UKMA news

The newsletter of the UK Metric Association
For a **single** *rational* system of measurement

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In this issue:

Spring time greetings to all UKMA newsletter readers

For this spring time edition of the UKMA newsletter there is news of the Annual General Meeting to which all UKMA members are warmly invited.

There is an engineering theme to this edition with lots about measurement on the railways, then we will discover that while road signs may not be metricated in the foreseeable future, car manufacturers may be developing ways around this problem, see page 7.

Continuing with the theme, take a look at a fundamental element of engineering with Sir Joseph Whitworth's design for a standard screw thread for nuts, bolts and other fixing devices on page 8.

Don't forget to keep up to date with all aspects of metrication at http://www.metric.org.uk/ and http://metricviews.org.uk/.

Notice of AGM

The AGM of UKMA will take place on Saturday 4th July 2015, 09:30 to 16:30 at Canada Water Library, 21 Surrey Quays Road, London, SE16 7AR. The library is beside Canada Water Station on the Jubilee line, normally just 5 minutes from London Bridge Station. The Annual Conference will follow immediately after the AGM. The agenda for the AGM and the programme for the Conference will be available in June.

Canada Water Library entrance is right next to station exit

London Overground and Jubilee line stations

New signals – trigger for metrication of the UK railway?

From: Rail Safety and Standards Board RULE BOOK BRIEFING LEAFLET ERTMS MODULES June 2010

European Directives and UK National law require fitment of the European Rail Traffic Management System (ERTMS) when certain criteria are met.

ERTMS aims to facilitate interoperability of signalling systems between different railway networks, simplify cross-acceptance of signalling equipment, and reduce the cost of signalling equipment through standardisation and greater economies of scale.

What is ERTMS?

ERTMS is a signalling system that provides information to the driver in the cab, it includes automatic train protection and also includes voice radio.

The driver is given information about the maximum train speed and distance that the train can travel so that the train can safely stop within this distance. This information is sent directly to the cab without the need for lineside signals. The driver will continue to drive the train, but ERTMS will supervise the train if it determines that it is going too fast or too far. Trains are monitored within the signalling centre using data from the train and trackside equipment.

ERTMS is a metric based system.

From: Rail Safety and Standards Board - Analysing the risk from having a mix of imperial and metric measures on the railway. T1013 - December 2014

Rail industry views for and against metrication

Overall, the majority of people interviewed as part of the project were in favour of migrating to a metrically measured railway.

The reasons for this are:

- Alignment with other countries that use metric units, to facilitate interoperability.
- Metric units are simpler to work with than imperial units.
- British schools have been teaching metric units for 40 years.
- The ability to use off-the-shelf products from around the world and gain of cost benefits through economies of scale.
- Avoidance of rounding problems for speeds.
- Metric units have been a success on the Cambrian route.
- ERTMS is the chosen future signalling system of GB and is a metric system.
- Opportunity to re-measure the railway, without sudden jumps in distance references, and in a consistent manner.

The reasons against migration to metric units were:

- The operational safety risks that could be introduced if front line users apply speeds incorrectly or make mistakes with location information during the migration towards a metric railway.
- Multiple transitions between ERTMS-fitted and non-fitted infrastructure whilst moving, and the different speed units required for each mode of operation. There is an assumption that conventionally operated infrastructure would be in mph and miles and chains, hence the transition to metric units when the train passes on to ERTMS infrastructure.
- The cost of changing systems, infrastructure, and processes.
- The size of the task.
- The lack of a business case.
- Other areas of British life are in imperial units, such as the roads.
- The reluctance of end users to change.

Pictures taken from Wikipedia and 'YouTube' video "The New Measurement Train - Network Rail engineering education".

The Network Rail New Measurement Train is a specialised train which operates to assess the condition of track so that engineers can determine where to work.

It is a specially converted High Speed Train and can check the condition of most main lines and some secondary routes in Great Britain over a 13 week rolling cycle.

