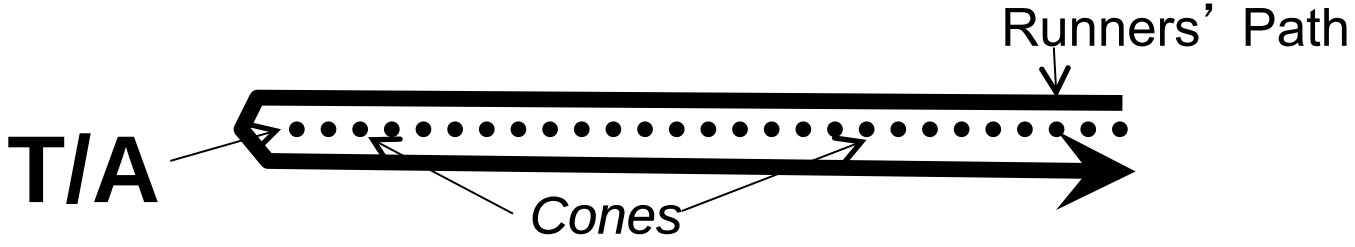
**Report your off-sets, even if only in your own notes**. These are where errors happen, and you may need to find out why your two measurements may not agree with each other.

**Off-Setting could, inherently, makes your course longer**. But never rely on that fact to shorten your course.

# Measuring the Course

## What is a Turnaround (T/A)?

A Turnaround is a point in the road where the runners double back and go the same way they came. There is usually a line of cones between runners moving toward the turnaround and those having just passed the turnaround. Runners keep to the same side of the cones all of the time. In the illustration below, the runners stay to the right of the cones (cones on the left side of the runners) going to it and coming back from it.



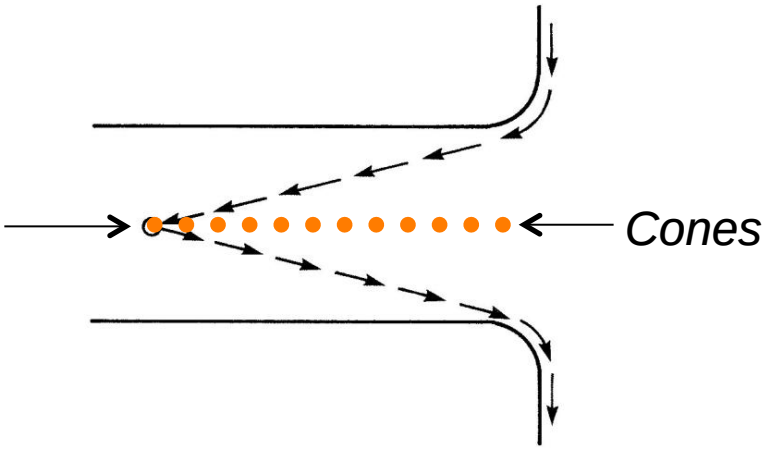

***Turnarounds are a good place to adjust a course if the Start and Finish cannot be adjusted.***

# Measuring the Course

## Measuring a Turnaround

Most turnarounds are created as a **HAIRPIN TURN**. The simplest way to measure such a layout is to ride up to the position of the turn, lock the front wheel, record the count, turn the bicycle around and then continue the measurement back in the other direction.

Usually, one cone placed on the nail is the apex of the turnaround, and runners keep to one side of the cones (cones always to their left or right)

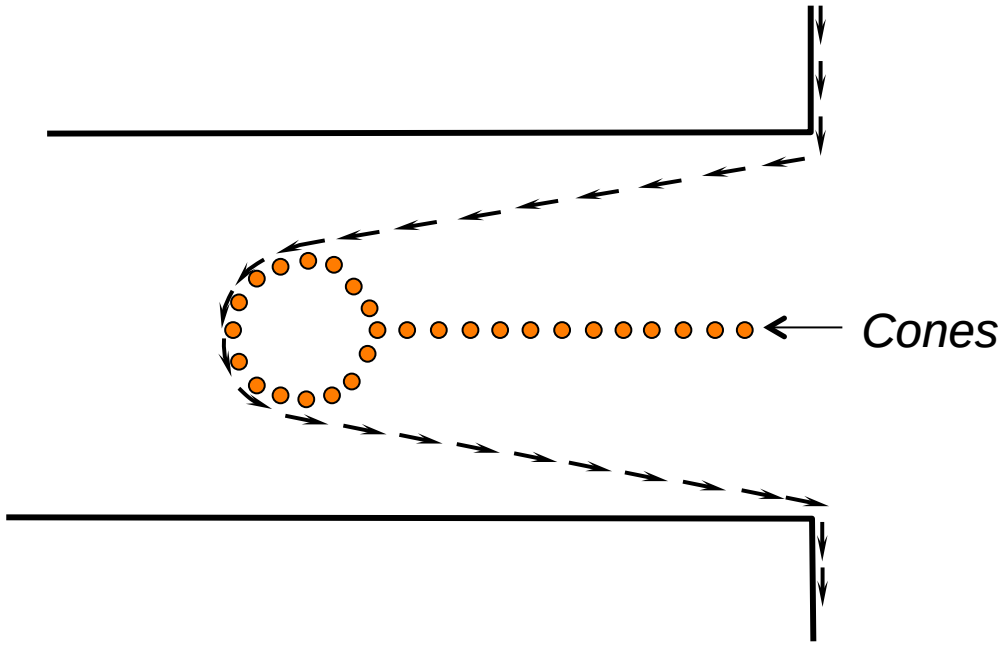


# Measuring the Course

## Measuring a Turnaround

Runners don't typically run like a basketball player, pivoting on one foot at the apex of the turn. Instead, an arc may be created, softening the turnaround for runners and race walkers.

***These kinds of turns are usually created for Race Walks and Championship Races. It is worth noting so that, you, the measurer are able to create this if the race desires or requires this kind of turn. Most measurers never create one of these kinds of turns.***



# Measuring the Course

## Adjusting an Arc Turn

If you're coning a radius R, the extra distance covered in running (or walking) around the turn, compared with doing a hair-pin right on the radius center is pi x (R + 30cm) or, if you prefer, pi x (R + 0.3m).

Turning a hair-pin turn into a 5' arc (10' diameter semi-circle), you would calculate the added distance as follows:

**pi x (1.524m + 0.3m)**

**= 5.730m = 18.8 ft**

*This is the distance that has been **added** to the course.*

# Measuring the Course

## Adjusting a Hair-pin Turn into an Arc Turn

To create an arc from a hair-pin turn without adding distance, you will use the following formula to figure out how far to set your turn back from the measured point:

**0.5 x pi x (R + 0.3m)**

***Example:***

***If you want a 5 ft arc (10 ft diameter semi-circle), you will substitute 1.524m (5 feet) for the R in the formula.***

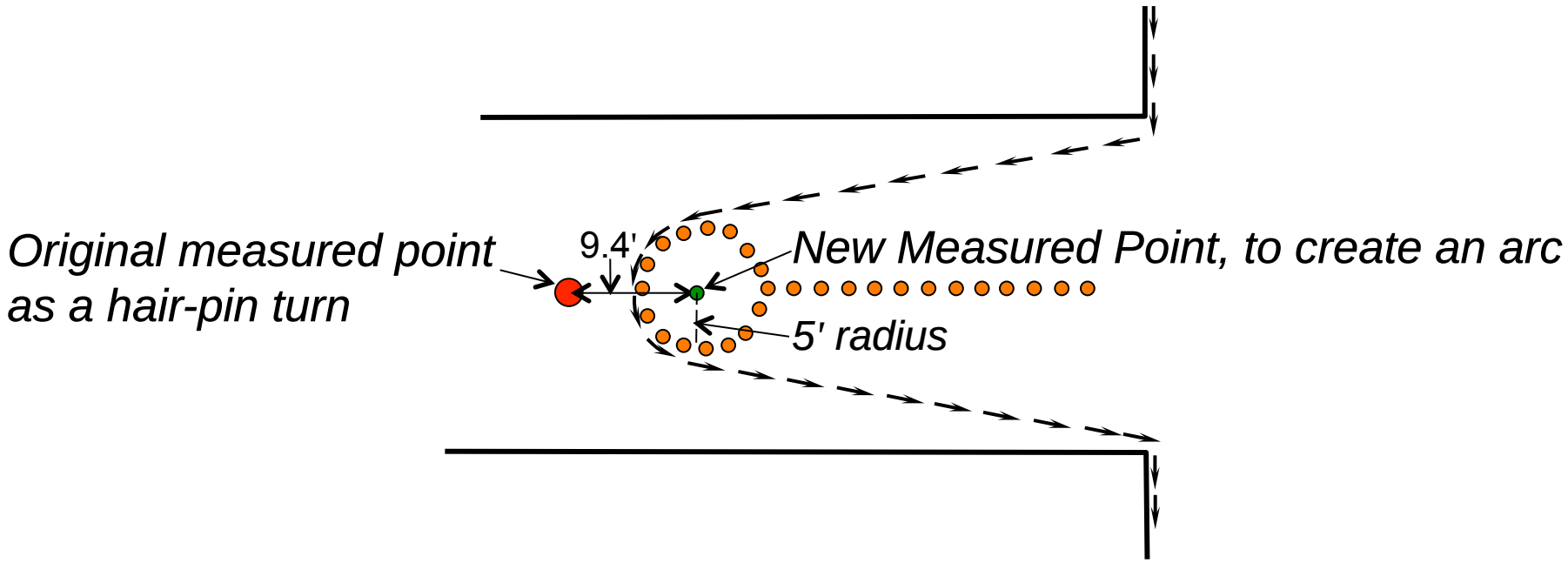
**0.5 x pi x (1.524m + 0.3m)**

**= 2.865m = 9.4 ft**

# Measuring the Course

## Adjusting a Hair-pin Turn into an Arc Turn

The arc may be laid out using chalk and string. Hold one end of the 5' string on the center nail. With the string fully extended, chalk the arc. This path may be painted, and/or nailed to aid the race director on race day.



