

# The Delivery Hub health, safety and environment

## Raising the bar 22

### Fatigue

Version I - March 2014

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## Objective

This raising the bar guidance aims to provide best practice on managing fatigue in the workplace.

## Background

This area was chosen as a raising the bar topic as the major projects delivery programme requires shift work and the existing maintenance environment also run shift work which has the potential to result in fatigue if not correctly managed.

Poorly designed shift-working arrangements and long working hours that do not balance the demands of work with time for rest and recovery can result in fatigue, accidents, injuries and ill health.

Fatigue refers to the issues that arise from excessive working time or poorly designed shift patterns. It is generally considered to be a decline in mental and/or physical performance that results from prolonged exertion, sleep loss and/or disruption of the internal clock. It is also related to workload; in that workers are more easily fatigued if their work is machine-paced, complex or monotonous.

Fatigue results in slower reactions, reduced ability to process information, memory lapses, absent-mindedness, decreased awareness, lack of attention, underestimation of risk, reduced coordination etc. Fatigue can lead to errors and accidents, ill-health and injury, and reduced productivity. It is often a root cause of major accidents eg Herald of Free Enterprise, Chernobyl, Texas City, Clapham Junction, Challenger and Exxon Valdez. Fatigue has also been implicated in 20 per cent of accidents on major roads and is said to cost the UK £115 to £240 million per year in terms of work accidents alone.

## Minimum requirements

All projects should undertake a risk assessment to consider the effects of fatigue from their programme of works. Appendices 1 and 2 provide risk assessment templates. In completing the risk assessment the following should be considered:

### 1. Legal requirement

The working time regulations detail limits on working hours and specify break times. It is common to hear people referring to opting out of the working time regulations; however, there is only one aspect (the 48 hour rule) that workers can choose to opt out from (choosing to work over 48 hours a week up to the maximum of 72 daytime hours per week). Workers cannot opt out of the following:

#### Summary of working time regulations

- Hours are limited to 72 within a seven day period (eg 6 x12 hour shifts or 7 x 10 hour shifts) for those working in the day.
- Hours are limited to an average eight hours in any 24-hour period for night workers (those working at least three hours between 11:00 and 18:00).
- Night workers are entitled to receive regular health assessments.
- The duration of shifts is to be no more than 12 hours including overtime.
- Employees are to have 5.6 weeks paid leave a year.
- Employees are to have 11 consecutive hours rest in any 24-hour period (commuting is not counted as work and therefore is considered as rest time).
- Employees are to have a 20-minute rest break if the working day is longer than six hours and one day off each week.

## 2. Hours of work

When planning works the safest and most efficient shift patterns should be used. The timing of shift patterns should take account of varying risk at different times of the day, for example, night shifts may reduce visibility but also reduce the risk from the traffic flow adjacent to the works. A suitable risk assessment will assist in determining the pros and cons of different activities at different times of the day. Legal requirements must be met at all times and following the guidance below will assist in preventing fatigue:

- assess the use of shift work to minimise risk
- limit the number of consecutive night shifts to six
- allocate shift workers consecutive days off
- schedule consistent start times or where rotating rosters are used, using forward rotation for shifts (morning-afternoon-night) rather than a backward rotation (night-afternoon-morning)
- identify ways to make sure shifts do not extend beyond usual finish times, for example, hold points to ensure that an activity that cannot be stopped part way through is not started if it cannot be finished within the shift such as planing and resurfacing a carriageway.

- monitoring actual hours worked against rostered hours to identify and review situations where excessive hours are being worked
- allowing new workers and workers returning from leave with time to acclimatise to shift work
- developing procedures for managing shift-swapping and reducing recalls to duty, for example, visualisation boards where all information is readily available and it is simple to highlight the important issues at handover.
- review travel distances to ensure that the door to door day does not exceed 14 hours.

### 2.1 Hours of work – 14 hours door to door

Figures 1 and 2 based on a five day week conform with the legal requirements of the working time regulations, as the shifts do not exceed 12 hours, they are providing 11 hours rest per day (commuting is not counted) and the total weeks hours are below 72 (12 hours x 5 days = 60 hours). Figure 3 is also compliant as the nightshift is limited to 8 hours.