The train measures the contact between rails, wheels and the overhead electric supply line. Lasers and other instruments are used to make measurements of the track geometry and features such as overhead line height and stagger, and track gauge, twist and cant.

On the West Coast Main Line, particular care has to be taken to ensure that clearances are maintained for the use of tilting trains. The train captures video footage from the front and rear power cars, and video of the pantograph and wheel interfaces.

The illustration below shows data being recorded as the measurement train is in motion.

Scare story from the Mail on Sunday

From: MARTIN DELGADO FOR THE MAIL ON SUNDAY

PUBLISHED: 22:19, 24 January 2015 | UPDATED: 22:21, 24 January 2015

Safety fear as EU make our railways go metric, forcing staff to calculate speeds and distances in both miles and kilometres during change-over

- Miles and yards will be banished from official signs and documents
- Drivers having to cope with signalling data in miles and km seen as risky
- Last night the switch was branded unnecessary by train drivers' union

Britain's rail network is to go metric on the orders of EU bureaucrats – sparking safety fears that the move could cause chaos and lead to more accidents.

Miles and yards will be banished from official signs and documents and translated into kilometres and metres under the plans.

But an official report seen by The Mail on Sunday states that railway workers will have to calculate speeds and distances in both imperial and metric measurements during the change-over, causing a risk of dangerous confusion.

And last night the switch was branded unnecessary by train drivers' union Aslef. General Secretary Mick Whelan said: 'It's a waste of money which would be better spent on keeping fare increases down.

'It is also an unacceptable safety risk to expect train drivers to cope with signalling data which switches between mph and kph* depending on which bit of track they are on.'

According to a 'risk analysis' by the Rail Safety and Standards Board (RSSB), problems could arise when staff are required to handle some trains which are metric-compliant and others whose speed is still measured in miles per hour during the transition period.

Trackside mile markers will be replaced by kilometre signs and staff rule books and training manuals will be rewritten following a directive from the European Railway Agency, an EU quango based in France.

The chain – a unit of measurement equivalent to 22 yards still used by engineers to calculate track lengths between stations and bridges – will also disappear. It follows a decision to introduce the European Rail Traffic Management System (ERTMS) in EU countries – a computerised signalling network that feeds information about the train's location and speed to a screen inside the cab.

A test run of the system on the remote Cambrian line between Shrewsbury and the West Wales coast has been blamed for a series of problems, including five incidents in five months of trains passing red signals. **

Train operator Arriva said in a report that difficulties had been encountered in introducing metric measurements on a route originally designed in miles.

Despite these problems, Network Rail has started rolling out the new signalling system across the country. The Department for Transport applied to Brussels for an opt-out from the metrication directive in 2012 but was turned down.

The RSSB 'hazard analysis' warns: 'Signallers will be required to advise train drivers of speed restrictions in kph for ERTMS-compliant trains and in mph for non-ERTMS compatible trains. That means the signaller will need to be able to identify the type of train he is dealing with before sending the information.'

It adds: 'Train drivers may... have to operate in metric one day and imperial another, thus exacerbating potential for confusion and error.'

The switch to metric will take place over the next two decades.

Network Rail said: 'Our aim is to digitise the railway to ensure Britain has the network it needs for the future.' The Department for Transport said: 'To meet EU regulations, ERTMS-equipped trains and signs will use the metric system.'

* Notice that the Mail on Sunday does not use the correct symbol for kilometres per hour – km/h

** Since ERTMS is a cab-based system with no external signals, it would be impossible to pass a red signal, so where does the Mail get this information from?

What the Mail on Sunday didn't say

The ERTMS system is being supported by the EU as a common standard for signalling. At present, there are many standards, mostly one per nation within Europe at least, leading to the ridiculous situation whereby the Eurostar had at one point three signalling systems to contend with on the journey from London to Brussels. This has been reduced to two since the high speed line (HS1) has been extended to St Pancras (removing the need to traverse track signalled by traditional means).

