



# Establishing a FAID Score Tolerance Level

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# 1. Establishing a FAID Score Tolerance Level

Bio-mathematical models do not make decisions on which work schedules are most appropriate in specific workplaces. What the models do, however, is provide information that can be useful when decisions about fatigue management need to be made. Tracking FAID results in relation to incident frequency, absenteeism levels, employee sick days or other organisationally meaningful data would allow a clearer illustration of the relationship between hours of work and its related costs.

Hours of work-related fatigue exposure can be limited by allocating work hours within a tolerance level or benchmark score.

As FAID produces FAID Scores it provides the facility for the user to set a **FAID Score Tolerance Level**. Desirable compliance percentages can also be set. FAID provides reports specific to these settings.

Different Tolerance Levels may be set for specific tasks or roles. A lower Tolerance Level may be set for a higher risk task or role, and a higher Tolerance Level may be set for a lower risk task or role. For a specific task or role, one Tolerance Level may be used for planned hours of work, with the option of reviewing actual hours against a higher Tolerance Level, acknowledging that variances to the plan may occur on day of operations.

The list below represents an example of a combination of hours of work rules that could fit within an organisation's FRMS guidelines, utilising FAID software as a key component in the development and audit of fatigue risks associated with hours of work:

- A Tolerance Level of **x** (or multiple Tolerance Levels for tasks of various risks)
- Monthly, or roster cycle period compliance to Tolerance Level of all shifts for each individual to be no less than **y**%
- Individual shifts should not exceed **z** points above the Tolerance Level
- Varying levels of actions/controls to be applied as exposures approach/exceed Tolerance Level
- Potential for differing values of **x**, **y**, and **z** for planned and actual hours.

## 1.1. Fatigue Hazard Analysis

FAID Score Tolerance Levels are usually determined after carrying out a Fatigue Hazard Analysis (FHA) risk assessment for a specific role<sup>1</sup>. That is, a risk assessment which reviews the hazards of a role when fatigue is present. The risk assessment would consider the current hours of work fatigue exposure analysed using FAID.

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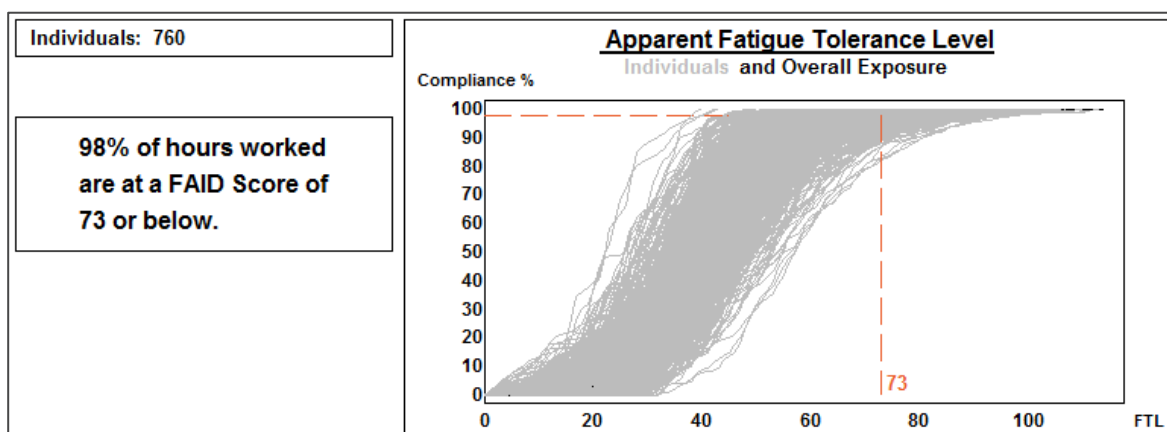
<sup>1</sup>InterDynamics' risk assessment methodology founded on Zurich's Hazard Analysis methodology aligned with AS/NZS ISO 31000:2009.

## 1.2. Using Current Hours of Work Exposure

The FHA risk assessment would consider the current hours of work fatigue exposure which can be analysed using FAID.

The FAID Apparent FTL report provides an indication of the current hours of work fatigue exposure, most appropriately reflected when at least 6 to 12 months of the most recent actual hours of work data is analysed. It is often helpful for an organisation to take into consideration its current Apparent FTL (current hours of work fatigue exposure) in setting a Fatigue Tolerance Level.

