Synthesis title:

Daylight Hours

Category: Other

Other Relevant Topics:

- Children (Pedestrians)
- Teenagers (Pedestrians)
- Adults (Pedestrians)
- Older (Pedestrians)
- Safe Route Planning (Pedestrians)
- Street Lighting (Roads)

Keywords:

Daylight hours, Clock Changes, Single/Double Summer Time (SDST), Darkness, Visibility

About the Road Safety Observatory

The Road Safety Observatory aims to provide free and easy access to independent road safety research and information for anyone working in road safety and for members of the public. It provides summaries and reviews of research on a wide range of road safety issues, along with links to original road safety research reports.

The Road Safety Observatory was created as consultations with relevant parties uncovered a strong demand for easier access to road safety research and information in a format that can be understood by both the public and professionals. This is important for identifying the casualty reduction benefits of different interventions, covering engineering programmes on infrastructure and vehicles, educational material, enforcement and the development of new policy measures.

The Road Safety Observatory was designed and developed by an Independent Programme Board consisting of key road safety organisations, including:

- Department for Transport
- The Royal Society for the Prevention of Accidents (RoSPA)
- Road Safety GB
- Parliamentary Advisory Council for Transport Safety (PACTS)
- RoadSafe
- RAC Foundation

By bringing together many of the key road safety governmental and non-governmental organisations, the Observatory hopes to provide one coherent view of key road safety evidence.

The Observatory originally existed as a standalone website, but is now an information hub on the RoSPA website which we hope makes it easy for anyone to access comprehensive reviews of road safety topics.

All of the research reviews produced for the original Road Safety Observatory were submitted to an Evidence Review Panel (which was independent of the programme Board), which reviewed and approved all the research material before it was published to ensure that the Key Facts, Summaries and Research Findings truly reflected the messages in underlying research, including where there may have been contradictions. The Panel also ensured that the papers were free from bias and independent of Government policies or the policies of the individual organisations on the Programme Board.

The Programme Board is not liable for the content of these reviews. The reviews are intended to be free from bias and independent of Government policies and the policies of the individual organisations on the Programme Board. Therefore, they may not always represent the views of all the individual organisations that comprise the Programme Board.

Please be aware that the Road Safety Observatory is not currently being updated; the research and information you will read throughout this paper has not been updated since 2017. If you have any enquiries about the Road Safety Observatory or road safety in general, please contact **help@rospa.com** or call **0121 248 2000**.

How do I use this paper?

This paper consists of an extensive evidence review of key research and information around a key road safety topic. The paper is split into sections to make it easy to find the level of detail you require. The sections are as follows:

Key Facts	A small number of bullet points providing the key facts about the topic, extracted from the findings of the full research review.
Summary	A short discussion of the key aspects of the topic to be aware of, research findings from the review, and how any pertinent issues can be tackled.
Methodology	A description of how the review was put together, including the dates during which the research was compiled, the search terms used to find relevant research papers, and the selection criteria used.
Key Statistics	A range of the most important figures surrounding the topic.
Research Findings	A large number of summaries of key research findings, split into relevant subtopics.
References	A list of all the research reports on which the review has been based. It includes the title, author(s), date, methodology, objectives and key findings of each report, plus a hyperlink to the report itself on its external website.

The programme board would like to extend its warm thanks and appreciation to the many people who contributed to the development of the project, including the individuals and organisations who participated in the initial consultations in 2010.

Key facts

- During the working week, casualty rates peak in the hours beginning at 8am and 5pm for adults, and the hours beginning at 8am and 3.30pm for children, with the afternoon peak being higher for both. Road casualty rates increase with the arrival of darker evenings and worsening weather conditions.

  (RoSPA, 2012)

- The timing of sunrise and sunset is relevant to Road Traffic Incidents (RTIs) because there is greater risk at night than in daylight and clock time has a greater effect on the pattern of activity on the roads than does the incidence of daylight; for example most people return from work between 5pm and 6pm, regardless of the timing of sunset.

  (Cronin and Garnsey, 2007)

- Every October when the clocks go back and sunset subsequently occurs earlier in the day, road casualties rise in the hour which now falls after sunset. The effects are worse for the most vulnerable road users like children, the elderly, cyclists and motorcyclists. The reverse happens in the spring when sunset occurs one hour later.
- Moving to Single Double Summer Time (SDST) would produce significant net benefits – although there would be a slight increase in the morning RTI peak, this would be more than offset by the reduction of RTIs during the evening peak.

  (RoSPA, 2012)

- Opponents of the change in Scotland, whose northerly latitude makes for particularly short winter days, worry that were SDST to be implemented, the loss of daylight in the morning would offset or outweigh the benefits of the extra light in the afternoons and evenings.

  (Hillman, 2010)

- Analysis (conducted for the DfT) confirms that the cost benefit case of SDST in road safety terms is clear, projecting a net benefit of implementation of about £2.5billion over 20 years in terms of reduced casualties and is based on the number of casualties avoided. It is estimated that the initial implementation cost would be around £5 million.

  (PACTS, 2010)

- A 2006 online survey by RoSPA found that 86 per cent of people were in favour of SDST.

  (cited in Sillito, 2008)

Summary

There is a peak in road traffic incidents (RTIs) when people are travelling to work and school in the mornings and a second peak in the evenings when they are travelling home. The peak in RTIs is much broader in the evenings because children and adults often do not go straight home, finishing work times are more flexible and they tend to socialise. Consequently, the evening peak lies fully or partially in darkness after the October clock change until the following spring. Vulnerable road users such as pedestrians and cyclists, especially those who do not wear brightly coloured clothing, are exposed to greater risk in the darker evenings.

In the UK clocks follow Greenwich Mean Time (GMT) in winter and British Summer Time (BST) in summer. The clocks go forward by one hour in March and back by one hour in October. There are both short-term and long-term effects of clock changes; the immediate effects related to the transfer of an hour of daylight, and the longer term effects of a long sequence of evenings in darkness.

Between 1968 and 1971 the government conducted an experiment where clocks were left on BST throughout the year. It was widely accepted that this resulted in a reduction in RTIs in the evenings, but there were more RTIs in the morning. Even though the reduction in the evenings outweighed the increased RTIs in the morning the experiment was concluded in 1971 and the UK reverted to the clock change regime that is still followed today.

In more recent times many organisations have advocated a change to the current clock change regime with the proposal of Single/Double Summer Time (SDST). In SDST clocks would be set to GMT+2 in summer and GMT+1 in winter, meaning one hour of daylight would be shifted from the morning to the evening throughout the year relative to the current regime.

The primary and most widely researched benefit of adopting SDST is that RTI rates would be reduced throughout the year, with an increase around sunrise but a larger reduction around sunset. Some researchers have used data from the 1970's experiment to extrapolate and model how many road casualties would be saved, and the cost savings involved, if SDST was introduced.

According to various surveys, people in England are generally in favour of SDST, although there is some opposition in Scotland as the change would mean the sun would not rise until 10am in some areas. Some early morning workers may also have concerns

The campaign to introduce SDST has significant support in Parliament, but proposed bills have been 'talked out' by some MPs. Organisations such as RoSPA are calling for a new 2-3 year trial. The data from such a trial would be analysed using modern techniques and this would allow the arguments for and against SDST to be tested.

Methodology

This synthesis is a summary of documents discussing the implications of introducing Single/Double Summer Time (SDST). The synthesis outlines the arguments for and against this change to the current clock change regime. This change would mean an hour of daylight would be moved from morning to evening throughout the year.

- Darkness is defined in Reported Road Casualties Great Britain as from half an hour after sunset to half an hour before sunrise, i.e. 'lighting-up time'. Daylight is defined as all times other than darkness.

(DfT, 2012)

This synthesis was compiled during November –December 2012.

A detailed description of the methodology used to produce this review is provided in the Methodology section of the Observatory website at http://www.roadsafetyobservatory.com/Introduction/Methods .

The steps taken to produce this synthesis are outlined below:

- **Identification of relevant research** – searches were carried out on pre-defined research (and data) repositories. As part of the initial search some additional information sources were also consulted, which included http://www.ingentaconnect.com and various project archives. Search terms used to identify relevant papers included but were not limited to:
    - 'Daylight hours';
    - 'Road safety';
    - 'Summertime';
    - 'Darkness';
    - 'Road casualties';
    - 'Daylight Savings Time (DST)';
    - 'British Summer Time (BST)';
    - 'Greenwich Mean Time (GMT)';
    - 'GMT + 1';
    - 'GMT + 2';
    - 'Single Double Summer Time (SDST)';
    - 'Clock change'; and
    - 'Scotland'.

  A total of 24 pieces of potentially relevant research were identified.

- **Initial review of research** – primarily involved sorting the research items based on key criteria, to ensure the most relevant and effective items went forward for inclusion in this synthesis. Key criteria included:
    - Relevance – whether the research has adequate focus on daylight hours i.e. did the research focus on the short and long term effects of current clock changes and the advantages and disadvantages of altering the clock change regime to Single/Double Summer Time (SDST).
    - Provenance – whether the research is relevant to road users, road safety policies or road safety professionals in the UK. If the research did not originate in the UK the author and expert reviewer have applied a sense check to ensure that findings are potentially relevant and transferable to the UK.
    - Age – priority is given to the most up to date titles in the event of over-lap or contradiction although, due to the nature of the subject and the long history of changing clocks, historical research has been referenced.
    - Effectiveness – whether the research credibly proves (or disproves) the effectiveness of a particular road safety initiative or intervention.