Benefits of ERTMS – the Mail on Sunday failed to report any – include:

- In-cab control, meaning a removal of the 'line-of-sight' method of signalling.
- Continuous monitoring of train position, using sensors along the track, called balises.
- Digital control of train performance, relating actual train speed and braking characteristics to the track conditions.
- A removal of the 'block signalling' system where no matter how an actual train might perform, a worst-case distance is allocated to enable a train to come to a complete halt before the next signal.

- Increased capacity of system, due to benefit above, allowing trains to travel closer at increased frequencies. This will be particularly important for train services through London where frequencies of up to 30 trains per hour are planned.
- Elimination of problems of maintaining out-of-date signalling equipment that relies on a supplier base that has reduced in size.
- Opportunity for suppliers that still exist to concentrate on one standard for the future and compete with any other supplier on an equal basis.
- Reduced cost due to the elimination of gantries, signal posts and all the equipment required to operate a manual system.

As can be seen from the above, the issue is about standards - intended to improve performance and simultaneously reduce the cost of controlling a rail system. The fact that the design is based on metric units is fundamental to any modern standard.

Safety is always of the utmost concern and far from being compromised, should improve, due to the benefits listed above.

As far as switching from metric to imperial speed limits and back again, this is no different than having to switch between totally different systems as is the case at present and the implementation of ERTMS will be carried out as the technology becomes established and together with other major improvements, such as electrification.

One such case is the Great Western Main Line, where electrification is taking place.

The plan for the implementation of ERTMS is under review in the rail industry, the Network Rail CEO Mark Carne wants to move to a 'Digital Railway' much more quickly than the previous plan to convert only when existing equipment is life-expired.

The reason is pretty obvious, he gets increased capacity at reduced cost!

So, after all that, ERTMS is not just about changing from mph to km/h (or kph as the Mail wrote), it is far more fundamental and deserves some serious consideration rather than just the flippant mockery of the Mail.

Some UK rail lines already use metric speed limits

Most UK tram lines, including Edinburgh, use speed limits in kilometres per hour as seen here.

The route between Gogarburn and Ingliston is the only section where the trams can travel at the maximum line speed of 70 km/h.

Signs that apply to tramways are diamond in shape to distinguish them from signs applicable to motor vehicles.

Notice that there is no need to add km/h!

Edinburgh tram at York Place tram stop waiting to depart, final destination Edinburgh airport.

High Speed 1, formally known as the Channel Tunnel Rail Link (CTRL) is the only high speed line in the UK. It connects the channel tunnel with London St Pancras station. Intermediate stations are at Ashford, Ebsfleet and Stratford.

It is a double track line designed to handle:

1. High speed passenger trains (8 trains per hour each way), running at 300 km/h;

Eurostar travelling through Stratford.

These trains travel mainly to Paris and Brussels using high speed lines.

2. High speed Domestic Services (8 trains per hour each way), running at 225 km/h;

Javelin domestic service train at St Pancras. This train uses High Speed 1 to destinations such as Dover.

At Ashford, the train crosses over to the conventional network to continue to Dover and other destinations.

Apart from changing from km/h speed limits to mph, it also changes from 25 kV overhead power to 750 V DC third rail at this point!

3. Freight trains, hauled by Class 92 locomotives and running at 140 km/h.

Freight train using the high speed connection to the channel tunnel.

The line speeds are 230 km/h from St.Pancras to the junction with the Waterloo connection at Southfleet (now not used by Eurostar) and then 300 km/h to the connection with Eurotunnel, except for an area around Ashford where the line speed is 270 km/h.

The control centre for the route covering both signalling and the traction power supply is located in the Ashford signalling centre that also controls the classic line network in Kent.

Ford cars slow when they see speed-limit signs

From the BBC website at: http://www.bbc.co.uk/news/technology-32049350

Ford is to sell a car that can read road signs and adjust its speed accordingly to ensure the vehicle is not driving too fast.

The speed-limiting tech can be activated via the steering wheel and briefly overridden by pressing firmly on the accelerator.

