

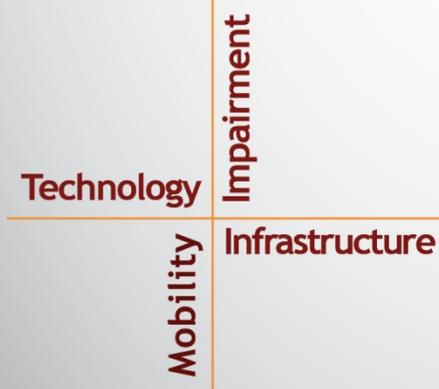
NSTSCCE

National Surface Transportation Safety Center for Excellence

Developing a Web-Based Return-on-Investment Calculator for Truck Safety Technologies

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LIST OF ABBREVIATIONS AND SYMBOLS

ADB	air disc brakes
AEB	automatic emergency braking
LDW	lane departure warning
PDO	property-damage only
OBMS	onboard monitoring system
ROI	return on investment
VTTI	Virginia Tech Transportation Institute

CHAPTER 1. INTRODUCTION

Previous research has shown that large truck advanced safety technologies have the potential to prevent tens of thousands of crashes and the resulting injuries and fatalities every year (Camden et al., 2018). Further, this research also showed that automatic emergency braking (AEB), lane departure warning (LDW), air disc brakes (ADB), and video-based onboard monitoring systems (OBMS) had a positive societal cost-benefit ratio (Camden et al., 2017; 2018). Although large truck advanced safety technologies are becoming more prevalent, adoption rates and use are lagging. A recently completed study sponsored by the Federal Motor Carrier Safety Administration found that one of the main barriers to the adoption of AEB in commercial motor vehicles is understanding its potential return on investment (ROI; Grove et al, 2020). In this study, ROI was repeatedly mentioned in every interview with original equipment manufacturers (OEMs), industry stakeholders, and fleets as the main barrier limiting adoption of AEB. Although this study only focused on AEB, the team's discussions with fleets over the years also found ROI to be the main barrier limiting the adoption of most truck safety technologies.

Although the initial purchase costs of these safety systems can be significant, previous studies have found positive ROIs for technologies that effectively prevent crashes (Hickman et al., 2013; Houser et al., 2009; Murray et al., 2009; Orban et al., 2009; Visvikis et al., 2008). These systems include AEB, LDW, and video-based OBMS. Thus, it is possible that fleets may have difficulty estimating the potential reductions in the quantity and severity of crashes. Additionally, fleets may not understand how to quantify their exposure to crashes related to the safety technologies or how to estimate reductions in the quantity or severity of crashes separately. These difficulties may be especially challenging for small fleets, which may lack the tools and resources for analyzing complex costs and benefits. Thus, the creation and dissemination of ROI tools that help fleets structure their thoughts about the technology and quantify abstract factors could benefit small fleets and reduce these barriers to adoption.

In an attempt to address this gap and subsequently increase the adoption of large truck advanced safety technologies, researchers at the Virginia Tech Transportation Institute (VTTI) developed an Excel-based ROI calculator and accompanying user manual (Camden et al., 2020a,b). This customizable calculator allows a fleet to enter information about their own operations (or use national averages if they are unsure) in order to understand the ROI associated with implementing AEB, LDW, or video-based OBMS. The results provided by the calculator are detailed and fleet-specific, but it is complex due to the various costs and benefit options, as well as the sensitivity analyses it offers. This may limit its usefulness to fleets.

PURPOSE OF THIS PROJECT

The purpose of this project was to create a public, visually appealing website for a Web-based version of the previously created ROI calculator. The Web-based calculator contains all the features and formulas used in the Excel-based version; however, it was designed to reduce some of the complexity associated with the Excel-based version. To learn more about how the website calculates the estimated ROI, please see Camden et al. (2020b).

CHAPTER 2. WEBSITE DESIGN

The Large Truck Advanced Safety Technology Return-on-Investment Calculator website (<https://www.vtti.vt.edu/roicalculator/>) was designed to improve dissemination of valuable ROI information about proven large truck advanced safety technologies. The website calculator also limits the number of data entry fields required to estimate a technology's potential ROI (compared to the Excel version). In addition to hosting the calculator, the website features a page with a description and a summary of research on the effectiveness of each safety technology, links to related resources (e.g., the Excel-based calculator), a forum for frequently asked questions, and contact information.

The following sections provide an overview of the ROI calculator website.