  Following the initial review, 16 pieces of research were taken forward to form the basis for this synthesis, 12 of which were published in the UK.
- **Detailed review of research** – key facts, figures and findings were extracted from the identified research to highlight pertinent road safety issues and interventions.
- **Compilation of Synthesis** – the output of the detailed review was analysed for commonality and a synthesis written in the agreed format. Note that the entire process from identifying research to compiling the synthesis was conducted in a time bound manner.
- **Review** – the draft synthesis was subjected to extensive review by a subject matter expert, proof reader and an independent Evidence Review Panel.

Key statistics

There is a lack of current statistical data directly relevant to the topic of this synthesis. The quantity of daylight hours available during the course of the day is relevant to road traffic incidents as reduced daylight leads to reduced visibility. The following contributory factor statistics relate to Road Traffic Incidents (RTIs) occurring during darkness. The statistics do not indicate whether the RTIs that occurred after sunset would still have occurred if there had been daylight. It should be noted that the contributory factors are largely subjective and dependent upon the skill and experience of the reporting police officer. Evidence is required to support the officer's opinion, so some contributory factors may be less likely to be reported than others.

Casualty statistics

- In 2011, the number of reported casualties (across all road user groups) was highest in the hours beginning at 8am and 5pm during Monday to Thursday (11,449 casualties and 10,759 casualties respectively).

(Kilbey et al, 2012)

Contributory factors

- In 2011, there were:
    - 5 fatal RTIs, 86 serious RTIs and 353 slight RTIs with the contributory factor "Not displaying lights at night or in poor visibility" assigned. Poor visibility includes twilight or other poor light conditions and/or weather related conditions (e.g. rain or fog). These figures include cyclists riding at night without lights as well as motor vehicle driver/riders who have failed to turn on their lights (whether intentionally or not).
    - 7 fatal RTIs, 88 serious RTIs and 368 slight RTIs with the contributory factor "Cyclist wearing dark clothing at night" assigned.
    - 66 fatal RTIs, 264 serious RTIs and 529 slight RTIs with the contributory factor "Pedestrians wearing dark clothing at night" assigned.

(Kilbey et al, 2012)

This review includes statistics from Reported Road Casualties Great Britain 2011, which were the latest available data when the review was written. More recent statistics are available in Reported Road Casualties Great Britain 2013, Reported Road Casualties Great Britain 2014 and Reported Road Casualties Great Britain 2015. An evidence table for each of these reports has been added to the Evidence section of the review.

Research findings

Summaries of key findings from several research reports are given below. Further details of the studies reviewed, including methodology and findings, and links to the reports are given in the References section.

The perceived problem

Peaks in road casualty rates

- During the working week, casualty rates peak in the hours beginning at 8am in the morning and 5pm in the evening for adults, and the hours beginning at 8am in the morning and 3.30pm in the afternoon for children, with the afternoon peak being higher and broader for both. Road casualty rates increase with the arrival of darker evenings and worsening weather conditions.

(RoSPA, 2012)

- In general there is an early morning peak in RTIs between 8am and 9am, but a higher and longer lasting RTI peak occurs between 3pm and 6pm when activity rates on the roads are higher than in the morning.
- The timing of sunrise and sunset is relevant to RTIs because clock time has a greater effect on the pattern of activity on the roads than does the incidence of daylight; for example most people leave work between 5pm and 6pm, regardless of the timing of sunset.
- Reduced light levels reduce visibility and so provide less opportunity for drivers to react to potentially dangerous situations.

(Cronin and Garnsey, 2007)

- Surveys show that RTIs are more likely to occur during the evening peak, when driver attentiveness declines and darkness reduces visibility.

(Hillman, 2010)

- The combination of the time of sunset and higher numbers of road users results in a significant increase in the numbers of road deaths and in the total number of people killed and seriously injured (KSI) between 3pm and 6pm.

(PACTS, 2010)

- The relative peaks may be explained by several factors including:
    - Motorists are more tired after a day's work and concentration levels are lower;
    - Adults tend to go shopping or visit friends after work, increasing their journey times and exposure to road dangers; and,
    - Social and leisure trips are generally made in the late afternoons and evenings.

(RoSPA, 2012)

Children's exposure

- Examination of 'time budget' surveys show that children's travel, involving journeys to friends' houses or to places of recreation, occupies nearly as much of their time as journeys to and from school, and that far more of it takes place in the late afternoon and early evening than in the morning peak hour when children are usually travelling straight to school.

(Hillman, 2010)

- Children tend to go straight to school in the morning but often digress on their way home, increasing their exposure to road dangers.

(RoSPA, 2012)

The effect of clock changes

In the UK, clocks follow Greenwich Mean Time (GMT) from October to March and British Summer Time (BST; GMT + 1 hour) from March to October. Research from the US has been included in this section because in the US clocks are put forward to Daylight Saving Time (DST) in the spring as the UK move to British Summer Time (BST). The US also put their clocks back in the autumn (revert from DST to Standard time).

Short term effects

The immediate effects (in the days after the clock change) of putting the clocks forward by one hour in March and putting the clocks back one hour in October have been examined in both the UK and US, and studies have examined the effects on RTI rate in the days following clock change.

- In 2009, the National Audit Office published 'Improving Road Safety for Pedestrians and Cyclists in Great Britain'. In a section looking at seasonal road casualty patterns from 2000-2007, the report stated that there were 10 per cent more RTIs killing or injuring a pedestrian in the four weeks following the clocks going back in October than in the four weeks before the clocks changed.
- In 2011, pedestrian deaths rose from 25 in September, to 34 in October, 48 in November and 65 in December. The overall casualty rate increased from 667 per billion vehicle miles in September to 708 per billion vehicle miles in December.

(RoSPA, 2012)

- A study conducted in 2001 examined the specific hypotheses that both sleep loss and behavioural changes occurring with the time shifts for daylight saving significantly affects the number of fatal RTIs in the US.
- There was a significant increase in RTIs for the Monday immediately following the spring shift to daylight saving. There was also a significant increase in the number of RTIs on the Sunday of the Autumn shift from daylight saving. No significant changes were observed for the other days.

- Public health educators should consider issuing warnings both about the effects of sleep loss in the spring shift and possible behaviours such as staying out later, particularly when consuming alcohol, in the autumn shift.

(Varughese and Allen, 2001)

Data analysis based on vehicle RTI data in Minnesota from 2001 to 2007 was used to evaluate the short term effects of DST on RTIs on the morning following the clock change.

- The analysis did not show a significant effect but some clinical researchers have performed controlled experiments to examine the relationship between hours of sleep and drivers' response time and vigilance; their main conclusion was that one-hour less sleep can boost the rise of RTIs.
- In addition, some other studies found that time change to Daylight Saving Time in the spring was associated with an increase in fatal RTIs, and attributed it to possible drivers' alcohol-drinking or late-night driving behaviour because of the extra hour of light available in the evening.

(Huang and Levison, 2010)

- Green (1980), in a study to examine the effects of darkness on RTI rates, studied the number of RTIs in the five working days before and after the Sundays in 1975, 1976 and 1977 when the clocks changed. The study examined six regions of Great Britain, including Scotland, and the data was confined to non built-up roads. It was found that in the evening period studied, the frequency of all injury RTIs was about 50 per cent higher and for fatal and serious RTIs about 100 per cent higher. It was also noted that the changes appear to be consistent over the country.

(cited in Hamilton and Kennedy, 2005)

Long term effects

The long term effects of changing the clocks have also been studied. Long term effects are those that occur during the months after the clock change and over the total autumn and winter period.

- Every October when the clocks go back and sunset occurs earlier in the day, RTI rates rise. The effects are worse for the most vulnerable road users like children, older adults, cyclists and motorcyclists.

(RoSPA, 2012)

- When clocks are put back to GMT in October and the 'rush-hour' period becomes darker, KSI increases.

(PACTS, 2010)

- Fatal RTIs were tabulated for a 6 hour period around sunrise and sunset, from 13 weeks before the autumn change to Standard Time until 9 weeks after the spring change to Daylight Saving Time. The effect of Daylight Saving Time on pedestrian and vehicle occupant fatalities was estimated from a model relating light level during morning and evening hours to fatal motor vehicle RTIs. The model accounts for both the abrupt changes in morning and evening light levels associated with the April and October time changes and the gradual day-to-day changes in light level in a given hour with the changing seasons of the year.
- The most notable effects of changing light levels on fatal RTIs were seen at times of the day when light levels changed from light to twilight (RTIs increased) and when twilight changed to light (RTIs decreased). These effects were greatest for pedestrians.
- The results of this study provide strong support for the proposition that Daylight Saving Time (and the equivalent BST) saves lives; extending Daylight Saving Time farther into the winter months could save additional lives. This conclusion is consistent with previous research conducted in the United States and Great Britain.

