

# **Crash Risk and Mobile Device Use Based on Fatigue and Drowsiness Factors in Truck Drivers**

Laura M. Toole

Thesis submitted to the Faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Master of Science  
In  
Industrial and Systems Engineering

Tonya L. Smith-Jackson, Co-chair  
Richard J. Hanowski, Co-chair  
Woodrow W. Winchester III

October 26, 2012  
Blacksburg, VA

Keywords: commercial motor vehicles, fatigue, drowsiness, distraction,  
Naturalistic Truck Driving Study

© Laura M. Toole, 2012

Draft 09/01/2009

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

## Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Laura Toole

Description of item under review for fair use: Figure 3. Representation of the Yerkes-Dodson inverted-u curve (Hebb, 1955, p. 250).

Report generated on: 11-07-2012 at : 11:40:59

### Based on the information you provided:

#### Factor 1

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### Factor 2

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### Factor 3

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### Factor 4

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use*

[Details about analysis of fair use \(Opens in a new window\)](#)

[Print this page or save as PDF.](#)

Draft 09/01/2009

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

## Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Laura Toole

Description of item under review for fair use: Figure 2. Representation of the multiple resource theory (Wickens, 2002, p. 163).

Report generated on: 11-05-2012 at : 10:37:21

### Based on the information you provided:

#### Factor 1

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### Factor 2

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### Factor 3

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### Factor 4

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use*

[Details about analysis of fair use \(Opens in a new window\)](#)

[Print this page or save as PDF.](#)

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

## Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Laura Toole

Description of item under review for fair use: Table 1 SCE Classifications (Olson et al., 2009, p. 25)

Report generated on: 11-05-2012 at : 11:50:41

**Based on the information you provided:**

### Factor 1

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### Factor 2

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### Factor 3

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### Factor 4

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

[Details about analysis of fair use \(Opens in a new window\)](#)

[Print this page or save as PDF.](#)

---

(Please ensure that Javascript is enabled on your browser before using this tool.)

## Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Laura Toole

Description of item under review for fair use: Table 2 Definitions of Subtasks Used in Current Research (Olson et al., 2009)

Report generated on: 11-05-2012 at : 10:42:10

**Based on the information you provided:**

### Factor 1

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### Factor 2

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### Factor 3

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### Factor 4

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

[Details about analysis of fair use \(Opens in a new window\)](#)

[Print this page or save as PDF.](#)

---

Draft 09/01/2009

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

## Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Laura Toole

Description of item under review for fair use: Table 3 Significant Odds Ratios for Tertiary Tasks (Hickman et al., 2010, p. 41)

Report generated on: 11-05-2012 at : 10:45:09

### Based on the information you provided:

#### Factor 1

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### Factor 2

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### Factor 3

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### Factor 4

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

[Details about analysis of fair use \(Opens in a new window\)](#)

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

## Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Laura Toole

Description of item under review for fair use: Table 4 Criteria Used to Define Each Level of Driving Task Demand (Fitch & Hanowski, 2011)

Report generated on: 11-05-2012 at : 10:47:43

### Based on the information you provided:

#### Factor 1

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### Factor 2

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### Factor 3

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### Factor 4

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

[Details about analysis of fair use \(Opens in a new window\)](#)

[Print this page or save as PDF.](#)

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

## Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Laura Toole

Description of item under review for fair use: Figure 5. Face camera located in truck cab (Blanco et al., in press).

Report generated on: 11-05-2012 at : 10:57:54

**Based on the information you provided:**

### Factor 1

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### Factor 2

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### Factor 3

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### Factor 4

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

[Details about analysis of fair use \(Opens in a new window\)](#)

[Print this page or save as PDF.](#)

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

## Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Laura Toole

Description of item under review for fair use: Figure 6. Five camera views (Blanco et al., in press).

Report generated on: 11-05-2012 at : 11:02:55

**Based on the information you provided:**

### Factor 1

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### Factor 2

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### Factor 3

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### Factor 4

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

[Details about analysis of fair use \(Opens in a new window\)](#)

[Print this page or save as PDF.](#)

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

## Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Laura Toole

Description of item under review for fair use: Table 6 Trigger Values Used in the NTDS (Blanco et al., in press)

Report generated on: 11-05-2012 at : 11:05:47

### **Based on the information you provided:**

#### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### **Factor 4**

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

[Details about analysis of fair use \(Opens in a new window\)](#)

[Print this page or save as PDF.](#)

---

Permission from author for Figure 5 and 6 on next page.

**From:** Laura Toole  
**Sent:** Monday, November 05, 2012 10:30 AM  
**To:** Myra Blanco  
**Subject:** Permission to Use Two Figures

Myra,

I would like to use the left image in Figure 3 and Figure 7 of the NTDS final report in order to show an example of the video cameras used and the images they collected. Can I please have your permission to use these images?

Thank you,

Laura

**From:** Myra Blanco  
**Sent:** Monday, November 05, 2012 10:48 AM  
**To:** Laura Toole  
**Subject:** RE: Permission to Use Two Figures

Please attach the figures to this e-mail for me to have in the same communications.

Thanks,

Myra

**From:** Laura Toole  
**Sent:** Monday, November 05, 2012 10:53 AM  
**To:** Myra Blanco  
**Subject:** RE: Permission to Use Two Figures



Figure 3



Figure 7- I added the description of each image.

**From:** Myra Blanco

**Sent:** Monday, November 05, 2012 10:54 AM



**To:** Laura Toole

**Subject:** RE: Permission to Use Two Figures

OK, please cite the report for those figures.

**From:** Laura Toole

**Sent:** Monday, November 05, 2012 11:02 AM

**To:** Myra Blanco

**Subject:** RE: Permission to Use Two Figures

I have