



UNIVERSITY OF THESSALY
SCHOOL OF ENGINEERING
DEPARTMENT OF CIVIL ENGINEERING

PROGRAMME

DOCTORAL DISSERTATION EXAMINING COMMITTEE ASSEMBLY

of

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Dipl. Civil Engineer, University of Thessaly, 2004

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Teleconference Room, School of Engineering, University of Thessaly

“Modeling the impact of road safety communication campaigns and training programs on driving behavior”

EXAMINING COMMITTEE

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ABSTRACT

Driving under fatigue, which, among others, may cause falling asleep at the wheel, is a highly contributing factor in traffic accidents worldwide, quantified by an average proportion of 20% of total accidents that are fatigue related (MacLean et al., 2003) and a range of 16-23% of total accidents that are due to sleepiness (Horne & Reyner, 1995).

The present dissertation aims at developing an integrated framework, which facilitates the design of road safety interventions, i.e. communication campaigns and training programs, the evaluation of their effectiveness, the assessment of their impact on driving behavior, and the development of behavioral models for predicting drivers' intentions and behavior towards safety. The framework is validated to a Greek road safety communication campaign and a training program targeting professional drivers of a leading company in building materials in Greece, both addressing an important safety issue thus, driver fatigue.

Implementing a coherent evaluation plan, self-reported data were collected through a face-to-face questionnaire survey, before, during and after the campaign realization and, before and after the training program. In addition, in the latter case, a naturalistic study took place, including data collected by trip recorders (Geographical Positioning System – GPS devices).

Evaluation results of both interventions showed a statistically significant increase in the proportion of drivers, who were aware of the causes and effects of fatigue while driving, and similar results were indicated when testing behavioral beliefs, risk comprehension, control beliefs, descriptive norms, behavioral intentions and past behavior. The main messages of the interventions reached the target audience, validated by the increase of the percentage of drivers self-reporting that they stop and rest for 15-20 minutes in the "after" period, compared to the period before the campaign and training program implementation. When assessing GPS data, results showed a slight improvement of drivers' behavior after the training program realization. The comparison between self-reported and observed behavior pointed out a clear positive impact of the training program on drivers' behavior according to the self-reported measurements, and a moderate impact, based on the GPS records.

Focusing on the development of behavioral models, in the case of the campaign, it was observed that the more constructs were added to the independent variables, the higher the values of the models' predictability were. Specifically, the construct that mostly affected behavior was behavioral intention. In the case of the training program, when predicting behavior towards stopping and resting when tired, it was observed that the strongest statistically significant predictor was descriptive norms, while when, testing behavior towards following other solutions to fatigue than stopping and resting, findings revealed that the strongest predictor was behavioral beliefs.

It can be concluded that drivers' behavioral changes do not directly reflect to actual driving compliance with safety standards. In order to define whether changes can actually be observed through objective measurements, i.e. by using GPS devices, consistency and repetitions are required, as well as long-term measurements. On the other hand, self-reported measurements seem to be more sensitive to behavioral changes. The advantages and disadvantages of the two methods are significant, and should be spherically assessed by researchers before implementing them to evaluate road safety interventions.

BIOGRAPHICAL SKETCH

1978 Born in Volos, Greece

2004 Diploma in Civil Engineering, University of Thessaly, Volos, Greece

2006 M.Sc. in Applied Engineering & Systems' Simulation, University of Thessaly, Volos, Greece

PUBLICATIONS

Scientific journals

Adamos, G. & Nathanail, E., 2016. "Predicting the effectiveness of road safety campaigns through alternative research designs". *Journal of Safety Research*, Volume 59, December 2016, Pages 83-95, Elsevier. DOI: 10.2016/j.jsr.2016.10.003.

Nathanail, E., Gogas, M. & **Adamos, G.**, 2016. "Assessing the contribution of urban freight terminals in last mile operations". *Transport and Telecommunication Journal*. Volume 17, no. 3, Pages 231-241. DOI: 10.1515/ttj-2016-0021.

Adamos, G. & Nathanail, E., 2016. "A before-after study on the impact of a road safety training program on professional drivers". To appear in *International Journal of Transportation: Special issue on road safety in Europe*, SERSC.

Adamos, G. & Nathanail, E., 2015. "How to train safe drivers: Setting up and evaluating a fatigue training program". *Transport and Telecommunication Journal*. Volume 16, Issue 1, Pages 9–20, ISSN (Online) 1407-6179, DOI: 10.1515/ttj-2015-0002, February 2015.

