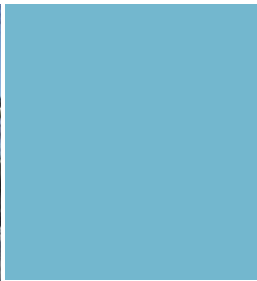
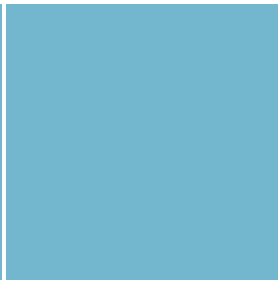
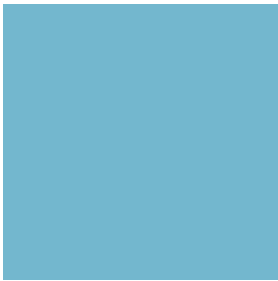
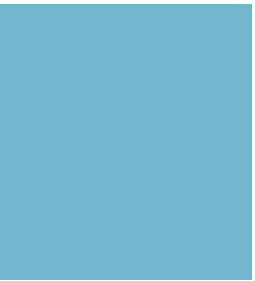




Transportation Risk Management

ShiftworkSolutions

Shiftwork Solutions is a Canadian based consulting company dedicated to providing world-class technology and consulting services for the prevention of mental fatigue related incidents.



Fatigue and Accidents in Transport Operations¹

It is the consensus of an international group of scientists who study human performance, safety, and prevention of accidents associated with work schedules, night activity, and inadequate sleep that:

1 The 24 h society, with around the clock operational demands in all transport modes, challenges the powerful and vital need for sleep. Sleep, alertness, and performance are fundamentally linked to the 24 h biological clock.

2 The major causes of fatigue are: (a) the time of day of the transport operation (e.g. night/early morning), (b) a long duration of wakefulness, (c) inadequate sleep, (d) pathological sleepiness (sleep apnea etc.), (e) prolonged work hours (not necessarily operating the vehicle).

3 **Fatigue (sleepiness, tiredness) is the largest identifiable and preventable cause of accidents in transport operations (between 15 and 20% of all accidents), surpassing that of alcohol or drug related incidents in all modes of transportation. Official statistics often underestimate this contribution.**

4 Underestimation of the impact of fatigue can lead to the under utilization of important countermeasures.

5 Public and environmental safety, health, and productivity are compromised by fatigue and sleepiness, with substantial financial costs to individuals and society.

6 Fatigue related risk may be reduced through a variety of interventions, that include education (about sleep, the biological clock, sleep disorders, fatigue countermeasures), improved scheduling of work hours, and the judicious use of strategies and technologies.

Risk Management Strategies

1 Providing Driver Fatigue Monitors

2 Identifying high risk drivers and recommending solutions

3 Identifying high risk work schedules and recommending solutions

4 Driver fatigue awareness and sleep hygiene training

5 Accident investigations

6 Driver Risk Assessment Profiling & Benchmarking



Research² has suggested that truck driver fatigue may be a contributing factor in as many as 30 to 40 percent of all heavy truck accidents.

1 Driver Fatigue Monitor (DFM)³

The Driver Fatigue Monitor alerts drivers of dangerous, impending fatigue an hour before a dangerous accident. The DFM plugs into the cigarette lighter and mounts easily on the dash. An audible alarm sounds when the unit detects that the driver is getting drowsy. In simple terms it is a real time infrared camera and computer that detects the drivers slow eyelid closures which are an early sign of drowsiness.



The DFM was invented at the Robotics Institute at Carnegie Mellon University over a 10 year period with funding from the US Department of Transportation and the US National Highway and Traffic Safety Administration. The DFM uses the only measure of driver fatigue that has been scientifically validated by the U.S. National Highway Transportation Safety Administration (NHTSA).

The DFM can be integrated into a truck's GPS system, depending on the carrier, to give the dispatcher real-time data on the fatigue levels of a driver. This system allows drivers to take remedial action such as napping or changing drivers etc. before major fatigue sets in.

2 Identifying High Risk Drivers and Recommending Solutions

Studies show that as many as 30% of drivers suffer from a lack of sleep and mental fatigue either due to a sleep disorder, work scheduling difficulties or lifestyle issues. These drivers pose a risk of mental fatigue related accidents.

