

SEAA Seminar for New Course Measurers

Abingdon

29/30 May 1999

Participants

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- John Catlin, Dunstable
- Ian Chalk, Romsey
- Bob Cripps, Eastbourne
- Mr Frost, Trotton
- Paul Wood, Broadstairs
- Tutor: Mike Sandford, Abingdon
SEAA Measurement Secretary

Time Table

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- Saturday

1000 Introductions (Coffee from 0930)
1015 Basic Measurement Method
1030 Calibration Courses
1100 Practical: Calibration Course
1215 Course Measurement
1315 Lunch
1400 Practical: Measure loop
1600 Errors in measurement
1630 Preparing for measurement
1730 Measurement Report
1800 End

- Sunday

0900 Practical : Layout of 5k
1230 Lunch
1330 Report write up
1400 Organisation
1415 Advanced Topics
1430 Final discussion
1500 Practical :Adjust to 3 m
1700 approx Depart

Post Course: Write up report and submit within 7 days

Basic Measurement Method

Calibrated Bicycle Wheel

The Jones Counter

Essential Equipment

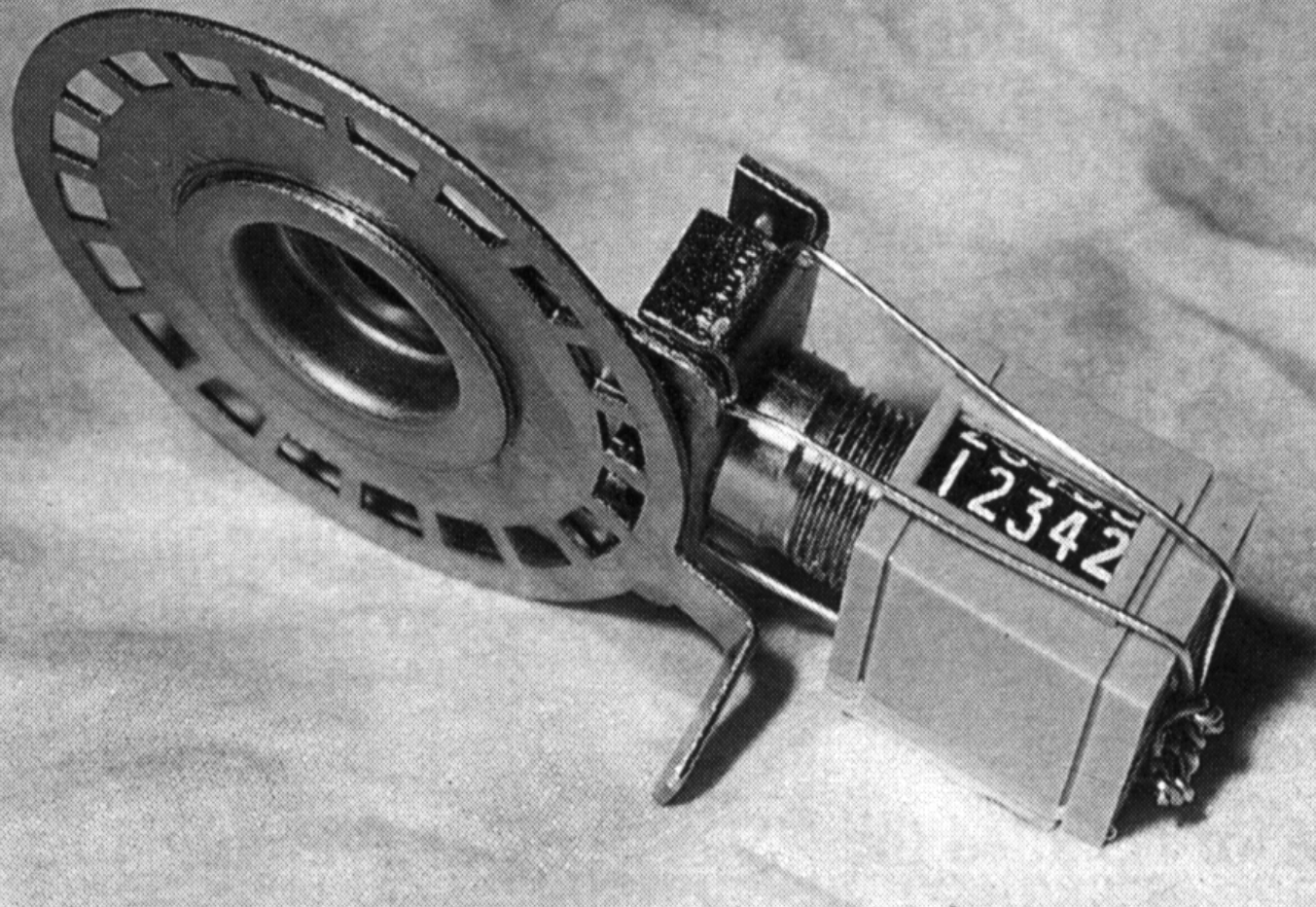
The Calibrated Bicycle Wheel Method

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- Calibrate circumference of front wheel
- Count revolutions over known distance
- Calibration constant = calibration counts \div distance
- Ride bike over course, counting revs
- Recalibrate front wheel to check for temperature changes or air leaks
- Course length = course counts \div calibration constant
- Use largest calibration constant to prevent short course

The Jones Counter

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- Fit between left hand front fork and wheel

The Jones Counter

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- Invented by Alan Jones, USA to replace spoke counting used by RRC measurers.
- Geared to front wheel, no counts lost
- Gives $200/10=20$ counts/wheel rev
- 1 count is about 10 cm (4 inches)
- New Jones-Oerth version gives $260/11=26.364$ counts/wheel rev
- Current Cost \$75 (£50)

Reading the Counter

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- On courses read nearest whole count
- For calibration on short courses it is worthwhile reading to $\frac{1}{2}$ count
- Can read 0.1 count, not normally useful.
- Beware of reading errors: 33579 (true)
- transposition error 33759
- 'carry errors' 33589
- duplicating wrong digit 35579

The Essential Equipment

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- Bicycle
- Pump & bike tools
- Jones Counter
- Road Marker
paint/chalk/crayon
- Note pad/pencils
- Calculator
- Safety :
