



Points from RSSB Project T1083 regarding the Fatigue & Risk Index

November 2016

ORR's "[Managing Rail Staff Fatigue](#)" (MRSF) guidance outlines a "triangulation" approach to assessing likely fatigue from a working pattern. The first step involves comparing the work pattern against good practice guidelines, to identify potentially fatiguing features - see ORR's hand-out "*Good practice guidelines – fatigue factors*" in the Further Information section.

The second step involves using a bio-mathematical fatigue model to help assess likely fatigue. Guidance produced by RSSB Project T1083 "*Preparing rail industry guidance on biomathematical fatigue models*" outlines some of the potential uses and limitations which users of such models should consider.

This information sheet highlights some specific points from Project T1083 concerning one of the most commonly used fatigue models in the GB railway industry, the HSE Fatigue & Risk Index (FRI) which FRI users should be aware of. Page numbers refer to the T1083 Project Report unless otherwise specified.

Points to consider

If using FRI to help assess a work pattern, always consider the other two corners of the fatigue triangle as well i.e. compliance with working pattern guidelines (minimising the "fatigue factors"); and collecting, assessing & acting on feedback from staff's experiences.

Fatigue Index (FI)

FI has **most "ticks"** of the 5 models assessed (page 39), but a tick only means that the model was able to predict an increase in fatigue level, and doesn't indicate the accuracy of that prediction.

- FI was very sensitive to **commute time** (p40, p185).
- FI was the most sensitive of the 5 models to "**duty length**" fatigue factors (p151).

- FI was sensitive to **rest period** duration (p155).
- FI was sensitive to **recovery time** fatigue factors (p 154, p156).
- FI provided consistent results for **daily rest interval** fatigue factors (p157).

FI was **less sensitive** in identifying the following fatigue factors - if a work pattern significantly features these, it will be particularly important to consider the other two corners of the fatigue triangle:

- **Cumulative** fatigue: all models struggle, and the data is complicated (p159-165).
- **Circadian phase shift** (body clock adjustment - p137), associated with e.g. a **backward rotating pattern** or wide **variation of shift start times**. Unclear whether FI is sensitive to a backward rotating pattern (p167). If workers may show some signs of body clock adjustment (e.g. an entire week of nights), FI will probably over-estimate i.e. it will be pessimistic (p90, p168)
- **First night shift** (p170).
- FI was less sensitive to **early & very early shifts** than night shifts (p149).

Other points to note:

- The need for caution if using **workload** as an input to models – the link between workload and fatigue is complex (p49, p194).
- FRI provides a **mean score** for the shift, not a peak score (p52).
- FI doesn't consider different **risk exposures** – the risks from tasks (p52).
- FI will probably over-estimate the risk of fatigue for **permanent night workers**, but can probably be applied to the majority of shift workers (p90).
- The models are unable to differentiate **work versus wake** periods (p161).
- The **default thresholds** used by the OTHER models picked up few of the fatigue factors (p196). There are NO agreed “thresholds” for HSE FRI. Overall, the default thresholds in the (other 4) models are very tolerant (Guidance p11, Report p22, 42). Caution on any thresholds: bio-mathematical models are just one component in assessing fatigue.

Risk Index (RI)

- RI was sensitive to all Duty Length & Recovery Time fatigue factors, less so to others (p173). RI was also sensitive to commute time (p185). However:
- The relationship between **fatigue and safety isn't linear** and depends on the type of operations, so use caution regarding T1083's findings on the Risk Index.

“Triangulating” fatigue

- It is worth re-iterating that bio-mathematical fatigue models should, if used, only form one part of a wider assessment of likely fatigue from a working pattern - always consider the other two corners of the fatigue triangle as well i.e.
 - compliance with working pattern guidelines (minimising the “fatigue factors”); and
 - collecting, assessing & acting on feedback from staff’s experiences.

Further Information

- ORR [Managing Rail Staff Fatigue](#) ORR, 2012. See Appendix A of the guidance regarding ORR’s recommended approach for “triangulating” fatigue
- RSSB [Managing Fatigue - a Good Practice Guide](#), RSSB, 2012.
- RSSB [Guidance document on biomathematical fatigue models](#)
- [RSSB T1083 Report](#) on preparing rail industry guidance on bio-mathematical fatigue models
- ORR hand-out “[Good practice guidelines – fatigue factors](#)”



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