# Measuring the Course

- Measure the course twice
- Note Key Points or mark points as it is measured
- Measurements must be within 0.08% of each other (4 meters over 5 km distance)
- Course length is the **SHORTER** of the two measured lengths
- Re-calibrate after you have two measurements that are within the required tolerance

# Measuring the Course

- Recalculate course length, if necessary
- Adjust course length with steel tape, if necessary, preferably at start, finish, or turnaround point
- Make sure all key points are permanently marked
- Make notes on any particulars that could have an effect on the measurement
  - Did you offset your Bicycle?
  - Did it rain on and off, or did a front go through during the measurement?
  - Was there a lot of stopping and starting due to traffic?
  - Did you need to back up the bicycle because you went past a key point?
  - Did you need to measure a third time because your first rides did not compare to less than 0.08%

# Measuring the Course

## Doing the Calculations (worksheet)

| | Counts Ride 1 | Difference | Counts Ride 2 | Difference |
|---|---|---|---|---|
| Start | | | | |
| 1 mile | | | | |
| 2 mile | | | | |
| 3 mile | | | | |
| Finish | | | | |

| | | | | |
|---|---|---|---|---|
| | Difference | Working Constant | Distance | |
| Length 1 | | | | |
| Length 2 | | | | |
| Lngth 1-Lngth 2 | | Div by Length 1 | ?< .0008 | |

| | | | | |
|---|---|---|---|---|
| | Difference | Finish constant | Distance | |
| Length 1 | | | | |
| Length 2 | | | | |

| | | | | |
|---|---|---|---|---|
| Desired Length | 5 km | Measured Length | Difference | |
| Distance to change Course | | | | |


# Session 4

# So, what should I get out of this session?

Objectives

# Objectives…

- Completing a Successful Application
- Filling in the Application COMPLETELY, what your Certifier will be looking for
- Learn how to draw a good course map
- Know how to send in your application to the Certifier
- What the Measurement Certificate looks like
- GPS-how it compares to the Calibrated Bicycle Method of Measuring
- Answer any questions


# Completing the Application for a Course Measurement

# Filling out the Application

- Download the latest version of the Bicycle Calibration Data Sheet, Course Measurement Data Sheet, and Application for Certification of a Road Race (the Calibrated Bicycle Method) from the rrtc.net website
- Fill in ALL blanks and answer ALL questions.
- Keep a copy of the application for your records

# Filling out the Application

**BICYCLE CALIBRATION DATA SHEET**

Name of Event _____ Date of Measurement _____

Name of Measurer _____

Length of Calibration Course _____

Calibration Course Number _____

1. Ride the calibration course 4 times, recording data as follows:

| Ride | Start Count | Finish Count | Difference |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

Pre-measurement
Average Count _____
Time of Day _____
Temperature

**Note**: The spread shouldn't exceed 2 to 3 counts for riding each direction of the calibration course.

WORKING CONSTANT = Number of counts in one kilometer or one mile, calculated from Pre-measurement average count, and multiplied by **1.001 "safety factor."**

WORKING CONSTANT =

2. Now, measure the course, including all intermediate distances, using the working constant. Enter data on the **"Course Measurement Data Sheet."**

3. Recalibrate the bicycle by riding the calibration course 4 times, recording data as follows:

| Ride | Start Count | Finish Count | Difference |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

Post-Measurement
Average Count _____
Time of Day _____
Temperature _____

**Note**: The spread shouldn't exceed 2 to 3 counts for riding each direction of the calibration course.

FINISH CONSTANT = Number of counts in one kilometer or one mile calculated from Post-measurement average count, and multiplied by **1.001 "safety factor."**

FINISH CONSTANT =

CONSTANT FOR THE DAY = **Either** the Working Constant **or** the Finish Constant, whichever is the **larger***.

Constant for the Day = _____

**Remember**, each day's measurement must be preceded and followed by a calibration run. You may measure as much as you want in a day, just so calibration precedes and follows it in the same 24 hour period. This is done to minimize error due to changes in tire pressure from thermal expansion and slow leakage. Frequent calibration "protects" the previous measurement. A smart measurer will calibrate frequently--you never know when a flat is coming!

**CONVERSION FACTOR: 1 mile = 1.609344 kilometers**

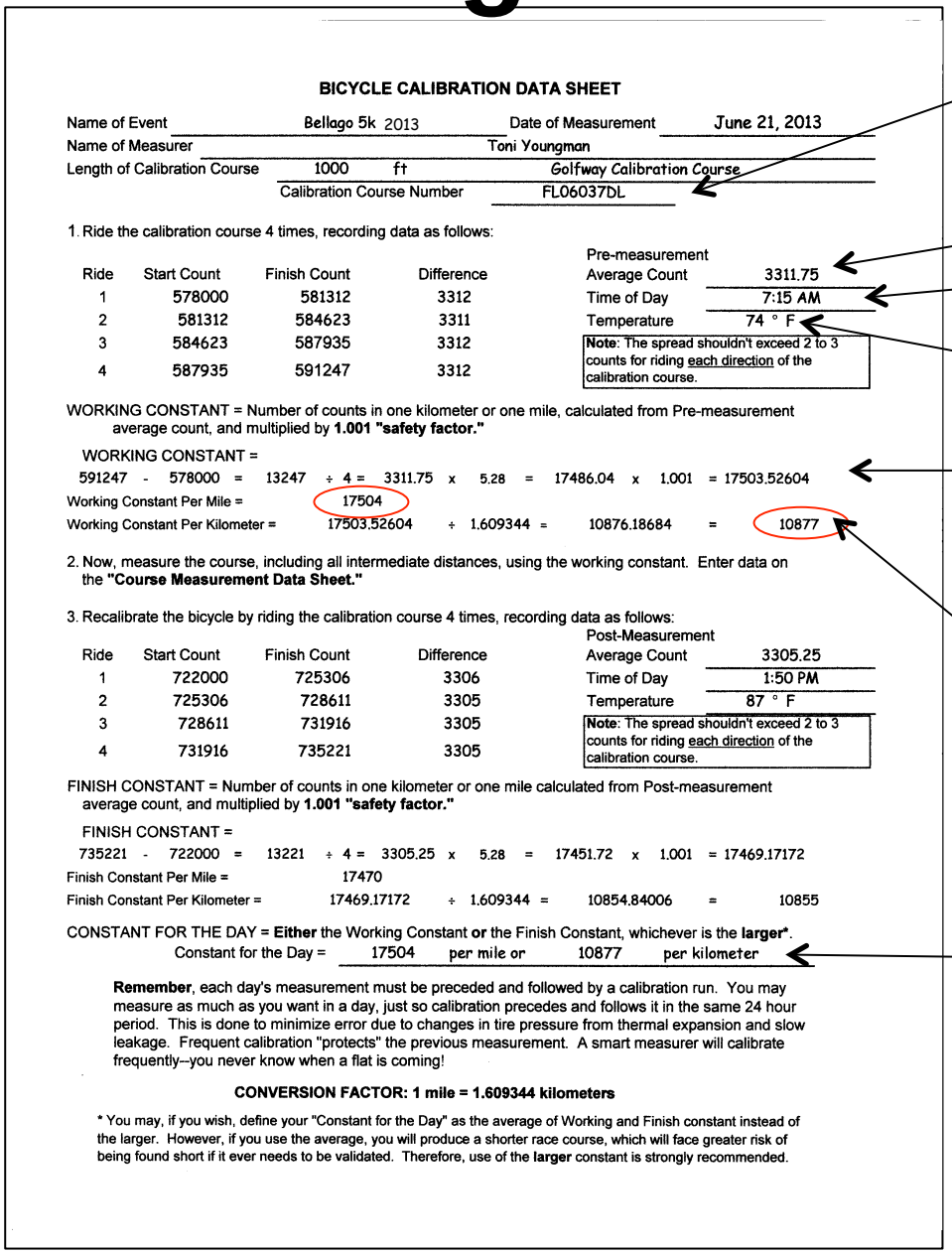
* You may, if you wish, define your "Constant for the Day" as the average of Working and Finish constant instead of the larger. However, if you use the average, you will produce a shorter race course, which will face greater risk of being found short if it ever needs to be validated. Therefore, use of the **larger** constant is strongly recommended.

