

# Fatigue Management International



**ASTiD**

Advisory System for Tired Drivers

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## OVERVIEW

**ASTiD**, the **A**dvisory **S**ystem for **T**ired **D**river has been developed using algorithms that incorporate over 15 years of sound scientific research into sleep and sleepiness by Loughborough Sleep Research Centre, University of Loughborough, UK world renowned for its work into the effects of driver fatigue and validated by the Centre for Intelligent Monitoring Systems, University of Liverpool, UK using unique signal processing technique.

ASTiD comprises two linked systems designed to advise and monitor a driver about his or her sleepiness whilst driving.

1. The first system is "*knowledge based*" and provides an electronic template predicting hour by hour the likelihood of the driver falling asleep over a 24h period. The template, which is research based, is also influenced by prior sleep
2. The second is a "*steering sensory*" system able to detect: (i) monotonous driving, and (ii) vehicle movement (steering) characteristics typifying sleepy driving. Information from (i) & (ii) is processed and fed into the knowledge based system.

In summary, the knowledge based system forewarns the likelihood of falling asleep at the wheel, whereas the steering sensory system warns the driver when he or she is doing so.

ASTiD continually assesses the various factors known to contribute to, or to be indicative of, driver tiredness. The assessment of these factors is used to produce **both** visual and audible alarms. These alarms warn drivers that they may be getting tired before they themselves are aware of the onset of dangerous fatigue.

**In calculating the likely degree of driver fatigue, ASTiD takes into account the:-**



**Time of day:** Circadian rhythms analysis shows that there are two peaks for tiredness; in the early hours of the morning and late afternoon

**Quality of prior sleep:** Lack of sleep affects driver performance & exacerbates the time of day effect.

### **The length and type of driving:**

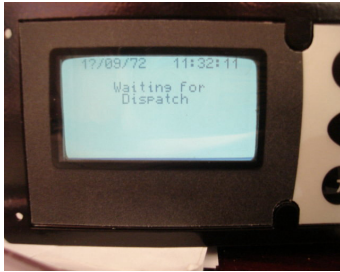
ASTiD determines both the length of driving time & whether the vehicle is being driven under monotonous conditions such as motorways or highways.

### **Vehicle movement:**

Using a state-of-the-art sensor ASTiD is continuously assessing the steering movements of the vehicle as changes in the number of steering movement and/or exaggerated corrections can also be indicative of tiredness and provide clues as to the driver's mental alertness.

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## MANAGEMENT INFORMATION



ASTiD has the ability to download/transmit its data in real time via its serial interface to any in-cab telemetry system subject to compatibility testing e.g. GPRS/GSM, Wireless, GPS or into any existing database be it locally hosted or web based access.

The cross reference of the 4 variables generates an accumulative “**Tiredness score**” which is transmitted on a minute by minute basis producing a fatigue index ranging between 0 and 150, where 0 represents a maximum operator alertness level and 150 a state where the driver is showing EARLY signs of fatigue.

At this point (150) a visual & audible alarm will be activated alerting the driver that he/she is starting to show deterioration in their driving.

Driver	Date	Time	Tiredness
CAT 22 16.03.0	16-03-2005	0002h	73
CAT 22 16.03.0	16-03-2005	0027h	83
CAT 22 16.03.0	16-03-2005	0028h	83
CAT 22 16.03.0	16-03-2005	0044h	91
CAT 22 16.03.0	16-03-2005	0111h	85