(Ferguson et al, 1995)

- The purpose of a study conducted in 2001 was to estimate the size of the influence of ambient light level on fatal pedestrian and vehicle RTIs in three scenarios. The scenarios were: fatal pedestrian RTIs at intersections, fatal pedestrian RTIs on dark rural roads, and fatal single-vehicle run-off-road RTIs on dark, curved roads.
- Scenarios involving pedestrians were most sensitive to light level, with some cases showing up to seven times more risk at night over daytime.
- In contrast, single-vehicle run-off-road RTIs showed little difference between light and dark time periods, suggesting factors other than light level play the dominant role in these RTIs.

(Sullivan and Flannagan, 2001)

- A 2002 paper analysed the effects of Daylight Saving Time (DST) on pedestrian and motor vehicle occupant fatalities in the United States. Multivariate analyses of county level data from the Fatality Analysis Reporting System for 2-week periods throughout 1998 and 1999 were used.
- Results show that full year DST would reduce pedestrian fatalities by 171 per year, or by 13 per cent of all pedestrian fatalities in the 5am - 10am and in the 4pm- 9pm time periods. Motor vehicle occupant fatalities would be reduced by 195 per year, or 3 per cent, during the same time periods.

(Coate and Markowitz, 2002)

The proposed solution: Single/Double Summer Time

Single/Double Summer Time (SDST) in the UK would change the clocks one hour forward from GMT in the winter and by two hours in the summer. Many organisations are campaigning to make such a change to the current clock change regime. This is partially due to concerns about the peak in road casualties in darker evenings after the return to GMT in October.

- Recently policymakers have been looking at this issue more closely, with an eye to possible reform. The most widely-discussed proposal is to move to GMT+1 in the winter and GMT+2 in the summer (SDST) – essentially advancing the UK's clocks by one hour throughout the year, moving an hour of daylight from the morning to the evening.
- Aligning the evening peak in traffic better with daylight hours is anticipated to reduce the frequency of RTIs.

(Hillman, 2010)

Arguments for SDST

- Moving to SDST would produce significant net benefits – although there would be a slight increase in the morning RTI peak, this would be more than offset by the reduction in the higher evening peak.

(RoSPA, 2012)

- Research shows that a change in Britain's timekeeping to fall in line with Central European Time (CET), a move often referred to as SDST, would bring about significant economic, social, environmental and health benefits. One of the major public health outcomes of such a change would be a reduction in the number of people killed and injured on our roads during the winter months.

(PACTS, 2010)

- Research published in April 2009 suggested that an estimated net 80 deaths and 200 serious casualties per year would be avoided if SDST was adopted (based on 2003-7 casualty levels) – around 10 per cent of these casualty savings would be in Scotland.
- More recent estimates suggest the savings may currently be slightly lower – around 70 deaths and 190 serious casualties, due to the recent reductions in overall casualties.

(DfT, 2012)

- In 1998, TRL undertook an assessment of the likely effects on RTIs of adopting SDST. The research built on work conducted in 1989 and used trigonometrical equations to calculate the altitude of the sun at any date and time for any point in the country.
- Two alternative statistical models were used to analyse RTI data for Great Britain for periods between 1969 and 1994 to investigate the effect of darkness on the number of casualties.

- The models showed that darkness leads to more casualties, and that the effect increases with casualty severity. The estimates of the reduction in the number of deaths per year range between 104 and 138, depending upon the assumptions made.

(Broughton and Stone, 1998)

- Normalised by average casualty reductions since the TRL estimate in 1998, the reduction is more likely to be around 270 fewer KSI casualties (of which a reduction in deaths of between 74 and 98 is likely).

(PACTS, 2010)

- The Agricultural Development Advisory Service (ADAS) published a report in 1995 examining the advantages and disadvantages of three clock change options for Europe. The model applied to the UK indicated that a change to SDST would lead to 0.75 per cent fewer people being injured on the roads each year and 1.3 per cent fewer killed or seriously injured (based on 2001 figures, about 527 fewer deaths and serious injuries).

(cited in RoSPA, 2005)

The potential cost savings associated with SDST have been calculated and are discussed here.

- In 2009, the Department for Transport's consultation paper, 'A Safer Way: Making Britain's Roads the Safest in the World', has suggested that moving to lighter evenings would prevent about 80 deaths on the road per year. There would be a one-off cost of about £5 million to publicise the change but then benefits of around £138 million per year.

(cited in RoSPA, 2012)

- Analysis (conducted for the DfT) confirms that the cost benefit case of SDST in road safety terms is clear, projecting a net benefit of implementation of about £2.5billion over 20 years in terms of reduced casualties and is based on the number of casualties avoided.

(PACTS, 2010)

- The number of deaths and serious injuries and of damage-only RTIs on the roads would be reduced by over 600 each year, with an estimated saving of over £200 million.

(Hillman, 1993)

Arguments against SDST

Although the benefits to moving to SDST have been outlined by many researchers, there are concerns about the effect of SDST on Scotland.

- The introduction of SDST would have a more pronounced effect in Scotland because more northerly latitudes have greater extremes in the extent of their daylight hours. For example on 31 December 2002 under SDST, dawn would be 9.06am in London and 10.20am in Stornoway (Isle of Lewis), while dusk would be 4.39pm in Stornoway and 5.01pm in London. This has led to considerable opposition to the introduction of SDST in Scotland, where many feel that the greater light available in the evening would not compensate for the longer dark in periods in the morning. (RoSPA, 2005)

- There would be a favourable impact from a policy change to SDST on all dimensions, with the exception of the impact on early morning workers. (Cronin and Garnsey, 2007)

Road casualty reductions in Scotland

Although there have been concerns about the impact of SDST on Scotland it has been suggested that the benefits would be similar to those experienced by the rest of Great Britain.

- In Scotland, as in the rest of Great Britain, earlier timing of sunrise and sunset under GMT shifts light to the morning, when traffic levels are lower, at the cost of an hour's less light in the evening period when the traffic peak is heavier and longer than during the morning peak.

- If SDST had been adopted during the 1990s in Scotland, there would have been an annual reduction in KSI casualties of over 40; a reduction of over 400 KSIs was estimated for the same time period in Great Britain (estimates based on TRL research). These casualties entail huge costs for the NHS. (Cronin and Garnsey, 2007)

- The 1998 study by TRL on the impact of SDST on road casualties estimated that it would lead to an overall reduction of 0.7 per cent in deaths and serious injuries on Scotland's roads, with a 0.2 per cent reduction in casualties of all severities.

- Applying these estimates to 2009 road casualty figures for Scotland implies potential reductions of around 20 deaths or serious injuries and around 30 casualties of all severities. However, it should be noted that the TRL report acknowledged a fair degree of uncertainty in its estimates. Indeed, there are strong grounds for suggesting that they are conservative.

- The evidence presented indicates that advancing the clocks would bring the Scottish people at least as great benefits as those predicted for the rest of the UK. This finding is combined with recent Scottish polls showing fairly evenly divided support for and against the move. (Hillman, 2010)

Public opinion

Various organisations have canvassed for opinions on a change to SDST. The main way in which organisations have reached conclusions about public opinion is via surveys.

- Alternative time regimes have historically struggled to gain traction, thanks in no small part to concerns about their effect on people in Scotland, whose northerly latitude makes for particularly short winter days. Opponents of the change in Scotland worry that, were SDST to be implemented, the loss of daylight in the morning would offset or outweigh the benefits of the extra light in the afternoons and evenings.

  (Hillman, 2010)

- In Scotland, there has been opposition to a change to SDST. A 2005 MORI poll suggested that only 40 per cent of Scots were in favour of the change, although opinions in Scotland seem to be changing.

  (RoSPA, 2012)

- A 2006 Gallup poll in England, Scotland and Wales found 68 per cent of participants approved of SDST, with this figure increasing to 73 per cent once individuals were informed about road safety findings. No current data exists for Northern Ireland specifically, but the aforementioned figures make it reasonable to predict similar support to that found in the rest of the UK.

  (Hillman, 2011)

- A 2006 online survey by RoSPA found that 86 per cent of people were in favour of SDST.

  (cited in Sillito, 2008)

- The most recent attempt to change Britain's legislation about lighter evenings was a Private Members' Bill, the 'Daylight Savings Bill', which would have required the Government to conduct a cross-departmental analysis of the potential costs and benefits of advancing time by one hour for all, or part of, the year. Unfortunately, despite having significant support in Parliament and getting much further through the parliamentary process than any other Private Members' Bill on this topic, the Bill was 'talked out' by a small number of MPs at its Third Reading in January 2012.

  (RoSPA, 2012)

Industry opinion

- In the past, a move to SDST has been opposed by those industries whose workers rise early and utilise morning light, for example some farmers, those who collect and deliver milk, the building industry and postal workers. There is now increasing evidence that these objections are less relevant.

(RoSPA, 2012)

- Opposition to the move has continually been related to traditional opposition which existed among agricultural workers, construction workers and postal workers who preferred light at earlier times of day.

(PACTS, 2010)

- RoSPA issued a questionnaire to seek the views on SDST of 189 organisations. Thirty-four organisations completed the questionnaire in full, of which 14 (41 per cent) would 'strongly approve' of legislation to introduce SDST, 13 (38 per cent) 'somewhat approved', 3 (9 per cent) 'somewhat disapproved' and 4 (12 per cent) would 'strongly disapprove' of such legislation. Therefore of the respondents, 3 to 1 were in favour of SDST. RoSPA acknowledges the limitations of the findings from this survey, which represents only a small sample, and not all organisations had canvassed the views of their members.