**All Math** should be shown on your sheet, so the Certifier can follow your logic.

Use units of measure, the details matter when you measure your course

If 2 people measure the course together, then 2 BCDS are needed, **one for each measurer.**

# Filling out the Application



**BICYCLE CALIBRATION DATA SHEET**

Name of Event: Bellago 5k 2013 — Date of Measurement: June 21, 2013
Name of Measurer: Toni Youngman
Length of Calibration Course: 1000 ft — Golfway Calibration Course
Calibration Course Number: FL06037DL

1. Ride the calibration course 4 times, recording data as follows:

| Ride | Start Count | Finish Count | Difference |
|---|---|---|---|
| 1 | 578000 | 581312 | 3312 |
| 2 | 581312 | 584623 | 3311 |
| 3 | 584623 | 587935 | 3312 |
| 4 | 587935 | 591247 | 3312 |

Pre-measurement
Average Count: 3311.75
Time of Day: 7:15 AM
Temperature: 74 ° F

**Note**: The spread shouldn't exceed 2 to 3 counts for riding each direction of the calibration course.

WORKING CONSTANT = Number of counts in one kilometer or one mile, calculated from Pre-measurement average count, and multiplied by **1.001 "safety factor."**

WORKING CONSTANT =
591247 - 578000 = 13247 ÷ 4 = 3311.75 x 5.28 = 17486.04 x 1.001 = 17503.52604
Working Constant Per Mile = 17504
Working Constant Per Kilometer = 17503.52604 ÷ 1.609344 = 10876.18684 = 10877

2. Now, measure the course, including all intermediate distances, using the working constant. Enter data on the **"Course Measurement Data Sheet."**

3. Recalibrate the bicycle by riding the calibration course 4 times, recording data as follows:

| Ride | Start Count | Finish Count | Difference |
|---|---|---|---|
| 1 | 722000 | 725306 | 3306 |
| 2 | 725306 | 728611 | 3305 |
| 3 | 728611 | 731916 | 3305 |
| 4 | 731916 | 735221 | 3305 |

Post-Measurement
Average Count: 3305.25
Time of Day: 1:50 PM
Temperature: 87 ° F

**Note**: The spread shouldn't exceed 2 to 3 counts for riding each direction of the calibration course.

FINISH CONSTANT = Number of counts in one kilometer or one mile calculated from Post-measurement average count, and multiplied by **1.001 "safety factor."**

FINISH CONSTANT =
735221 - 722000 = 13221 ÷ 4 = 3305.25 x 5.28 = 17451.72 x 1.001 = 17469.17172
Finish Constant Per Mile = 17470
Finish Constant Per Kilometer = 17469.17172 ÷ 1.609344 = 10854.84006 = 10855

CONSTANT FOR THE DAY = **Either** the Working Constant **or** the Finish Constant, whichever is the **larger***.
Constant for the Day = 17504 per mile or 10877 per kilometer

**Remember**, each day's measurement must be preceded and followed by a calibration run. You may measure as much as you want in a day, just so calibration precedes and follows it in the same 24 hour period. This is done to minimize error due to changes in tire pressure from thermal expansion and slow leakage. Frequent calibration "protects" the previous measurement. A smart measurer will calibrate frequently--you never know when a flat is coming!

**CONVERSION FACTOR: 1 mile = 1.609344 kilometers**

* You may, if you wish, define your "Constant for the Day" as the average of Working and Finish constant instead of the larger. However, if you use the average, you will produce a shorter race course, which will face greater risk of being found short if it ever needs to be validated. Therefore, use of the **larger** constant is strongly recommended.

Name and Number of the Calibration Course

Do not round this number up or down

Reference time of day with AM or PM

Reference Temperature with F or C

Show all of your math, so the Certifier can follow how you achieved your working and finish constants

Rounding UP happens at the end of your calculations. There is no way to see partial Jones counts.

This is a metric course, but miles are used for splits, both constants are noted. Since this is a metric measurement, the metric constant is the "Official" constant

# Filling out the Application

**COURSE MEASUREMENT DATA SHEET**

Name of Course or Race Name _____

Name of Measurer for ride #1 _____ Working Constant #1 _____

Date _____ Start: Time _____ Temperature _____

Finish: Time _____ Temperature _____

Name of Measurer for ride #2 _____ Working Constant #2 _____

Date _____ Start: Time _____ Temperature _____

Finish: Time _____ Temperature _____

**Measurement Data.** Use the first measurement ride to lay out the start/finish points and all intermediate split points. Use the second ride to record counts at those **same** points. **Do not lay out a second set of marks.**

| Measured Point | Counts for Measurment #1 Recorded | Interval | Counts for Measurement #2 Recorded | Interval |
|---|---|---|---|---|

| Preliminary Course Length | start to finish counts | divided by | working constant | = | measured length |
|---|---|---|---|---|---|
| Measurement #1 | _____ | / | _____ | = | _____ |
| Measurement #2 | _____ | / | _____ | = | _____ |

| Difference between lengths #1 and #2 | divided by | length #1 | = | Measurement comparison (less that 0.0008) | |
|---|---|---|---|---|---|
| _____ | / | _____ | = | _____ | (YES) [yes or no] |

**IMPORTANT. Before** you leave the course, compare the two measurements. They should agree to within 0.08%. If the two preliminary measurements do not agree to withing 0.08%, something is wrong. Fix it. Then go to the calibration course and recalibrate. .

If either of the **Constants for the Day** (for measurement #1 or #2) is **not** the same as the **Working Constant** for that measurement, recalculate the length of the course here:

| Final Course Length | start to finish counts | divide by | constant for the day | = | length of course |
|---|---|---|---|---|---|
| Measurement #1 | _____ | / | _____ | = | _____ |
| Measurement #2 | _____ | / | _____ | = | _____ |

The length of the race course is the lesser of the two lenghts calculated above.

Measured course length _____ Desired course length _____

Use a steel tape to add or subtract distance as required to bring the **minimum** length to the same value as the desired course length.

How much did you add or subtract, and where (start, finish, turn-around point)?

_____

**Note:** you need not adjust intermediate split points unless certification is desired for those points. Did you adjust the intermediate points and, if so, how?

When filling out this Data Sheet, make sure the name of the race agrees with the name of the race on your map and application.

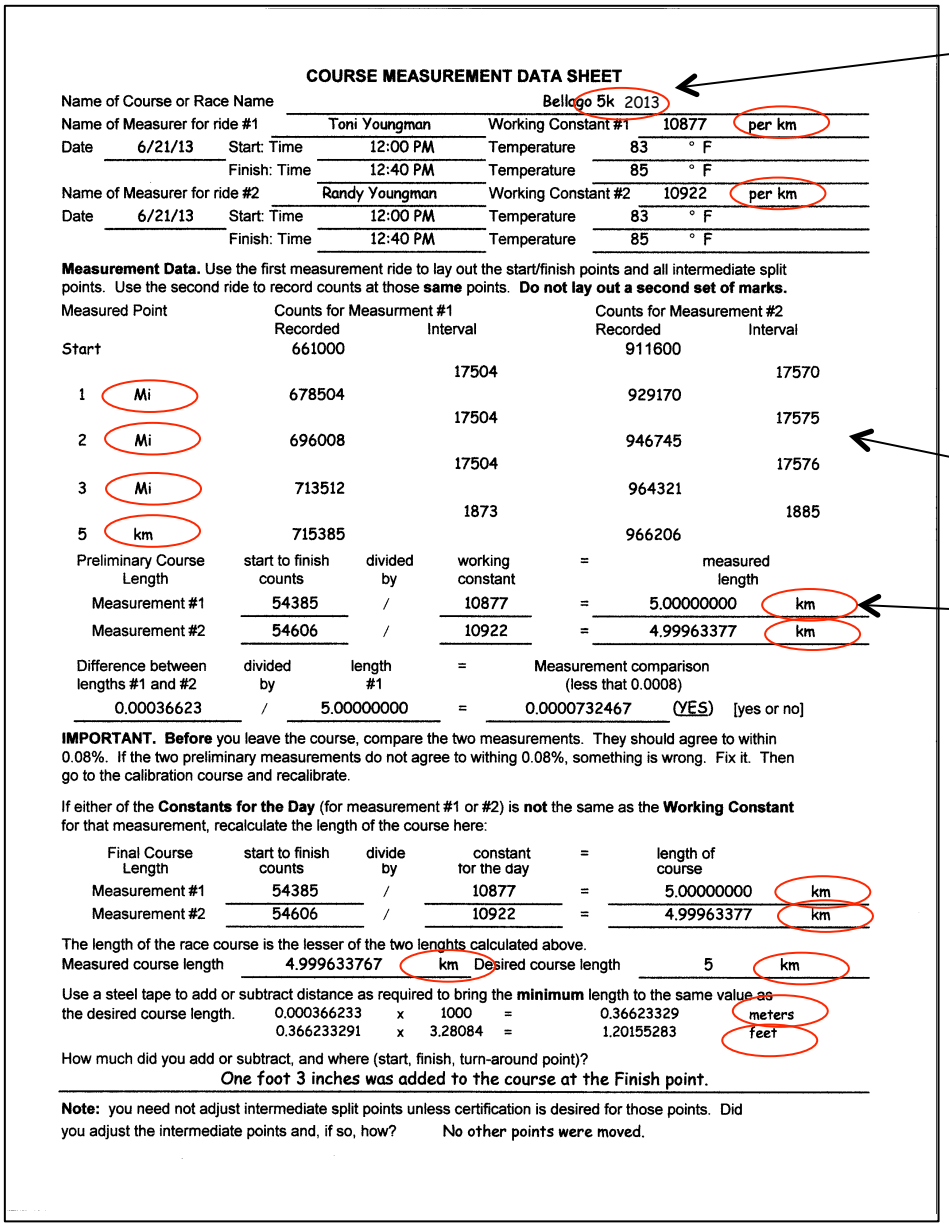
If more room is needed under the measurement data section, feel free to add a sheet with all the information for each split. This is just about enough room for a 5 km measurement complete set of data