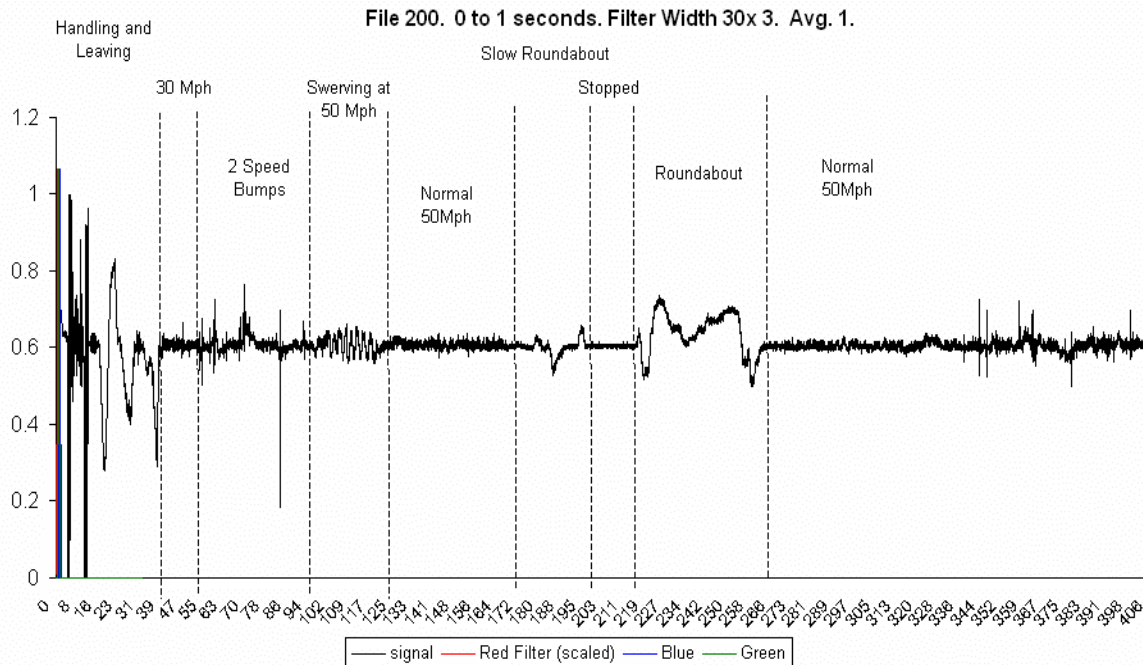
Driver ID	ASTID Score	Time Stamp
11111111	02:07:38	1160200,02:08:38
1170200	02:11:38	1170200,02:10:38
1180200	02:15:38	1180200,02:13:38
1180200	02:16:38	1180200,02:14:38
1190200	02:17:38	1190200,02:18:38
1190200	02:19:38	1190200,02:18:38
1190200	02:20:38	1200200,02:21:38
1200200	02:21:38	1200200,02:22:38
1200200	02:23:38	1200200,02:24:38
1210200	02:24:38	1210200,02:25:38
1210200	02:25:38	1210200,02:26:38
1210200	02:27:38	1210200,02:28:38
1220200	02:28:38	1220200,02:29:38
1220200	02:29:38	1220200,02:30:38
1220200	02:31:38	1220200,02:32:38
1230200	02:32:38	1230200,02:33:38
1230200	02:33:38	1230200,02:34:38
1230200	02:35:38	1230200,02:36:38
1240200	02:36:38	1240200,02:37:38
1240200	02:38:38	1240200,02:38:38
1240200	02:39:38	1240200,02:40:38
1250200	02:40:38	1250200,02:41:38
1250200	02:42:38	1250200,02:42:38
1250200	02:43:38	1250200,02:44:38
1260200	02:44:38	1260200,02:45:38
1260200	02:46:38	1260200,02:46:38
1260200	02:47:38	1260200,02:48:38
1270200	02:48:38	1270200,02:49:38
1270200	02:50:38	1270200,02:50:38
1270200	02:51:38	1270200,02:52:38
1280200	02:52:38	1280200,02:53:38
1280200	02:54:38	1280200,02:54:38
1280200	02:55:38	1280200,02:56:38
1290200	02:56:38	1290200,02:57:38
1290200	02:58:38	1290200,02:58:38
1290200	02:59:38	1290200,03:00:38
1300200	03:01:38	1300200,03:02:38
1300200	03:03:38	1300200,03:04:38
1310200	03:04:38	1310200,03:05:38
1310200	03:06:38	1310200,03:06:38
1310200	03:07:38	1310200,03:08:38
1320200	03:08:38	1320200,03:09:38
1320200	03:10:38	1320200,03:10:38
1320200	03:11:38	1320200,03:12:38
1310200	03:12:38	1310200,03:13:38
1310200	03:14:38	1310200,03:14:38
1310200	03:15:38	1310200,03:16:38
1300200	03:16:38	1300200,03:17:38
1300200	03:18:38	1300200,03:18:38

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## TECHNICAL INFORMATION

ASTiD has been rigorously trialled around the world in the UK, EU, Australia, Middle East, South America, US, Canada and Africa. Importantly for operators it is very easy to install, requiring only a normal vehicle power supply in the range of 9v to 28v. It can be supplied as a retrofit item or as an OEM item and is standard Din 1 size.

Using gyroscopic signal processing we can quite easily detect very small changes in signal variations which are as a result of vehicle manoeuvres and external road conditions. The system can detect whether the truck is in a monotonous driving environment such as a mine pit or open road and how long it has been in this mode of driving for. This is then fed back into the **ASTiD** algorithm .



## System Specifications.

### Power Supply operating conditions.

Supply range (normal operation): 10-34V.

Under-voltage shutdown: 10V max.

Over-voltage shutdown: 44.5V min.

Maximum current consumption: 0.334A (24V). 0.667A (12V).

Typical Standby current: 1.6mA (24V). 2.9mA (12V).

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## Environmental Conditions.

-40°C to +85°C operating.

-55°C to +85°C Storage.

These temperatures apply to the interior of the enclosure.

## EMC.

CISPR-25 for conducted emissions on supply lines.

Radiated emissions as per EU directive 2004/104/EC: 30-1000MHz,  $E \leq 63 \text{ dB}\mu\text{V/m}$ .

RFI: 30V/m over 90% 20-2000MHz band.

## ESD.

Designed for ISO10605:2001.

Handling test (unpowered): Severity III. 8kV Contact. 25kV Air discharge. (150pF 2K)

In vehicle test (powered): Severity IV. 8kV Contact. 15kV Air Discharge. (330pF 2K).

## Vehicle supply variations.

To ISO16750.

- a) Supply voltage range E (10-32V).
- b) Over-voltage.  $34\text{V} \pm 0.2\text{V}$  for 60min. Functional class C (actually A).
- c) Superimposed AC voltage. 32V DC with Severity I (1V p-p) 50-20kHz. Functional class A.
- d) Supply voltage discontinuities. 9V for 100ms (24V system). Though Functional class B is required, Reset may be permitted. This system will shut off and restart after this dip below the under-voltage limit.
- e) Reset behaviour at voltage drop. Reset trip point should be  $\sim 8.8\text{V}$ , giving functional class C.
- f) Cold cranking as previously covered.
- g) Reversed voltage.  $-28\text{V}$  for 60sec. Functional class C. Unit can withstand reverse voltage indefinitely.
- h) Short circuit protection (signal circuits). All inputs and outputs connected in sequence to  $V_{\text{max}}$  and ground for 60sec. Supply active or inactive, outputs active or inactive. Functional class C.
- i) Short circuit protection (load circuits). Unit may be damaged to functional class E, complying to flammability class V0. This unit has current limited outputs so will be Functional class C.
- j) Withstand Voltage. There are no galvanic separated circuits, hence this test does not apply.