

**CETRA**<sup>2014</sup>

3<sup>rd</sup> International Conference on Road and Rail Infrastructure  
28–30 April 2014, Split, Croatia

## Road and Rail Infrastructure III

Stjepan Lakušić – EDITOR

Organizer  
University of Zagreb  
Faculty of Civil Engineering  
Department of Transportation



**CETRA<sup>2014</sup>**

**3<sup>rd</sup> International Conference on Road and Rail Infrastructure**  
28–30 April 2014, Split, Croatia

TITLE

Road and Rail Infrastructure III, Proceedings of the Conference CETRA 2014

EDITED BY

Stjepan Lakušić

ISSN

1848-9850

PUBLISHED BY

Department of Transportation  
Faculty of Civil Engineering  
University of Zagreb  
Kačićeva 26, 10000 Zagreb, Croatia

DESIGN, LAYOUT & COVER PAGE

minimum d.o.o.  
Marko Uremović · Matej Korlaet

PRINTED IN ZAGREB, CROATIA BY

“Tiskara Zelina”, April 2014

COPIES

400

Zagreb, April 2014.

Although all care was taken to ensure the integrity and quality of the publication and the information herein, no responsibility is assumed by the publisher, the editor and authors for any damages to property or persons as a result of operation or use of this publication or use the information's, instructions or ideas contained in the material herein.

The papers published in the Proceedings express the opinion of the authors, who also are responsible for their content. Reproduction or transmission of full papers is allowed only with written permission of the Publisher. Short parts may be reproduced only with proper quotation of the source.

Proceedings of the  
3<sup>rd</sup> International Conference on Road and Rail Infrastructures – CETRA 2014  
28–30 April 2014, Split, Croatia

# Road and Rail Infrastructure III

**EDITOR**

**Stjepan Lakušić**

Department of Transportation

Faculty of Civil Engineering

University of Zagreb

Zagreb, Croatia

CETRA<sup>2014</sup>

3<sup>rd</sup> International Conference on Road and Rail Infrastructure

28–30 April 2014, Split, Croatia

## ORGANISATION

### CHAIRMEN

Prof. Stjepan Lakušić, University of Zagreb, Faculty of Civil Engineering

Prof. Željko Korlaet, University of Zagreb, Faculty of Civil Engineering

### ORGANIZING COMMITTEE

Prof. Stjepan Lakušić

Prof. Željko Korlaet

Prof. Vesna Dragčević

Prof. Tatjana Rukavina

Assist. Prof. Ivica Stančerić

dr. Maja Ahac

Ivo Haladin

dr. Saša Ahac

Josipa Domitrović

Tamara Džambas

All members of CETRA 2014 Conference Organizing Committee are professors and assistants of the Department of Transportation, Faculty of Civil Engineering at University of Zagreb.