The below **Apparent Fatigue Tolerance Level** report from FAID shows the current hours of work fatigue exposure of an organisation being at an Apparent FTL of 73.



Until the organisation conducts a FHA, the Apparent FTL can be used as a rough guide.

## 1.3. FAID Scores

The following graphic illustrates different Peak FAID Scores for different hours of work patterns.

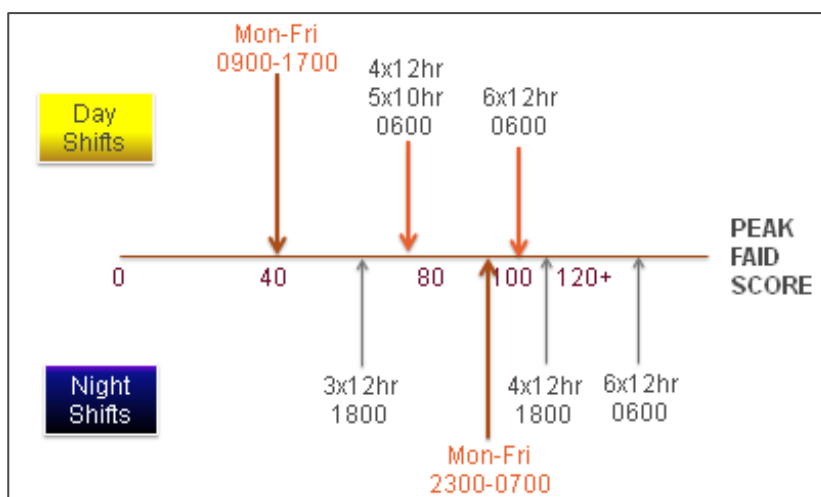


Figure 1 - Peak FAID Score for work pattern over seven days

See *Appendix A* for each shift's Peak FAID Score during the work pattern for a seven day period.

## 1.4. Using the FAID Sample FTL of 80

Research<sup>2</sup> indicates that scores between 80 and 100 are equivalent to the predicted level of work-related fatigue achieved after 23-24 hours of continuous sleep deprivation (starting at 0800h). This result was observed when the sleep deprivation started at 0800h on a Monday, following a week working Monday to Friday 0900-1700h and with Saturday and Sunday off.

Performance impairment at such a level of sleep deprivation has been associated with blood alcohol concentration over 0.05%<sup>3</sup>.

In a study of 100 train drivers driving 50 locomotives with data loggers on board, Dorian et al. (2007)<sup>4</sup>, investigated changes in driving parameters associated with work schedules with different fatigue exposure levels (or Peak FAID Scores). Three exposure levels were categorised as part of the study:

- Low, representing work hours associated with FAID Scores of less than 65;
- Moderate, representing work hours associated with scores between 65 and 80; and
- High, representing scores of greater than 80.

Dorian et al. (2007) found that statistically significant relationships were associated with fuel consumption, heavy brake violations and higher FAID Scores. The results indicated that train drivers in the High group, with working hours associated with Peak FAID Scores of greater than 80 were more likely to perform heavy brake violations and exceed the target maximum fuel rate.

## 1.5. Simulator & Field Observations data

**Rail Operations Research:** Simulator studies with locomotive engineers determined:

FAID® Scores 90-100 - a significant increase in errors and high risk behaviors due to fatigue: eg, less critical planning, improper braking techniques; and  
FAID Scores 100 & above - likelihood of errors occurring doubled

**Field observations** of operating behaviors & analysis of black-box data revealed:

Scores below 90 did not result significantly in increased errors or adverse behaviors;  
FAID Scores over 90 - errors increased significantly.

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<sup>2</sup> Dawson, D. and Reid, K. *Fatigue, alcohol and performance impairment. Nature* July 1997, 388: 235.

<sup>3</sup> Fletcher, A., Lamond, N., van den Heuvel, C., & Dawson, D. (2003). *Prediction of performance during sleep deprivation and alcohol intoxication by a quantitative model of work-related fatigue. Sleep Research Online*, 5(2), 67-75

<sup>4</sup> Dorrian, J., Hussey, F., & Dawson, D. (2007). *Train driving efficiency and safety: examining the cost of fatigue, Sleep Research*, 16, 1-11.

## 1.6. Validation studies

FAID Scores below 80 broadly consistent with a safe system of work.

FAID Scores above 100 broadly consistent with an unsafe system of work.

