

# THE RETURN ON INVESTMENT OF FATIGUE RISK MANAGEMENT

REDUCE FATIGUE  
RISK BY **24%**

REDUCE  
ACCIDENTS BY **18%**

SEE ROI OF AT  
LEAST **12X**



FATIGUE  
SCIENCE

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# AN INTRODUCTION TO FATIGUE SCIENCE AND FATIGUE RISK MANAGEMENT

Fatigue Science is a pioneer in fatigue risk management technology. We work with leading organizations in industry, government and defense. We're also active in sleep and performance management for elite athletes.

We hold exclusive commercial rights to the SAFTE™ Fatigue Model, and have developed the Fatigue Science Readiband™, a scientifically-validated device for sleep data collection. Our fatigue management solution lets employers and workers manage their sleep to predict and mitigate workplace fatigue risk.

In this eBook, you'll discover how Fatigue Science's Readiband™ Solution reduces workplace fatigue risk and drives significant financial benefits in fatigue risk management for mining, construction, oil & gas, and transportation firms



# WINNER OF INDUSTRY AWARDS

**WINNER**  
2017 VINCI INNOVATION AWARDS



**WINNER**  
2017 NEW CIVIL ENGINEER TECHFEST AWARDS



**FINALIST**  
2017 BRITISH CONSTRUCTION  
INDUSTRY AWARDS



**HIGH COMMENDATION**  
2017 INTERNATIONAL RAIL INDUSTRY AWARDS



# HOW OBJECTIVE FATIGUE DATA CHANGES EVERYTHING

Historically, transportation and industrial organizations have recognized that fatigue has a very large, very real cost to their operations, but they've lacked the means to put a number on it.

**Objective fatigue data changes everything.** With our wrist-worn Readiband™, companies can now get an objective, quantified view into the fatigue exposure of their workforces. With validated sleep data from the wrist-worn Readiband™ and the world's leading biomathematical fatigue algorithm, the SAFTE™ Fatigue Model, it's finally possible to put a number on fatigue.

This fatigue data is the key to linking your workforce's fatigue exposure with the ultimate cost that fatigue is having on your business.

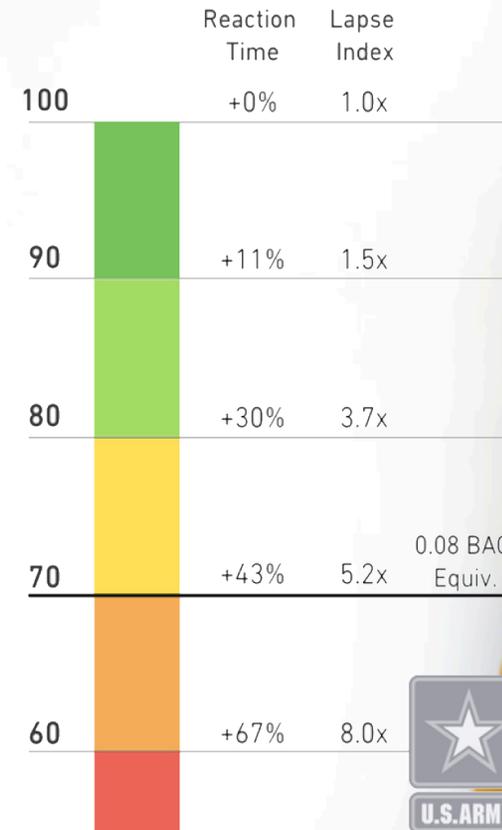
# THE SAFE™ MODEL AND THE SCIENCE OF QUANTIFYING FATIGUE

## What is the SAFTE™ Model?

The SAFTE™ Biomathematical Fatigue Model is the core algorithm we use to quantify worker fatigue. The SAFTE Model was developed by the **US Army Research Lab** over the past 25 years, with over \$37 Million invested in R&D and validation costs. **The US Army** developed the model to optimize the human performance of soldiers, who often face many of the same demands and conditions as industrial workers.