Adamos, G., Nathanail, E. & Kapetanopoulou, P., 2014. "Cluster modelling of driving behavior under fatigue". *Transportation Research Record: Journal of Transportation Research Board*, No. 2465, Transportation Research Board of the National Academies, Washington, D.C., 2014, pp. 24-32, DOI: 10.3141/2465-04.

Nathanail, E., **Adamos, G.**, Kapetanopoulou, P. & Efraimidou, E., 2013. "Does talking with a fellow passenger affect everybody the same while driving? An impact assessment on driving performance and behavior". *Advances in Transportation Studies*, Special Issue 2014, Volume 1, pp. 77-86.

Nathanail, E. & **Adamos, G.**, 2013. "Road safety communication campaigns: Research designs and behavioral modeling". *Transportation Research Part F: Traffic Psychology and Behavior* 18, pages 107-122, ISSN 1369-8478, DOI: 10.1016/j.trf.2012.12.003.

Adamos, G., Nathanail, E. & Kapetanopoulou, P., 2013. "Do road safety campaigns work? How to assess the impact of a national fatigue campaign on driving behavior", *Transportation Research Record: Journal of Transportation Research Board*, No. 2364, Transportation Research Board of the National Academies, Washington, D.C., 2013, pp. 62-70, DOI: 10.3141/2364-08.

Nathanail, E. & **Adamos, G.**, 2013. "Planning and financing schemes linked to the decision-making for the interconnection of long-short distance transport". *Transport and Telecommunication*. Volume 14, Issue 1, Pages 20–28, ISSN (Online) 1407-6179, ISSN (Print) 1407-6160, DOI: 10.2478/ttj-2013-000, February 2013.

Adamos, G., Nathanail, E. & Kapetanopoulou, P., 2012. "Does the theme of a road safety communication campaign affect its success?" *Transport and Telecommunication Scientific Journal* Volume 13, Issue 4, Pages 294-302, ISSN (Online) 1407-6179, ISSN (Print) 1407-6160, DOI: 10.2478/v10244-012-0025-5, December 2012.

PUBLICATIONS

Conference proceedings with peer review

Adamos, G. & Nathanail, E., 2017. "Training professional drivers towards complying with safety standards: a naturalistic study". Transportation Research Board (TRB) 96th Annual Meeting, Washington, D.C., USA, January 8-12, 2017. *Accepted for presentation.*

Mitropoulos, L., **Adamos, G.**, Nathanail, E., Yatskiv (Jackiva), I. & Kabashkin, I., 2017. "Developing an educational program for transportation across regions: the case for intermodal connections for Latvia and the region". Transportation Research Board (TRB) 96th Annual Meeting, Washington, D.C., USA, January 8-12, 2017. *Accepted for presentation.*

Nathanail, E., Gogas, M. & **Adamos, G.**, 2016. "Smart interconnections and urban freight transport towards achieving sustainable city logistics". Transport Research Arena 2016, Warsaw, Poland, April, 18-21, 2016.

Nathanail, E., **Adamos, G.** & Gogas, M., 2016. "A novel framework for assessing sustainable urban logistics. 14th World Conference on Transport Research, Shanghai, China, July, 10-15, 2016.

Nathanail, E., Gogas, M. & **Adamos, G.**, 2016. "Assessing the performance of intermodal city logistics terminals in Thessaloniki". 3rd Conference on Sustainable Urban Mobility, 26-27 May 2016, Volos, Greece.

Nathanail, E., Gogas, M. & **Adamos, G.**, 2016. "Urban freight terminals: A sustainability cross-case analysis". 2nd International Conference Green Cities 2016: Green Logistics for Greener Cities, 02-03 March 2016, Szczecin, Poland.

Adamos, G., Tsami, M. & Nathanail, E., 2015. "Urban interchanges: Moving towards a seamless transportation solution". 5th International Conference on Environmental Management, Engineering, Planning and Economics (CEMEPE) and SECOTOX Conference. Mykonos Island, Greece, June 14-18, 2015.

Tsami, M., **Adamos, G.** & Nathanail, E., 2015. "Transport Interchange Design: Analyzing the case of the New Railway Station of Thessaloniki". International Conference on Changing Cities II. Spatial, Design, Landscape & Socio-economic dimensions, Porto Heli, Peloponnese, June, 22-26, 2015.