The car company suggests the facility will help drivers avoid fines and could reduce the number of accidents.

However, one expert said the innovation might only serve as a "stopgap".

"There's a plan for speed restrictions to be beamed to your car's computer systems and controlled from there, rather than requiring street sign visual recognition systems," said Paul Newton, an automotive industry analyst at the IHS consultancy.

"This would be part an extension of the networks that will connect vehicles, allowing cars to warn those behind them if they are slowing down, which is all part of a move toward autonomous vehicles that drive themselves."

Note that speed is shown in km/h only.

There is no mention of the possibility (or probability) of the UK using this advancement in technology as a trigger for the adoption of metric speed limits and distance indications but if not, why not?

Whitworth's forgotten legacy

Posted on MetricViews by derekp

Whitworth is famous for the eponymous screw thread, and for his promotion of standard measures and interchangeability that brought about an engineering revolution. Less well known are his enthusiasm for decimal measurement and his opposition to the introduction of the metric system in Britain.

When I started secondary school in 1954, the curriculum included carpentry. Measurement in the school workshop was by inches and fractions. I never got the hang of this, my carpentry was characterised by wonky joints, and my completed projects were fit only for firewood. This would have disappointed my grandfather, for I grew up in a home with several fine items of oak furniture that he had made.

This is an illustration of folding rulers that would have been used by carpenters in the late nineteenth and the first half of the twentieth centuries.

Ten years after my introduction to carpentry, I started work setting out foundations and the like on construction sites. Measurements involving inches and fractions continued to be a challenge, but now included feet to complicate the arithmetic even further.

So if carpentry and construction were still in a medieval world of halves and quarters of inches in 1964, how could British manufacturing industry be thriving at the same time? Step forward the ghost of Joseph Whitworth.

Sir Joseph Whitworth (1803 – 1887) was an English engineer, entrepreneur, inventor and philanthropist. In 1841, he created a widely accepted standard for screw threads. His contribution to the promotion of decimal measures is illustrated by this extract from an article in Wikipedia:

"The introduction of the thousandth of an inch as a sensible base unit in engineering and machining is generally attributed to Joseph Whitworth who wrote:

...instead of our engineers and machinists thinking in eighths, sixteenths and thirty-seconds of an inch, it is desirable that they should think and speak in tenths, hundredths, and thousandths...

Up until this era, workers such as millwrights, boiler makers, and machinists measured only in traditional fractions of an inch, divided as far as 64ths. Each 64th is about 15 thousandths of an inch. Communication about sizes smaller than a 64th of an inch was subjective and hampered by a degree of ineffability—while phrases such as "scant 64th" or "heavy 64th" were used, their communicative ability was limited by subjectivity.

Dimensions and geometry could be controlled to high accuracy, but this was done by comparative methods: comparison against templates or other gauges, feeling the degree of drag of calipers, or simply repeatably cutting, relying on the positioning consistency of jigs, fixtures, and machine slides. Such work could only be done in craft fashion: on-site, by feel, rather than at a distance working from drawings and written notes. Although measurement was certainly a part of the daily routine, the highest-precision aspects of the work were achieved by feel or by gauge, not by measuring (as in determining counts of units). This in turn limited the kinds of process designs that could work, because they limited the degree of separation of concerns that could occur.

These days, standards of tolerancing are defined by ISO (the International Organization for Standardization) ISO 286-1:2010 - Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes.

The introduction of thou as a base unit for machining work required the dissemination of vernier calipers and screw micrometers throughout the trade, as the unit is too small to be measured with practical repeatability using rules alone (most rule-markings were far too wide to mark a single mil). During the following half century, such measuring instruments went from expensive rarities to widespread, everyday use among machinists. Bringing more metrology into machining increased the separation of concerns to make possible, for example, designing an assembly to the point of an engineering drawing, then having the mating parts made at different firms who did not have any contact with (or even awareness of) each other—yet still knowing with certainty that their products would have the desired fit."