Use units of measure, the details matter when you measure your course

If 2 people measure the course together, only one sheet is needed here. There is room for both rides to be noted on this sheet.

Make sure to answer every question

# Filling out the Application



**COURSE MEASUREMENT DATA SHEET**

Name of Course or Race Name: Bellago 5k 2013

Name of Measurer for ride #1: Toni Youngman — Working Constant #1: 10877 per km

Date: 6/21/13 — Start: Time: 12:00 PM — Temperature: 83 ° F

Finish: Time: 12:40 PM — Temperature: 85 ° F

Name of Measurer for ride #2: Randy Youngman — Working Constant #2: 10922 per km

Date: 6/21/13 — Start: Time: 12:00 PM — Temperature: 83 ° F

Finish: Time: 12:40 PM — Temperature: 85 ° F

**Measurement Data.** Use the first measurement ride to lay out the start/finish points and all intermediate split points. Use the second ride to record counts at those **same** points. **Do not lay out a second set of marks.**

| Measured Point | Counts for Measurment #1 Recorded | Interval | Counts for Measurement #2 Recorded | Interval |
|---|---|---|---|---|
| Start | 661000 | | 911600 | |
| | | 17504 | | 17570 |
| 1 Mi | 678504 | | 929170 | |
| | | 17504 | | 17575 |
| 2 Mi | 696008 | | 946745 | |
| | | 17504 | | 17576 |
| 3 Mi | 713512 | | 964321 | |
| | | 1873 | | 1885 |
| 5 km | 715385 | | 966206 | |

| Preliminary Course Length | start to finish counts | divided by | working constant | = | measured length | |
|---|---|---|---|---|---|---|
| Measurement #1 | 54385 | / | 10877 | = | 5.00000000 | km |
| Measurement #2 | 54606 | / | 10922 | = | 4.99963377 | km |

| Difference between lengths #1 and #2 | divided by | length #1 | = | Measurement comparison (less that 0.0008) | |
|---|---|---|---|---|---|
| 0.00036623 | / | 5.00000000 | = | 0.0000732467 | (YES) [yes or no] |

**IMPORTANT. Before** you leave the course, compare the two measurements. They should agree to within 0.08%. If the two preliminary measurements do not agree to withing 0.08%, something is wrong. Fix it. Then go to the calibration course and recalibrate.

If either of the **Constants for the Day** (for measurement #1 or #2) is **not** the same as the **Working Constant** for that measurement, recalculate the length of the course here:

| Final Course Length | start to finish counts | divide by | constant for the day | = | length of course | |
|---|---|---|---|---|---|---|
| Measurement #1 | 54385 | / | 10877 | = | 5.00000000 | km |
| Measurement #2 | 54606 | / | 10922 | = | 4.99963377 | km |

The length of the race course is the lesser of the two lenghts calculated above.

Measured course length: 4.999633767 km — Desired course length: 5 km

Use a steel tape to add or subtract distance as required to bring the **minimum** length to the same value as the desired course length.

| | | | | | |
|---|---|---|---|---|---|
| 0.000366233 | x | 1000 | = | 0.36623329 | meters |
| 0.366233291 | x | 3.28084 | = | 1.20155283 | feet |

How much did you add or subtract, and where (start, finish, turn-around point)?

One foot 3 inches was added to the course at the Finish point.

**Note:** you need not adjust intermediate split points unless certification is desired for those points. Did you adjust the intermediate points and, if so, how? No other points were moved.

Name Matches the Name of the Race

Two measurers, a different working constant for each measurer

Note F or C for Temperature

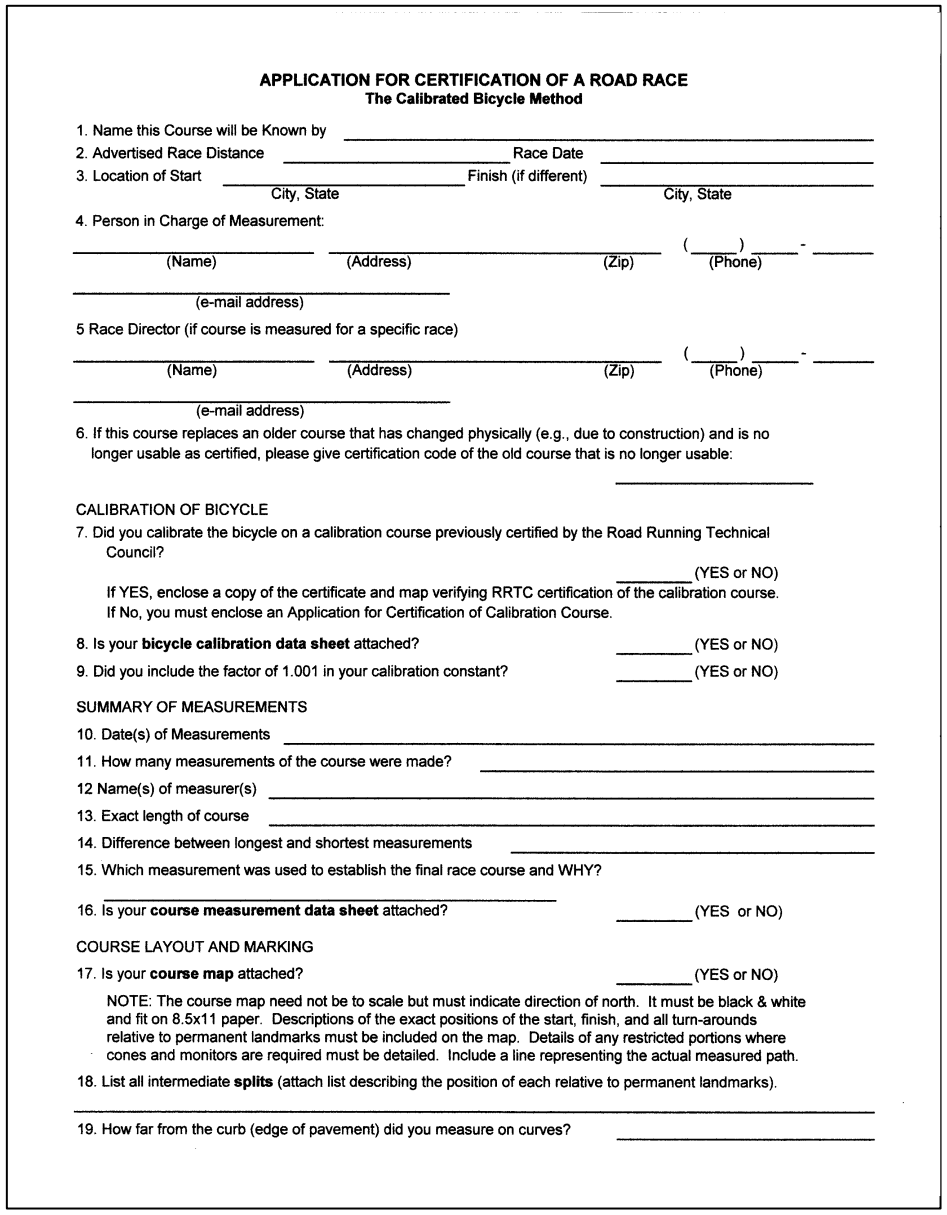
Note AM and PM for Time

Counts for each point measured as well as the difference between each point

Note all references for distance. This is a metric measurement, not Imperial. **The final numbers have to be in metric. A 5k is NOT a 3.106856 mile course.** The conversion is correct, but not accurate. The Imperial conversion is used to help with US mile key points on the measurement and adjusting the course with an imperial tape.