Adamos, G. & Nathanail, E., 2015. "Assessing the impact of a fatigue training program on driving behavior". 6th pan-Hellenic Conference on Road Safety, Athens, Greece, March, 12-13, 2015.

Adamos, G. & Nathanail, E., 2015. "Comparison of experimental, quasi-experimental, and non-experimental designs when predicting the effectiveness of road safety campaigns", Transportation Research Board 94th Annual Meeting, Washington, D.C., USA, January 11-15, 2015.

Adamos, G., Nathanail, E. & Tsami, M., 2014. "Designing sustainable urban transport interchanges". 2nd Conference of Sustainable Urban Mobility, 05-06 May 2014, Volos, Greece.

Adamos, G., Nathanail, E. & Kapetanopoulou, P., 2014. "Predicting the impact of a road safety communication campaign on driving behavior". Transportation Research Board 93rd Annual Meeting, Washington D.C., USA, January 12-16, 2014.

Nathanail, E. & **Adamos, G.**, 2014. "Associating risk-taking driving with risk index of urban road intersections". Transport Research Arena (TRA) 2014, 14-17 April 2014 Paris La Défense (France).

PUBLICATIONS

Conference proceedings with peer review

Tsami, M., **Adamos, G.** & Nathanail, E., 2014. "Designing women friendly transport interchanges". 5th International Conference on Women's Issues in Transportation - Bridging the Gap, Paris - La Défense, France, 14-16 Apr 2014.

Tsami, M., **Adamos, G.** & Nathanail, E., 2013. "Sustainable development design for the transformation of the Thessaloniki's railway station into a city hub". European Transport Conference (ETC) 2013, Frankfurt, Germany, 30 September 2013 - 2 October 2013.

Tsami, M., **Adamos, G.** & Nathanail, E., 2013. "Investigating the accessibility level for disabled users at urban transport interchanges". International Conference on Reliability and Statistics in Transportation and Communication (RELSTAT'13), Riga, Latvia, 16-19 October 2013.

Adamos, G., Nathanail, E. & Kapetanopoulou, P., 2013. "Predicting the impact of a fatigue campaign on driving behavior". International Conference on Reliability and Statistics in Transportation and Communication (RELSTAT'13), Riga, Latvia, 16-19 October 2013.

Nathanail, E. & **Adamos, G.**, 2013. "Assessing the impact of information provision on driving behavior". Road Safety and Simulation International Conference (RSS2013), Rome, Italy, October, 22-25, 2013.

Nathanail, E., **Adamos, G.**, Kapetanopoulou, P. & Efraimidou, E., 2013. "Does talking with a fellow passenger affect everybody the same while driving? An impact assessment on driving performance and behavior". Road Safety and Simulation International Conference (RSS2013), Rome, Italy, October, 22-25, 2013.

Tsami, M., **Adamos, G.** & Nathanail, E., 2013. "Moving towards the development of sustainable transportation hubs in Europe: Investigating the role of soft modes in Thessaloniki railway station reformation". 4th International Conference on Environmental Management, Engineering, Planning and Economics (CEMEPE 2013) & SECOTOX Conference, Mykonos Island, Greece, June, 24-27, 2013.

Tsami, M., Nathanail, M. & **Adamos, G.**, 2013. "Designing urban transport interchanges: The case of Thessaloniki railway station". International Conference on "Changing Cities": Spatial, morphological, formal & socio-economic dimensions. Skiathos Island, Greece, June, 18-21 2013.

Adamos, G. & Nathanail, E., 2013. "Recommendations on the development and implementation of a coherent decision making process in the short-long transport interconnection". 13th World Conference on Transport Research, Rio de Janeiro, Brazil, July 15-18, 2013.

Nathanail, E. & **Adamos, G.**, 2013. "Safety system guidelines for car-pooling". 13th World Conference on Transport Research, Rio de Janeiro, Brazil, July 15-18, 2013.

Adamos, G., Nathanail, E. & Kapetanopoulou, P., 2013. "Do road safety campaigns work? How to assess the impact of a national fatigue campaign on driving behavior", Paper 13-4152, 92nd Annual Meeting of TRB, Washington, D.C., 13-17 January, 2013.

Adamos, G., Nathanail, E., Zacharouli, Ch., Nima, Ch. & Parastatidis, S., 2012. "Development of driving profiles under mobile phone usage for the assessment of hazard". 5th pan-Hellenic Conference on Road Safety, Volos, Greece, October, 26-27, 2012.