- Bib, helmet, mirror
- Steel Tape 30m or 50m
- Spring Balance 5kg
- Thermometer
- Masonry nails,
washers & hammer

Calibration Courses

How to lay them out

How to calibrate the bike

The SCPF: Short Course Prevention Factor

Choosing a Site for a Calibration Course

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- Perfectly straight and fairly flat
- No obstructions eg parked cars, people
- Can be ridden safely both ways, two courses, on each side of the road, may be needed.
- Representative surface
- Close to measurement location / convenient to home.
- Preferably 500 - 700 m long, but 300m is acceptable with care in riding & reading

Measurement by Steel Tape

- A Steel tape *must* be used. Plastic(fibre glass) tapes are inaccurate
- A 50 m steel tape expands about 13mm under 5kg tension at which it is calibrated
- A Steel tape is calibrated at 20 C
- A 100m length expands with increasing temperature by 1.16mm per C ie $1.16 \times 10^{-5} \text{ C}^{-1}$
- Choose tape with clear mm markings and numbering.

Solo Taping

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- Drive masonry nail partly in at one end
- Hook Tape over nail
- Measure zero offset (use pencil/paper)
- Move in *straight line* down the course
- Drive nail in just before end of tape
- Tension tape, record nail head in mm
- Move tape to next nail and repeat
- Take tape temperature
- Check by repeating all measurements

Example Calculation of calibration course length

- Measured Distance from nail to 10cm mark=9.4 cm
- Zero offset = $100 - 94 = -6$ mm
- Tape temp = 11 C
- number of 50m lengths = 12
- Uncorrected length= $12 \times 50 = 600$ m = 600,000 mm
- Offset correction= $-12 \times 6 = -72$ mm
- Temp cor. = $(11-20) \times 11.6 \times 600,000 \div 1,000,000$
= - 63 mm
- Corrected length = $600.000 - 0.072 - 0.063 = 599.865$ m

Temperature correction for steel tapes

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CORRECTION FACTORS FOR CALIBRATION COURSES

Correction factors are in centimetres

DEG °C	LENGTH OF CALIBRATION COURSE (METRES)						
	400	500	600	700	800	900	1000
35°	7	-9	-10	-12	-14	-16	-17
30°	-5	6	-7	8	-9	-10	-12
25°	-2	3	-3	-4	-5	-5	6
20°	0	0	0	0	0	0	0
15°	2	3	3	4	5	5	6
10°	5	6	7	8	9	10	12
5°	7	9	10	12	14	16	17
0°	9	12	14	16	19	21	23
5°	12	15	17	20	23	26	29
-10°	14	17	21	24	28	31	35

Example: You lay out a 600 metre calibration course at 10°C. To correct for temperature, add 7cm to the length before you put down permanent marks. If the temperature is 25°C, remove 3cm before putting down final marks.