### INTERNATIONAL ACADEMIC SCIENTIFIC COMMITTEE

Prof. Vesna Dragčević, University of Zagreb

Prof. Isfendiyar Egeli, Izmir Institute of Technology

Prof. Rudolf Eger, RheinMain University

Prof. Ešref Gačanin, University of Sarajevo

Prof. Nenad Gucunski, Rutgers University

Prof. Libor Izvolt, University of Zilina

Prof. Lajos Kisgyörgy, Budapest University of Technology and Economics

Prof. Željko Korlaet, University of Zagreb

Prof. Zoran Krakutovski, University of Skopje

Prof. Stjepan Lakušić, University of Zagreb

Prof. Dirk Lauwers, Ghent University

Prof. Zili Li, Delft University of Technology

Prof. Janusz Madejski, Silesian University of Technology

Prof. Goran Mladenović, University of Belgrade

Prof. Otto Plašek, Brno University of Technology

Prof. Vassilios A. Profillidis, Democritus University of Thrace

Prof. Carmen Racanel, Technical University of Civil Engineering Bucharest

Prof. Tatjana Rukavina, University of Zagreb

Prof. Andreas Schoebel, Vienna University of Technology

Prof. Mirjana Tomičić-Torlaković, University of Belgrade

Prof. Audrius Vaitkus, Vilnius Gediminas Technical University

Prof. Nencho Nenov, University of Transport in Sofia

Prof. Marijan Žura, University of Ljubljana



## TEACHING ETHICS TO TRANSPORT ENGINEERS – THE RATIONALE BEHIND AND PRACTICE AT VIENNA UNIVERSITY OF TECHNOLOGY

Tadej Brezina, Harald Frey, Günter Emberger, Ulrich Leth  
*Vienna University of Technology, Institute of Transportation,  
Research Centre of Transport Planning and Traffic Engineering, Vienna, Austria*

### Abstract

Transport engineers' methods and designs alter existing structures. People's technological products create people as products of technology. From small-scale application of fair share policies to large-scale ubiquitous access policies, the ethics of transport and settlement systems play an important role. Too often, ethics are not considered appropriately, are overlooked or even ignored. However, engineers do not act detached from ethical values. A frequent practice among engineers is to adopt ethics of good intention instead of ethics of responsibility for their interventions. Engineers use models which represent only a window of reality. As engineers perceive what they have learned to perceive, education is of critical relevance. In our contribution we first carve out the dimension and importance of transport engineering ethics by referring to philosophers of technology including Jacques Neiryck, Günther Anders and Daniela Bailer-Jones and by giving examples. Adding to this we introduce the approach at the Research Center of Transport Engineering (IVV) at Vienna University of Technology (VUT) to engineering students' ethics education by providing three lecture series covering a very broad view on transport. Zooming in from general ethics concepts to mode-related points of view, these lecture series are: "Ethics and technology", "Barrier-free transport planning for public spaces" and "Cycling in the city". These lectures do not only provide an extended viewpoint from other engineering branches but also – which is most valuable – add perspectives from sociology, public health, law, philosophy and religion to transport planning.

*Keywords: education, engineers, ethics, lectures*

### 1 Introduction

Planners and engineers intervene in existing structures and shape them from nanotechnologies via light bulbs to nuclear power. Transport engineers are also part of the wide spectrum of engineers shaping the world. Philosophers of technology like Günther Anders [1] coined the notion that technology is not a neutral means to an end – free of virtue. But technology and its devices inherit determined usage by design. Specific economic, social and political conditions produce technology and devices that in turn entail economic, social and political changes. Human beings become as much a product of technology as technology is a product of humans. This notion is illustrated well in the energy flow density of the human being embedded in its socio-technological environment (see Figure 1).

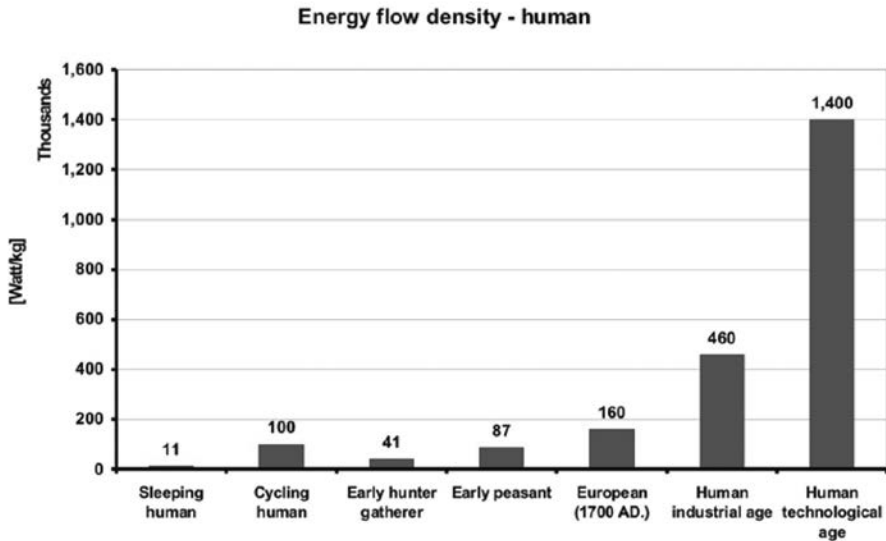


Figure 1 The energy flow density of the human in its socio-technological embedding. The more technology human beings utilize in their surroundings the more energy intensive become their lives [2]