PUBLICATIONS

Conference proceedings with peer review

Efrimidou, E., Nathanail, E., **Adamos, G.** & Kapetanopoulou, P., 2012. "Assessing the impact of conversing with a fellow passenger on driving behavior". 5th pan-Hellenic Conference on Road Safety, Volos, Greece, October, 26-27, 2012.

Adamos, G. & Nathanail, E., 2012. "Identification and assessment of emerging mobility schemes in the interconnection of long and short distance freight transport". 2nd International Conference on Supply Chains, Katerini, Greece, October, 5-6, 2012.

Gogas, M., Papoutsis, K., Nathanail, E., **Adamos, G.** & Kapetanopoulou, P., 2012. "A comparison study on urban-interurban interfaces on ports – The Constantza and Thessaloniki ports case studies". 2nd International Conference on Supply Chains, Katerini, Greece, October, 5-6, 2012.

Adamos, G., Nathanail, E. & Zacharaki, E., 2012. "Developing a Decision-Making Framework for collaborative practices in long-short distance transport interconnection". *Procedia – Social and Behavioral Sciences*, Volume 48, 2012, Pages 2849-2859.

Vogiatzis, K., **Adamos, G.** & Eliou, N., 2011. "Environmental noise measurements and DTM modeling in dense urban conditions in Volos city center according to the 2002/49/EU Directive". 18th International Congress on Sound and Vibration, Rio de Janeiro, Brazil, July, 10-14, 2011.

Adamos, G. & Nathanail, E., 2011. An experimental approach towards the evaluation of mass media safety campaigns – A comparative analysis of two case studies. Transportation Research Board 90th Annual Meeting, January 23-27, 2011, Washington DC.

Nathanail, E., **Adamos, G.**, Prevedouros, P. & Petamidis, Ch., 2011. An integrated framework for assessing the impact of advanced traveler information systems on traffic performance. Transportation Research Board 90th Annual Meeting, January 23-27, 2011, Washington DC.

Nathanail, E. & **Adamos, G.**, 2010. Impact assessment of a mass media campaign on fatigue. 24th ARRB Conference – Building on 50 years of road and transport research. Melbourne, Australia, October 13-15, 2010

Adamos, G. & Nathanail, E., 2010. "Aspects of co-modality in long and short distance freight transport". 1st International Conference on Supply Chains, Katerini, Greece, October 1-2, 2010.

Nathanail, E. & **Adamos, G.**, 2010. Assessment of the impact of mass media campaigns to driver behavior. Transport Research Arena Europe 2010. Brussels, Belgium, June 7-10, 2010.

Nathanail, E., **Adamos, G.** & Petamidis, Ch., 2010. A Simulation framework for the assessment of the impact of advanced traveler information systems on users' choice and behaviour. 12th World Conference on Transport Research, Lisbon, Portugal, July 11-15, 2010.

Adamos, G. & Nathanail, E., 2009. "Evaluation of the Greek media road safety campaign on driving fatigue", 4th pan-Hellenic Conference on Road Safety, Athens, Greece, November 05-06, 2009.

Adamos, G., Nathanail, E. & Eliou, N., 2008. "Design and evaluation of road safety campaigns – The CAST research project" 4th International Conference on Transportation Research, Athens, May 28-30, 2008.

PUBLICATIONS

Conference proceedings with abstract peer review

Nathanail, E., Gogas, M., & **Adamos, G.**, 2015. "Life-cycle evaluation of urban logistics processes". Reliability and Statistics in Transportation and Communication International Conference, Riga, October 21-24, 2015.

Nathanail, E. & **Adamos, G.**, 2015. "Driver inattention at signalized intersections: A comparison of self-reported and observed data". Reliability and Statistics in Transportation and Communication International Conference, Riga, October 21-24, 2015.

Adamos, G., 2015. "Modeling the impact of road safety communication campaigns and training programs on driving behavior and accidents". 3rd PHD Research Workshop, Volos, Greece, May 20, 2015.

Tsami, M., **Adamos, G.** & Nathanail, E., 2014. "Evaluating travellers' level of satisfaction at a Greek urban transportation hub". ?" Reliability and Statistics in Transportation and Communication International Conference, Riga, Latvia, October 14-18, 2014.

Nathanail, E. & **Adamos, G.**, 2013. "Assessing urban intersection safety improvement through risk taking driving control and enforcement". 6th International Conference on Driving Behaviour & Training". Helsinki, Finland, August 19-20, 2013.

