North American Fatigue Management Program:
Return-on-Investment Calculator User Guide

Introduction

A cost-benefit calculator has been developed that allows users to estimate the monetary benefits of implementing the North American Fatigue Management Program (NAFMP), either in its entirety or select components in a customized program (e.g. fatigue management training, sleep disorder screening and treatment, technology deployment, and scheduling tools). This user guide explains the various data input requirements and results generated by the calculator, and provides the sources used to generate the default values for several data elements.

Input Requirements

This section describes each of the major data element fields used to complete the NAFMP return-on-investment (ROI) calculation. It is recommended that users have the calculator open while reviewing this section.

Helpful hints for using the calculator:

- Yellow highlighted cells require user input.

- Blue cells have a default value provided but customized figures may be added through the drop down menu.

- White cells have a drop down menu of selections that you must choose from.

- Grey cells do not require any input.

- Cells with red triangles in the upper right-hand corners have pop-up boxes with additional information and/or instructions.

Section 1: Cost Calculations

Step 1: Company Location – used to determine appropriate currency values (USD or CAD) to utilize throughout the calculator.

> **Where is your fleet based?** – select either "US" or "Canada" through the drop down menu in cell C5.

Step 2: Employee Type and Wages – used to calculate costs of employee training and driver screening/treatment for sleep apnea if you choose to select these options.

> **Employee Type** – a list of common employee titles that would potentially take part in the NAFMP training are provided in column B, rows 8-11.

Number of Employees – enter in the total number of NAFMP participants for each employee type in column C, rows 8-11. If you expect no employees of a predetermined type to participate, enter "0" in the corresponding cell.

Average Hourly Wage – default hourly wage values[1] are provided in column D for each of the employee types listed in column B. You may enter a different wage by clicking on the desired cell and using the drop down menu.

Step 3: Number of Employees Receiving Fatigue Management Training – used to calculate the cost of training for those employees taking part in the NAFMP training if you choose to select this option.

Fatigue Management Training – continue across the spreadsheet to column F, rows 8-11 and indicate whether each employee type (yes or no) will receive the fatigue management training (available online at www.nafmp.org).

The estimated number of training hours for each employee type is displayed in column G, rows 8-11. These durations are based on the estimated amount of time to complete each of the NAFMP training modules recommended for that particular target audience. Please see the NAFMP Implementation Manual for more information on the training modules.

Total Training Costs – cell G14 calculates the total NAFMP training costs based on number of employees and corresponding wages entered and does not require any user input.

Step 4: Number of Drivers to Be Screened and Treated for Sleep Apnea – used to calculate the cost of sleep apnea screening and treating for commercial drivers if you choose to select this option.

Sleep Apnea Screening – indicate in cell C14 whether or not you plan to screen your drivers for sleep apnea. If yes, move down to cell C16 and enter the percent of the driver workforce that will be screened for sleep apnea. A default value is provided based on previous research which found that approximately 28 percent of truck drivers have mild, moderate or severe sleep apnea;[2] however, you may enter any value between 0 and 100 percent.

Next, select which type of sleep apnea screening will be used in cell B19. Two screening options are provided (polysomnography or ambulatory) but you may enter a different option through the drop down menu.

Polysomnography (PSG) is performed in a clinic, usually over a full night. Alternately, *ambulatory* screening may be completed outside of a clinic setting by using portable

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[1] **U.S. Wages**: Bureau of Labor Statistics, National Industry-Specific Occupational Employment and Wage Estimates. **Canadian Wages**: Statistics Canada, Employment Income Statistics.
[2] Pack A.I., Dinges D.F, & Maislin G. (2002). A study of prevalence of sleep apnea among commercial truck drivers (Report No. DOT-RT-02-030). Washington, DC: U.S. Department of Transportation, FMCSA.

monitoring devices. While it monitors fewer body signals and therefore is not as comprehensive as the PSG, ambulatory screening offers more flexibility and is less costly. A qualified medical sleep specialist must evaluate the test results from either screening process, complete a health review of the driver and determine if he or she has sleep apnea.

Based on which type of sleep apnea screening you chose in B19, select either the default screening cost provided in cell C19 or enter a new value using the drop down menu.

Total Sleep Apnea Screening Costs – cell C21 calculates the total sleep apnea screening costs and does not require any user input.