## 2 Ethics and planning

The development of the classical natural sciences accompanied by technical disciplines was obviously much faster, than a responsible use of those new achievements was possible. The technical environment has (technically) expanded our physical abilities and sensory organs and thus exceeded our evolutionary experience areas [3]: e.g. during millions of years evolution designed our brain for walking speeds, but the couldn't possibly have adapted yet to the ever increasing speeds of transport means within the last 200 years.

The reaction to these changes and the social, economic, environmental and political consequences were not considered adequately. The consequences often even appeared surprising to many people. Another philosopher of technology, Jacques Neiryneck, states that engineers show an infant understanding of ethics, not feeling responsible for their actions [4]. This notion is specified by Knoflachner [3] as ethics of good intention vs. ethics of responsibility. While the infant ethics of good intention are based on "meaning one's actions well", the adult ethics of responsibility are founded on "being accountable for one's actions". But today in transport planning ethics of good intention are still applied instead of ethics of responsibility, which would mean that transport engineers would apply the best of knowledge and would stand up for their designs and proposed solutions. Pure technical feasibility too often prevails over ethical evaluation of impacts. In transportation for example environmentally harming transport behaviors of the future are predetermine and prolonged by today's decisions for non-sustainable infrastructure like new roads or motorways. Unfortunately though, too often engineers retreat to modeling results and exterior causes, when transport engineering actions don't provide forecasted results. Due to increased computing power, engineers have put model results on a very high pedestal of relevance. But one has to be aware that models only represent assumptions central to model builders and users, which by definition need to be considered as true to work within the model's framework [5].

Not only do transport engineers build models of the world, they also massively shape the urban and natural landscapes (see Figure 2) and the everyday mobility behaviour of people.



**Figure 2** Transport engineers' products are massively shaping the urban and natural landscapes. Left: Parking lot dominating the central square of the UNESCO world heritage village Hallstatt (AUT). Right: national road, motorway and motorway junction ramps spare little of the quaint valley near Trojane (SLO). Photos: Brezina

So, figuratively speaking for engineers, finding the key (sustainable solutions to problems) is easier when the light beam (of knowledge and perspective) shines wider for them (see Figure 3). In this allegory ethical education provides a tool for increasing the illuminated area. With this perspective in mind it is therefore necessary to educate transport engineering students in ethical matters.



**Figure 3** Streetlight effect: How to find the key (right edge) outside of the light beam? Ethical education will increase the illuminated area. Drawing: Knoflacher

When asking what kinds of dimensions ethics education may have, IVV's educational concept offers a 3-step approach of ethical experience. The increasing likely power of effect on a planner increases from one to three:

- 1 The point of view of others. This includes other people and fields, often with a very different horizon and experience.
- 2 The point of view of the most fragile regular participant. The biggest Issue here is, how to incorporate this view systematically into planning.
- 3 Self-experience. Students will experience hands-on differences in design, e.g. with or without barrier-free planning.

### 3 Practice at VUT

Educating transport engineers from an ethical perspective has a long lasting tradition at the Research Center of Transport Planning and Traffic Engineering (IVV) of the Vienna University of Technology (VUT).

#### 3.1 Base course in transport planning

In an early stage all civil engineering students at VUT need to attend the basic course (lecture and field work) in transport planning. Obligatory part of the field work is the one hour movement through the city with a baby stroller or a wheelchair. There students are at the mercy of good or bad design provided by active engineers (see Figure 4). This is the first hand opportunity for future engineers to experience, how small decisions about the design of the public space and public transport effect everyday lives of people with special needs.