Measurement by EDM

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- A Surveyor's Electronic Distance Measurer can be used and is potentially more accurate.
- The EDM is lined up over the nail at one end, a reflector at the other.
- The EDM reads directly in mm up to a max distance depending on model
- Corrections must be made for temperature and pressure

Calibrating the Bicycle

- Line bike up about 30 cm before end nail
- Move exactly onto nail, this avoids counter backlash,
- Write down counter reading
- Ride to other end, stop just before nail, push bike on to nail, record reading
- Turn round do ride 2 in opposite direction
- Repeat obtaining ride 3 and ride 4
- *Always* use 4 rides & both directions to average wind and slope & check for a mistake in reading.

Example Calculation of average count for one ride

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- Ride 1 start = 70015, Finish = 77120, Difference = 7105
- Ride 2 start = 77180, Finish = 84286, Difference = 7106
- Ride 3 start = 84310, Finish = 91414, Difference = 7104
- Ride 4 start = 92473, Finish = 99580, Difference = 7107
- Average = $(7105+7106+7104+7107) \div 4 = 7105.5$

Short Course Prevention Factor

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- Courses are laid out 1m long for each km
- Ensures that even if small errors made the course is at least the advertised distance
- 10km course is laid out 10,010m
- Marathon 26m 385y is laid out 26m 431y
- To do this *increase* the calibration constant by multiplying by 1.001
- All intermediate distances include the SCPF
- On the measurement certificate describe a 10k including the SCPF as 10,000m not 10,010m

Example Calculation of Calibration Constant

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	Start Count	Finish Count	Difference	Calibration Course length 695.254m	
Ride 1	26694.5	34323.5	7629		
Ride 2	34435.5	42063	7627.5	Average Count for 1 ride	7628.25
Ride 3	42159	49788	7629	Time of Day	1102
Ride 4	49882	57509.5	7627.5	Temperature C	13.0

$$\text{Calibration Constant} = \frac{\text{average count} \times 1.001}{\text{calibration course length}} = \frac{7628.25 \times 1.001}{0.695254} = 12000 \text{ cts/km}$$

Kilometres, Miles, Yards, Marathons & Half Marathons

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- Using your cal course length in km, gives calibration constant in counts/km
- 1 mile = 1.609344 km, 1 mile = 1760 yards
- Multiply by 1.609344 to convert counts/km to counts/mile
- Marathon = 42.1950km = 26 miles 385 yards
= 26.21875 miles
- Half Marathon = 21.0975km = 13ml 192.5 yds
= 13.10938 miles

Exercise 1: Calculate Calibration Constants per km & per mile

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- On a 500m cal course
- Ride 1 start 44763
- Ride 1 finish 52123
- Ride 2 start 52123
- Ride 2 finish 59485
- Ride 3 start 59485
- Ride 3 finish 66845
- Ride 4 start 66845
- Ride 4 finish 74207
- On a 699.723m cal course
- Ride 1 start 80000
- Ride 1 finish 86016.5
- Ride 2 start 86016.5
- Ride 2 finish 92032.5
- Ride 3 start 92032.5
- Ride 3 finish 98049
- Ride 4 start 98049
- Ride 4 finish 04066

Practical 1

Fitting the Jones Counter
Calibration Course Layout
Calibration

Fitting the Jones Counter

- Remove front wheel
- Place counter over axle
- Put wheel back into front fork with counter on LEFT HAND SIDE of bike, protruding forwards
- Tighten wheel nuts ensuring counter gear freely rotates and counter reading visible from riding position
- Pump tyre up to maximum pressure

Calibration Course Layout

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- Work in teams of three to layout two parallel courses 150m long
- One hook tape over nail
- One tension tape to 50N (10.5 lbs)
- One hammer in nail and record reading
- Record temperature of tape

Calibration

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- ride one practice ride of each course lining up on end points and noting reading
- now start calibration. 4 rides two in each direction. Record start reading and finish reading of each ride
- Record time of day and air temperature
- Now work out your calibration constant per km and per mile.