Inch protractor

By the early twentieth century, many in Britain had become familiar with measuring both in fractions and in decimals of an inch. The illustration here shows a boxwood protractor from the 1930s, marked with fractions and decimals of an inch together with millimetres. I remember too that my school ruler had decimals of an inch and centimetres on the two front edges and fractions of an inch on the back.

So, you might say, this should have made the metric changeover easier. Certainly in construction this was the case. Imperial measures using fractions were scarcely fit for purpose. The changeover began in 1968 and was largely completed in 1975 as planned.

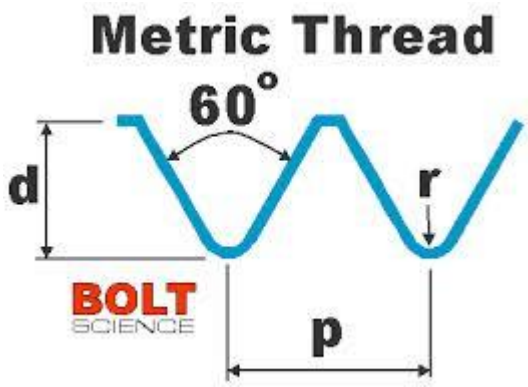
However, many in manufacturing saw little benefit from metrication. The industry was already decimal, thanks in part to Whitworth's foresight. Overseas demand for Imperial products was declining, but, thanks to the home market, there was enough work for many companies to make a living. As a result, the industry programme for the changeover was often ignored. Targets were frequently missed. By 1975, when the metric changeover should have been completed, there was still much work to be done. Thereafter, into the 1980s, export markets for inch products collapsed and a sharp decline in manufacturing occurred.

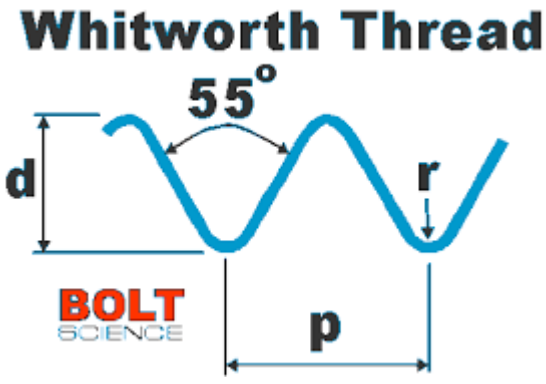
We can only guess what Whitworth would have made of this had he been alive. We do know that he opposed the introduction of the metric system, and suggested that if the French had to have a metre then they should make it forty English (sic) inches!

And what about the Whitworth thread, arguably the best ever created?

Paradoxically, problems with lack of interchangeability among American, Canadian, and British parts during World War 2 led to an effort to unify their inch-based standards, and the Unified Thread Standard was adopted in 1949 by the Screw Thread Standardization Committees of Canada, the United Kingdom and the United States, with the hope that it would be adopted universally. However, internationally, the metric system was eclipsing inch-based units. With continental Europe and much of the rest of the world turning to SI and the ISO metric screw thread, the UK gradually leaned in the same direction. In 1965, the British Standards Institution strongly recommended in a statement that British industry should adopt the ISO metric screw thread system. Today, fifty years on, the Whitworth thread is history, and the inch unified thread is generally found only in products manufactured in North America or for American companies.

Again, we can only guess what Whitworth would have made of the disappearance of his thread system, of the almost universal adoption of metric measures, and of an 'English' inch defined as exactly 25.4 mm giving a metre of 39.370 inches. However, we can be sure he would be pleased that decimals now rule nearly everywhere.





And finally!

On 24th May 1965, in reply to a Parliamentary question, the President of the Board of Trade wrote "... the Government consider it desirable that British industries on a broadening front should adopt metric units sector by sector, until that system can become in time the primary system of weights and measures for the country as a whole."

UKMA is looking for ways to mark this event as the fiftieth anniversary approaches. Suggestions from readers are welcome. Please send to chair@metric.org.uk.