**Figure 4** Students of the base course on transport planning at VUT experiencing first hand the shortcomings and barriers in the transportation system from the point of view of the weakest participants. Photos: Hölesic

#### 3.2 Lecture series “Ethics and technology”

It is astonishing that questions of ethics are not part of basic education at universities of technology. Questions of responsibility and reflective action could not be limited to technical disciplines, particularly because problems occur between the different disciplines. Interdisciplinary thinking and collective working is in demand for engineers to reduce differences and find better solutions. Therefore, we at IVV provide the lecture “Ethics and technology” since 2008 for students of all disciplines at VUT. The topics of the lectures are from various disciplines reaching from natural sciences, technology, social sciences up to religious studies and politics. More than 150 students attend the lectures every year since. The ever-increasing number of students confirmed the importance of this topic for the future graduates of technological studies.

The lectures address the issues of, for instance, the interaction between technology and ecology. This is exemplified by the topic of climate change, technology assessment and ecological principles – shown by the assessment of consequences of the application of engineering and technology in nuclear energy. The lectures examine the question of how engineers and technicians can act in everyday life ethically at all. In this case, the categorical imperative of Immanuel Kant is in the focus of discussions: “Act only according to that maxim whereby you can at the same time will that it should become a universal law without contradiction.”[6] This rule can be also found in modified form in the principles of the five world religions.



The lectures give an overview and show that common fundamental ethical principles exist. At the end of each lecture, the students have to take part in a discussion about the content of the presentation. Thereby they learn to deliberate, to argue and to develop their own opinion. The discussions show that it is becoming more and more difficult to accomplish a comprehensive principle of responsibility (in dubio pro malo)[7] according with the global economic dependencies and an increasing constraint of technical producibility.

### 3.3 Lecture series “Barrier-free design of public space”

Recently carried out research studies (EGALITE [8] and EGALITE-Plus [9]) have tried to identify groups of mobility impaired people and to quantify the development of these mobility impaired people in Austria till the year 2050. The findings of these studies were alarming. One result for example was that more than 40% of the total population of Austria is temporarily or permanently handicapped and this share is even expected to increase till 2050. At the same time when these studies were carried out, the IVV was procured to carry out a study called GABAMO [10] where the education sector in Austria regarding planning for mobility impaired people was under scrutiny. In total 93 bachelor and master courses with 654 lectures were investigated and analysed regarding their contribution towards barrier-free planning. It turned out that at Austria’s universities and also at the so called “Fachhochschulen” no dedicated master course for barrier-free planning exists and even worse, no dedicated lectures for barrier-free planning are offered nationwide.

Based on the findings of the afore mentioned studies, IVV made the decision to offer an explicit lecture for barrier-free planning of public space open for students of the civil engineering, architecture and land-use planning faculties. The first lecture took place in the winter semester 2012/2013 and since then, it has been repeated every year. In the starting year about 20 students took the opportunity to learn about planning principles for barrier-free design [11]. The lecture’s contents are:

- existing national and international norms and guidelines dealing with barrier-free design of public place;
- discussion with international well known experts on barrier-free public transport station building designs;
- the application of the MofA-method (developed in Vienna) [12] to assess the barrier-freeness of public space and public transport station buildings.

The lecture seems to have become a success story because in the second year we had to limit the number of students to 50 persons due to capacity restraint reasons.

Summarising it can be said that universal design and design for mobility impaired people groups is becoming more and more important, not only in Austria but also worldwide. An aging population combined with climate change and scarceness of non-renewable resources will lead to a significant change of our future ways of living and mobility patterns. And our future planners will need to have the skills to design the built environment so that all members of the society can fulfill their mobility needs. With our lecture “barrier-free planning for the public space” we help these planners to gain these necessary skills.

### 3.4 Lecture series “Cycling in the city”

The third and youngest lecture with a strong ethics background at IVV is the lecture series “Cycling in the city”, where on 13 to 15 evenings experts from the most diverse disciplines concerned with cycling provide the “other field’s point of view”. This lecture is open to students of all fields, but a numerous general audience attends too. Established in the year 2013, which was proclaimed as the year of cycling by the City of Vienna, the lecture goes in the second season this year. And we managed to win over new and international lecturers, providing

engineering students with new perspectives from disciplines revolving around cycling. Urban planners, transport engineers, historians, sociologists, physicians, psychologists, lawyers, designers, philosophers, mechanical engineers, marketing and advocacy professionals and public administrators stimulate the discovery of new facets of urban cycling.