Course Measurement Procedure

Layout Ride

SPR : Shortest Possible Route

Obstructions

Course adjustments

Final Ride, Marking the splits

Calculating the Results

Layout Ride

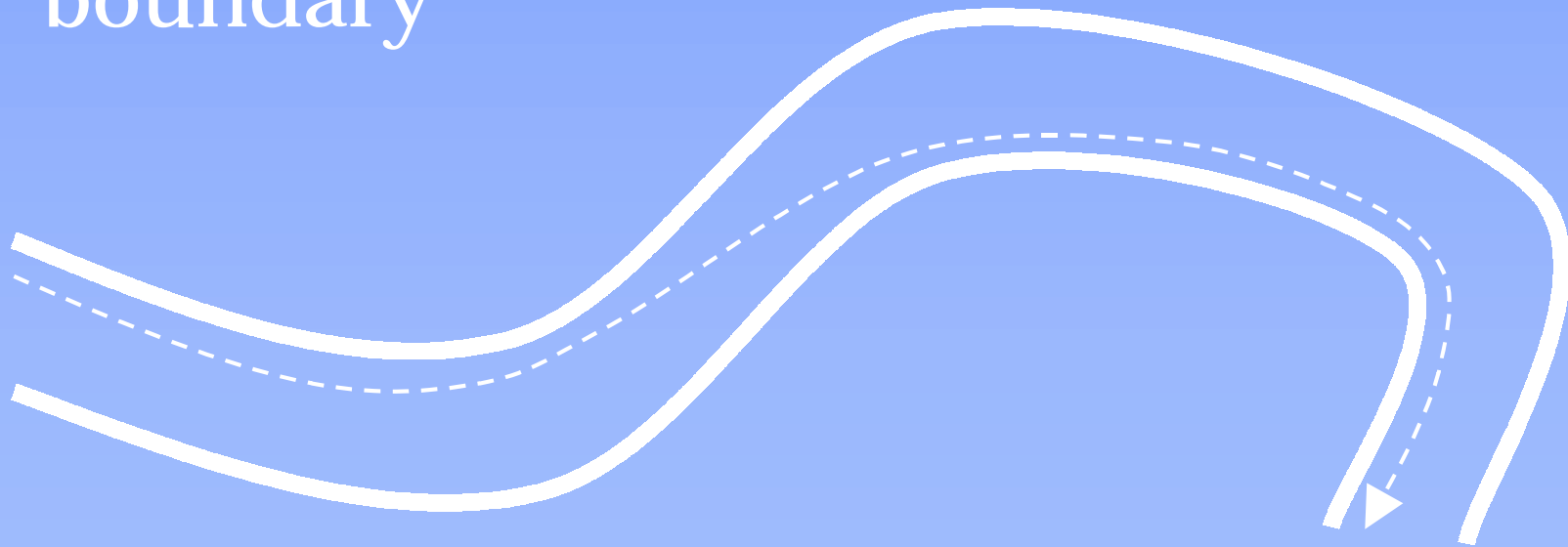
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- Use Provisional Start (note exact location)
- Note Counter Reading (double check)
- Note Time, Temperature, Weather
- Ride behind race director to provisional finish using SPR, have bike or car giving protection behind if necessary
- At provisional finish note counts (double check) or ride to calculated finish count and mark road. Note time & weather/temp

SPR : Shortest Possible Route

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- The shortest route is along straight lines between corners: the line taken up by a piece of string stretched along the course
- At corners keep 30 cm (one foot) from boundary



Example Calculation of Course Length

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- Calculate measured length:
(Finish Count - Start Count) = Count Diff
Length = Count Diff \div Calibration Const
- Example
Start Count 12530, Finish Count 69704
Calibration Constant = 11218 counts/km
Calculation:
Length = (69704 - 12530) \div 11218 = 5096.6 m

Adjusting a Course

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- Adjustment in counts to be added to start or finish = $(\text{Required length} - \text{measured length}) \times \text{Calibration constant}$
- Go to start or finish, read counter, add adjustment in counts, and ride until counter indicates calculated reading.
- Example :Course 96.6 m = 0.096 km too long
Calibration Constant = 11218 counts/km
Counts to take off = $0.096 \times 11218 = 1077$ counts

Final Ride

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- A second ride is usually necessary to layout the split distances after an adjustment of the start
- For beginners a second ride is essential as a check against mistakes in your first ride
- Go to start, read counter, add counts for each mile or km and write this list on note pad
- Ride to count for first split, make mark on road, record count at near by *fixed* street furniture, (numbered lamppost, drain gulley, house gatepost)
- Continue recording splits to finish, read counter

Calculating the Result

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- Take the shortest length of the layout and final ride to be the course length.
- So far you have used your pre-measurement constant as your working constant.
- Now from your a post calibration and obtain a post-measurement constant & work out the constant for the day (largest of the working & final constants)
- Recalculate the shortest length using the constant for the day. You may have then to make a slight change to start or finish, but splits need not be changed