In order to bring the SAFTE Model to a wider market, Fatigue Science acquired its exclusive rights. We then built a wearable platform called Readiband™ Solution to enable industrial workers and athletes to benefit from this military-grade fatigue solution.

The SAFTE Model projects cognitive fatigue that will occur based on sleep-related factors, including historical sleep patterns, the timing of one's sleep, and one's expected circadian rhythm (based on seasonal factors like sunrise times). When sleep data is collected, the SAFTE Model creates an hour-by-hour projection of one's fatigue for the day ahead. These hourly projections are called **SAFTE Alertness Scores**.



*SAFTE Alertness Scores, with projected physiological impacts*

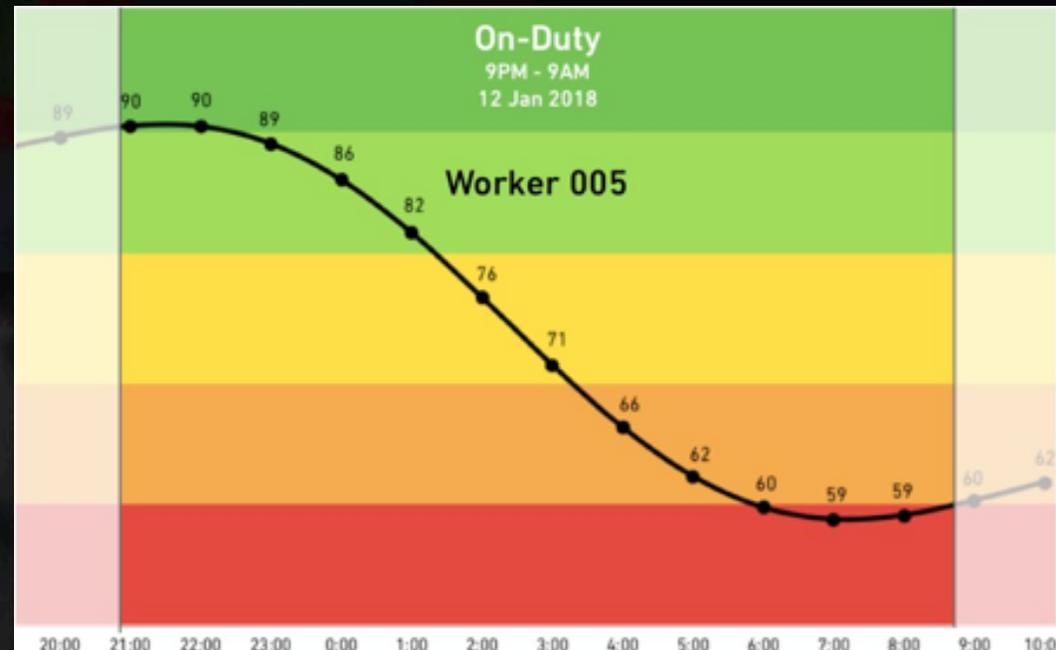
*Readiband™ is relied on by top sports teams, including recent Superbowl™ and World Series™ winners.*

# SAFTE ALERTNESS SCORES

SAFTE Alertness Scores can be related to physiological impacts such as Reaction Time, Lapse Index (a measure of one's tendency for momentary lapses), and Cognitive Effectiveness.

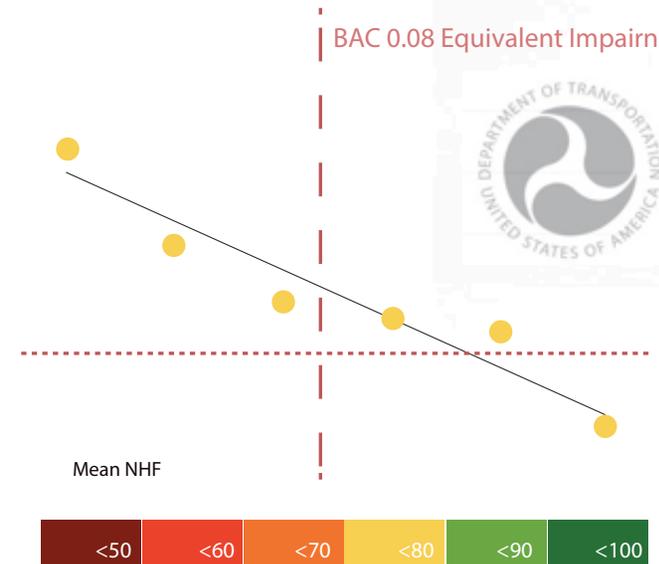
Cognitive Effectiveness (indicated by the score), is based on research using an objective set of decision-making tests.