Sleep Apnea Treatment – indicate in cell C23 whether or not you plan to treat drivers that have been found to have sleep apnea. If yes, move down to cell C25 and enter the percent of drivers that will be treated for sleep apnea. A default value is provided based on previous research which found that approximately 11 percent of truck drivers have moderate or severe sleep apnea[3] (and would therefore be potential candidates for treatment); however, you may enter any value between 0 and 100 percent.

Next, select which type of sleep apnea treatment will be used in cell B28. Select either the *Continuous Positive Airway Pressure* (CPAP) treatment default option or enter a new treatment using the drop down menu. CPAP is one of the most widely used treatments for sleep apnea. The CPAP machine is a device that delivers pressurized air through the airway via a hose connected to a facial mask. The pressurized air, which is prescribed by the sleep physician, splints the airway open and reduces airway collapses and/or obstructions. When used properly and consistently, this treatment decreases the severity of OSA, thereby reducing daytime fatigue, improving mood, attitude, and daytime performance, as well as reducing blood pressure and cardiovascular complications that are worsened by OSA.

A default cost value is also provided for the CPAP option in cell C28. If you chose to enter a different treatment option in cell B28, enter the associated cost in cell C28. It should be noted that the cost value is for the initial purchase of the CPAP and does NOT include ongoing monitoring or maintenance costs.

Total Sleep Apnea Treatment Cost – cell C30 calculates the total costs incurred in the purchase of a sleep apnea treatment option and does not require any user input.

Step 5: Fatigue Management Tools – used to calculate the cost of purchasing various types of fatigue management tools if you choose to select these options. As described in the NAFMP Implementation Manuel, the tools included in the calculator are not meant as a recommendation or endorsement but rather provide a broad overview of fatigue management tools that are currently available. The prices provided in the calculator are average costs obtained directly from the vendors and are current as of May 2012. Carriers should contact the manufacturers for more information.

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[3] Pack A.I., Dinges D.F, & Maislin G. (2002). A study of prevalence of sleep apnea among commercial truck drivers (Report No. DOT-RT-02-030). Washington, DC: U.S. Department of Transportation, FMCSA.

Driver-Based Fatigue Tools – move down the spreadsheet to cell B33 and select which of the driver-based tools (if any) you plan to purchase or enter the name of an alternate device. A default cost value is provided in cell C33 for each of the predefined tools. If you have chosen to enter a different tool in cell B33, enter the associated per unit purchase cost in cell C33. Next, enter the number of units that you plan to purchase in cell E33. A total cost for the purchase of driver-based fatigue tools will then be calculated in cell F33.

Driver-based fatigue management technologies identify and alert the driver of impending fatigue to reduce risky driving behaviors, performance degradation and driving errors. These technologies continuously monitor the driver and provide feedback and alerts. Driver-level fatigue management tools can monitor eye movement, steering input or reaction time depending on the system.

The specific systems included in the calculator are:
- Motionlogger by Ambulatory Monitoring
- Readiband by Fatigue Science
- EA401 Driver Fatigue Monitor by EyeAlert
- Alertness Monitoring System by Optalert
- Critical Tracking Task by Systems Technology
- PVT-192 by Ambulatory Monitoring

Vehicle-Based Fatigue Tools – move to cell B36 and select which of the vehicle-based tools (if any) you plan to purchase or enter the name of an alternate device. A default purchase cost value is provided in cell C36 for each of the predefined tools. If you have chosen to enter a different tool in cell B36, enter the associated purchase cost value in cell C36. Next, enter the number of units that you plan to purchase in cell E36. A total cost for the purchase of vehicle-based fatigue tools will then be calculated in cell F36.

In-vehicle fatigue monitoring systems are designed to monitor the driver and roadway with video to determine potential driver fatigue through risky driving behaviors and alert the driver of impending danger. A number of these systems also record data from the vehicle such as speed, braking and location. The video and data can be reviewed and analyzed, either by a third party or within the fleet. Risky driving behavior can then be flagged for review with the driver for coaching and training.

The specific systems included in the calculator are:
- Autovue Lane Departure Warning System (LDWS) by Bendix
- Advisory System for Tired Drivers (ASTID) by Fatigue Management International
- Drivecam
- DV101E by Rosco Vision
- Antisleep Pilot
- Intelli Route TND760 by Rand McNally

Fatigue-Related Scheduling Tools – move to cell B39 and select which of the fatigue-related scheduling tools (if any) you plan to purchase or enter the name of an alternate

device. A default cost value is provided in cell C39 for each of the predefined tools. If you have chosen to enter a different tool in cell B39, enter the associated cost value in cell C39. Next, enter the number of units that you plan to purchase in cell E39. A total cost for the driver-based fatigue tools will then be calculated in cell F39.

