Solar & Local Time

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There are two systems of time measurement in use when anaysing sunlight in relation to a reference point and these are **Local Time** and **Solar Time**. Local Time is the one we use to order our daily lives.

- **Solar Time**

Solar Time (also known as 'Sun Time') is based upon a 24 hour clock and is longitude dependant. It is calculated relative to the particular location in question. Most tables & charts (such as those found within British Standards, BRE documents, etc) tend to use Solar Time as its reference system.

Solar Noon (12.00) is the point when the sun is at its highest point in the sky and **appears due south** * **of the specified point in question** (i.e. a tree or dwelling etc). **Solar Noon will seldom occur at 12.00 o'clock (noon) local time**. Solar Time is location specific so would be useless to use as a national time system.

The following situation illustrates the problem of nationally using solar time.

If the suns position in the sky is **due south** of the city of Norwich (*near the east coast of Britain*), then this city would be at **Solar Noon** for that point in time. However, for the same point in time, the town of Aberystwyth (*which is located on the west coast of Britain*) can not also be at Solar Noon. It would be at Solar Noon approximately **22 minutes later**.

This is because the two places are separated by approximately 5 degrees and 23 minutes of longitude (*Aberystwyth is 4 degrees and 6 minutes west of Greenwich while Norwich is 1 degree and 17 minutes east*). The sun appears to move across our sky from east to west at 1 degree per 4 minutes of time (*360 degrees x 4 = 1440 minutes or 24 hours)* so would take 22 minutes to be due south of Aberystwyth. It is impossible for the two locations to be at Solar Noon at the same time (unless they hold the same longitude) **but they can both be at Noon when using Local Time**.

In the UK, we have a relatively narrow land-mass so the time the sun takes to transit across the UK is short. Consequently local time will always lie fairly close to Solar Time (apart from when the daylight saving hour is in force).

Although Solar Time is displayed on charts as hours before and after noon, the actual duration of a solar hour can change in relation to the time of year. For example, if I was to start a stopwatch at the exact point when the sun is **precisely due south of my current position** and then stop the watch at this exact same position on the following day when the sun was again, precisely due south, the measured time is unlikely to measure 24 hours. It will be a few seconds out. This is because, as the earth travels around the sun on its elliptical path, it moves at a slightly different speed in relation to its distance from the sun.

[* for the northern hemisphere **]**

- **Local Time**

Local Time (also known as 'Standard Time' or 'Mean Solar Time') is the system which we use in our daily lives. Local Time is dependent upon a designated Time Zone for the area in which we live. Also, further adjustment may be made to suit national needs such as the daylight saving hour. A Time Zone can stretch 100's of miles and the **local time for all places within the zone is the same**. Local Time is political.

Time Zones are important as they enable all regions around the globe to have their 12.00 Noon (Local Time) placed near to the middle of the day.

In the UK we are in the **Western European Time Zone (WET)** also known as **Greenwich Mean Time(GMT)**. However, we adjust WET during the summer months and call the result **British Summer Time (BST)**. We adjust our clocks by adding 1 hour during the end of March and then adjusting them again at the end of October by removing the hour (the clocks go forward 1 hour and then back). So, during BST we are using GMT (or WET) +1 hour.

- **Time Conversion**

It is important to be able to calculate Solar Time (especially Solar Noon) when carrying out calculations relating to shadows. The conversion is relatively straightforward and requires the **longitude** of the location in question (degrees east or west of Greenwich, UK), the **time zone** (+/- hours from GMT) and any **daylight saving time** which may be in force. In the UK we don't need to worry about considering the time zone offset because GMT is the reference point for the global zones and it is the zone in which we live! We must however allow for the hour daylight saving adjustment of British Summer Time (BST) and of course Longitude.

Since Local Time is measured from GMT and solar noon would occur at Greenwich at 12.00 GMT (not BST) *(give or take a few minutes as defined by the EOT... see below)* then any location west of Greenwich will meet Solar Noon a few minutes later. We use the longitude value to calculate this time difference.

As an example, suppose I need to calculate the suns position (in solar time) for the 26th July at the city of Bristol, UK.

First I adjust for BST so start with a pool value of 60 minutes (+ 1 hour).

Then I must adjust for longitude, Bristol is 2 degrees and 35 minutes (*approximately 2.5 degrees*) west of Greenwich so 2.5 x 4 =10 minutes (*the 4 relates to the time the sun takes to transit 1 degree*). This amount is added to my total to give me a value of 1 hour 10 minutes.

Finally, one more adjustment must be made which relates to the distance of the sun from the earth. This is called the **Equation of Time (EOT)** and is a changing value roughly between -17 to +17 mins. For my date of the 26th July the EOT is -6.43 minutes. So to balance this I must add 6.43 minutes to my total to give a final value of 1 hour and 17 minutes. This is the difference between Solar Time and Local Time.

Using this calculated offset of + 1 hour 17 minutes I can now predict that true Solar Noon, for my site at Bristol on the 26th July, will occur at 1.17pm BST. This is the time when the sun should appear due south of Bristol and be at its highest altitude in the sky.