Exercise 2

Calculating Course Lengths

Practical 2

Measure a loop

Recalibrate & Calculate Results

Repeat if Time

Measure a Loop: use whole width of road, no pavements

Abingdon 2.1 km loop



Recalibrate & Calculate Results

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- Calculate finish constant and constant for the day.
- Use constant for the day to calculate loop length
- Discussion of results
- Repeat if measurement if time. This time put in km splits and record street furniture references. Use Measurement Data form

Errors In Measurement

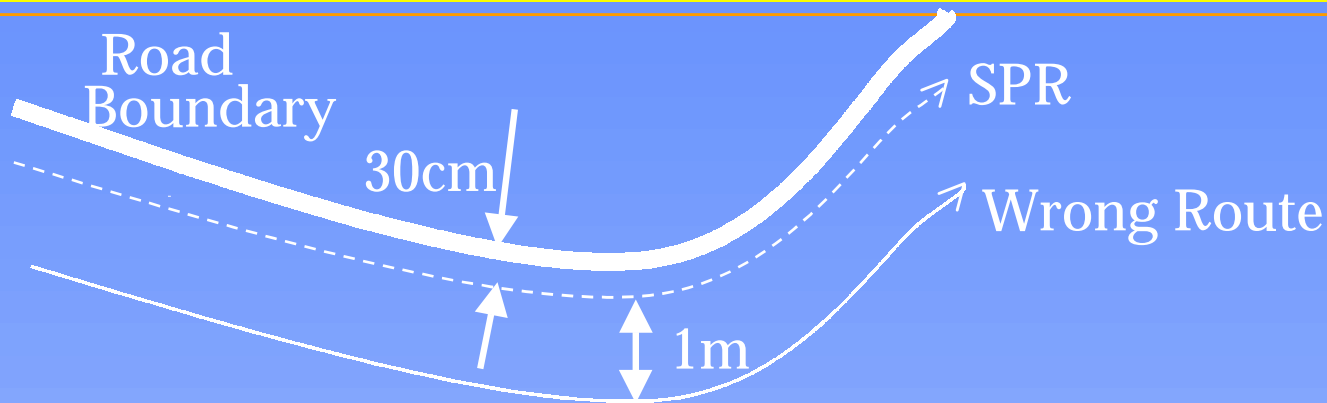
SPR

Calibration Constant

Wobbles

Shortest Possible Route - Too far from Kerb

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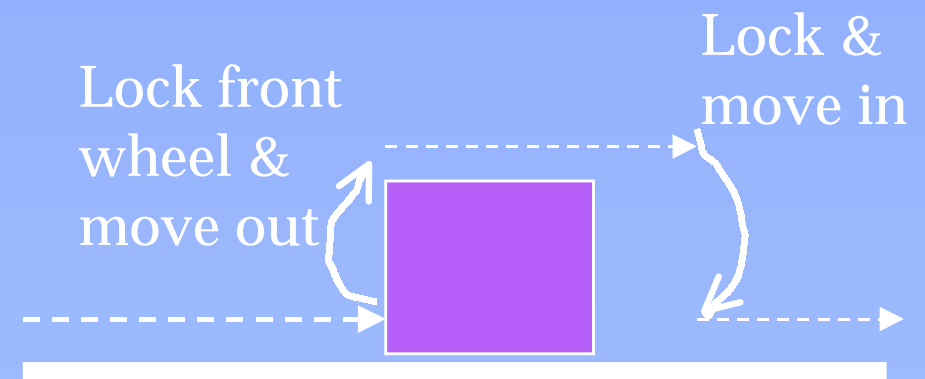
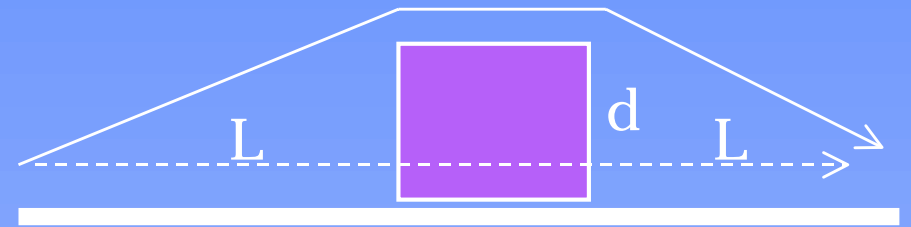


- For a 90degree corner, the error if d metres outside the 30cm from the boundary rule = $d \times 1.6$ m.
- So for a course with 8 left hand 90 degree corners riding at 1.3m instead of 0.3m gives an extra $8 \times 1 \times 1.6 = 12.8$ m

Shortest Possible Route - Obstacles

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- For an obstacle d metres wide L metres ahead, moving out will add $0.5 \times d \times d \div L$ m. So a car 2m wide 20m ahead adds 0.1m moving out and another 0.1m moving back in over 20 m
- Alternatively, use the offset procedure. Lock front wheel, move out, measure, lock front wheel again, move in.



