

Key factors to become successful road safety auditor

Cite as: AIP Conference Proceedings **2227**, 030001 (2020); <https://doi.org/10.1063/5.0000920>
Published Online: 07 May 2020

Ni Luh Putu Shinta Eka Setyarini, and Leksmono Suryo Putranto



View Online



Export Citation

ARTICLES YOU MAY BE INTERESTED IN

[Improved design of multi-axis radiation heat transfer measurement apparatus for research and educational purposes](#)

AIP Conference Proceedings **2227**, 020004 (2020); <https://doi.org/10.1063/5.0003090>

[Determinant variables that affect severity of pedestrian accidents in the city of Magelang](#)

AIP Conference Proceedings **2227**, 030008 (2020); <https://doi.org/10.1063/5.0001061>

[Understanding the behavior of elementary student's school travel mode choice based on active transportation](#)

AIP Conference Proceedings **2227**, 030002 (2020); <https://doi.org/10.1063/5.0001066>

Lock-in Amplifiers
up to 600 MHz



Key Factors to Become Successful Road Safety Auditor

Ni Luh Putu Shinta Eka Setyarini^{1, a)} and Leksmono Suryo Putranto^{1, b)}

¹*Civil Engineering Department, Tarumanagara University, Jl. Let.Jen.S.Parman No.1, Jakarta 11440, Indonesia*

^{a)}niluhs@ft.untar.ac.id

^{b)}leksmonop@ft.untar.ac.id

Abstract. The rapid increase of the number of motorized vehicles, increase exposure to more accidents both in terms of the number and the severity. The road safety audit (RSA) is one of the measures to overcome this problem. An RSA is a form of official test of a road section (along its stages of construction) conducted independently by a trusted auditor who is capable to assess the potential accident. To conduct the road safety audit comprehensively, systematically and independently, it is required to recruit auditors who are capable to carry on road and street furniture design and construction based on a specified standard. At present, there are no guidelines regarding recruitment and training for road safety auditors. This paper is intended to develop such guidelines. Hypothetically to be successful, the road safety auditors not only need to be intelligent but also got suitable personalities to undertake road safety audit tasks.

INTRODUCTION

In Indonesia, according to data from [1], in IRSMS (Integrated Road Safety Management System) number of accidents 105,374 in 2016, increased 5.26% from 100,106 in 2013. Fatality 26,100 in 2016, decreased 1.20% from 26,416 in 2013. Most accidents involve motorcycles, i.e. 72% in 2013 and 74% in 2016. Fatality Index per 10 thousand vehicles 2.02 (2016), decreased 21.8% from 2.58 (2013). Fatality indicator per 100 thousand population 10.011 (2016), decreased 5.71% from 10.62% (2013). Case Fatality Rate 0.245 (2016), decreased 7% from 0.264 (2013). Victim Fatality Ratio 0.152 (2016), decreased 4.65% from 0.160 (2013). Although most of the accident indicators were decreasing between 2013 and 2016, we understand that road safety condition in Indonesia is still far from satisfactory. Almost 92% of accidents were due to the human factor, 5% due to the vehicle factor and only 3% due to the road [2]. The interaction between the human and the road contributes to 35% of accidents in the highway [3] To decrease the deficiency of road infrastructure, there were 3 important aspects in a safer road, i.e. forgiving road environment, self-explaining road, self-regulating road [4-6]. One of the activities was RSA.

RSA is a form of formal test of an existing/ future/ under construction road section conducted independently by a trusted auditor who is capable to assess the potential accident. RSA activities are intensively conducted, not limited to activities funded by national was budget but also activities funded by a foreign grant or soft loan (mainly from Australia) as one of the efforts to decrease fatality index per 10,000 vehicles by 50% from 2016 to 2020 as targeted in National Road Safety General Plan 2011-2035 [7].

One of the requirements of good quality RSA is the availability of road safety (RS), qualified auditors. Vardaki et al [8] conducted a very comprehensive survey directed to road safety experts in 10 countries regarding RSA training to develop a training course/ education material for the candidate of RS auditors in Greece. However, very little attention was given to the recruitment process of road auditor candidates. Our present paper will discuss the proposed method to assess suitable candidates to be provided with further training to be able to conduct road safety auditing tasks. This will not only be covering the intellectual parts of the candidates but also covering the psychological parts of the candidates. Therefore it will not only cover road design and construction knowledge skills but also cover personality assessments.