For instance, at a score of 70, one is predicted to be 70% as mentally effective, with 43% slower reaction time and a 5.2x greater chance of a lapse—similar to the effects of a 0.08 Blood Alcohol Concentration. Unlike alcohol use however, fatigue is sometimes unavoidable, such as on night shifts where even healthy sleepers may briefly dip below 70 on account of fighting against one's natural circadian rhythm.



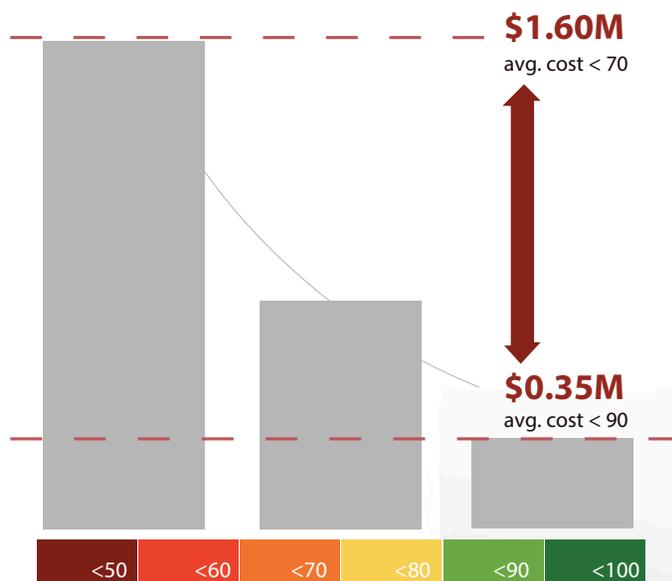
*Hourly Alertness Scores for a worker during a 12-hour Night Shift*

# SAFTE™ SCORES AND THEIR REAL-WORLD SAFETY OUTCOMES



The real world impacts of operating with a low SAFTE Alertness Score have been studied extensively by leading agencies such as by the **US Department of Transportation** and the **US Federal Aviation Administration**. The US Department of Transportation found a direct correlation between one's predicted SAFTE Alertness Score and his or her accident propensity.

This study also revealed that accidents are not only much more likely with a low SAFTE Score, they are often much costlier.



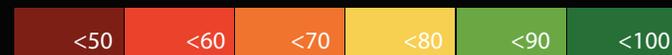
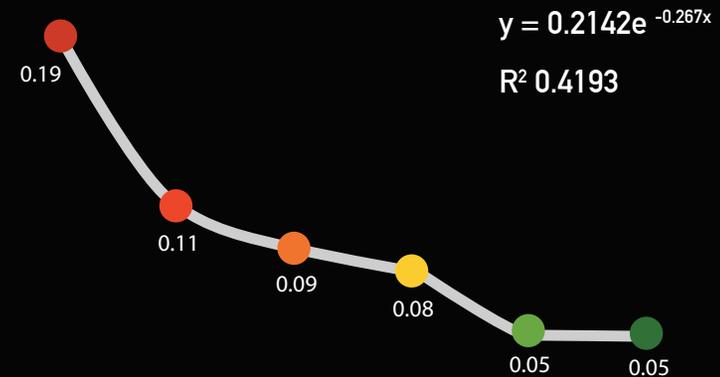
*Accidents resulting from low SAFTE Scores cost up to 5x a typical non-fatigued accident.*

# THE EFFECT OF SAFTE™ SCORES ON DRIVERS

A study of our own clients' telematics data further confirms these tendencies, revealing that drivers operating with a score below 50 are 8.5x more likely to excessively speed.