Drivers simply wear a sleep performance bracelet (an actigraph)⁴ for 4 to 7 days and the data is downloaded via the internet and analyzed at Sleep Performance Inc. The reports will tell you:

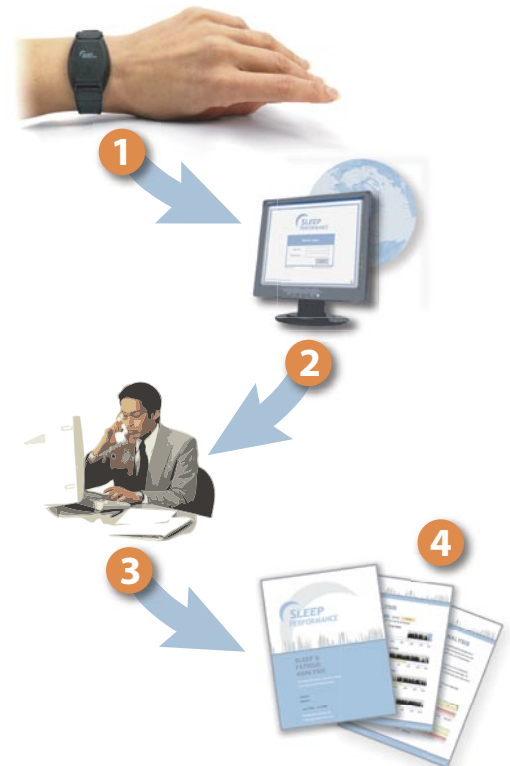
- 1 When you sleep, how long you sleep and how well you sleep.
- 2 How your sleep compares to a database of normal sleepers
- 3 How your sleep patterns affect your fatigue levels including a comparison of your performance to an equivalent Blood Alcohol Level.
- 4 **Your average increased accident risk at work.**⁵

Providing drivers with a complete sleep and fatigue analysis allows them to make lifestyle changes, including changes in their sleeping habits to significantly reduce their fatigue levels. Recommendations and tools to assist workers can be provided.

This system can identify and rank operators who are at the highest risk of fatigue related accidents.



The Sleep Performance Bracelet

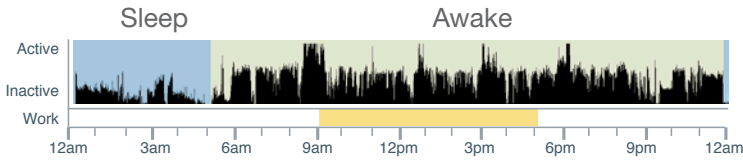


The Sleep Performance™ System⁶

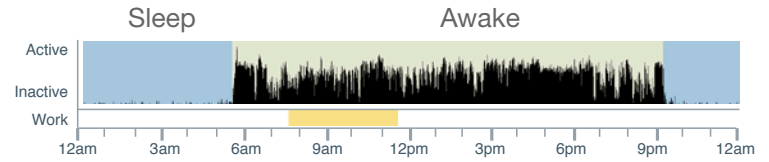


Examples:

Sleep Apnea

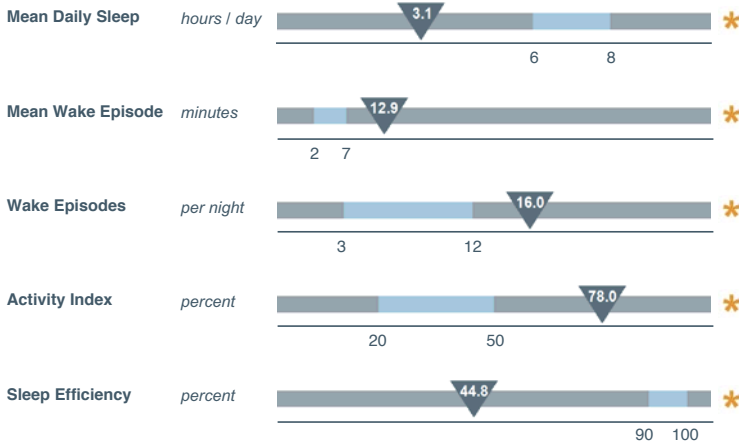


Normal Sleeper



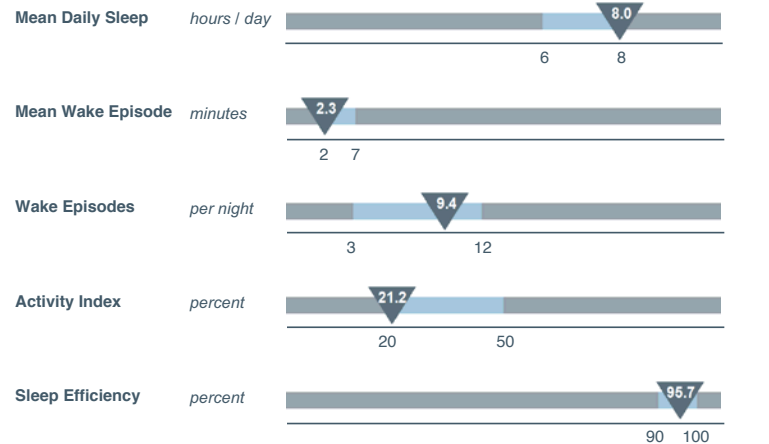
Sleep Data

Ideal Range = Outside Ideal Range = *

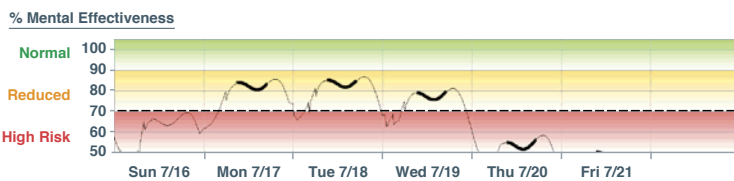
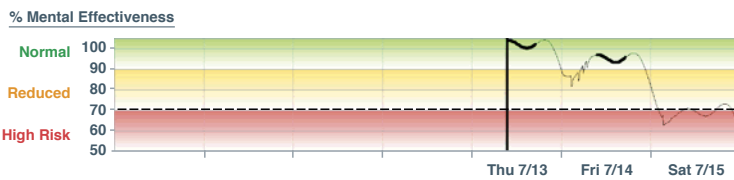


Sleep Data

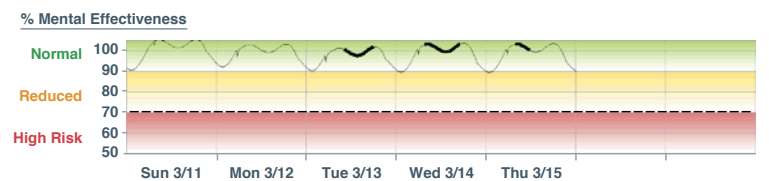
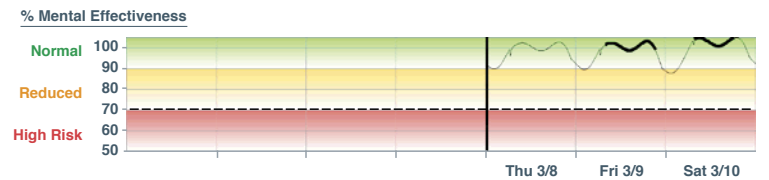
Ideal Range = Outside Ideal Range = *



Fatigue Data



Fatigue Data



Average Increased Accident Risk at Work: 25.1%

Average Increased Accident Risk at Work: 0.2%

3 Identifying High Risk Work Schedules and Recommending Solutions

Mental fatigue is a combination of cumulative sleep debt and the time of day circadian rhythms of the drivers. Work schedules need to be designed properly to reduce the risk of creating cumulative or acute sleep debt in the drivers.

Mental fatigue related to the design of work schedules is measured by applying a sophisticated computer based model developed for the US Department of Defence and US Department of Transportation that takes into account these important factors. The model is called FAST™ (Fatigue Avoidance Scheduling Tool).⁷

Work schedules are imported into the FAST™ program to produce a visual printout showing the likely fatigue levels of drivers at any point in time. This analysis shows when drivers will likely be the most fatigued based on their shift scheduling. This allows employers to know at what time of the day or night their drivers are at the greatest risk of fatigue related accidents and to undertake remedial action (e.g. work breaks, shift rescheduling).

> Sample fatigue analysis showing the percent mental effectiveness (fatigue levels) of drivers over time for one shift schedule.

4 Driver Fatigue Awareness and Sleep Hygiene Training

We offer a unique course called “Understanding and Coping with Driver Fatigue” as a learning tool that helps managers and drivers to manage fatigue effectively. This course presents an engaging look at the human body’s natural sleep patterns. Participants learn practical techniques like scheduling wheel time that is in tune with human biorhythms. Drivers will learn how to detect the early signs of drowsiness. They will also learn how to get rest without decreasing productivity or increasing drive times.