HOME PAGE

The home page creates a landing site to introduce users to the VTTI ROI calculator (Figure 1). On this page, users are provided with a brief overview of the calculator and five additional tabs to move throughout the website.



Figure 1. Screenshot. Safety Technology ROI Website homepage.

Clicking on the “More Information” button automatically scrolls down the home page to where additional information is displayed (Figure 2). Specifically, users are shown which technologies are included in the calculator, given a definition of each technology, and provided general information about navigating the website.

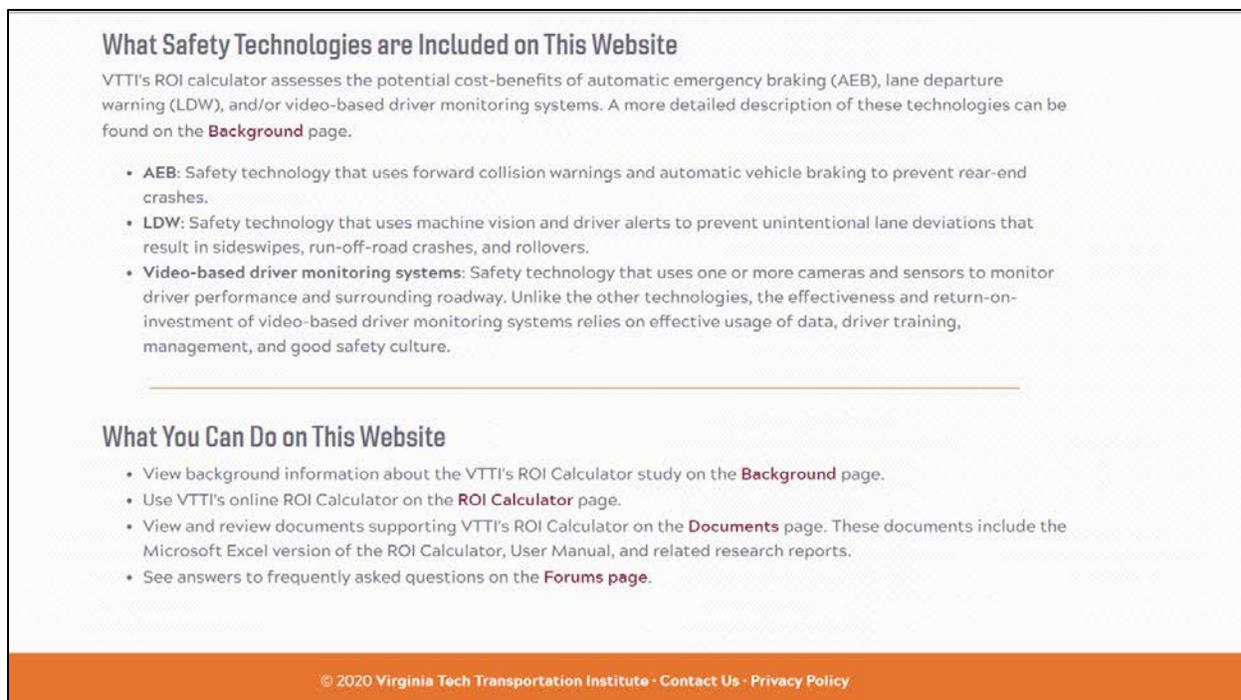


Figure 2. Screenshot. Additional information on home page.

BACKGROUND

The background section of the website contains a brief description describing the purpose of the study and a full description of each of the three technologies included in the ROI calculator. This information was written to be brief and easily understood for users who have little background in advanced safety technologies. Figure 3 shows an example related to AEB.



Figure 3. Screenshot. Example of the background section for AEB.

Also included on the Background page is a summary of the effectiveness and cost data used as default values in the calculator, along with a list of references (Figure 4).

Industry Expert Effectiveness and Cost Recommendations			
AST	Low Effectiveness	High Effectiveness	Cost
AEB	28% of preventable rear-end crashes	41% of preventable rear-end crashes	\$2,500
LDW	30% of preventable sideswipes run-off-road, and head-on crashes	47.8% of preventable sideswipes run-off-road, and head-on crashes	\$1,000
Video-Based OSM	20% of preventable crashes	52.2% of preventable crashes	\$525 for hardware, \$40 monthly fee, driver and manager coaching

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Figure 4. Screenshot. Default effectiveness and cost data used in the ROI calculator.