**Figure 1: Day shift 12 hours with 3 hour commute**

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

**Figure 2: Day shift 12 hours with 5 hour commute**

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

**Figure 3: Nightshift 8 hours**

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

Time at work

Commuting

Time at home

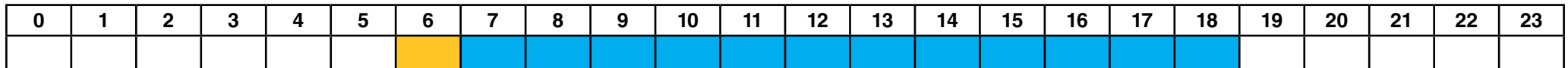
Whilst legally compliant, it is recognised that it is likely to increase the risk of fatigue if a commute significantly adds time to the individual's day. In Figure 1 a daily 3 hour return commute takes the door to door time to 15 hours and in Figure 2 a daily 5 hour return commute takes this to 17 hours.

As a result of the transient nature of the construction industry it is common for people to commute greater than average distances to and from work. Therefore in order to reduce the likelihood of fatigue and align with other national infrastructure clients, a door to door measure is more holistic approach. The door

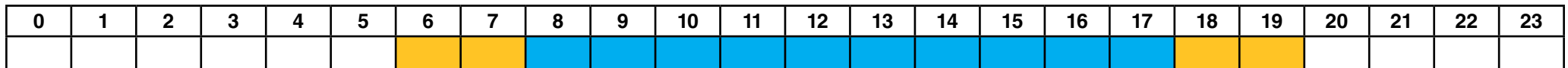
to door measure aims to limit personnel to a 14 hour day from leaving to returning home (or temporary accommodation). In Figures 4 and 5 the individual's door to door time is 14 hours (06:00 to 20:00).

In working efficiently, it may be beneficial to provide an accommodation allowance so personnel can stay close to the work site, reducing their commute and therefore the length of their door to door day whilst maximising the hours on site (within the limits of working time regulations).

**Figure 4**



**Figure 5**



Time at work

Commuting

Time at home

### 3. Rest periods

In order to work safely it is important that all personnel get sufficient rest.

Working time regulations state that...workers over 18 are usually entitled to three types of rest breaks:

- Rest breaks at work – If they work more than six hours a day, they have the right to one uninterrupted 20 minute rest break during their working day (this could be a tea or lunch break).
- Daily rest – Workers have the right to 11 hours rest between working days (eg if they finish work at 20:00, they shouldn't start work again until 07:00 the next day).
- Weekly rest – Workers have the right to an uninterrupted 24 hours without any work each week or 48 hours each fortnight.

Where employees are receiving an allowance from their employer for accommodation local to the site, steps should be taken to ensure that this allowance is used for the intended purpose, for example checking accommodation receipts. Employees should not be permitted to sleep in vans etc overnight in order to retain their accommodation allowance as the quality of rest is unlikely to be adequate.

Commercial drivers must comply with breaks as recorded on their tachograph, other drivers should plan a break every two hours when driving.

### 4. Work demands

It is not only the hours that an individual works that can lead to fatigue; the demands within those hours can affect people in different ways. Some pressure can act as a motivator; however, excessive pressure can lead to physical and mental harm.

In order to reduce the risk of fatigue the following points should be considered when developing a risk assessment:

- Introduce a variety of tasks to minimise physical and mental demands and assist in maintaining alertness during a shift
- Use plant, machinery and equipment (such as lifting equipment) to eliminate or reduce excessive physical demands. **Further guidance can be found in [B8 manual handling raising the bar](#).**

- Introducing job rotation to limit a build-up of mental and physical fatigue. **Further guidance can be found in [B12 occupational health raising the bar](#).**

- Using regular rest periods in addition to scheduled meal breaks.

### 5. Work environment

The work environment can influence the likelihood of fatigue and this can change on a daily basis, for example, a ground-worker is more likely to become fatigued in hot weather, even though they may be conducting a task they are familiar with.