5 Accident Investigations

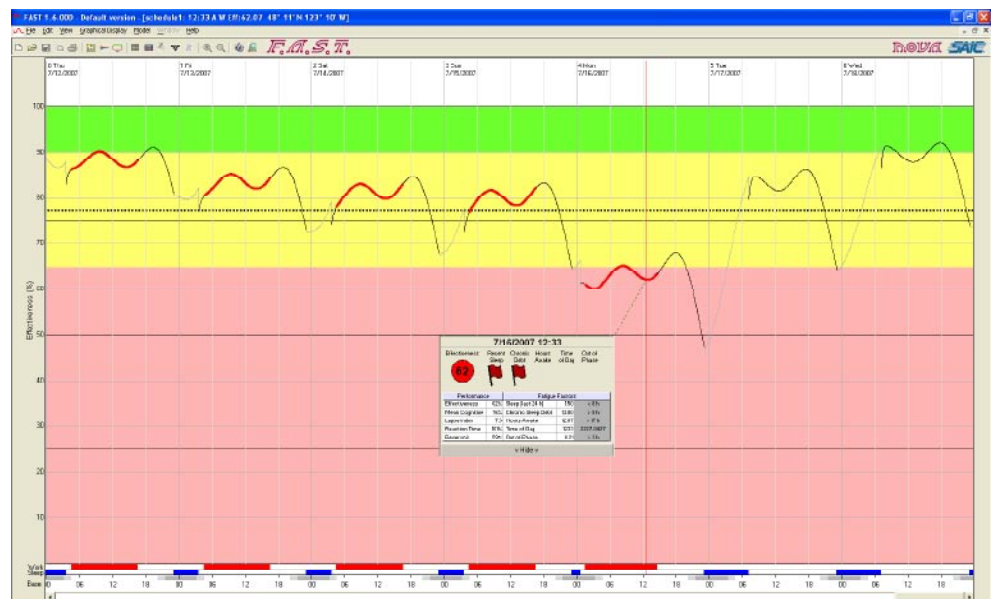
In order to prevent further accidents it is important that serious accidents and incidents be thoroughly investigated to discover their root cause(s). Part of that investigation should include an analysis as to whether fatigue played a role in the incident/accident. By inputting information about work scheduling into FAST™ we are able to determine the likely mental fatigue state of the

individual at the time of the accident or incident.

We are able to determine at the time of the accident:

- The percent mental effectiveness, (the predicted score on a psychomotor vigilance test),
- The mean cognitive performance (the predicted score on a battery of cognitive tests),
- The lapse index (the probability of having a lapse in attention),
- The reaction time, and the remaining sleep reservoir of the individual(s) involved

This is an internet-based service provided to accident investigators.





6 Driver Risk Assessment Profiling & Benchmarking

One of the primary reasons for commercial and heavy motor accidents and expenses owing to moving violations is deficient driver selection methods and inadequate driver risk profiling. Whether a driver will prove to be low or high risk is governed by a variety of “human factor” variables. For example:

- Prior learning and conditioning (i.e., personality & behavioral development)
- Stress tolerance
- Propensity to take risks
- Impulsiveness
- Wellness
- Professional driver attitude

In partnership with PHD, we are now able to offer transportation companies access to new **Driver Risk Assessment** technology that will enable them to evaluate current and prospective drivers against these and other critical human risk factors quickly and easily.

With these tools, companies will be able to determine if a driver is likely to be low risk as well as a long tenure prospect before any offer of employment is made. Current drivers can also be assigned a Driver Risk Index: a simple numerical indicator of whether an individual is likely low or high risk. The Risk Index can help companies with the assignment of drivers to certain types of work. It can also be used to help assess the outcome of various safety management or training interventions. Driver Risk Profiles can be viewed through a secure online website and results are available immediately after a candidate or driver completes a 10 minute written assessment.

Previous studies⁸ involving PHD’s Driver Risk Assessment technology have shown that accidents can be reduced by more than 25% and moving violations by more than 30%.

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References:

- ¹ J. Sleep Res. (2000) 9, 395
- ² NTSB Publication SS-95/01, January 18, 1995
- ³ The Driver Fatigue Monitors models DD850-H and DD850-M are manufactured by Attention Technologies Inc., Pittsburgh, PA, USA.
- ⁴ Practice Parameters for the Use of Actigraphy in the Assessment of Sleep and Sleep Disorders: An Update for 2007. SLEEP, Vol. 30, No. 4, 2007
- ⁵ Validation and Calibration of a Fatigue Assessment Tool for Railroad Work Schedules, Summary Report. US Department of Transportation, October 2006. DOT/FRA/ORD-06/21
- ⁶ www.SleepPerformance.com
- ⁷ Fatigue models for applied research in warfighting. Aviat Space Environ Med 2004; 00(3,Suppl.):A000-00
- ⁸ Study of the Effectiveness of PHD Performance Benchmark Selections on the Performance of U.S. Truck Drivers, www.phdassessments.com

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