CALCULATOR

The Calculator page houses the actual ROI calculator (Figure 5). On the left side of this page are the key pieces of information that the user must enter to obtain an estimated ROI. Results are displayed on the right side of the page.

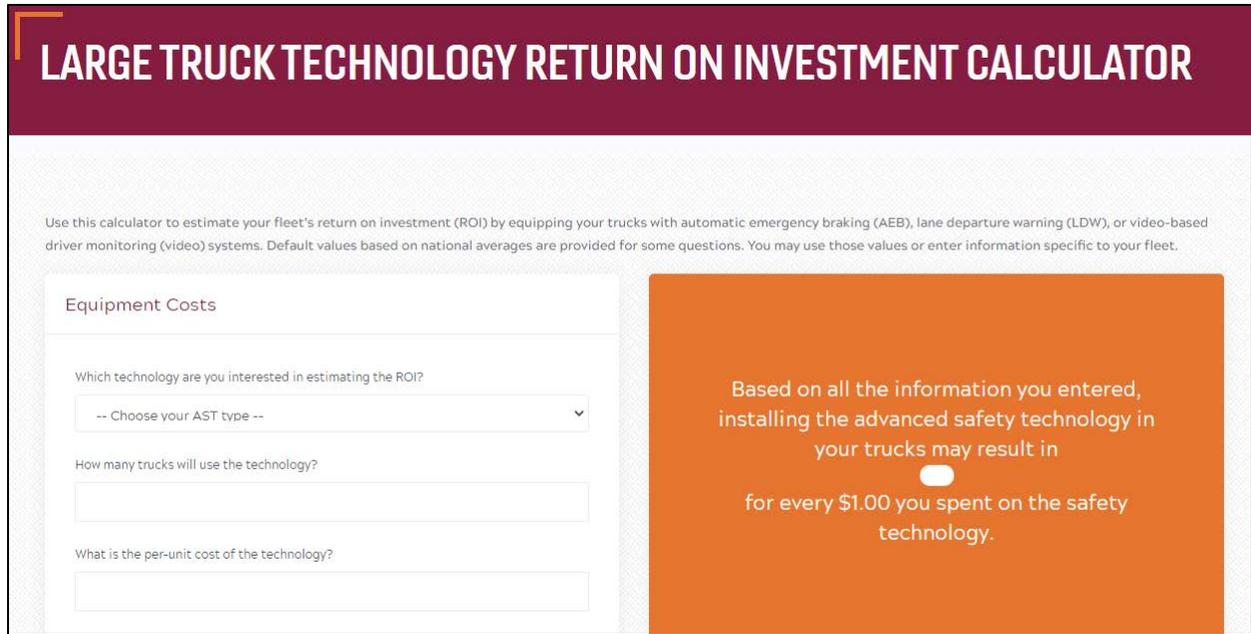


Figure 5. Screenshot. Calculator webpage.

Users are prompted to select which safety technology they are interested in exploring. Default cost and benefit data are automatically populated based on this selection. Users have the option of continuing with these default values or overriding them with information specific to their fleet. Users are asked to answer the following questions (required questions are bolded):

1. **Which technology are you interested in estimating the ROI?**
2. **How many trucks will use the technology?**
3. What is the per-unit cost of the technology (default value provided)?
4. Will the purchase of the technology be financed?
5. What is your drivers' average salary per hour (default value provided)?
6. What is your managers' average salary per hour (default value provided)?
7. What is the yearly fee associated with the technology (default value provided)?
8. What is the expect discount rate (default value provided)?
9. **Are you insured or self-insured?**
10. If insured, what are your liability, cargo, and physical damage deductibles (default values provided)?
11. How many total miles does your fleet travel each year (optional)?
12. **How many years of crash data do you have available?**
13. **How many property-damage only (PDO) crashes did your fleet have over that time frame?**
14. **How many injury crashes did your fleet have over that time frame?**
15. **How many fatal crashes did your fleet have over that time frame?**
16. What is your average cost per PDO crash (default value provided)?
17. What is your average cost per injury crash (default value provided)?
18. What is your average cost per fatal crash (default value provided)?
19. **What percentage of crashes will the technology prevent (default values provided)?**

20. Do you move high-value cargo (default values provided)?

After entering all the information, the user presses “Result” and will immediately be returned to the results section at the top of the page. If the user does not provide one of the required pieces of information, the missing field is highlighted, and the user is prompted to enter text.