These Scores have been independently scrutinised & accepted as evidence by agencies including the Australian Transportation Safety Bureau & the Special Commission of Inquiry into the Waterfall Rail Accident near Sydney <sup>5</sup>.

## 1.7. For further reference

Below are some documents available from InterDynamics for further reference:

- Getting Real About BMMs
- What you need to know about FAID

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<sup>5</sup> *Waterfall Rail Safety Investigation Report 2003*

## Appendix A - Peak FAID Score Example Shifts

Shift Type	Shift #	Start	End	Peak FAID Score	Non-Work	Work
Mon-Fri 0900-1700	1	8/08/2016 9:00	8/08/2016 17:00	25	64	8
Mon-Fri 0900-1700	2	9/08/2016 9:00	9/08/2016 17:00	29	16	8
Mon-Fri 0900-1700	3	10/08/2016 9:00	10/08/2016 17:00	33	16	8
Mon-Fri 0900-1700	4	11/08/2016 9:00	11/08/2016 17:00	37	16	8
Mon-Fri 0900-1700	5	12/08/2016 9:00	12/08/2016 17:00	41	16	8
Mon-Fri 2300-0700	1	8/08/2016 23:00	9/08/2016 7:00	65	64	8
Mon-Fri 2300-0700	2	9/08/2016 23:00	10/08/2016 7:00	73	16	8
Mon-Fri 2300-0700	3	10/08/2016 23:00	11/08/2016 7:00	81	16	8
Mon-Fri 2300-0700	4	11/08/2016 23:00	12/08/2016 7:00	89	16	8
Mon-Fri 2300-0700	5	12/08/2016 23:00	13/08/2016 7:00	97	16	8
3x12hr 1800	1	8/08/2016 18:00	9/08/2016 4:00	34	110	10
3x12hr 1800	2	9/08/2016 18:00	10/08/2016 4:00	48	14	10
3x12hr 1800	3	10/08/2016 18:00	11/08/2016 4:00	62	14	10
4x12hr 0600	1	8/08/2016 6:00	8/08/2016 18:00	35	84	12
4x12hr 0600	2	9/08/2016 6:00	9/08/2016 18:00	49	12	12
4x12hr 0600	3	10/08/2016 6:00	10/08/2016 18:00	62	12	12
4x12hr 0600	4	11/08/2016 6:00	11/08/2016 18:00	76	12	12
4x12hr 1800	1	8/08/2016 18:00	9/08/2016 6:00	64	84	12
4x12hr 1800	2	9/08/2016 18:00	10/08/2016 6:00	79	12	12
4x12hr 1800	3	10/08/2016 18:00	11/08/2016 6:00	94	12	12
4x12hr 1800	4	11/08/2016 18:00	12/08/2016 6:00	110	12	12

5x10hr 0600	1	8/08/2016 6:00	8/08/2016 16:00	47	62	10
5x10hr 0600	2	9/08/2016 6:00	9/08/2016 16:00	55	14	10
5x10hr 0600	3	10/08/2016 6:00	10/08/2016 16:00	63	14	10
5x100600	4	11/08/2016 6:00	11/08/2016 16:00	71	14	10
5x100600	5	12/08/2016 6:00	12/08/2016 16:00	79	14	10
6x12hr 0600	1	8/08/2016 6:00	8/08/2016 18:00	78	36	12
6x12hr 0600	2	9/08/2016 6:00	9/08/2016 18:00	83	12	12
6x12hr 0600	3	10/08/2016 6:00	10/08/2016 18:00	87	12	12
6x12hr 0600	4	11/08/2016 6:00	11/08/2016 18:00	92	12	12
6x12hr 0600	5	12/08/2016 6:00	12/08/2016 18:00	96	12	12
6x12hr 0600	6	13/08/2016 6:00	13/08/2016 18:00	101	12	12
6x12hr 1800	1	8/08/2016 18:00	9/08/2016 6:00	108	36	12
6x12hr 1800	2	9/08/2016 18:00	10/08/2016 6:00	113	12	12
6x12hr 1800	3	10/08/2016 18:00	11/08/2016 6:00	118	12	12
6x12hr 1800	4	11/08/2016 18:00	12/08/2016 6:00	124	12	12
6x12hr 1800	5	12/08/2016 18:00	13/08/2016 6:00	129	12	12
6x12hr 1800	6	13/08/2016 18:00	14/08/2016 6:00	134	12	12