In order to reduce the risk of fatigue the following points should be considered when developing a risk assessment:

- Avoid physically demanding work during periods of extreme temperature or increasing the frequency of breaks.
- Use heating/cooling devices in extreme temperature work environments (where appropriate) and/or providing appropriate work clothing and shelter.
- Install ventilation/cooling devices in hot, confined work environments such as vehicle cabins.
- Provide access to facilities for rest, meal breaks and other essential requirements such as bathroom facilities.
- Provide access to accommodation when workers need to work away from home, where the sleep environment is conducive to restorative sleep (ie quiet, dark, cool). **Further guidance can be found in [B6 caravan temporary sleeping accommodation raising the bar](#).**
- Monitor exposure to noise, temperature and chemicals and enforcing strict controls to ensure that exposure is limited.
- Provide personal protective equipment and ensuring correct use.
- Rotate workers through different tasks to reduce the effects of environmental factors on fatigue.

## 6. Work scheduling/planning

The risk from fatigue can be minimised through thorough scheduling and planning.

The following points should be considered when developing a risk assessment:

- Manage deadlines so workload can be safely undertaken, this may be ensuring there is not a rush towards the end of a programme or that there are not incentives to finish a task more quickly than safely.
- Include adequate breaks during a work schedule, especially during a night shift.
- Making sure there are adequate resources to do the job so breaks during and between shifts are not adversely affected and excessive demands are not placed on workers.
- Arrange for vacant positions to be filled in a timely manner to ensure there are sufficient numbers of workers to complete work schedules.
- Plan work tasks so that work demands decrease towards the end of the shift
- Review supply chain working practices to ensure that double shifting (moonlighting) is not occurring.

**Figure 6: Example shift plan with tasks allocated to individuals**

	07:30-10:45	Break	11:00 – 13:00	Break	13:30-17:30
<b>Joe</b>	Hand dig, photo and backfill trial hole 123ABC		Hand dig, photo and backfill trial hole 456ABC		Painting fence 789XYZ
<b>Pete</b>					Painting fence 789UVW
<b>Rob</b>	Litter pick ch.300- 500.		Footpath improvements to plan 987CBA		Erect heras fencing to plan 234ABC
<b>Alex</b>	Litter pick ch.500- 700.				

## 7. Non-work factors

Fatigue can be caused by external influences outside the control of the workplace.

Support and assistance should be provided in order to assist the individual and ensure their and their colleagues safety. Points to consider include:

- Briefing workers on fatigue risk factors and their responsibility to present for work as fit for duty.
- Checking that workers are fit-for-work and encouraging them to self-identify where appropriate.
- Following up when a worker self-identifies by identifying difficulties she/he may have with rostering arrangements, health conditions, family/carer responsibilities.
- Assessing applications for secondary employment and approving applications only if they are satisfied that there is no increased risk of fatigue.
- Encouraging workers to seek medical advice to manage both temporary illnesses and chronic health conditions which may lead to higher levels of fatigue.
- Providing new workers and those returning from leave with time to acclimatise to shift arrangements.
- Monitoring leave to ensure workers do not accrue excess annual leave.
- Monitoring sick leave to make sure that workers affected by fatigue are identified and managed appropriately.
- Referring workers who may be experiencing fatigue as a result of personal issues to the organisations employee assistance program.

Individual factors for example medical conditions (eg sleep apnia) should be considered along with support offered through the delivery partners employee assistance programme for family or study commitments. Individuals also have a responsibility to manage their sports and social commitments to ensure they are fit for work.

## 8. Consultation with employees

When setting up new shift patterns or changing existing shift patterns employees should be consulted via their workforce representatives. It should be noted that some personnel may wish to work longer but fewer shifts, this could increase the chance of fatigue so should be reviewed to balance operational, personal and health needs.

### Desirable

It is desirable to comply with the 48 hour rule contained within the working time regulations. Individuals should not be encouraged to opt out, however, legally they can choose to work up to 72 hours.

It is also desirable to schedule safety critical work\* outside periods when natural sleep cycles encourage people to sleep i.e. avoid scheduling work between 12 am and 6 am, however, a holistic view has to be taken for example, conducting high speed road works at night may have a lower overall risk as the traffic flows are lower than during daytime hours.

\*The term safety critical work is defined by constructing better health as: Where the ill health of an individual may compromise their ability to undertake a task defined as safety critical, thereby posing a significant risk to the health and safety of others. Occupations covered include those working on high speed roads, working trackside, working with heavy plant or machinery, working in confined spaces or tunnels, working with asbestos and those working at height.