The website displays the following results:

1. The estimated benefit-cost ratio (i.e., ROI estimate)
2. The estimated payback period
3. A table summarizing the technology-related costs per truck
4. A table summarizing the fleet-wide ROI results
5. A table summarizing the fleet-wide crash costs that may be prevented by implementing the technology

DOCUMENTS

The Documents page (see Figure 6) provides links to relevant reports. These include the more complex Excel-based version of the calculator, the user manual for the Excel-based version of the calculator, a guide to implementing video-based OBMS, and four AAA Foundation for Traffic Safety reports documenting the societal benefit-cost analysis of four large truck safety technologies. Also included on the Documents page is a list of relevant references related to the ROI of AEB, LDW, and video-based OBMS.

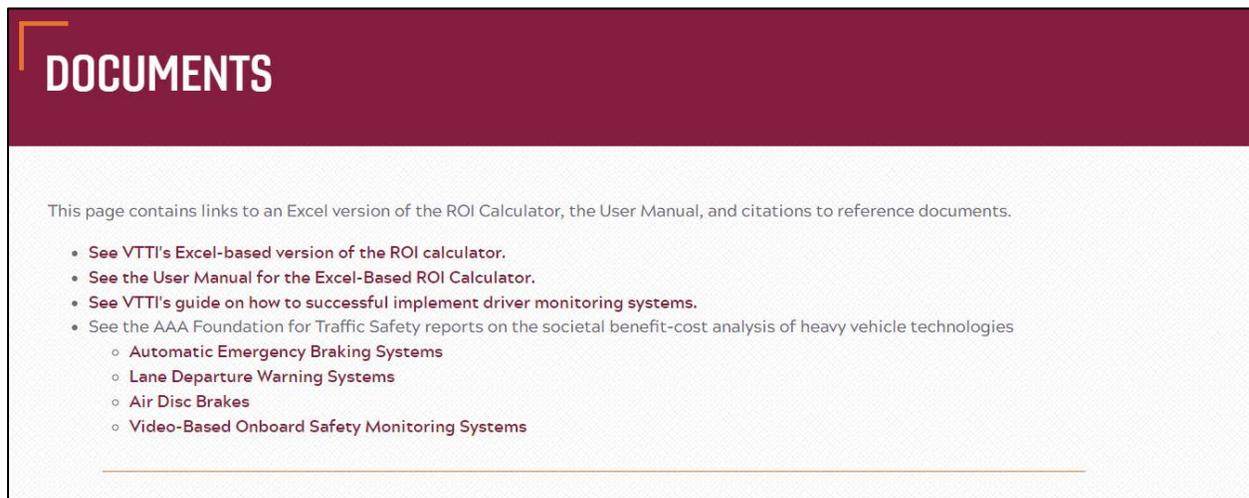


Figure 6. Screenshot. Documents page.

FORUMS

The Forums page provides the following five commonly asked questions about the calculator and VTTI's responses (see Figure 7).

1. Do I have to pay to use VTTI's ROI calculator?
2. Where did the default data originate?
3. How were the cost-benefit ratios calculated?