Fatigue-related scheduling tools are aimed at preventing driver fatigue. These technologies are considered "back-office" systems and can be administered by dispatchers, driver trainers, safety managers and other office personnel. Examples of these tools include driver scheduling software, trip planning/routing software and fitness-for-duty testing.

The specific systems included in the calculator are:
- Fatigue Avoidance Scheduling Tool (FAST) by Fatigue Science
- Intelli Route TND760 by Rand McNally
- Intelli Route TND510 by Rand McNally

<u>Total Cost of NAFMP</u> – cell C41 calculates the total cost associated with implementing your customized NAFMP, including the total fatigue management training, sleep apnea screening and treatment costs as well as the costs associated with purchasing any fatigue-related driver, vehicle or scheduling based tools.

Section 2: Benefit Calculations

Step 6: Number of Crashes and Average Cost – used to estimate potential cost savings which might be realized based upon deployment of some or all NAFMP components.

Total Crashes – beginning in cell C46, enter the average number of crashes that your fleet experiences each year for each of the crash types listed in column B, rows 46-50. Only include only those crashes where the commercial driver was found to be at fault. If your fleet has recorded no crashes of a particular type, enter "0" in the appropriate cell. These five crash types (rollovers, jackknifes, run-off road, and head-on collisions and rear-end collisions where the CMV driver was responsible) were selected as ones where fatigue may be a factor.

Percent Due to Fatigue – beginning in cell D46, enter the percent for each crash type listed in column B, rows 46-50 where fatigue may be a factor or use the default value. The default value is based on research by the Federal Motor Carrier Safety Administration (FMCSA) that found that fatigue was a contributing factor in 13 percent of serious CMV crashes (i.e. involving serious injury and/or fatalities).[4]

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[4] Federal Motor Carrier Safety Administration. (2006). *Report to Congress on the Large Truck Crash Causation Study* (Report No. MC-R/MC-RRA). Washington, DC: Federal Motor Carrier Safety Administration

Number of crashes where fatigue may be a factor – cells E46 through E50 show the number of crashes where fatigue may be a factor based on the total number of crashes entered in column C and the percent entered in column D. These cells do not require any user input.

Average Cost per Crash – beginning in cell F46, enter the average cost for each of the crash types listed in column B, rows 46-50. Default crash cost values are provided and represent aggregated crash costs in ATRI's extensive database of crash data from U.S. and Canadian motor carriers and motor carrier insurers.

Number of fatigue crashes potentially mitigated by the NAFMP – cell C56 calculates the total number of crashes that could potentially be mitigated by implementing your customized NAFMP and does not require any user input.

This figure is based on the number of crashes where fatigue may be a factor calculated in cell E53 and an efficacy rating (shown in cell E56) based on the specific NAFMP components chosen in the first section of the calculator. Please see appendix A for more information on how the efficacy ratings were determined.

Total potential cost savings from crashes avoided (where fatigue may be a factor) by deployment of parts or all of the NAFMP – cell C60 displays the total cost savings that could potentially be realized through implementing your customized NAFMP and does not require any user input.

Step 7: ROI Calculation

For every dollar spent on the NAFMP, the potential return on investment is – cell C62 estimates the potential total cost savings that may be experienced based on the total costs of implementing your customized NAFMP and the corresponding benefit of potentially reduced crash rates. It should be noted that the estimated ROI calculation is for the initial investment year only. Over time, users may continue to experience annual cost savings based on continued training of new employees, screening and treatment of drivers at risk for sleep apnea, and continued use of any fatigue management tools purchased.

Appendix A – Fatigue Management Tool Efficacy Ratings

The efficacy rating for the NAFMP components was determined by a panel of subject matter experts (SME) through a two-step Delphi model evaluation process. First, one group of SME identified and prioritized the potential crash avoidance associated with the deployment of an individual or group of NAFMP components (Training, Screening and Treatment, Driver-based tools, Vehicle-based tools and Scheduling). The second group of SME then reviewed Group A's results and either validated the previous findings or, in some instances, provided a new recommendation which was factored into the final results.

The following organizations provided subject matter experts in the evaluation process:

- Coastal Pacific Xpress
- Con-way Freight
- Dupre Logistics, LLC
- Liberty Linehaul, Inc.
- Pitt Ohio
- Prime, Inc.
- Schneider National, Inc.
- Trimac Transportation
- American Trucking Associations
- Canadian Trucking Alliance