## Legislation/guidance

Working Time Regulations 1998 <http://www.acas.org.uk/index.aspx?articleid=1373>

Network Rail – Guidance on the management of door to door work and travel time. NR/GN/INI/001

Fatigue film to aid toolbox talks can be downloaded at <http://safety.networkrail.co.uk/Alerts-and-Campaign/Safety-Films#>

HSG256 Managing shift work

Health and Safety Executive Fatigue and Risk Index Calculator [www.hse.gov.uk/research/rrpdf/rr446cal.xls](http://www.hse.gov.uk/research/rrpdf/rr446cal.xls)

## Additional information

Appendix 1: Example extension of hours risk assessment

Appendix 2: Health and Safety Executive calculator

Appendix 3: Case studies



## Appendix 1: Extension of hours risk assessment

This assessment must only be made if there is an exceptional circumstance which:			
<ul style="list-style-type: none"> <li>Is likely to increase the risks to health and safety of colleagues or the public.</li> <li>Is likely to cause significant disruption to the public and it is not reasonably practicable to take alternative steps e.g. by providing relief staff.</li> </ul>			
<b>The circumstances that have lead to this situation are:</b>			Tick those applicable
Extreme weather conditions			
Equipment failure			
Accident or serious incident			
Shortage of staff which was not foreseeable e.g. sudden illness, and which would cause significant operational disruption			
Other (provide details)			
What alternative have been considered and why are they not being implemented?			
<b>Type of exceedance</b>			
+ 13 consecutive shifts		+ 12 hours per shift	
+ 72 hours in a week		Less than 11 hours rest between shifts	
<b>Estimated exceedance</b>	Additional hours or additional shifts		
<b>Details</b> person who is require to work extended hours			
Name		Project	
Position		Location	
Company		Work type	
Date		Duties	
<b>Employee considerations</b>			Yes No
Has the had their required 11 hour rest break prior to the start of this shift			
Do they show signs of fatigue?			
<b>As the person who is required to work extended hours I confirm that I am not fatigued and am willing to extend my working hours.</b>			
Name		Signature	Date
The activity specific risk assessment has been reviewed in light of the above change in circumstances and ( <i>delete as appropriate</i> ) remains valid/ has been revised to take account of changes.			
Requested by (Line Manager)		Signature	Date
Authorised by (Senior Manager)		Signature	Date

## Appendix 2: Health and Safety Executive calculator

The Health and Safety Executive fatigue and risk index calculator provides a tool to complete the risk assessment.

**Fatigue Index Calculator**

Read the manual before using! Go to <http://www.hse.gov.uk/RESEARCH/mpdf/rr446g.pdf>

Company:

Location:

Shift ID:

Date:

Assessor:

Display schedule  
 Display charts

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Version 2.3

About

Day	On Duty	Off Duty	Job type / breaks	Commuting Time	Duty Length	Rest Length	Average duty per day	Cumulative component	Duty timing component	Job type / Breaks component	Risk Index
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The calculator contains two separate indices, one which relates to fatigue (Fatigue Index) and one that relates to risk (Risk Index).

While the two indices are similar in many respects they diverge in others. The main differences are due to the different time of day effect: the peak in risk occurs close to midnight, whereas the peak in fatigue tends to occur some five hours later, in the early morning. Therefore, when assessing a pattern of work it is important to review both the fatigue and risk indices.

In the risk assessment spreadsheet, both the risk and the fatigue indices are expressed in terms of three individual components:

1. A cumulative component. This relates to the way in which individual duty periods or shifts are put together to form a complete schedule. The cumulative component associated with a particular shift depends on the pattern of work immediately preceding that shift.
2. A component associated with duty timing, ie the effect of start time, shift length and the time of day throughout the shift.
3. A job type / breaks component. This relates to the content of the shift, in terms of the activity being undertaken and the provision of breaks during the shift.

**Further guidance on interpreting fatigue and risk index outputs is available on the Health and Safety Executive website.**

<http://www.hse.gov.uk/research/rrhtm/rr446.htm>

### Limitations of the fatigue and risk index

It is important to note that the FRI is based on group data and does not, take into account factors such as individual differences (e.g. age), specific work-related issues (eg exposure to chemical hazards) or social factors (eg lifestyle, domestic responsibilities), although it should be recognised that that these may affect a worker's tolerance to shift work. The industry sector and the type of work done will also affect the risk of fatigue and it is important to recognise that the mathematical formulae used in the FRI cannot take into account such variations.