DETAILS, DETAILS, DETAILS!!!!!!!

# Filling out the Application



**APPLICATION FOR CERTIFICATION OF A ROAD RACE**
**The Calibrated Bicycle Method**

1. Name this Course will be Known by _____
2. Advertised Race Distance _____ Race Date _____
3. Location of Start _____ Finish (if different) _____
   City, State City, State
4. Person in Charge of Measurement:
   _____ _____ (____) ____ - ____
   (Name) (Address) (Zip) (Phone)
   _____
   (e-mail address)

5 Race Director (if course is measured for a specific race)
   _____ _____ (____) ____ - ____
   (Name) (Address) (Zip) (Phone)
   _____
   (e-mail address)

6. If this course replaces an older course that has changed physically (e.g., due to construction) and is no longer usable as certified, please give certification code of the old course that is no longer usable:
   _____

CALIBRATION OF BICYCLE

7. Did you calibrate the bicycle on a calibration course previously certified by the Road Running Technical Council?
   _____(YES or NO)
   If YES, enclose a copy of the certificate and map verifying RRTC certification of the calibration course.
   If No, you must enclose an Application for Certification of Calibration Course.
8. Is your **bicycle calibration data sheet** attached? _____(YES or NO)
9. Did you include the factor of 1.001 in your calibration constant? _____(YES or NO)

SUMMARY OF MEASUREMENTS

10. Date(s) of Measurements _____
11. How many measurements of the course were made? _____
12 Name(s) of measurer(s) _____
13. Exact length of course _____
14. Difference between longest and shortest measurements _____
15. Which measurement was used to establish the final race course and WHY?
    _____
16. Is your **course measurement data sheet** attached? _____(YES or NO)

COURSE LAYOUT AND MARKING

17. Is your **course map** attached? _____(YES or NO)
    NOTE: The course map need not be to scale but must indicate direction of north. It must be black & white and fit on 8.5x11 paper. Descriptions of the exact positions of the start, finish, and all turn-arounds relative to permanent landmarks must be included on the map. Details of any restricted portions where cones and monitors are required must be detailed. Include a line representing the actual measured path.
18. List all intermediate **splits** (attach list describing the position of each relative to permanent landmarks).
    _____
19. How far from the curb (edge of pavement) did you measure on curves? _____

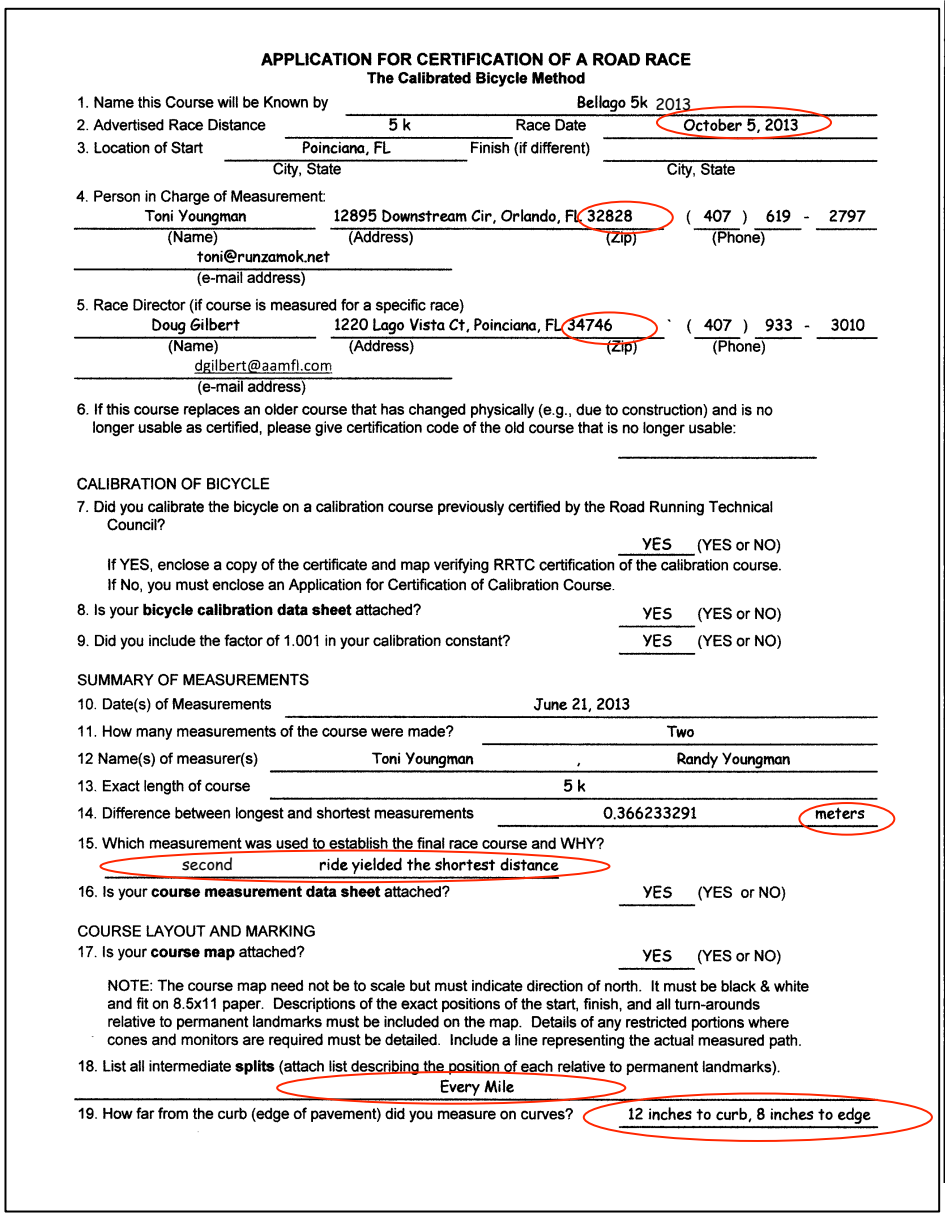
When filling out the Application, make sure the name of the race agrees with the name of the race on your map and Data Sheets.

Make sure to answer every question

Many Applications are sent back because they are incomplete. Take care to review your work before submitting

This is Page 1 of a two page application

# Filling out the Application



**APPLICATION FOR CERTIFICATION OF A ROAD RACE**
**The Calibrated Bicycle Method**

1. Name this Course will be Known by: Bellago 5k 2013
2. Advertised Race Distance: 5 k — Race Date: October 5, 2013
3. Location of Start: Poinciana, FL (City, State) — Finish (if different): _____ (City, State)

4. Person in Charge of Measurement:
Toni Youngman (Name) | 12895 Downstream Cir, Orlando, FL 32828 (Address / Zip) | ( 407 ) 619 - 2797 (Phone)
toni@runzamok.net (e-mail address)

5. Race Director (if course is measured for a specific race)
Doug Gilbert (Name) | 1220 Lago Vista Ct, Poinciana, FL 34746 (Address / Zip) | ( 407 ) 933 - 3010 (Phone)
dgilbert@aamfl.com (e-mail address)

6. If this course replaces an older course that has changed physically (e.g., due to construction) and is no longer usable as certified, please give certification code of the old course that is no longer usable: _____

CALIBRATION OF BICYCLE

7. Did you calibrate the bicycle on a calibration course previously certified by the Road Running Technical Council? YES (YES or NO)
If YES, enclose a copy of the certificate and map verifying RRTC certification of the calibration course.
If No, you must enclose an Application for Certification of Calibration Course.