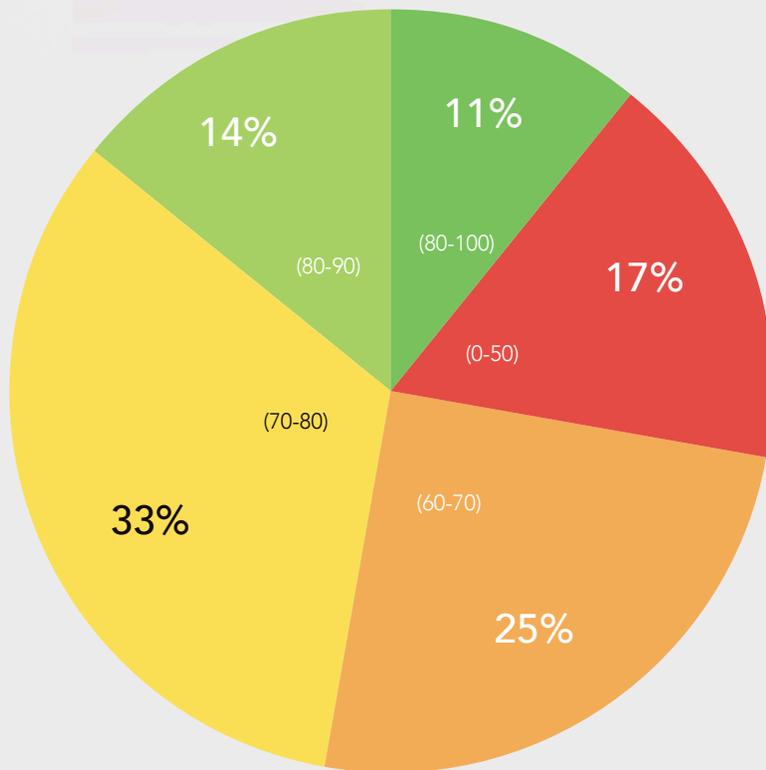
*SAFTE Score vs. Excessive Speedin*



*SAFTE Score vs. Harsh Braking*

Drivers operating with a score below 50 were found to carry a 4x greater likelihood to engage in excessive speeding.

# THE “FATIGUE RISK PROFILE”



(% of duty hours, by SAFTE Score)

*Individual Fatigue Risk Profile  
Worker ABC, Jan 2018*

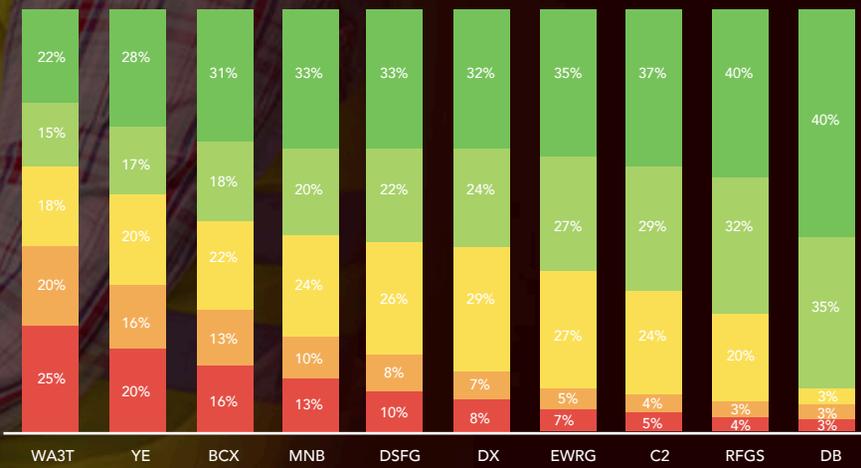
Understanding of your operation’s current fatigue exposure is a key step in projecting ROI. Typically, when companies begin their journey with the ReadiBand™, they start with a 30-day baseline fatigue assessment.

In this baseline assessment, it’s typical to have a sample of 10 – 15% of workers at a given site wear the ReadiBand™ for data capture purposes. Here, we anonymously capture hourly fatigue data for each of the workers during their on-duty hours.