## Appendix 3: Case studies

### Carillion case study

#### Background / aim

The Highways Agency would like to introduce a guidance document on working hours to try to combat fatigue. The document would be very much based on the requirements of the working time regulations but in addition they would also like to introduce a maximum 14 hour door to door policy similar to Network Rail. Before being implemented Carillion, as one of their delivery partners in both MP and NDD, was asked to undertake a feasibility study to understand whether this is achievable and if there are any operations likely to exceed this figure.

#### Methods

Data was collected from a cross section of trades and from both Major Projects smart motorways schemes to Network Delivery managing agent contracts. Time sheets and travel plans of a large selection of individuals plus a number of engagements were used as source material. Working hours and the proximity of where individuals live / place of rest were scrutinised over a 4 week period (Monday 21 October to Monday 18 November 2013). The review also looked at possible future working needs such as longer summer working hours, the height of winter maintenance provision etc to try to identify any possible future issues.

#### Results

Within MP projects the site hours are generally capped at 10 hours for most site operations, cross referencing this with a large sample of home addresses few were required to travel at a distance greater than two hours each way (<20 per cent). Of those individuals whose home addresses were outside the required distance (generally over 100 miles) all had been provided temporary accommodation. Three individuals were identified as having a single journey commute of over four hours to get to the place of work on a Monday morning and again to leave on a Friday night. Local arrangements were put in place either to ensure the individuals travelled to accommodation the night before or started / finished their shift to ensure adequate rest was maintained.

Although not evidenced by the trial, but through anecdotal engagement with operatives, another area of possible concern within major projects was with regard to traffic management maintenance operatives. For these operations, operatives work 12 hour shifts which are generally well managed due to embedded shift patterns introduced to comply with the working time regulations. However on occasion, a replacement for illness / leave entitlement may be required for an odd day, so to remedy a temporary labour agency operative, whose normal place of rest maybe more than one hour travel from the place of work is brought in to assist. Because the individual is only procured for one day, temporary accommodation is not normally requested or offered. But it was stressed these incidences are few and far between.

In NDD the shift patterns were considered to be really well managed as the majority of workers are permanent labour that lives within close proximity to their base locations. The only cause for concern was with winter maintenance operations, especially if required to split shift, but because all drivers are governed by the UK driving hours their time is stringently managed and measure are effectively implemented to control.

In both businesses office workers, generally senior managers, brought the greatest concern as they are not bound by the site hours and were identified as having a long working hour's culture, but even though this custom exists, those sampled did not exceed the 14 hour door to door rule. For those office workers who worked in the office for periods of more than 12 hours, had been provided with accommodation close to the site.

#### Conclusions

In the main workers are able to comply with the 14 hour door to door policy. Site hours are set and the majority of workers and subcontractors work to these hours rigidly. It is therefore considered compliance with a 14 hour door to door policy wouldn't be beyond the abilities of most schemes and through discussion, it is generally seen as a proactive, positive step for the industry.

There were some notable instances where this was not applied but rather than being a reason to discourage the introduction of a standard this should only reiterate the importance of introducing such a requirement as with greater forethought, planning and control these instances can be easily eradicated.

### Costain / A-one+ fatigue case study

A review of the Highways Agency Hub raising the bar proposal for a 14 hour door to door day was reviewed with Costain and A-one+ Joint Venture operations.

Data was collected from 20 operatives within NDD Area 7 during September 2013. Over 438 shifts the 20 operatives worked an average of 9.74 hours with a range of 8 to 12 hours. These operatives are based locally so unless there are exceptional circumstances do not exceed two hours travel and therefore are within the 14 hours door to door.

Timesheets were reviewed from the CSJV major project M1 junctions 28 to 35a. The analysis of this data showed operatives work a set day 07:00 -17:30 and live locally so were within the 14 hours. There was greater concern with the management team who were found to be working longer hours and were more likely to exceed to the 14 hours door to door. This is not a reason not to implement the policy, it just highlights an at risk group.

These findings concur with those found by Carillion plc who conducted a similar review.

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