4. How do I interpret my results?
5. Will my information remain confidential?

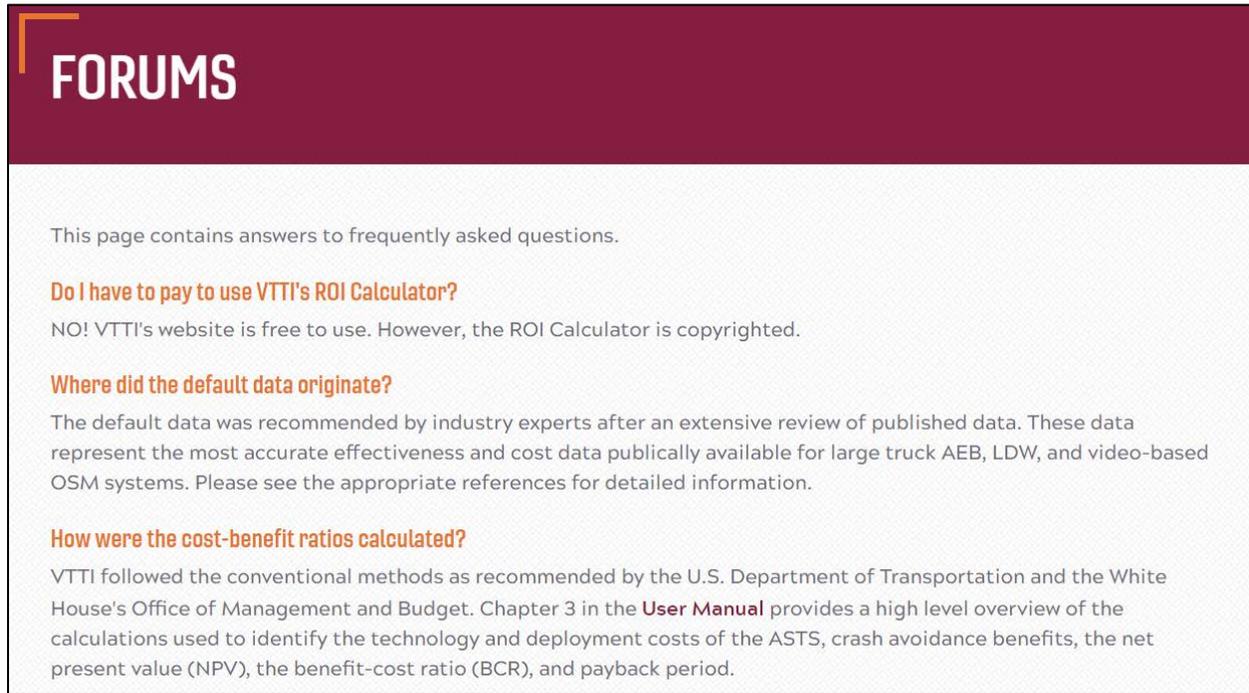


Figure 7. Screenshot. Forums page.

CONTACT US

The contact page provides a dedicated email and phone number for users to reach out to VTTI with questions, comments, opportunities, and/or concerns.

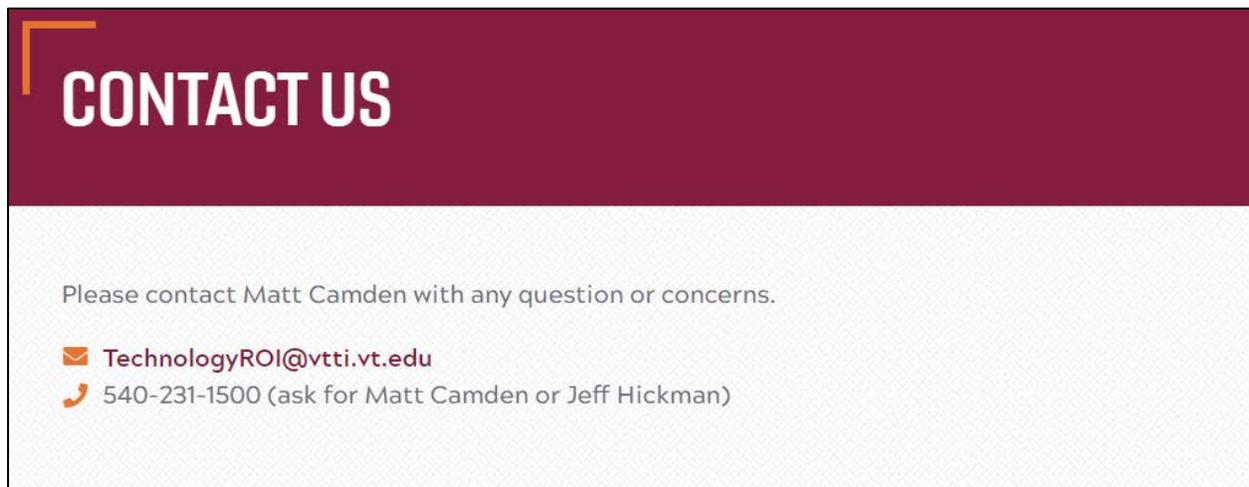


Figure 8. Screenshot. Contact page.

CHAPTER 3. CONCLUSIONS

The Safety Technology ROI website provides fleets with a third-party, science-based calculator to estimate the ROI of three popular large truck safety technologies: AEB, LDW, and video-based OBMS. This website used the previously developed Excel-based calculator but reduced some of the complexity by reducing the number of options and user inputs. Currently, the Web user can estimate the ROI of one of the technologies by only providing eight key pieces of information and using industry average data. However, the user has the option of providing data on up to 20 questions to obtain a more customized estimation.

To date, feedback on the Web-based ROI calculator has been positive. The large truck technology ROI website can be found at <https://www.vtti.vt.edu/roicalculator/>.

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