Nathanail, E. & **Adamos, G.**, 2012. "Planning and financing schemes linked to the decision-making for the interconnection of long-short distance transport". Reliability and Statistics in Transportation and Communication International Conference, Riga, Latvia, October 17-20, 2012.

Adamos, G., Nathanail, E. & Kapetanopoulou, P., 2012. "Does the theme of a road safety communication campaign affect its success?" Reliability and Statistics in Transportation and Communication International Conference, Riga, Latvia, October 17-20, 2012.

Adamos, G. & Tsami, M., 2012. "Urban transportation hubs: The City-HUB project". 1st Hellenic Conference on Sustainable Urban Mobility, December 14 2012, Volos, Greece.

Nathanail, E. & **Adamos, G.**, 2012. "Road safety campaigns". 1st Hellenic Conference on Sustainable Urban Mobility, December 14 2012, Volos, Greece.

Nathanail, E. & **Adamos, G.**, 2012. "The effect of information provision under non-recurrent traffic congestion on driver route choice". 5th International Conference on Traffic and Transport Psychology 2012, Groningen, The Netherlands, August, 28-30, 2012.

Nathanail, E. & **Adamos, G.**, 2009. "The national road safety fatigue campaign CAST – Organization – implementation – results". 4th Hellenic Conference on Sleep Disorders, Athens, Greece, October 2009.

PUBLICATIONS

Chapters in books

Monzón, A., Di Ciommo, F., Hernández, S., Nathanail, E., **Adamos, G.**, Tsami, M., Poppeliers, R., Heddebaout, O., Jarvi, T., Nokkala, M., Kostianen, J., Palmer, D., Harmer, C., Millard, K., Andersen, J., Christiansen, P., Gabor, A., Pusztai, A., Virag, A., Spousta, J., 2015. CITY-HUBS: Sustainable and Efficient Interchange Stations. Taylor and Francis Group, 2015.

Nathanail, G. & **Adamos, G.**, 2014. "How to assess the impact of road safety communication campaigns: research designs and behavioural modelling". In: Liakopoulos, A., Mistakidis, E. & Giannakopoulos, A. (Editors). Advances in Civil Engineering Research: A Collection of Articles on the Occasion of the Twentieth Anniversary of the Founding of the Civil Engineering Department. Department of Civil Engineering, School of Engineering, University of Thessaly, Volos, Greece, 2014. ISBN: 978-960-88490-4-4.

Delhomme, P., De Dobbeleer, W., Forward, S., Simoes, A., **Adamos, G.**, Areal, A., Chappi, J., Eyssartier, Ch., Loukopoulos, P., Nathanail, E., Nordbakke, S., Peters, H., Phillips, Ph., Pinto, M., Ranucci, M-F, Sardi, G-M., Trigoso, J., Vaa, T., Veisten, K., Walter, E., 2009. Road Safety Communication Campaigns - Manual for Designing, Implementing, and Evaluating Road Safety Communication Campaigns (abridged version). Luxembourg: Publications Office of the European Union, 2010, ISBN: 978-92-79-15433-1, doi: 1-2832/65366.

Delhomme, P., De Dobbeleer, W., Forward, S., Simoes, A., **Adamos, G.**, Areal, A., Chappi, J., Eyssartier, Ch., Loukopoulos, P., Nathanail, E., Nordbakke, S., Peters, H., Phillips, Ph., Pinto, M., Ranucci, M-F, Sardi, G-M., Trigoso, J., Vaa, T., Veisten, K., Walter, E., 2009. Manual for Designing, Implementing, and Evaluating Road Safety Communication Campaigns. Published September, 2009 D/2009/0779/96, © Copyright Belgian Road Safety Institute (BIVV - IBSR) Bruxelles.

Sonja Forward, Ali Kazemi (eds), **Adamos, G.**, Ausserer, K., Brijs, K., Brijs, T., Daniels, S., Divjak, M., Forward, S., Haupt, J., Kazemi, A., Krol, B., Malasek, J., Nathanail, T., Phillips, R. O., Risser, R., Tamis, K., Ullberg, P., Vaa, T., Zabukovec, V. A theoretical approach to assess road safety campaigns - Evidence from seven European countries, Published September, 2009 D/2009/0779/96, © Copyright Belgian Road Safety Institute (BIVV - IBSR) Brussels.