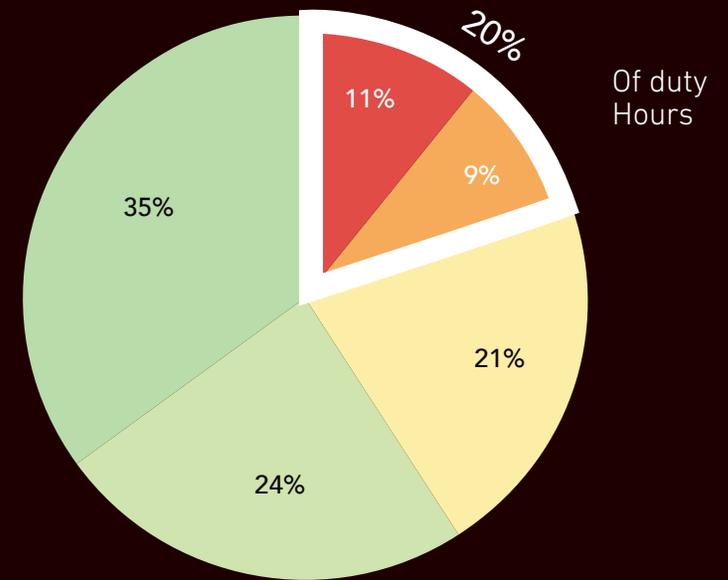
Over ~30 days (or sometimes, one full rotation), we use these hourly data to construct an anonymous “Fatigue Risk Profile” for each worker in the sample. This profile reveals what percentage of time on- duty each individual spends in each of five key SAFTE Score ranges, as shown in the example of a heavily fatigued worker below.

# AGGREGATE FATIGUE RISK PROFILES

With enough workers in a sample, the individual Fatigue Risk Profiles can be combined to construct an Aggregate Fatigue Risk Profile for your organization. Your Aggregate Fatigue Risk Profile can be used as a benchmark of your fatigue risk exposure to track reductions over time.



All Individual Fatigue Risk Profiles



(% of duty hours, by SAFTE Score)  
Aggregate Fatigue Risk Profile Site A, Jan 2018

# RELATING YOUR FATIGUE RISK PROFILE TO YOUR ACCIDENT EXPOSURE & COSTS

The next step in determining Return on Investment is to come up with an assessment of how many accidents in your organization are caused by fatigue. Without a record of fatigue's presence in each historical accident, this will always require an estimation exercise. There are three key data points that help us make an informed assessment:

## 1. YOUR ACCIDENT EXPOSURE

Fatigue causes many types of accidents, from Lost-Time Incidents (LTI's) to less significant ones. We'll typically focus just on LTI's, and we'll use either company-specific data or general data from your industry to inform this estimate.

## 2. YOUR INDUSTRY

Because fatigue affects organizations differently, using benchmarks for your industry is a good place to start. A 2011 study by Caterpillar Global Mining found that 65% of surface haul truck accidents were linked to fatigue. One could conservatively assume that 50% of accidents in general mining and Oil & Gas industries are fatigue related. Reports by the US Department of Transportation and Air Transportation Stabilization Board suggest that 35-40% of accidents were fatigue related. In the field of construction, 35% may be a safe assumption.

## 3. YOUR FATIGUE RISK PROFILE

Your organization's Fatigue Risk Profile is calibrated by comparing it to industry benchmarks. For example, an organization may have 5.34 total Long Term Injuries (LTI's) per 1,000 workers annually. If 50% of these LTI's are fatigue related, that's 2.67 fatigue-related LTI's annually. If the organization projects about 16% of all its duty hours to be fatigue-impaired, 1,000 workers would work about 316,000 hours annually while fatigue-impaired. This means that 2.67 LTI's occur for every 316,000 fatigue-impaired duty hours.

## DIRECT COSTS OF FATIGUE-RELATED LTI'S

Direct costs from injuries can include things like workers compensation payouts, medical costs, and equipment damage. Fatigue-related incidents are generally found to be far worse than non-fatigue related, with the US Department of Transportation finding up to a 5x cost differential.