(RoSPA, 2005)

HOW EFFECTIVE?

The British Standard Time Experiment of 1968-1971

An experiment was conducted between 1968 and 1971 to find out the effects of retaining British Summer Time throughout the year.

- One of the rare examples of a large scale experiment which affected road safety occurred in the UK between 1968 and 1971, when the system of timekeeping was changed. Clocks were not put back to GMT in the autumn of 1968, so that BST was retained through the winter. The experiment ended in 1971 when clocks were once more put back to GMT in the autumn and the earlier cycle was resumed.

  (Broughton and Stone, 1998)

- BST was introduced all year round in 1968-71 as an experiment, but its continuation was blocked following a vote in the House of Commons. The main issues raised were morning RTIs and disruption to early morning workers.

  (Sillito, 2008)

- Research has shown that the 1968-71 experiment saved around 2,500 deaths and serious injuries each year of the trial period. Since the 1968-71 experiment, it is estimated that more than 5,000 people have died and more than 30,000 have received serious injuries in the UK on the roads due to the clocks being put back to GMT each year.

  (RoSPA, 2012)

- Road casualty figures during the morning (7am-10am) and afternoon (4pm - 7pm) for the period affected by time change in the two winters (1966/67 and 1967/68) before the experiment and in the first two winters (1968/69 and 1969/70) when BST was retained were analysed. The data showed that keeping BST had resulted in an 11 per cent reduction in casualties during the hours affected by the time change in England and Wales and a 17 per cent reduction in Scotland. The overall reduction for Great Britain was 11.7 per cent. Although casualties in the morning had increased, the decrease in casualties in the evening far outweighed this.
- However it should be noted that the 1968-71 experiment coincided with the introduction of roadside breath tests and the 70mph speed limit, which may have affected the casualty reduction figures.

  (RoSPA, 2005)

Gaps in the research

- The only way to reach a conclusion about the effects of a move to SDST in this country is to conduct an experiment similar to that held during 1968-71. A trial adoption of SDST over at least two years will provide real data that can allow the changes associated with SDST to be calculated reliably, in terms of casualty reductions as well as other key measures. Such an experiment would give people an opportunity to experience the change for themselves and may be useful in crystallising opinions.
- Since the 1968-71 experiment, the road environment and people's travel habits have changed enormously. Society is more reliant on the car, fewer children walk or cycle to school, opportunities for leisure activities are significantly greater, people take holidays more frequently and overseas travel is much more common. All these factors indicate the need for a new trial of SDST.

(RoSPA, 2005)

References

Title: Transport Topics – Single/Double Summertime
Author / organisation: Department for Transport **Date:**2012 **Format:** Webpage **Link:** https://www.gov.uk/government/policies/making-roads-safer **Free / priced:** Free
Objectives: To provide information on transport topics.
Methodology: N/A

Key Findings:
• Daylight saving Single/Double Summer Time (SDST) means putting the clocks forward by one hour throughout the entire year, so we would be one hour ahead of Greenwich Mean Time in the winter and two hours ahead in the summer.
• An hour of daylight is moved from the morning to the evening.
• Benefits of SDST include:
  ○ More daylight is available in the evening when the RTI rate is at its highest;
  ○ There are wider benefits, for the environment, tourism, health and leisure, as more of us are awake to enjoy daylight.
• However, there are also concerns about making this change, including in the north of Scotland.
• Research published in April 2009, suggested that an estimated net 80 deaths and 200 serious casualties per year would be avoided if SDST was adopted (based on 2003-7 casualty levels) – around 10 per cent of these casualty savings would be in Scotland.
• These figures takes into account the possible increase in casualties in darker winter mornings as well as the greater reductions expected in the lighter evenings, when more casualties occur.
• More recent estimates suggest the savings may currently be slightly lower – around 70 deaths and 190 serious casualties, due to the recent reductions in overall casualties.

Themes: Single/Double Summer Time, Benefits, Casualties, Concerns.
Comments: This information discusses the main advantages and disadvantages of Single/Double Summertime but does not describe these in detail. The research described within the webpage is not referenced.

Title: Reported Road Casualties Great Britain: 2011 annual report

Author / organisation: P. Kilbey, D. Wilson, O. Beg, G. Goodman and A. Bhagat for Department for Transport (DfT)
Date: 2012
Format: Pdf
Link:https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/9280/rrcgb2011-complete.pdf
Free / priced: Free

Objectives: This report delivers statistics relating to all Road Traffic Incidents (RTIs) reported to the police in Great Britain in 2011.

Methodology: Statistics are compiled from the STATS19 database of road traffic RTIs.

Key Findings:

- In 2011, the number of reported casualties (across all road user groups) was highest in the hours beginning at 8am and 5pm during Monday to Thursday (11,449 casualties and 10,759 casualties respectively).
- In 2011, there were:
    - 5 fatal RTIs, 86 serious RTIs and 353 slight RTIs with the contributory factor “Not displaying lights at night or in poor visibility” assigned. Poor visibility includes twilight or other poor light conditions and/or weather related conditions (e.g. rain or fog). These figures include cyclists riding at night without lights as well as motor vehicle driver/riders who have failed to turn on their lights (whether intentionally or not).
    - 7 fatal RTIs, 88 serious RTIs and 368 slight RTIs with the contributory factor “Cyclist wearing dark clothing at night” assigned.
    - 66 fatal RTIs, 264 serious RTIs and 529 slight RTIs with the contributory factor “Pedestrians wearing dark clothing at night” assigned.

Themes: Road, Road Traffic Incident, Statistics, Darkness, Daylight

Comments: The national road casualty statistics remain the single largest source of RTI data. It includes contributory factors, which give an indication of the role that daylight hours might play in RTIs.

Title: Reported Road Casualties Great Britain: 2013 annual report

Author / organisation: P. Kilbey, D. Wilson, O. Beg, G. Goodman and A. Bhagat for Department for Transport (DfT)
Date: 2014
Format: Pdf
Link:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/359311/rrcgb-2013.pdf
Free / priced: Free

Objectives: This report delivers statistics relating to all Road Traffic Incidents (RTIs) reported to the police in Great Britain in 2013.

Methodology: Statistics are compiled from the STATS19 database of road traffic RTIs.

Key Findings:

- In 2013, the number of reported casualties (across all road user groups) was highest in the hours beginning at 8am and 5pm during Monday to Thursday (9,582 casualties and 10,592 casualties respectively).
- In 2013, there were:
    - 7 fatal RTIs, 97 serious RTIs and 349 slight RTIs with the contributory factor “Not displaying lights at night or in poor visibility” assigned. Poor visibility includes twilight or other poor light conditions and/or weather related conditions (e.g. rain or fog).
    - These figures include cyclists riding at night without lights as well as motor vehicle driver/riders who have failed to turn on their lights (whether intentionally or not).
    - 4 fatal RTIs, 112 serious RTIs and 439 slight RTIs with the contributory factor “Rider wearing dark clothing” assigned.
    - 68 fatal RTIs, 242 serious RTIs and 514 slight RTIs with the contributory factor “Pedestrians wearing dark clothing at night” assigned.

Themes: Road, Road Traffic Incident, Statistics, Darkness, Daylight

Comments: The national road casualty statistics remain the single largest source of RTI data. It includes contributory factors, which give an indication of the role that daylight hours might play in RTIs.

Title: Reported Road Casualties Great Britain: 2014 annual report

Author / organisation: P. Kilbey, D. Wilson, O. Beg, G. Goodman and A. Bhagat for Department for Transport (DfT)
Date: 2015
Format: Pdf
Link:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/463797/rrcgb-2014.pdf
Free / priced: Free

Objectives: This report delivers statistics relating to all Road Traffic Incidents (RTIs) reported to the police in Great Britain in 2014.

Methodology: Statistics are compiled from the STATS19 database of road traffic RTIs.

Key Findings:

- In 2014, the number of reported casualties (across all road user groups) was highest in the hours beginning at 8am and 5pm during Monday to Thursday (10,376 casualties and 11,200 casualties respectively).
- In 2014, there were:
    - 4 fatal RTIs, 88 serious RTIs and 339 slight RTIs with the contributory factor “Not displaying lights at night or in poor visibility” assigned. Poor visibility includes twilight or other poor light conditions and/or weather related conditions (e.g. rain or fog).
    - These figures include cyclists riding at night without lights as well as motor vehicle driver/riders who have failed to turn on their lights (whether intentionally or not).
    - 4 fatal RTIs, 126 serious RTIs and 448 slight RTIs with the contributory factor “Rider wearing dark clothing” assigned.
    - 61 fatal RTIs, 266 serious RTIs and 550 slight RTIs with the contributory factor “Pedestrians wearing dark clothing at night” assigned.

Themes: Road, Road Traffic Incident, Statistics, Darkness, Daylight

Comments: The national road casualty statistics remain the single largest source of RTI data. It includes contributory factors, which give an indication of the role that daylight hours might play in RTIs.