Shortest Possible Route

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- Cut across pavements unless you are convinced organiser will keep runners off pavements
- If road is closed or a very quiet country lane use full width of road
- If race director plans to keep runners on left hand half, measure up to central white line. On right hand corners make sure he has enough good marshalls, or cross to right before corner, cross back to left half after corner.
- Describe your exact route in measurement report summary. It must be possible for an official to check whether runners were kept to the measured route.

Calibration Constant Changes: Temperature

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- Pneumatics decrease constant by 1 to 1.6 counts in 10,000 for every deg C rise, 6 to 10 C rise accounts for whole SCPF
- Solids decrease constant by 0.2 to 0.6 counts for every deg C rise, 16 to 40C rise accounts for whole SCPF
- Both type of tyres also show changes of upto 2 or 3 counts in 10,000 at constant temperature, depending on the history

Wobbles

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- Wobbles add counts. 3.5 counts in 10000 was once measured for a practiced rider.
- If we wobble during calibration as we wobble during the measurement the extra distance due to wobbles calibrate out
- Under good conditions, variable wobbles are only a worry for a poor rider. One indication would be inconsistent cal rides in the same direction.
- Wobbling on steep hills or into a strong gale is a problem for all measurers.

Preparing For a Measurement

Questions for Race Director

Course maps

Police approval

Section of Road Available

Multi-terrain Events

Expenses Estimate

Preparation : Questions for Race Director

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- How has distance has been estimated?
- Have police been consulted. Objections?
- Will he send you a course map?
- Is start or finish fixed? Where will distance be adjusted?
- What section of road will be available?
- Route on right hand bends/turns?
- Estimate expenses. Agree payment at measurement
- Agree measurement date & accompanying escort

The Map

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- Ask organiser for map showing the course, start/finish
- Check the direction of running is anti-clockwise on roads shared with traffic to minimise right hand turns at junctions
- Using a map measurer or cotton check organiser's estimate of distance
- Check if map will be usable for the measurement report, if not buy OS or street map & charge organiser

Police Approval

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- Refuse to measure a course which has not been approved by the police since changes required by the police could invalidate the measurement
- Check race director knows UKAthletics Guidelines (see handout)

Section of Road Available: Safety

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- Ask race director what he has planned and agreed with the police.
- You may be the only Athletics official to see the details of an inexperienced race director's plans
- If in your opinion it is not safe to measure or to run, refuse to measure without modification, but it is *not* your responsibility to give a specific approval of safety arrangements. If necessary refer to County Permit secretary
- Check race director knows Guidelines (see handout)

Section of Road Available

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- Check in detail road available all round course
- Road closed, or very light traffic - Entire road width available
- Use left half only of road. Marshalls to stop runners crossing centre line on right hand bends
- Use 1m from left kerb, cones/marshalls on right hand bends
- Are runners allowed access to pavements on bends?
- Are there any corners where shortcuts are possible on grass verges?

Multi-terrain Events

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- On grass or rough surfaces calibration constant may vary by 1%
- If more than 5 - 10% of race length is not on a good surface the measurement may be inaccurate i.e. 500 to 1000m of a 10k race
- Tell organiser that he can not have a road race measurement certificate but he can still get a permit from the SEAA for a multi-terrain event.
- If you send a measurement report on a multi-terrain event, I send a letter explaining that an accurate distance should not be claimed by the event.

Expenses Estimate

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- Measurers time is free, out of pocket expenses should be agreed with race director
- Standard Administration Fee £5 to cover stationery, copying, postage, telephone
- Car Mileage at 30p/mile (incl cal course visit)
- Meals
- Maps & Paint if not provided by race director

The Measurement Report

Measurement Summary

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- Standard form available
- If very hilly estimate additional time allowance for RRC standards for races 5 miles and over. One minute for 300 foot of climb
- Attached to summary sheet should be: Bicycle calibration sheet, measurement data sheet, course map, start & finish and any other sketches.
- Some measurers write an entirely optional narrative report. Don't if you are short of time.