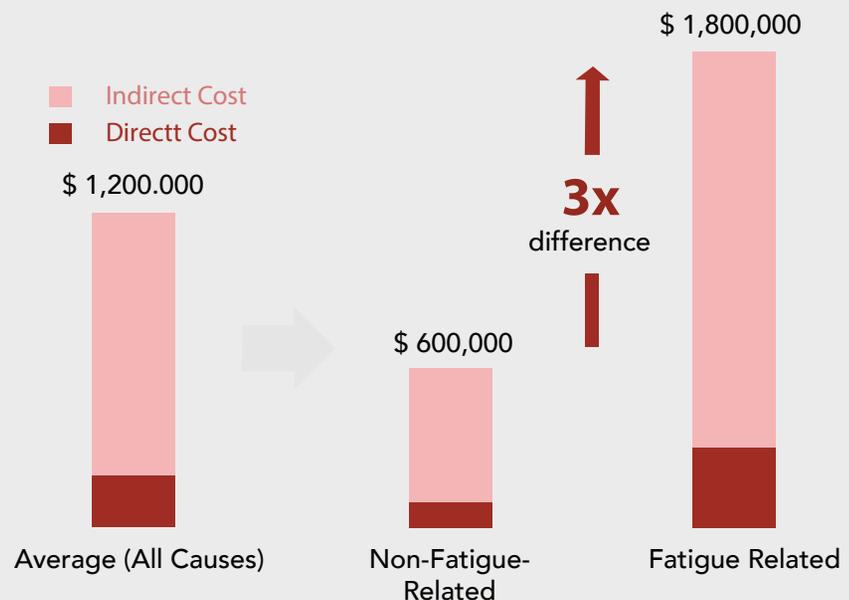
In Oil & Gas, the average direct cost of a LTI is estimated at US\$200,000. With a 50/50 ratio of Fatigue- Related to non-fatigue related accidents and a conservative estimate of a 3x cost differential, this suggests a \$300,000 average direct cost for fatigue-related LTI's.

## INDIRECT COSTS OF FATIGUE-RELATED LTI'S

Indirect costs can include damages to buildings, sites, resources, work stoppage, re-training, HR replacement, crisis management time, and legal fees. The indirect costs of LTI's can be many times larger than the direct costs, with studies suggesting a 5:1 ratio of indirect to direct costs<sup>1</sup>.

With the above ratio in mind, we find the average "fully-loaded cost" of a fatigue-related LTI in the oil & gas industry is \$1.8M. Using this math, we estimate that the 2.67 fatigue-related LTI's incurred by 1,000 workers annually would cost approximately \$4.8M.

<sup>1</sup>Based on data from a 2012 report by Hubler et al. which described the weighted-average direct cost for Lost-Time Injuries (LTI) to be \$200,000 across all (both FR and non-FR) accidents. This report also projected a 5:1 ratio between indirect costs and direct costs, resulting in an average total "all-cause" accident cost of \$1,200,000 for LTI.)



# PRODUCTIVITY IMPACTS

Aside from accidents, there is believed to be a massive impact to productivity when fatigue is present in any field of work. While this is intuitive—workers are less productive when tired—it's also difficult to quantify. We need to be cautious because even a single percentage point change to productivity<sup>2</sup> can have a massive impact on projected cash flows and ROI.

The best estimates available suggest that worker fatigue costs workforces about 4% of total productivity . For our Oil & Gas example, annual output is estimated at be \$727,000 per worker, suggesting a productivity loss of \$29M annually per 1,000 workers.

Because this figure is so large, let's assume that only a quarter of this amount is addressable. That would mean \$7.3M in productivity gains are possible if all fatigue was eliminated.

## TOTAL OPPORTUNITY SIZE

Combining direct cost, indirect costs, and impacts to productivity, we estimate a total addressable opportunity of \$12.1M per 1,000 workers annually – if all fatigue were to be completely eliminated.