Title: Single/Double British Summertime Factsheet

Author / organisation: The Royal Society for the Prevention of Accidents (RoSPA)
Date: 2012
Format: Pdf
Link: http://www.rospa.com/rospaweb/docs/advice-services/road-safety/british-summertime-factsheet.pdf
Free / priced: Free

Objectives: N/A

Methodology: N/A

Key Findings:

- In the UK, clocks follow Greenwich Mean Time (GMT) from October to March and British Summer Time (BST) which is GMT + 1 hour from March to October. Most of Europe follows Central European Time, which is one hour ahead of GMT in winter and 2 hours ahead of GMT in summer – always one hour ahead of the UK.
- One of the consequences of the UK's system is that more people are killed and injured on the road because of darker evenings in the autumn and winter than would be if we adopted Single/Double British Summertime (SDST).
- During the working week, casualty rates peak at 8am and 5pm for adults and 8am and 3.30pm for children, with the afternoon peak being higher for both. Road casualty rates increase with the arrival of darker evenings and worsening weather conditions.
- Every autumn when the clocks go back and sunset occurs earlier in the day, road casualties rise. The effects are worse for the most vulnerable road users like children, the elderly, cyclists and motorcyclists.
- In 2011, pedestrian deaths rose from 25 in September, to 34 in October, 48 in November and 65 in December. The overall casualty rate increased from 667 per billion vehicle miles in September to 708 per billion vehicle miles in December.
- The relative peaks are explained by several factors, including:
    - Motorists are more tired after a day's work and concentration levels are lower;
    - Children tend to go straight to school in the morning but often digress on their way home, increasing their exposure to road dangers;
    - Adults tend to go shopping or visit friends after work, increasing their journey times and exposure to road dangers; and,
    - Social and leisure trips are generally made in the late afternoons and evenings.
- Moving to SDST would produce significant net benefits – although there would be a slight increase in the morning RTI peak, this would be more than offset by the reduction in the higher evening peak.
- The most recent research estimates that adopting Single/Double Summer Time would have the net effect of saving around 80 lives and 212 serious injuries a year confirming earlier research which showed

that the 1968/71 experiment, when British Standard Time (GMT + 1) was employed all year round (the clocks were advanced in March 1968 and not put back until October 1971) saved around 2,500 deaths and serious injuries each year of the trial period.

- In 2009, the Department for Transport's consultation paper, 'A Safer Way: Making Britain's Roads the Safest in the World', confirmed that moving to lighter evenings would prevent about 80 deaths on the road a year. There would be a one-off cost of about £5million to publicise the change but then benefits of around £138million per year.
- Also in 2009, the National Audit Office published 'Improving Road Safety for Pedestrians and Cyclists in Great Britain'. In a section looking at seasonal road casualty patterns from 2000-2007, the report stated that there were 10 per cent more RTIs killing or injuring a pedestrian in the four weeks following the clocks going back than in the four weeks before the clocks changed.
- In the past, a move to SDST has been opposed by those industries whose workers rise early and utilise morning light, for example some farmers, those who collect and deliver milk, the building industry and postal workers. There is now increasing evidence that these objections are less relevant.
- In Scotland, there has been opposition to the change. A 2005 MORI poll suggested that only 40 per cent of Scots were in favour of the change.
- Opinions in Scotland seem to be changing.
- The most recent attempt to change Britain's legislation about lighter evenings was Rebecca Harris MP's Private Members' Bill, 'Daylight Savings Bill', which would have required the Government to conduct a cross-departmental analysis of the potential costs and benefits of advancing time by one hour for all, or part of, the year. If the analysis finds that this would benefit the UK, a trial would be conducted and evaluated to finally determine the full effects. Unfortunately, despite having significant support in Parliament and getting much further through the parliamentary process than any other Private Members' Bill on this topic, the Bill was talked out by a small number of MPs at its Third Reading on 20 January 2012.
- RoSPA recommends that a change to lighter evenings should be introduced on a trial basis for 2- 3 years. This would provide objective, up-to-date evidence about the effects of SDST and also enable the public and the various industry and business sectors that would be affected to experience the change for themselves.

Themes: Daylight Savings Bill, SDST, Road casualty rates.

Comments:

Title: Making the Most of Daylight Hours, the implication for Northern Ireland

Author / organisation: M. Hillman, Policy Studies Institute, University of Westminster.
Date: March 2011
Format: Pdf
Link: www.psi.org.uk/pdf/2011/PSI_NI_daylight_saving.pdf
Free / priced: Free

Objectives: This Memorandum is focused on the implications for Northern Ireland of the adoption of the proposal to advance clocks by one hour. It seeks to provide an impartial assessment of whether the move would be of general benefit to the people of Northern Ireland.

Methodology: An analysis of the potential advantages and disadvantages of advancing clocks by an additional hour in summer and winter

Key Findings:

- The frequency and severity of RTIs is closely related to lighting conditions. RTIs are more likely to occur in the evening 'peak', when driver attentiveness declines and darkness reduces visibility.
- The risk is particularly pronounced for vulnerable road users – children, elderly people, pedestrians and cyclists. During the 1968 – 71 trial of continuous British Summer Time in the UK, the afternoon peak occurred in daylight for a greater portion of the year, improving visibility and reducing the frequency of injuries.
- Putting clocks forward by one hour would be likely to reduce road casualties in Northern Ireland. The 1998 Transport Research Laboratory study on the impact of the proposed clock change on road casualties estimated that it would lead to an overall reduction of over 100 deaths and serious injuries and would save £138 million each year. Unfortunately, this study only covered England, Wales and Scotland, but Northern Ireland is likely to benefit pro rata in relation to its population accounting for 3 per cent of that total. In 2009, the Public Accounts Committee confirmed the validity of this benefit.
- In 2005 an IPSOS MORI poll found that 61 per cent of respondents in Greater London and Scotland approved of the proposal to advance the clocks. A 2006 Gallup poll in England, Scotland and Wales found 68 per cent of participants approved of SDST, with this figure increasing to 73 per cent once individuals were informed about road safety findings. Sadly, no current data exists for Northern Ireland specifically, but the aforementioned figures make it reasonable to predict similar support to that found in the rest of the UK.

Themes: Public opinion, Northern Ireland, SDST

Comments: Covers the main advantages and disadvantages of SDST.

Title: Making the Most of Daylight Hours, The Implications for Scotland

Author / organisation: M. Hillman, Policy Studies Institute, University of Westminster
Date: 2010
Format: Pdf
Link: www.psi.org.uk/pdf/2010/scotland_daylight_final_v4.pdf
Free / priced: Free

Objectives:

- Assess the consequences of the proposal to introduce Single Double Summertime (SDST) for all sectors of Scottish society.
- Establish whether a move to lighter evenings would be of general benefit to people in Scotland.

Methodology: Review of existing literature and data.

Key Findings:

- Recently policymakers have been looking at this issue more closely, with an eye to possible reform. The most widely-discussed proposal is to move to GMT+1 in the winter and GMT+2 in the summer – essentially advancing the UK's clocks by one hour throughout the year.
- Alternative time regimes have historically struggled to gain traction, thanks in no small part to concerns about their effect on people in Scotland whose northerly latitude makes for particularly short winter days. Opponents of the change in Scotland worry that, were SDST to be implemented, the loss of daylight in the morning would offset or outweigh the benefits of the extra light in the afternoons and evenings.
- Surveys show that road RTIs are more likely to occur during the evening peak, when driver attentiveness declines and darkness reduces visibility. Aligning the evening 'peak in traffic with daylight hours is therefore anticipated to reduce the frequency of such RTIs.
- The 1998 study by the Transport Research Laboratory (TRL) on the impact of the clock change on road casualties estimated that it would lead to an overall reduction of 0.7 per cent deaths and serious injuries on Scotland's roads, with a 0.2 per cent reduction in casualties of all severities.
- Applying these estimates to 2009 road casualty figures for Scotland implies potential reductions of around 20 deaths or serious injuries and around 30 casualties of all severities.
- Examination of 'time budget' surveys show that children's travel, involving journeys to friends' houses, or to places of recreation, occupies nearly as much of their time as journeys to and from school, and that far more of it takes place in the late afternoon and early evening than in the morning peak hour when children are usually travelling straight to school.
- However, it should be noted that the TRL report acknowledged a fair degree of uncertainty in its estimates. Indeed, there are strong grounds for suggesting that they are conservative.
- Because the risk of casualties on Scottish roads is higher than in England and Wales, there is also greater scope for casualty reduction.

- Based on the Department for Transport's figures for the costs of road casualties, the value attached to these reductions would be in the region of £8 million.
- The evidence presented in this report indicates that advancing the clocks would bring the Scottish people at least as great benefits as those predicted for the rest of the UK. This finding - combined with recent Scottish polls showing fairly evenly-divided support for and against the move - adds up to an exceptionally strong case for reform.

Themes: Scotland, Casualties, Children, Cost, Lighter evenings, SDST.

Comments: Provides specific information about the effect of SDST on Scotland.

Title: The effects of Daylight Saving Time (DST) on vehicle crashes in Minnesota

Author / organisation: A. Huang and D. Levison, Journal of Safety Research Volume 41, pp. 513–520.
Date: 2010
Format: Pdf
Link: http://nexus.umn.edu/papers/daylightsavingstime.pdf
Free / priced: Free

Objectives: To assess the effects of putting clocks forward in Spring.