The first season proved to be more popular among students and general audience than ever expected. On average 255 students (min: 185, max: 287) attended the lectures (see Figure 5), so that the talks had to be live streamed to a second lecture room to meet the demand.



Figure 5 Overcrowded lecture room at the “Cycling in the city“ lecture“. Photos: Brezina/Schumich

## 4 Conclusion

Even though there’s hardly any tradition in ethics education to be found at universities of technology, the success of IVV’s lectures shows that students are highly interested in adding ethical perspectives to their mental toolboxes where otherwise purely engineering tools would dominate. We therefore strongly recommend that ethics related courses are provided at departments with technology focused studies at other universities – especially where transport engineers are educated.

## References

- [1] Dries, C.: Technik als Subjekt der Geschichte? Technik- und Gesellschaftsphilosophie bei Günther Anders. Darstellung und Kritik., in: Philosophische Fakultät, Albert-Ludwigs-Universität, pp. 132, 2004.
- [2] Chaisson, M.: Cosmic evolution – The rise of complexity in nature, Harvard University Press, 2001.
- [3] Knoflacher, H.: Evolution – Ethik – Technik (Chapter), Ethik und Technik, H. Knoflacher, et al., Editors, Lit-Verlag: Wien, pp. 35-55, 2009.
- [4] Neirynek, J.: Der göttliche Ingenieur. Die Evolution der Technik, Expert-Verlag GmbH, 2001.
- [5] Bailer-Jones, D.M.: Scientists’ Thoughts on Scientific Models, Perspectives on Science, 10 10(3), pp. 275-301, 2002.
- [6] Kant, I.: Grounding for the Metaphysics of Morals – with: On a Supposed Right to Lie because of Philanthropic Concerns, 3rd (1993) ed, Hackett Publishing Company, Inc., 1785.
- [7] Schulze, S.: Die Etablierung der Bioethik, Philopedia. <http://www.uni-potsdam.de/ethik-online/index.php/24-teilbereiche/bereichsethiken/bioethik>. Universität Potsdam, 10.02.2014.
- [8] Graf, W., Meschik, M., Meth, D., Neumann, A., Sammer, G., Unbehaun, W., Millonig, A., Schechtner, A., Aleksa, M., Maurer, P., Saleh, P., Stütz, R., Dangschat, J.S. & Pfaffenbichler, P.C.: ÉGALITÉ – Ein gleichberechtigter Alltag im telematikgestützten Verkehrsgeschehen. 2006

- [9] Sammer, G., Uhlmann, T., Unbehaun, W., Millonig, A., Mandl, B., Dangschat, J. & Mayr, R.: Identification of Mobility-Impaired Persons and Analysis of Their Travel Behavior and Needs, *Transportation Research Record: Journal of the Transportation Research Board*, 2320 2320, pp. 46-54, 2012.
- [10] Schopf, J.M., Haller, R., Lemmerer, H. & Mayerthaler, A.: Aus- und Weiterbildung im Bereich der barrierefreien Mobilität. Beiträge zu einer ökologisch und sozial verträglichen Verkehrsplanung, ed. H. Zukal, Vol. 1/2011, Institut für Verkehrswissenschaften – Forschungsbereich für Verkehrsplanung und Verkehrstechnik, 2011.
- [11] Emberger, G., König, I., Krpata, R., Rollinger, W. & Grundner, M.: Public transport for (disabled) people – the Vienna experience, 13th World Conference on Transport Research (WCTR), Rio de Janeiro, pp. 20 (Paper nr. 2913), 2013.
- [12] FFG: MofA – Mobilität für alle – mobility for all. <http://www2.ffg.at/verkehr/projekte.php?id=595&lang=en&browse=programm>. FFG