<sup>2</sup> Loss of 4% in productivity due to fatigue is estimated based on "The Cost of Poor Sleep: Workplace Productivity Loss and Associated Costs", Journal of Occupational and Environmental Medicine, Jan 2010



# IMPROVING YOUR ORGANIZATION'S FATIGUE RISK PROFILE

## BETTER SLEEP, LESS FATIGUE

After estimating the total addressable opportunity from fatigue reduction, the next question naturally becomes, “what amount of ROI can ReadiBand™ actually realize?”

The answer depends on how much our ReadiBand™ Solution can reduce worker fatigue: the more fatigue is reduced, the more gains are projected.

Fundamentally, ReadiBand™ Solution helps workers achieve better sleep habits and reduce fatigue. It achieves this by not only revealing fatigue levels and trends to workers, but also by providing them with education and concrete tools to put this guidance into action.

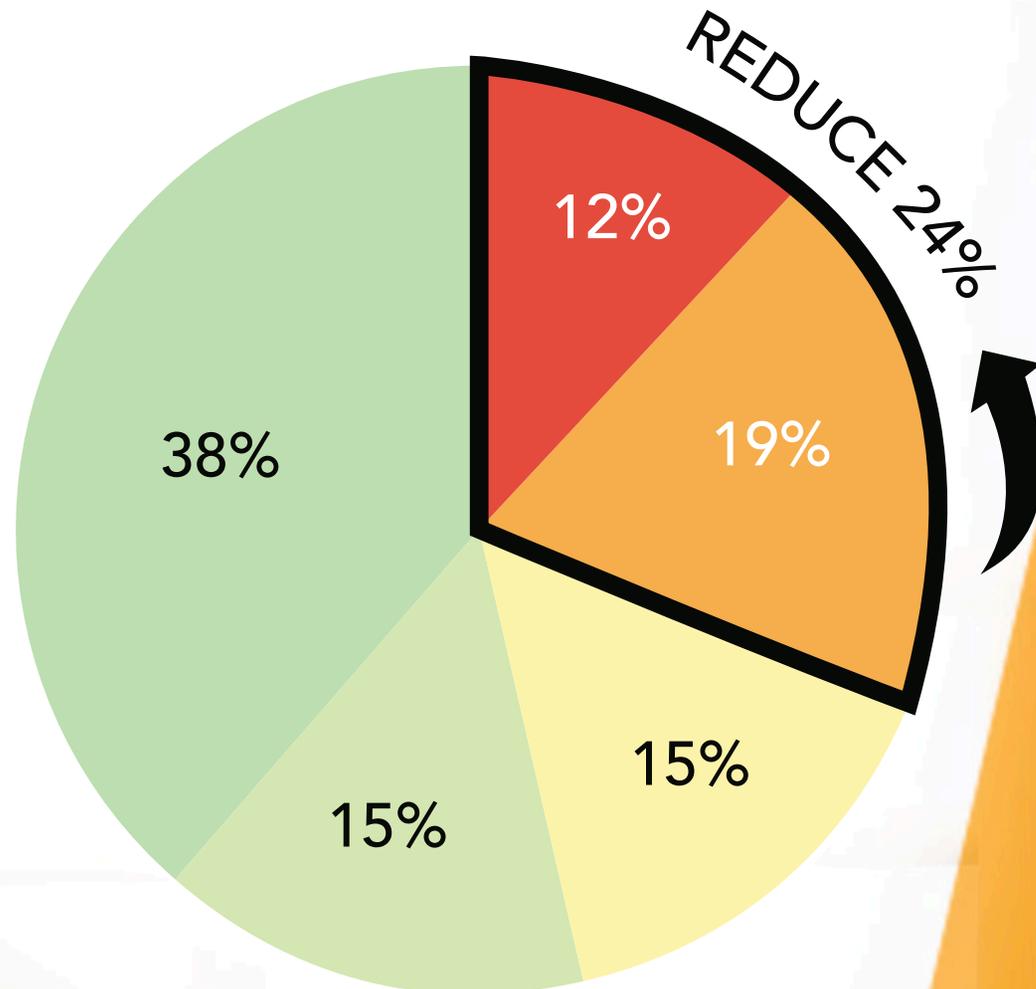
Guidance includes practical tactics in the areas of Sleep Opportunity Planning, Sleep Hygiene, and Sleep Environment. As workers use the ReadiBand™ app daily, they strive for “Alertness Goals” – higher SAFTE Alertness Scores that are personally achievable for them