Methodology: Based on vehicle RTI data in Minnesota from 2001 to 2007, this paper evaluates long- and short-term effects of DST on daily vehicle RTIs. To provide evidence to explain the causes of more/fewer RTIs in DST, the impact of DST was examined on RTIs in four periods of a day: 3am-9 am, 9am-3pm, 3pm-9 pm and 9 pm-midnight. The effects of risk and exposure to traffic are also separated.

Key Findings:

- The relationship between DST and road injuries or fatalities has been a topic of extensive research.
- There are generally two schools in studying the effects of DST on road safety, which concentrate on either long-term effects or short-term effects.
- One of the schools claims that DST in the long run decreases vehicle RTIs due to better visibility in the evenings, reducing the likelihood of RTIs in darkness.
- The other school contended that time change to DST resulted in more vehicle RTIs in the short run.
- The main hypothesis was that time change in spring deprived people of one-hour of sleep, which, in the short run, could induce drivers' sleepiness or fatigue while driving.
- Some clinical research performed controlled experiments to examine the relationship between hours of sleep and drivers' response time and vigilance; their main conclusion was that one-hour less sleep can boost the rise of traffic RTIs.
- In addition, some other studies found that time change to DST was associated with an increase in fatal vehicle RTIs, and attributed it to possible drivers' alcohol-drinking or late-night driving behaviour because an extra hour is available in the evening.

- In contrast, other research found that time change did not have a statistically significant impact on vehicle RTIs.
- While different data may produce different results, the effects of DST do not seem to have been sufficiently investigated.
- The major finding of the data analysis is that the short-term effect of DST on RTIs on the morning of the first DST is not statistically significant.
- Moreover, it is interesting to notice that while DST per se is associated with fewer RTIs during dusk, this is in part offset because it is also associated with more traffic on roads (and hence more RTIs).
- A path analysis shows that overall DST reduces RTIs.
- Daylight saving time can lead to fewer RTIs on roads by providing better visibility for drivers.

Themes: Daylight Saving Time, Road Traffic Incidents, Exposure, Traffic volume

Comments: Reviews previous literature and presents data analysis on the short-term effects of putting the clocks back by one hour in Autumn.

Title: The Benefits of Moving to Single/Double Summertime

Author / organisation: A. Sillito, Tourism Insights
Date: 2008
Format: Webpage
Link:
http://www.insights.org.uk/articleitem.aspx?title=The%20Benefits%20of%20Moving%20to%20Single/Double%20Summertime
Free / priced: Free

Objectives: To summarise how moving to SDST could benefit tourism and life in the UK in general.

Methodology: Literature review.

Key Findings:

- In the UK clocks follow Greenwich Mean Time (GMT) from October to March. From March to October, the clocks are put forward by an hour to British Summer Time (BST/GMT+1).
- Over recent years campaigns for the introduction of Single/Double Summertime (SDST) have gained momentum. SDST would mean moving the clocks one hour ahead of GMT in the winter (GMT+1) and two hours ahead of GMT in the summer (GMT+2). This system would give lighter evenings all year round.
- BST was introduced all year round in 1968-71 as an experiment, but its continuation was blocked following a vote in the House of Commons. The main issues raised were morning RTIs and disruption to early morning workers.
- SDST has been proposed in a series of private member bills over the last 15 years, but none have progressed into law.
- The most recent bill 'Lighter Evenings (Experimental)' – was introduced in 2006 by Tim Yeo MP. It proposed a three-year experiment of SDST, bringing time in England in line with Central European Time (CET). Also responsibility for changing time would be devolved to Scotland, Wales and Northern Ireland.

- The Royal Society for the Prevention of Accidents (RoSPA), Brake (the road safety charity) and the Parliamentary Advisory Council for Transport Safety (PACTS) strongly support SDST.
- Road casualty rates increase with the arrival of darker evenings and worsening weather conditions. Every Autumn when the clocks go back and the evenings become darker earlier, road casualties and the casualty rate rise. RoSPA states that introducing SDST would create lighter evenings all year round and result in fewer people being killed and injured in RTIs
- A 2006 online survey by RoSPA found that 86 per cent of people are in favour of SDST.
- The effects of darker evenings are greatest for the most vulnerable road users such as children, the elderly, cyclists and motorcyclists. RoSPA reports that in 2002 pedestrian deaths and serious injuries rose from 759 in October to 851 after the clock change in November.
- There have been a number of studies into the impact of SDST on road safety and estimates have been debated. The most recent and in-depth study was commissioned by the Government in 1998 to resolve the arguments about the likely impact of SDST. The study found that overall:
    - There would be 450 fewer deaths and serious injuries on UK roads each year;
    - In Scotland, the casualty reductions would be slightly lower proportionally than for Great Britain as a whole, but nevertheless there would be an overall reduction; and,
    - The reductions are greater for fatalities than for non-fatal casualties.
- Although there would be more casualties in the morning during the winter, these would be outweighed by a reduction in causalities due to an hour of extra daylight in the evenings, producing an overall reduction. Typically there are more RTIs in the afternoon rush hour than the morning. Reasons for this include:
    - In the afternoon motorists are more tired after a day's work and concentration levels are lower;
    - Children tend to go straight to school in a morning, but may go to after school clubs, friends' houses and playgrounds on the way home; and,
    - Social trips tend to be made in the afternoon and evening.

Themes: SDST, Casualty reductions

Comments: Literature review which outlines the main advantages and disadvantages of moving to SDST, research is referenced.

Title: Daylight Saving in GB; Is there evidence in favour of clock time on GMT?

Author / organisation: B. Cronin and E. Garnsey, Centre for Technology Management, Department of Engineering and Judge Business School, University of Cambridge.

Date:2007 **Format:** Pdf

Link:
http://www.eng.cam.ac.uk/news/stories/2007/BSTvGMT/garnsey_gmt_policy_191007.pdf

Free / priced: Free

Objectives:

- Review of evidence neglected by policy makers.
- Examine the evidence on the impact of returning to GMT in winter (1) on RTIs (2) the alignment of activity patterns with solar time (3) on energy use patterns (4) on generation costs and (5) other issues relating to clock time policy are examined.

Methodology: Re-analysis of existing data.

Key Findings:

- No evidence in favour of imposing GMT in winter was found.
- There would be a favourable impact from a policy change to GMT+1 in winter on all dimensions shown, with the exception of the impact on early morning workers. However working hours could be altered for particular groups, as in Scandinavia.
- There is an early morning peak in RTIs from 8am to 9am, but a higher and longer lasting RTI peak occurs from 3pm to 6pm when activity rates are higher than in the morning.
- In Scotland, as in the rest of GB, earlier timing of sunrise and sunset under GMT shifts light to the morning, when traffic is lighter, at the cost of an hour's less light in the evening period when the traffic peak is heavier and longer than during the morning peak.
- Clock time on GMT results in over a hundred unnecessary deaths on the road annually in GB, and over 40 deaths and serious injuries in Scotland. These tragedies entail massive costs for the NHS.
- The available evidence is already more than sufficient to justify this policy change.
- However the impact of setting the clocks back to Greenwich Mean Time after the end of British Summer Time is an institutional practice so well entrenched that it appears to be exempt from evidence-based policy making.
- Whether a move to double summer time (GMT +2) would be beneficial is a separate question for which less evidence is available since this time regime is not currently applied.
- The timing of sunrise and sunset is relevant to RTIs because clock time has a greater effect on the pattern of activity on the roads than does the incidence of daylight; for example most people return from work between 5pm and 6pm., whatever the timing of sunset. Reduced daylight reduces visibility and so provides less opportunity for drivers to react.

- The extensive evidence that RTIs overall would be reduced by GMT+1 in winter has been overlooked.
- Scottish MPs have not been provided with comprehensive and clearly explained evidence. The reduction in road RTIs from changing to GMT+1 all year would be no less in Scotland than the UK as a whole.

Themes: Scotland, NHS cost, Casualties, Evidence, GMT +2.

Comments: Outlines the main advantages of keeping clock on GMT+1 all year round. The research seems to be biased and is not peer reviewed.

Title: Single/Double Summer Time Position Paper

Author / organisation: The Royal Society for the Prevention of Accidents (RoSPA)
Date: 2005 **Format:** Pdf
Link: http://www.rospa.com/rospaweb/docs/advice-services/road-safety/british-summertime-paper.pdf
Free / priced: Free

Objectives: To review the research about Single Double British Summertime

Methodology: Literature Review

Key Findings:

- The introduction of SDST would make the difference in Scotland more pronounced. For example on 31 December 2002 under SDST, dawn would be 9.06am in London and 10.20am in Stornoway (Isle of Lewis), while dusk would be 16.39 in Stornoway and 17.01 in London. This has led to considerable opposition to the introduction of SDST in Scotland, where many feel that the greater light available in the evening would not compensate for the longer dark periods in the morning.
- Road casualty rates increase with the arrival of darker evenings and worsening weather conditions. Every autumn when the clocks go back and sunset occurs earlier in the day, road casualties and the casualty rate rise.
- The effects of clocks going back in October are greatest for the most vulnerable road users. In 2004, pedestrian deaths rose from 56 in October to 76 in November and 78 in December.
- Road casualty figures during the morning (7am-10am) and afternoon (4pm-7pm) for the period affected by time change in the two winters (1966/67 and 1967/68) before the experiment and in the first two winters (1968/69 and 1969/70) when BST was retained were analysed. The data showed that keeping British Standard Time had resulted in an 11 per cent reduction in casualties during the hours affected by the time change in England and Wales and a 17 per cent reduction in Scotland. The overall reduction for Great Britain was 11.7 per cent. Although casualties in the morning had increased, the decrease in casualties in the evening far outweighed this.
- Overall, about 2,500 fewer people were killed and seriously injured during the first two winters of the experiment.
- However, the 1968/71 experiment coincided with the introduction of roadside breath tests and the 70mph speed limit, which may have affected the casualty reduction figures.