8. Is your **bicycle calibration data sheet** attached? YES (YES or NO)

9. Did you include the factor of 1.001 in your calibration constant? YES (YES or NO)

SUMMARY OF MEASUREMENTS

10. Date(s) of Measurements: June 21, 2013
11. How many measurements of the course were made? Two
12 Name(s) of measurer(s): Toni Youngman , Randy Youngman
13. Exact length of course: 5 k
14. Difference between longest and shortest measurements: 0.366233291 meters
15. Which measurement was used to establish the final race course and WHY?
second ride yielded the shortest distance
16. Is your **course measurement data sheet** attached? YES (YES or NO)

COURSE LAYOUT AND MARKING

17. Is your **course map** attached? YES (YES or NO)

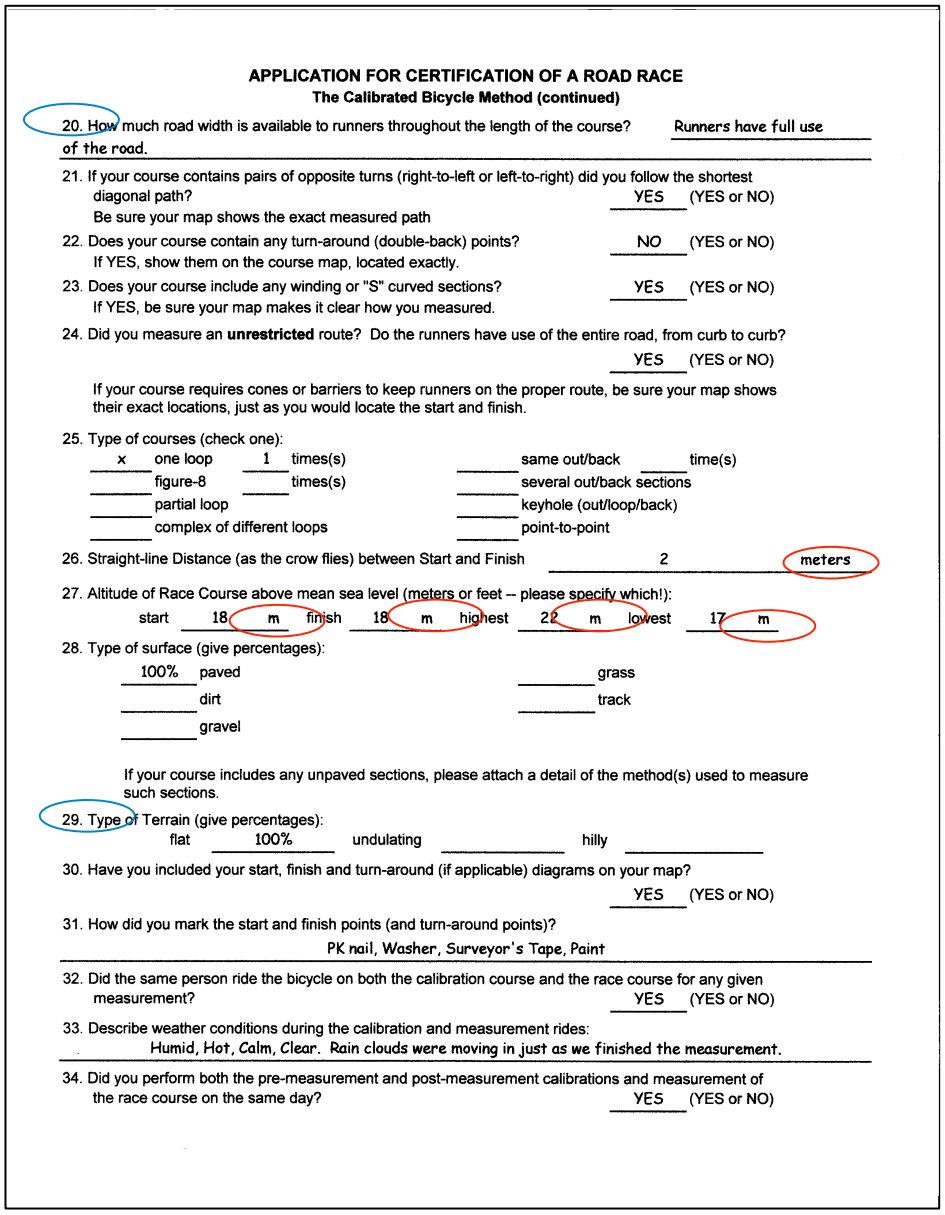
NOTE: The course map need not be to scale but must indicate direction of north. It must be black & white and fit on 8.5x11 paper. Descriptions of the exact positions of the start, finish, and all turn-arounds relative to permanent landmarks must be included on the map. Details of any restricted portions where cones and monitors are required must be detailed. Include a line representing the actual measured path.

18. List all intermediate **splits** (attach list describing the position of each relative to permanent landmarks).
Every Mile
19. How far from the curb (edge of pavement) did you measure on curves? 12 inches to curb, 8 inches to edge

The circled sections are parts that are often ignored or not filled in on the application. They may be filled in incorrectly.

Your application may be sent back for rework if you have not completed these to the certifier's satisfaction.

# Filling out the Application



**APPLICATION FOR CERTIFICATION OF A ROAD RACE**
**The Calibrated Bicycle Method (continued)**

20. How much road width is available to runners throughout the length of the course? Runners have full use of the road.

21. If your course contains pairs of opposite turns (right-to-left or left-to-right) did you follow the shortest diagonal path? YES (YES or NO)
Be sure your map shows the exact measured path

22. Does your course contain any turn-around (double-back) points? NO (YES or NO)
If YES, show them on the course map, located exactly.

23. Does your course include any winding or "S" curved sections? YES (YES or NO)
If YES, be sure your map makes it clear how you measured.

24. Did you measure an **unrestricted** route? Do the runners have use of the entire road, from curb to curb? YES (YES or NO)

If your course requires cones or barriers to keep runners on the proper route, be sure your map shows their exact locations, just as you would locate the start and finish.

25. Type of courses (check one):

| | | | |
|---|---|---|---|
| x one loop | 1 times(s) | ____ same out/back | ____ time(s) |
| ____ figure-8 | ____ times(s) | ____ several out/back sections | |
| ____ partial loop | | ____ keyhole (out/loop/back) | |
| ____ complex of different loops | | ____ point-to-point | |

26. Straight-line Distance (as the crow flies) between Start and Finish 2 meters

27. Altitude of Race Course above mean sea level (meters or feet -- please specify which!):
start 18 m finish 18 m highest 22 m lowest 17 m

28. Type of surface (give percentages):

| | |
|---|---|
| 100% paved | ____ grass |
| ____ dirt | ____ track |
| ____ gravel | |

If your course includes any unpaved sections, please attach a detail of the method(s) used to measure such sections.

29. Type of Terrain (give percentages):
flat 100% undulating ____ hilly ____

30. Have you included your start, finish and turn-around (if applicable) diagrams on your map? YES (YES or NO)

31. How did you mark the start and finish points (and turn-around points)?
PK nail, Washer, Surveyor's Tape, Paint

32. Did the same person ride the bicycle on both the calibration course and the race course for any given measurement? YES (YES or NO)

33. Describe weather conditions during the calibration and measurement rides:
Humid, Hot, Calm, Clear. Rain clouds were moving in just as we finished the measurement.

34. Did you perform both the pre-measurement and post-measurement calibrations and measurement of the race course on the same day? YES (YES or NO)

This is page 2 of the application. There are a few extra questions on this application than there are on the current USATF Application. This Application doubles for IAAF Certification. The extra questions asked are circled in BLUE. A new application may come out soon, that incorporates these questions.

Note that the elevations and distances are in metric, and are included on the Certificate. It is now required that these be noted in metric, unless the race is an Imperial distance (e.g., a 5 mile race). ALL altitudes should always be metric.

Your application may be sent back for rework if you have not completed these to the certifier's satisfaction.

# Filling out the Application

35. Provide an overview below of the processes and procedures you followed when undertaking this measurement:

This course was measured on the same day that another course was to be measured in that area. Calibration was done at Golfway Cal course, and measurement was started upon arrival to the area. The course was measured and adjustment of 1 foot 3 inches was made to the Finish point at the end of the measurement. The course is one loop and practically starts where it finishes. There was no preference about the exact start or finish location, so course was measured from the start. The finish ended just past the start, but due to the temperature change, the course could be shorter than what was measured. Left the start and finish as is (one on one side of the crosswalk, and one on the other side, with only a 6 foot overlap.

There were several offset areas on the Valley View Drive section of the course. This was due to local parking on the street.

This is a third page I include with all of my applications. It is also a part of the IAAF application, but may soon be a part of the USATF application. It is where I note things of importance. Sometimes there is nothing to note, and I include that on this sheet.

This is where details may be very helpful during the measurement. Should this course ever need to be adjusted, due to road closures or changes to the course, this page helps determine how this measurement was completed, and may give me insights to making the changes correctly.

If this course is ever audited, it allows the auditor to understand any difficulties that may be on the course, and where errors may have happened, if the course is found to be short.

# Drawing the Course Map

- Must give the name of the course, city, and state
- Must show and identify every street, path, etc. that the course follows
- Must include details of coning and course restrictions, if any is necessary
- Must include **WRITTEN DESCRIPTIONS** of Start, finish, and Turnaround points—points that "define the course".
- While it is **best to include** **DETAIL MAPS** of the Start, Finish and Turnaround on the main map document, they may be made on a separate sheet of paper but are not required.
- While it is **best to include** other key points (mile or km marks), they may be made on a separate sheet of paper if space is an issue, but are not required.
- Must be 8.5" x 11", Black **INK** and White paper, suitable for copying with ½ inch margins. Pencil is not acceptable
- Must include the Measurer's contact information
- Must have a compass to show direction
- Must be easy to read. This is a permanent "Official" document, and could be used for 10 years. Make a document you will be proud to show.