Course Maps

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- Easiest is a photo copied OS Path Finder 1:25000
- In towns use photo copied street maps
- Hand drawn maps take time but can show exact measured route. Alternative: put detail in sketches
- Show start & finish, approx mile/km positions
- Show direction of running
- Show North
- 6 figure Grid Ref of start/finish may be useful
- Make sure there is some way of finding the locality

Start & Finish Sketches

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- Start and finish lines must be shown
- Distance from fixed street furniture marked on map
- Direction of running to be shown
- Mention general location to aid locating exact position on the overall course map
- Suggest show North and grid ref

Submitting Measurement Report

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- One copy to race organiser
- One copy to Area Measurement Secretary (SEAA: M.Sandford) who will check the report and issue the certificate direct to Race
- One copy for your own files
- If a non-zero RRC time allowance is recommended one copy to RRC (R.Fisher) who will check the allowance

Review of Day 1, Day 2 Objectives

Practical 3

Measurement of 5 km course

5 km Course Map

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Section of road available

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- Long Tow, Cholswell Rd: Left half
- Faringdon Rd: Left half except at top of Bridge use left hand 1m from kerb
- Larkhill Road, Berrycroft, Thornhill Walk: full width
- Wootton Rd to Evelin Rd: Left half
- Service Rd: Full width and foot path
- Cross roundabout through Island and stay on cycle path/footpath to Long Tow
- Pavements forbidden except where specified

Layout of 5 km course

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- Calibrate on Long Tow
- Measure loop
- Calculate extra counts required
- Finish will be on grass opposite Fitzharris Arms about 30m from white line at drain on road
- Locate a suitable position for start by measuring back from finish along Berrycroft
- Measure whole course from start, recording 1, 2, 3, 4 km splits and finish, include a loop reading
- Recalibrate

Calibration

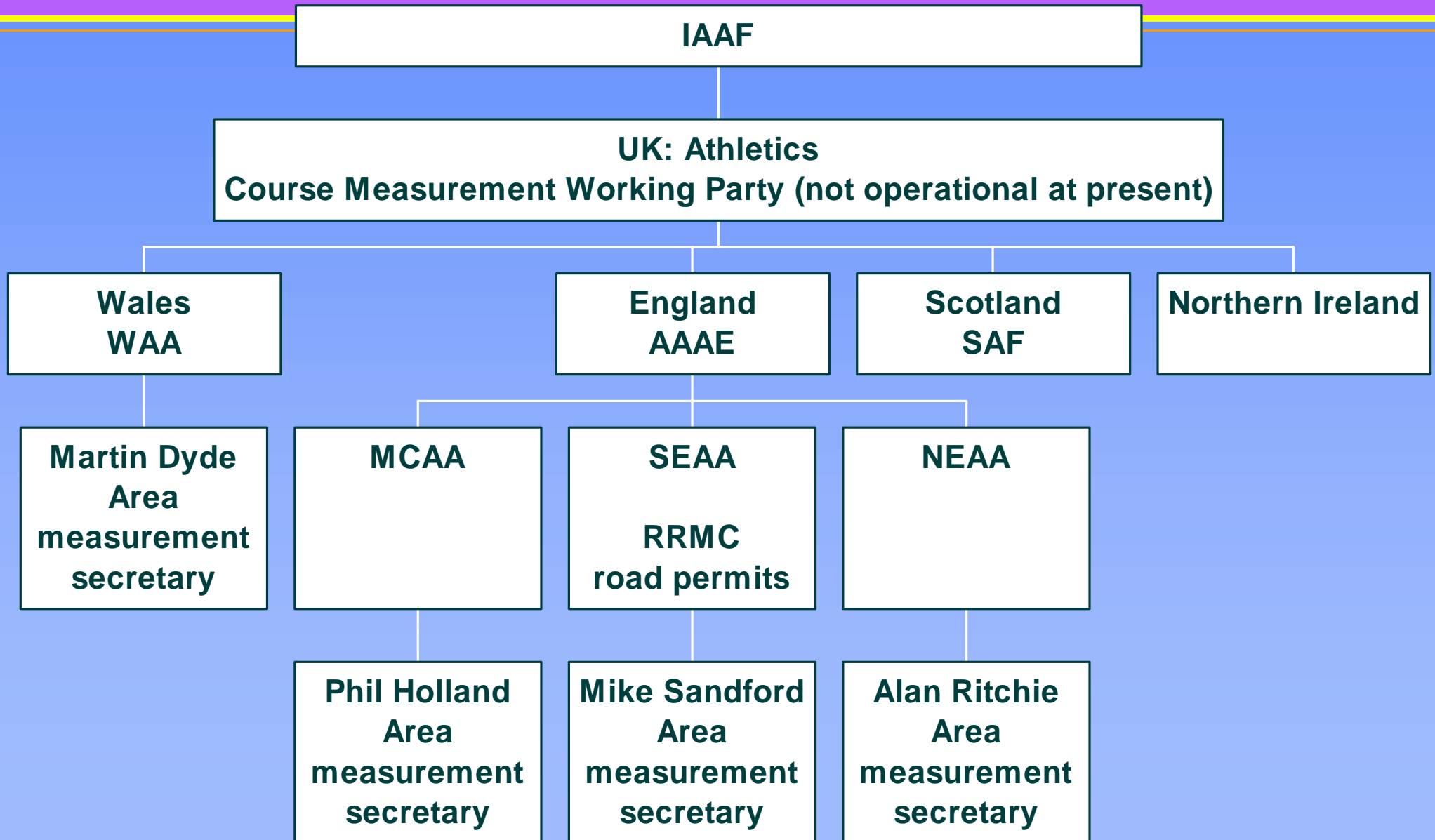
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- Use 695.254 m calibration course marked on both sides of Long Tow
- Ride 30 to 40 cm from the road edge
- Remember to always calibrate before first layout ride and again when you have finished your final ride