- The Agricultural Development Advisory Service (ADAS) published a report in 1995 examining the advantages and disadvantages of three options for Europe. The model applied to the UK indicated that a change to SDST would lead to 0.75 per cent fewer people being injured on the roads each year and 1.3 per cent fewer killed or seriously injured (on 2001 figures, about 527 fewer deaths and serious injuries).
- RoSPA issued a questionnaire to seek the views on SDST of 189 organisations, 34 organisations completed the questionnaire in full, of which 14 (41 per cent) would 'strongly approve' of legislation to introduce SDST, 13 (38 per cent) 'somewhat approved', 3 (9 per cent) 'somewhat disapproved' and 4 (12 per cent) would 'strongly disapprove' of such legislation. Therefore of the respondents, 3 to 1 were in favour of SDST. RoSPA acknowledges the limitations of the findings from this survey, which represents only a small sample and not all organisations had canvassed the views of their members.
- The only way to reach a conclusion about the effects of a move to SDST in this country, to align the UK clock with that of its European neighbours, is to conduct an experiment similar to that held during 1968/71. A trial implementation of SDST over at least two years, with modern evaluation methods and all data correctly and comprehensively recorded, will result in data that is unequivocal in terms of casualty savings and could cover much wider issues also. Such an experiment would give people an opportunity to experience the change for themselves and may be useful in crystallising opinions.
- Since the 1968/71 experiment, the road environment and people's travel habits have changed enormously. Society is more reliant on the car, fewer children walk or cycle to school, opportunities for leisure activities are significantly greater, people take holidays more frequently and overseas travel is much more common. The advancements in communication technology have opened up the opportunities for worldwide trade even further. Even weather conditions are changing as the effects of global warming are felt. None of the research conducted to date is able to address these factors successfully, hence the need for a new trial.

Themes: SDST, 1968/1971 experiment, Road casualties

Comments: This position paper outlines the history of the debate.

Title: Rural Road Safety: A Literature Review

Author / organisation: K. Hamilton and J. Kennedy, TRL Limited for The Scottish Executive Social Research
Date: 2005
Format: Pdf
Link: http://www.scotland.gov.uk/Resource/Doc/55971/0015841.pdf
Free / priced: Free

Objectives: The overall aim of this project is to identify, collate and review published research and other information relating to RTIs on rural roads, suggest how it may be applied to the situation in Scotland and provide recommendations for action.

Methodology: It consists of a review of published literature, mainly from the UK but also including some international papers, on issues and topics related to rural road safety.

Key Findings:

- Green (1980), in a study to examine the effects of darkness on RTI rates, studied the number of RTIs in the five working days before and after the Sundays in 1975, 1976 and 1977 when the clocks changed. The study examined six regions of Great Britain, including Scotland, separately and the data was confined to non built-up roads.
- Green (1980) found that in the evening period studied, the frequency of all injury RTIs is about 50 per cent higher and of fatal and serious RTIs about 100 per cent higher. Green (1980) also noted that 'the changes appear to be consistent over the country'.
- The evidence that casualty rates, particularly fatal and serious injuries, are higher in darkness has led to several investigations of the potential road safety effects of adopting so called Single/Double Summer Time (SDST). SDST would involve setting clocks to one hour ahead of Greenwich Mean Time (GMT +1) from October to March and two hours ahead (GMT +2) from March to October.
- A recent study into the potential effects of adopting SDST (Broughton and Stone, 1998) found that the effects of darkness are greater for pedestrians than for vehicle occupants and greater for fatalities than non-fatalities.
- Overall, Broughton and Stone (1998) predicted that KSI casualty rates for the whole of Great Britain for the period 1991-94 would have been 0.8 per cent lower had SDST been in place. The predicted reduction for Scotland was slightly lower at 0.7 per cent. However, it should be noted that the separate analysis for Scotland was limited by sparse data – particularly in the morning. The data could not be disaggregated by severity, time of day or into pedestrian and vehicle occupants.
- Therefore, the effect of SDST on rural casualty rates in Scotland is not clear.
- On the basis of the evidence, several road safety organisations support the adoption of SDST. For example, RoSPA has suggested that SDST be introduced on a trial basis for two to three years so that the effects can be directly measured (RoSPA, 2003).

Themes: SDST, KSI casualties, Scotland

Comments: Literature review which references historical research.

Title: The effects of daylight and daylight saving time on US pedestrian fatalities and motor vehicle occupant fatalities

Author / organisation: D. Coate and S Markowitz, Accident Analysis and Prevention, Volume 36
Date: 2002
Format: PDF
Link: http://www.sciencedirect.com/science/article/pii/S0001457503000150
Free / priced: $41.95

Objectives: To analyse the effects of daylight and daylight saving time (DST) on pedestrian and motor vehicle occupant fatalities in the United States.

Methodology: Multivariate analyses of county level data from the Fatality Analysis Reporting System for 2-week periods throughout 1998 and 1999 were used.

Key Findings:

- Daylight is an important determinant of morning and evening pedestrian fatalities in the US.
- Results show that full year daylight saving time would reduce pedestrian fatalities by 171 per year, or by 13 per cent of all pedestrian fatalities in the 5.00pm –10.00am and in the 4.00pm –9.00 pm time periods. Motor vehicle occupant fatalities would be reduced by 195 per year, or 3 per cent, during the same time periods.
- Daylight is a less consistent determinant of motor vehicle occupant fatalities in the morning and evening time periods.
- However, results for the standard time period indicate that full year daylight saving time would decrease fatalities by 195 per year, or 3 per cent of motor vehicle occupant fatalities during the morning and evening hours. The smaller percentage decrease in motor vehicle occupant deaths relative to pedestrian deaths may be explained by the presence of vehicle lights, which make vehicles visible to other drivers during darkness.

Themes: Daylight saving, United States, Pedestrian, Fatalities

Comments: Data from the US but still shows how casualties can be reduced.

Title: The role of ambient light level in fatal crashes: inferences from daylight saving time transitions
Author / organisation: J. M. Sullivan and M. J. Flannagan, University of Michigan Transportation Research Institute, Accident Analysis and Prevention Volume 34, pp.487–498. **Date:** 2001 **Format:** Pdf **Link:** http://www.sciencedirect.com/science/article/pii/S000145750100046X **Free / priced:** $41.95
Objectives: The purpose of this study was to estimate the size of the influence of ambient light level on fatal pedestrian and vehicle RTIs in three scenarios. The scenarios were: fatal pedestrian RTIs at intersections, fatal pedestrian RTIs on dark rural roads, and fatal single-vehicle run-off-road RTIs on dark, curved roads.
Methodology: Each scenario's sensitivity to light level was evaluated by comparing the number of fatal RTIs across changes to and from daylight saving time, within daily time periods in which an abrupt change in light level occurs relative to official clock time. The analyses included 11 years of fatal RTIs in the United States, between 1987 and 1997.
Key Findings: • Scenarios involving pedestrians were most sensitive to light level, some cases showing up to seven times more risk at night over daytime. • In contrast, single-vehicle run-off-road RTIs showed little difference between light and dark time periods, suggesting factors other than light level play the dominant role in these RTIs. • These results are discussed in the context of the possible safety improvements offered by new developments in adaptive vehicle headlighting.
Themes: Pedestrians, Daylight savings, Fatalities
Comments: No reference to SDST but useful facts about risks to pedestrians.

Title: Fatal accidents following changes in daylight savings time: the American experience

Author / organisation: J. Varughese and R. P. Allen, Sleep Medicine Volume 2(1), 31-36.
Date: 2001
Format: Pdf
Link: http://www.ncbi.nlm.nih.gov/pubmed/11152980
Free / priced: $31.50

Objectives: This study examines specific hypotheses that both sleep loss and behavioural changes occurring with the time shifts for Daylight Savings Time (DST) significantly effect the number of fatal RTIS in the United States of America.

Methodology: Data from 21 years of United States' fatal automobile RTIs were gathered. The mean number of RTIs on the days at the time of the shifts (Saturday, Sunday and Monday) was compared to the average of the corresponding mean number of RTIs on the matching day of the weeks preceding and following the shift. This was repeated for each DST shift. The number of RTIs for a particular shift was also correlated with the year of the RTIs.

Key Findings:

- There was a significant increase in RTIs for the Monday immediately following the spring shift to daylight savings.
- There was also a significant increase in number of RTIs on the Sunday of the Autumn shift from daylight savings.
- No significant changes were observed for the other days.
- A significant negative correlation with the year was found between the number of RTIs on the Saturdays and Sundays but not Mondays.
- The sleep deprivation on the Monday following shift to daylight savings in the spring results in a small increase in fatal RTIs.
- The behavioural adaptation anticipating the longer day on Sunday of the shift from daylight savings in the Autumn leads to an increased number of RTIs suggesting an increase in late night (early Sunday morning) driving when traffic related fatalities are high possibly related to alcohol consumption and driving while sleepy.
- Public health educators should probably consider issuing warnings both about the effects of sleep loss in the spring shift and possible behaviours such as staying out later, particularly when consuming alcohol in the fall shift.
- Sleep clinicians should be aware that health consequences from forced changes in the circadian patterns resulting from daylight savings come not only from physiological adjustments but also from behavioural responses to forced circadian changes.