# Drawing the Course Map

Name of Race → **Bellalago 5k 2013**

City and State → Poinciana, FL

Measurer Contact Information

Measured by Toni Youngman,
USATF Certifier, IAAF B Grade Measurer
Randy Youngman, 2nd Rider
June 21, 2013
(407) 619-2797
toni@runzamok.net

Good Margins

All Streets Named and Cross Streets included. Restrictions Noted. Easily Reproduced

Written Descriptions of Key Points

**KEY POINTS**

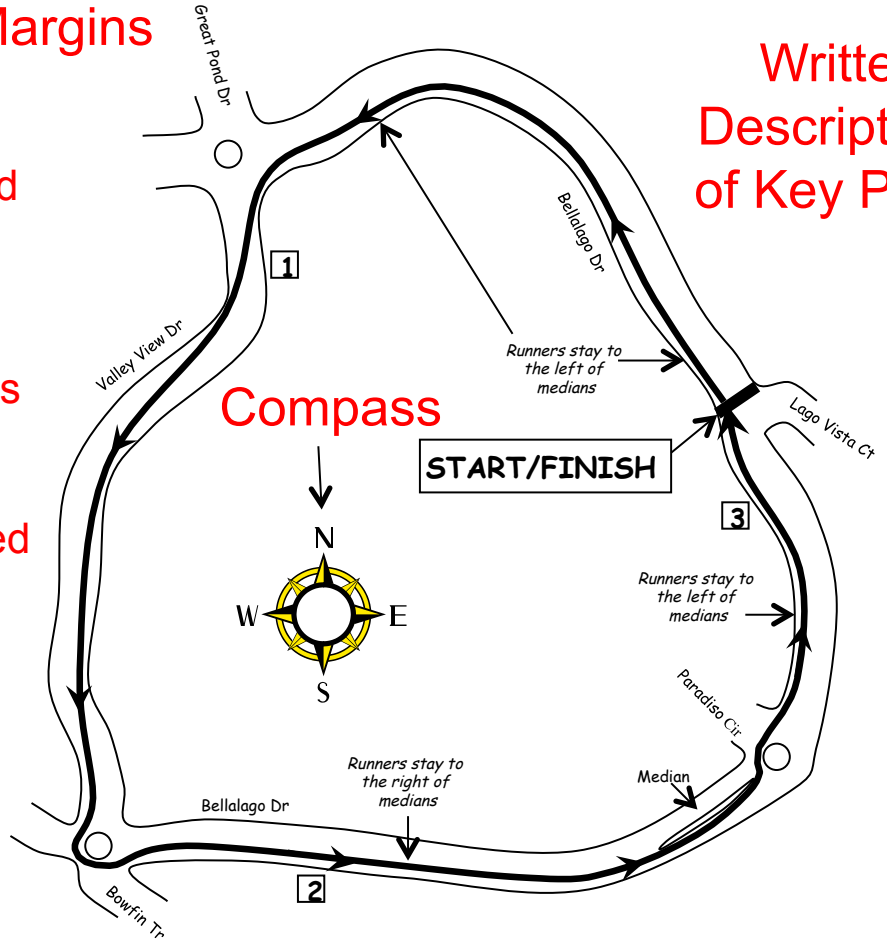
**START** IS ON THE WEST SIDE OF BELLALAGO DR, FACING NORTH. POINT IS IN LINE WITH THE SOUTH EDGE OF THE PAINTED CROSSWALK AT THE INTERSECTION OF LAGO VISTA CT/ BELLALAGO DR.

**FINISH** IS ON THE WEST SIDE OF BELLALAGO DR, FACING NORTH. POINT IS IN LINE WITH THE NORTH EDGE OF THE PAINTED CROSSWALK AT THE INTERSECTION OF LAGO VISTA CT/ BELLALAGO DR.

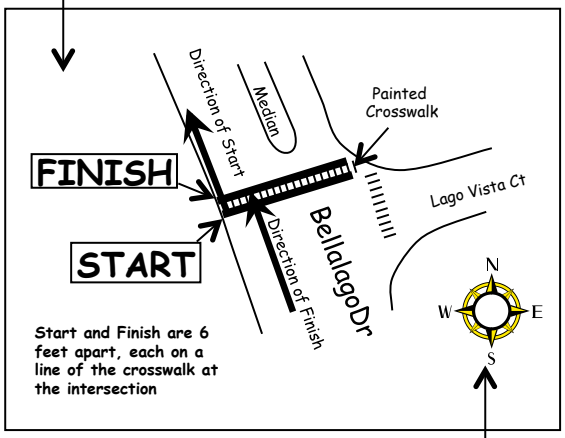
**1 MILE** IS ON THE WEST SIDE OF VALLEY VIEW DR, FACING SOUTH. POINT IS IN LINE WITH THE SOUTH EDGE OF DRIVEWAY APRON TO 3518 VALLEY VIEW DR.

**2 MILE** IS ON THE SOUTH SIDE OF BELLALAGO DR, FACING EAST. POINT IS 19 FT 6 IN WEST OF (BEFORE) LP32493 AT EAST END OF BRIDGE EAST OF BELLALAGO DR/VALLEY VIEW DR TRAFFIC CIRCLE.

**3 MILE** IS ON THE WEST SIDE OF BELLALAGO DR, FACING NORTH. POINT IS 8 FEET NORTH OF (AFTER) LP 31809 NORTH OF BRIDGE THAT IS SOUTH OF INTERSECTION BELLALAGO DR/LAGO VISTA CT.




Detail Map of Start and Finish



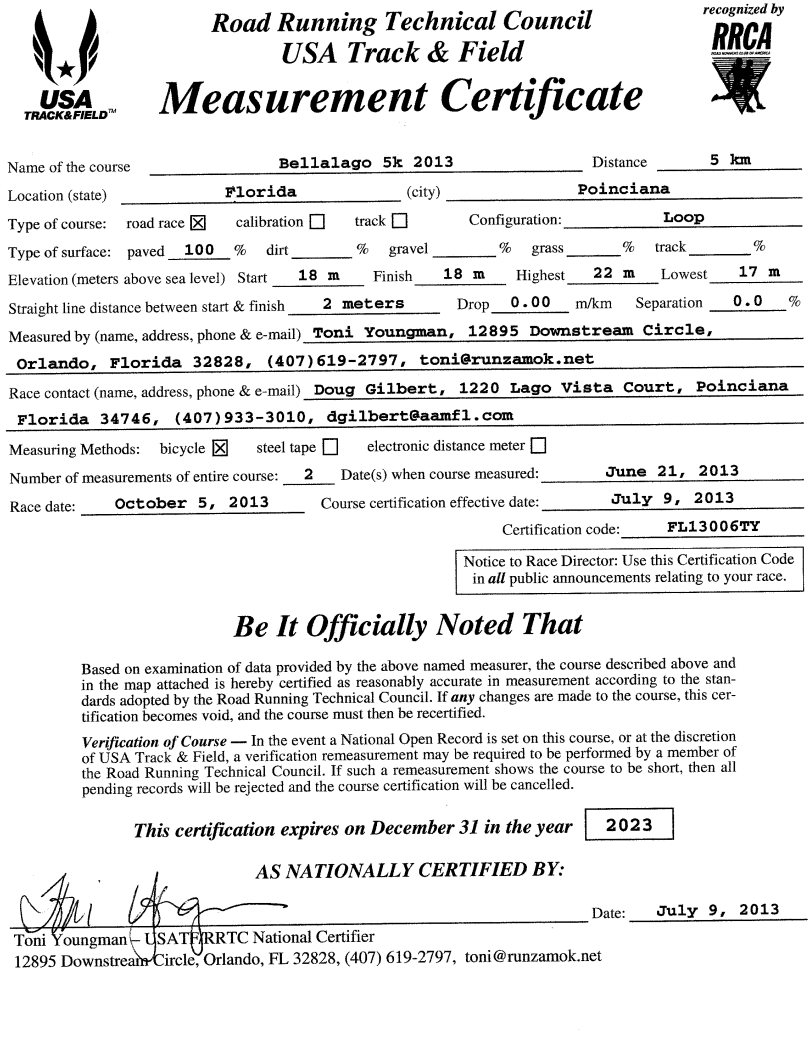

Compass

# Sending the Application to the Certifier

- May be sent by mail, fax, or as a scanned attachment to an e-mail note. Ask your Certifier how they prefer the application sent.
- **MUST** be sent **BEFORE** the date of the event (postmarked if mailed)
- Certifier's fee must be paid before Certification is completed.
- No fee for calibration courses.
- The Course is not Certifiable until **ALL** pieces of the application have been submitted correctly. Corrections must be completed before the event.