# HOW EFFECTIVE IS READIBAND™?

Using the earliest version of the Readiband™ app beginning in 2017, users achieved an average of 26 minutes more sleep per night, with over 80% of them raising their SAFTE Alertness Scores. Consequently, our clients saw a 24% average reduction in on-duty fatigue risk.

Since then, we've launching an even more powerful Readiband™ app that provides users with a full suite of data, education, and concrete tools to support sustainable sleep habit changes.



# ADDING IT ALL UP TO PROJECT YOUR RETURN ON INVESTMENT

## PROJECTED ACCIDENT REDUCTION

By adjusting your Fatigue Risk Profile, we can project how many less hours would be worked while in a state of fatigue impairment. In our example, we projected exposure to 316,000 fatigue-impaired hours per 2M total hours, with an estimated 2.67 fatigue-related LTI's.

If we assume that the ReadiBand™ Solution can achieve a 24% average reduction in fatigue-impaired hours, this reduces 316,000 to only 240,000 fatigue-impaired hours per 2M hours.

In this example, we now project 1.70 fatigue-related LTI's per 1,000 workers, down from the 2.67 fatigue-related LTI's previously projected. This means a projected reduction of 0.97 fatigue-related LTI's per 1,000 workers annually.

SAFTE Alertness Range	% of Duty Hours	# of Duty Hours (per 2M)	Implied # of F.R. Accidents
90 - 100	15.9%	318,000	
80 - 90	41.0%	820,000	
70 - 80	31.1%	622,000	
65 - 70	6.5%	130,000	0.70
60 - 65	3.5%	70,000	0.37
55 - 60	1.3%	26,000	0.34
50 - 55	0.4%	8,000	0.14
0 - 50	0.3%	6,000	0.15
<b>Total</b>	<b>100.0%</b>	<b>2,000,000</b>	<b>1.70</b>
<i>Total &lt; 70</i>	<i>12.0%</i>	<i>240,000</i>	

# HOW EFFECTIVE IS READIBAND™?

## PROJECTED COST REDUCTION

To project reductions in costs, we can take the 0.97 projected fewer fatigue-related LTI's per 1,000 workers, and multiply this figure by \$1.8M, the estimated cost per fatigue-related LTI.

This allows us to project accident cost savings of **\$1.75M annually per 1,000 workers.**

## PROJECTED PRODUCTIVITY GAIN

Similarly, we previously projected productivity gains of up to \$7.3M per 1,000 workers annually if all fatigue impairment were to be eliminated.

With a 24% reduction in fatigue impairment, we project **\$1.74M in gains per 1,000 workers.**

## TOTAL IMPROVEMENT & ROI

In total, using conservative assumptions we project a grand total of \$3.49M in annual financial benefit by equipping 1,000 workers with Readiband™ Solution.

Readiband™ technology and deployment costs vary, but equipping 1,000 workers is generally achievable for under \$300,000 annually. In our example, we project a total ROI of 11.6x.

# LET US ESTIMATE YOUR ORGANIZATION'S SAFETY AND FINANCIAL IMPACT

The ROI projected here is merely a framework. During a 30-Day Trial of ReadiBand™, we'll provide you with a customized, comprehensive Fatigue Risk Assessment that will estimate your organization's fatigue risk exposure and the opportunity for reduction.

Our expert team of analysts will also work closely with your stakeholders to build a business case customized to the parameters of your organization. Through this consultation, you'll gain a clear, quantifiable picture of how ReadiBand™ can make a material improvement to both the safety and financial outcomes of your organization.

**SPEAK TO A MEMBER OF OUR SALES TEAM FOR A FREE CONSULTATION:**

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