Themes: Daylight savings, Short-term effects.

Comments: Discusses the short-term effects on the clock change in the Autumn. The research uses data from the US.

Title: A new assessment of the likely effects on road accidents of adopting SDST (TRL Report 368)

Author / organisation: J. Broughton and M. Stone, TRL prepared for Road Safety Division, Department of the Environment, Transport and the Regions
Date: 1998
Format: Pdf
Link: https://trl.co.uk/reports/TRL368
Free / priced: Free

Objectives: The aim of the work described in this report is to explore the effect of the level of natural light on the incidence of casualties, and to predict the effect on casualty totals of altering the system of timekeeping in Great Britain.

Methodology: An important conceptual advance, relative to the 1989 TRRL study, lies in the use of trigonometrical equations to calculate the altitude of the sun at any date and time for any point in the country. The main part of the report describes two separate studies which have been made of the level of natural light on the incidence of casualties. These studies have been conducted in parallel, embodying different assumptions and techniques and exploiting the varying altitude of the sun in different ways. The results achieved by the two studies are independent, except that they use the same body of data.

Key Findings:

- Proposals to amend the system of timekeeping have a long history in the United Kingdom.
- At present, clocks follow Greenwich Mean Time (GMT) from October to March and are set forward one hour to Summer Time, i.e. GMT+1 hour, from March to October.
- In recent years the case for adopting Single/Double Summer Time (SDST) has been advocated: with SDST, clocks would be set to GMT+1 from October to March and to GMT+2 from March to October, so that with respect to the clocks the sun would rise and set one hour later than at present throughout the year.
- Two alternative statistical models have been used to analyse RTI data for Great Britain for periods between 1969 and 1994 to investigate the effect of darkness on the number of casualties. These show that darkness leads to more casualties, and that the effect increases with casualty severity.
- The adoption of SDST in Great Britain would transfer an hour of daylight from the morning, when there are relatively few casualties, to the afternoon and evening when there are more. It is predicted that this would reduce the number of people killed and injured in RTIs.
- The estimates of the reduction in the number of deaths per year range between 104 and 138, depending upon the assumptions made.

Themes: Casualty reductions, Modelling, SDST.

Comments: In-depth statistical research.

Title: Daylight Saving Time and Motor Vehicle Crashes: The Reduction in Pedestrian and Vehicle Occupant Fatalities

Author / organisation: S.A Ferguson, D.F. Preusser, A.K. Lund, P.L. Zadorand R.G. Ulmer, American Journal of Public Health, Volume 85, No. 1.
Date: 1995
Format: Pdf
Link:
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1615292/pdf/amjph00439-0094.pdf
Free / priced: Free

Objectives: To determine the effect of daylight savings time on road casualties.

Methodology: Fatal RTIs were tabulated for 6-hour period around sunrise and sunset, from 13 weeks before the Autumn change to standard time until 9 weeks after the spring change to daylight saving time. The effect of daylight saving time on pedestrian and vehicle occupant fatalities was estimated from a model relating light level during morning and evening hours to fatal motor vehicle RTIs. The model accounts for both the abrupt changes in morning and evening light levels associated with the April and October time changes and the gradual day-to-day changes in light level in a given hour with the changing seasons of the year.

Key Findings:

- Fatal-RTI occurrence was related to changes in daylight, whether these changes occurred abruptly with the Autumn and Spring time changes or gradually with the seasons of the year.
- During daylight savings time, which shifts an hour of daylight to the busier evening traffic hours, there were fewer fatal RTIs (727 involving pedestrians, 174 involving vehicle occupants) than might have occurred if daylight saving time had been retained year-round from 1987 through 1991.
- The most notable effects of changing light levels on fatal RTIs were seen when light levels changed from light to twilight (RTIs increased) and when twilight changed to light (RTIs decreased). These effects were greatest for pedestrians.
- The results of this study provide strong support for the proposition that daylight saving time saves lives; extending it farther into the winter months could save additional lives. This conclusion is consistent with previous research conducted in the United States and Great Britain.

Themes: Daylight saving, Casualty reductions.

Comments: Study is US based but the results are comparable with research conducted in Great Britain.

Title: Time for Change, Setting Clocks Forward by One Hour Throughout the Year, A New Review of the Evidence

Author / organisation: M. Hillman, Policy Studies Institute
Date:1993
Format: Pdf
Link: http://www.psi.org.uk/mayerhillman/Time%20fora%20Change.pdf
Free / priced: Free

Objectives:

- Update the original study of the costs and benefits for the UK of putting its clocks forward by one hour in summer and in winter which was published in 1988 by Policy Studies Institute under the title 'Making the Most of Daylight Hours'.
- Incorporation of additional evidence which was previously unavailable.
- Editing of text to produce a summary of the principal findings of the original report in order to make it more accessible for informed public and parliamentary debate on the subject.

Methodology: Review of existing literature.

Key Findings:

- Such a clock change would have the effect of transferring an hour of daylight from the morning to the evening. The extra hour of daylight in the evening would be experienced for all 365 days of the year whilst, for most of the population, the loss of the hour of daylight in the morning would be noticeable only in the winter months, as most people get up after sunrise for about nine months of the year.
- The widely expressed concerns about the adverse effects on road and other outdoor RTIs of SDST - that is moving the hour of daylight from morning to evening - are perverse. The small increase in RTIs on the darker winter mornings, especially among children on their way to school which occurred during the experimental period from 1968 to 1971 of maintaining BST throughout the year seems to have been so imprinted on the public memory that the far more substantial decrease stemming from the lighter late afternoons in the winter and evenings in the summer has been overlooked.
- The number of deaths and serious injuries and of damage-only RTIs on the roads would now be reduced by over 600 each year, with an estimated saving of over £200 million. All the main organisations concerned with safety have indicated their support for the adoption of SDST.
- Analysis of the frequency of RTIs by hour of day in relation to patterns of travel indicates that the attention paid by all road users deteriorates as the day wears on.
- Examination of 'time budget' surveys show that children's travel, involving journeys to friends' houses, or to places of recreation, occupies nearly as much of their time as journeys to and from school, and that far more of it takes place in the late afternoon and early evening, in marked contrast to the morning and mid afternoon peaks of school travel.

Themes: Cost savings, Children, SDST.

Comments: Outlines the benefits of adopting SDST.

Title: Policy Briefing – Single/Double Summertime

Author/organisation: Parliamentary Advisory Council for Transport Safety (PACTS)
Date: 2010 **Format:** Pdf
Link: http://www.pacts.org.uk/wp-content/uploads/sites/10/docs/pdf-bank/POLICY%20BRIEFING%20-%20Single%20Double%20Summertime.pdf
Free / priced: Free

Objectives: To provide a policy briefing about Single Double Summer Time.

Methodology: N/A

Key Findings:

- In the UK, clocks are set to Greenwich Mean Time (GMT) from October to March and British Summer Time (BST), which is GMT + 1, from March to October. Most European Countries follow Central European Time (CET) which is GMT + 1 in winter and GMT + 2 in summer.
- Research shows that a change in Britain's timekeeping to fall in line with CET, a move often referred to as 'Single/Double Summertime', would bring about significant economic, social, environmental and health benefits. One of the major public health outcomes of such a change would be a reduction in the number of people killed and injured on our roads during the winter months.
- The combination of the sun setting and high numbers of road users results in a significant increase in the numbers of road deaths and in the total number of people killed and seriously injured (KSI) between 3pm and 6pm. The higher number of injury RTIs in the evenings is linked to the compounding effects of darkness, driver fatigue and the increased exposure of children returning from school.
- When clocks are put back to GMT in October and this 'rush-hour' period becomes darker, KSI increases. This rise is particularly observed by the more vulnerable road users. In 2008, pedestrian road deaths rose from 38 in August and 38 in September to 55 in October and 62 in November.
- Research conducted by TRL in 1998 estimated that the adoption of Single/Double Summertime in the UK would result in a reduction in road user KSI of around 450. Normalised by average casualty reductions since then, the reduction is more likely to be around 270 fewer KSI casualties of which a reduction in deaths of between 74 and 98.
- In A Safer Way, the DfT confirmed that the cost benefit case in road safety terms is clear, projecting a net present value of implementation of £2,451.71 million over 20 years. It is estimated that the implementation cost would be around £5 million.
- Opposition to the move has continually been related to traditional opposition which existed among agricultural workers, construction workers and postal workers who preferred light at earlier times of day.
- In 2004, PACTS and RoSPA produced a position paper on SDST which called for a new trial, similar in length to that held in 1968/71. A trial of this nature, using modern evaluation methods and effective data recording, would provide the evidence with which government could make a decision about the overall benefits to society of SDST.

Themes: SDST, Implementation costs, KSI, Cost benefit.

Comments: Summarises the main points related to the introduction of SDST and references other research.

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