# The Measurement Certificate

- Front side has contact information for race director and measurer
- Other information includes elevations, start to finish distance
- Also dates course measured and date documents submitted



USA TRACK&FIELD™

*Road Running Technical Council*
*USA Track & Field*

**Measurement Certificate**

*recognized by* RRCA

Name of the course: Bellalago 5k 2013 Distance: 5 km

Location (state): Florida (city): Poinciana

Type of course: road race ☒ calibration ☐ track ☐ Configuration: Loop

Type of surface: paved 100 % dirt ____ % gravel ____ % grass ____ % track ____ %

Elevation (meters above sea level) Start 18 m Finish 18 m Highest 22 m Lowest 17 m

Straight line distance between start & finish 2 meters Drop 0.00 m/km Separation 0.0 %

Measured by (name, address, phone & e-mail) Toni Youngman, 12895 Downstream Circle, Orlando, Florida 32828, (407)619-2797, toni@runzamok.net

Race contact (name, address, phone & e-mail) Doug Gilbert, 1220 Lago Vista Court, Poinciana Florida 34746, (407)933-3010, dgilbert@aamfl.com

Measuring Methods: bicycle ☒ steel tape ☐ electronic distance meter ☐

Number of measurements of entire course: 2 Date(s) when course measured: June 21, 2013

Race date: October 5, 2013 Course certification effective date: July 9, 2013

Certification code: FL13006TY

Notice to Race Director: Use this Certification Code in ***all*** public announcements relating to your race.

***Be It Officially Noted That***

Based on examination of data provided by the above named measurer, the course described above and in the map attached is hereby certified as reasonably accurate in measurement according to the standards adopted by the Road Running Technical Council. If ***any*** changes are made to the course, this certification becomes void, and the course must then be recertified.

***Verification of Course*** — In the event a National Open Record is set on this course, or at the discretion of USA Track & Field, a verification remeasurement may be required to be performed by a member of the Road Running Technical Council. If such a remeasurement shows the course to be short, then all pending records will be rejected and the course certification will be cancelled.

***This certification expires on December 31 in the year*** 2023

***AS NATIONALLY CERTIFIED BY:***

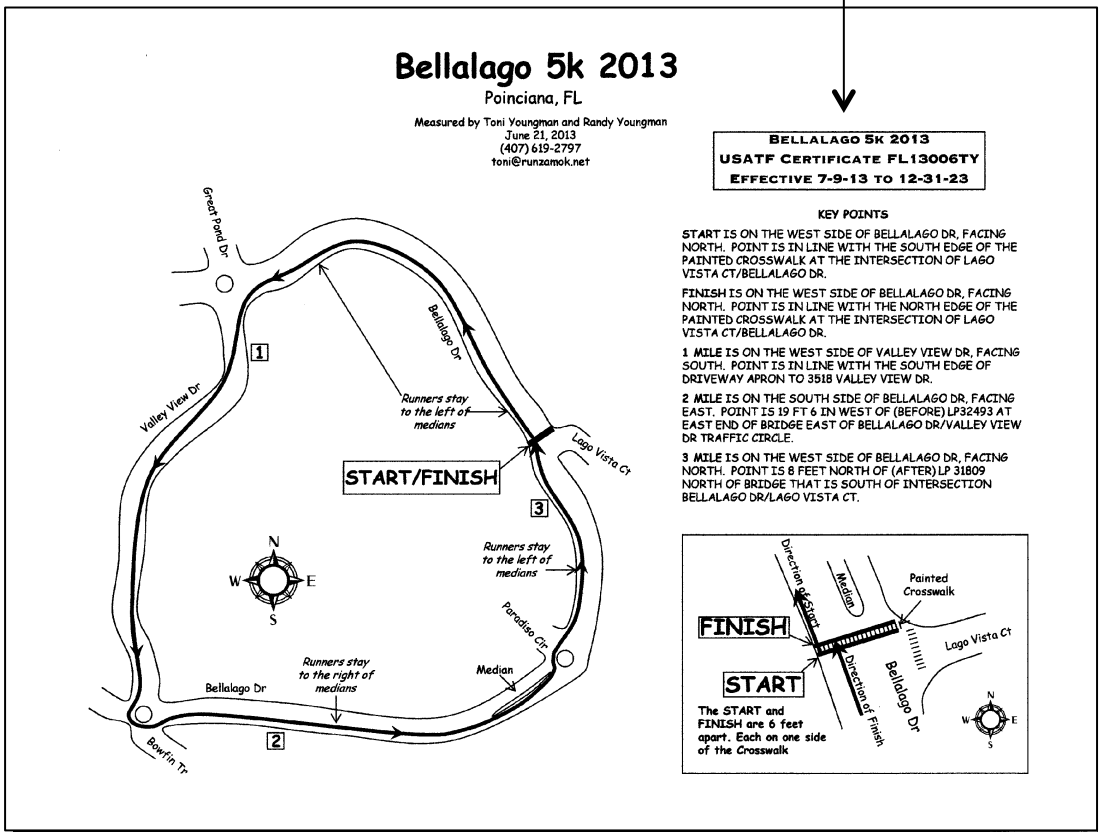
Date: July 9, 2013

Toni Youngman – USATF/RRTC National Certifier
12895 Downstream Circle, Orlando, FL 32828, (407) 619-2797, toni@runzamok.net

# The Measurement Certificate

- The reverse side of the USATF Measurement Certificate is the course map
- Includes name of course, city and state
- Includes the Certificate Stamp, which gives the certificate number and tells when the course will expire

**Certificate Stamp**



**Bellalago 5k 2013**

Poinciana, FL

Measured by Toni Youngman and Randy Youngman
June 21, 2013
(407) 619-2797
toni@runzamok.net

**BELLALAGO 5K 2013**
**USATF CERTIFICATE FL13006TY**
**EFFECTIVE 7-9-13 TO 12-31-23**

KEY POINTS

START IS ON THE WEST SIDE OF BELLALAGO DR, FACING NORTH. POINT IS IN LINE WITH THE SOUTH EDGE OF THE PAINTED CROSSWALK AT THE INTERSECTION OF LAGO VISTA CT/BELLALAGO DR.

FINISH IS ON THE WEST SIDE OF BELLALAGO DR, FACING NORTH. POINT IS IN LINE WITH THE NORTH EDGE OF THE PAINTED CROSSWALK AT THE INTERSECTION OF LAGO VISTA CT/BELLALAGO DR.

1 MILE IS ON THE WEST SIDE OF VALLEY VIEW DR, FACING SOUTH. POINT IS IN LINE WITH THE SOUTH EDGE OF DRIVEWAY APRON TO 3518 VALLEY VIEW DR.

2 MILE IS ON THE SOUTH SIDE OF BELLALAGO DR, FACING EAST. POINT IS 19 FT 6 IN WEST OF (BEFORE) LP32493 AT EAST END OF BRIDGE EAST OF BELLALAGO DR/VALLEY VIEW DR TRAFFIC CIRCLE.

3 MILE IS ON THE WEST SIDE OF BELLALAGO DR, FACING NORTH. POINT IS 8 FEET NORTH OF (AFTER) LP 31809 NORTH OF BRIDGE THAT IS SOUTH OF INTERSECTION BELLALAGO DR/LAGO VISTA CT.

# USATF Certification

- Expires at the end of the year ten years after the certificate was issued
- Even if the course has not changed, it expires after 10 years and must be re-measured
- If you change your course, you should plan to have it re-measured
- If a course is adjusted using the original measurement data, the new certificate expires on the same date as the original certificate *(e.g., Originally measured and certified June 6, 2011. The course will expire on Dec 31, 2021, Then adjusted only a mile of the course on May 1, 2014, the new certificate will expire Dec 31, 2021. Be prepared to resubmit original data with the new application and data)*
- A race director has the discretion to lengthen a course with coning and restrictions, but may never shorten the course or use a different path.

# GPS

# My GPS says your course is LONG!

Why it probably isn’t…

# My GPS says your course is LONG!

- **Runners in races rarely run the SPR**
- **Consumer-grade GPS can be unreliable when:**
  - Around tall buildings or heavily wooded areas
  - Batteries are low
  - Not initialized for long enough
- **Consumer-grade GPS measurements of courses are not as accurate as measurements with a calibrated bicycle**
  - Repeated measurements with a calibrated bicycle are routinely within 0.08% of each other
  - Consumer-grade GPS measurements cannot match that repeatability

# Thank You!

- Phone:  407-619-2797
- E-mail:  toni@runzamok.net
- USATF website: http://www.usatf.org/events/courses/certification/
- Road Racing Technical Council website: http://www.rrtc.net