UK Athletics / SEAA Organisation

Road Running & Measuring

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BAF Measurers Grading

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- Grade 1 Measurers
 - Qualify by experience of measuring at least 10 -20 courses & having course remeasured by a grade 1
 - For upgrading, apply to area measurement sec
 - May measure national championship events
- Grade 2 Measurers
 - Qualify by completing training seminar
 - Appointed by chairman of UK: Athletics CMWP
 - May measure any event except national champs

Useful Addresses

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- UK Athletics: 30a Harborne Rd, Edgbaston, Birmingham B15 3AA. Tel 0121 4565098
- SEAA: Suite 106, City of London Fruit Exchange, Brushfield St, London E1 6EX
- SEAA Measurers: see list
- SEAA Measurement Sec. : M.Sandford, 22 Stevenson Dr, Abingdon, OX14 1SN, Tel:01235 532207
- County Road Running Secretaries: see list

Advanced Topics

Validation

Pneumatic vs Solid Tyres

More Information

Validation

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- If a world or national best time is to be claimed course should be validated
- The validator measures according to measurement report or other evidence if runners cut the course
- SCPF is not used in the calibration constant
- If the course is 1 part in 2000 less than advertised distance, the course is proved short

Pneumatic Tyres vs Solid Tyres

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- PNEUMATICS
 - Large change with temperature. If more than 7C change, use of larger constant may give a long course
 - Tends to give a slightly smaller constant on rougher roads
 - I recommend pneumatics
- SOLIDS
 - Made by GreenTyre plc
 - Available from Halfords
 - Small change with Temperature
 - Give larger constant on rougher roads
 - No problems with punctures

More information on Measuring

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- IAAF booklet *Measurement of Road Race Courses* - Similar to this course less detailed
- SEAA newsletter *Certified Accurate*- free 2 pa
- *Measurement News* - US and international - 6 pa.
Subscript. \$20pa to P.Riegel, 3354 Kirkham Rd, Columbus, Ohio 43221-1368,
USA. Email to Riegelpete@aol.com
- *Aims Newsletter*. Editor Hugh Jones, 19 Kelly St, London.
Email to aimssec@aol.com
- Email news: *Measurement News Forum*.
– Email to MNForum@aol.com with subject 'Subscribe'
- World Wide Web: www.hit.net/~bobbau/rrtc/

More Information: Road Races

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- UK Athletics Rules for Competition (annual) about £4
 - General Rules 1-25
 - Road Race Rules 201-229
- BAF Road Race Handbook (1994) £3

Practical 4

Adjust course to 3 miles

Adjustment to 3 miles

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- Take the Abingdon 5 km course already measured and adjust to 3 miles by moving the start.
- Use this morning's post calibration as the precalibration
- locate new start using this morning's results
- measure from start to finish recording mile points and overall length. (Make sure you get another pair of readings to calculate the loop length) Recalibrate.

Report Write Up

Abingdon 3 miles

Checks, Report Write up, Home work

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- Check overall measurement is consistent with layout (within 5m)
- You should have 3 readings of loop length. How do they compare?
- Check you have all details for course map, start finish sketch, and measurement data sheets with location of splits
- Check calibration constant from the recalibration has not changed by more than 1 part in 1000
- Go home, write up full report and submit not later than 6 June
- You should contact me in case of difficulties
- When I have received a satisfactory report I will recommend that you should be accredited as a grade 2 course measurer
- Then, have fun measuring!