LITERATURE REVIEW

Vardaki et al [8], as stated in the previous section conducted survey regarding RSA in 10 countries, mainly in Europe i.e. Australia, Sweden (SE), the Czech Republic (CZ), Hungary (HU), Slovenia (SI), Portugal (PT), Italy (IT), Switzerland, the Netherlands (NL) and Germany (DE). The observation covered the existence and use of RSA procedure, execution of RSA, preliminary training and certification of RS auditors, RSA training course in surveyed countries and expected competence of junior and senior road safety auditors. Table 1 summarizes the main themes taught in the RSA course in the participated countries.

TABLE 1. Main themes included in the RSA course in surveyed European countries.

| | DE | NL | IT | PT | SI | HU | CZ | SE |
|----------------------|----|----|----|----|----|----|----|----|
| RSA stages | x | x | x | x | x | x | x | x |
| Safety management | x | x | x | x | x | x | x | x |
| Human factors | x | x | | | x | x | x | X |
| Safe system | | x | | x | x | x | x | x |
| Geometric design | x | | x | | | x | x | |
| Accident preventions | x | | x | | x | x | x | x |

According to Vardaki et al [8], the assessment to the RS auditor candidates will be firstly related to the higher education attained and experience. Their competence to conduct RSA should also be observed. The required technical ability per topic and the detailed test stages were decided by academia and practitioners and summarized in the test guidelines. To be able to pass the test, they should correctly answer enough amount of exam items, showing a performance beyond the minimum level of competence in certain topics. The exam items of the theoretical test will assess the gained competence and review them concerning their learning results. They include overall topics but their proportion to the overall score will show the significance of the quantified competences as summarized by the test guidelines.

According to Vardaki et al [8], the minimum competences to carry out RSAs in the observed European countries are:

- Civil/ traffic engineers or graduated from engineering/ natural sciences higher education (Sweden) who can carry out RS and design. In Portugal, RS auditors should be formally registered.
- Previous works especially in geometric design, RS and crash evaluation. Generally, it should be at least 5 years, except in certain countries it could be more (e.g. Slovenia) or less (e.g. Portugal).
- Pass the exam following the RSA course.

Qualifications for senior road safety auditor should off course beyond the above list with additional expertise, e.g. more years of RS fields have joined in 2 RSAs or more and have been participating in a refresher training endorsed by the related government bodies.

RSA must be carried out by a people or group of people with sufficient skills in RS engineering rules and practices, crash investigation and avoidance, traffic engineering and road design. Moreover, individuals with knowledge and skill in traffic law prosecution, maintenance, and human factors can be included in the team if necessary at distinctive RSA phases. Human factor knowledge and skill might be beneficial to an RSA by p understanding of the interaction between road user behaviour with the road environment [9-10].

According to Ram [11], a road safety audit will be successful if:

- Supported by a good team, i.e. a team that can work together to comprehensively overcome road safety problem at every stage of road development (transport planning, traffic engineering, road construction plan, road construction plan, and project management).
- Intensively interact and coordinate with the client in meetings from the start to the end of road safety audit phases until an agreement of all related stakeholders is reached.
- There should be a consideration regarding different characteristics of a driver in dealing with different roads and vehicles
- Manage and ensure that the team is not influenced by the view of road management.
- Be able to provide an effective method to complete road safety audit tasks with minimum time, personnel and costs.

Therefore, according to Ram [11], an auditor should possess relevant knowledge regarding the audit object which can be reflected by good academic grade related to the road problem to be audited, got experience and skill to conduct the audit and be able to suggest effective method to provide accurate, independent and responsible audit result without affected by the owner, the design consultant, the supervision consultant and the contractors. To be able to reach the expected objective then every stakeholder should comply with their obligations. Tasks and obligations of the stakeholders involved in RSA are:

- The designer should design road geometric, road construction and pavement structure according to the recommendation provided by the auditor as expected in the road safety audit.
- The owner must be neutral and open mind to receive the audit result from the auditor. If there is any dispute between designer and auditor on the audit result, the owner should be able to settle the dispute and choose the best option for the sake of road safety.
- The auditor must provide accurate and prudent audit and consider all environment in audited road segments to produce a feasible and responsible report.

FACTORS AFFECTING ROAD SAFETY AUDITOR SUCCESS

There are several factors hypothetically affecting road safety auditor success. Firstly is the suitability of the educational background mainly in higher education level (at least at the bachelor level). Road safety requires knowledge and experience on transport planning, traffic engineering, traffic safety, road geometric design, road pavement design, etc which are thought to undergraduate students in Civil Engineering.

Secondly, road safety should be intelligent enough. One indicator that can be used to assess one's intelligence is by looking at their intelligence quotient (IQ). According to Oommen [12], IQ is affected by genetic factors and environmental factors. Evidence of the influence of genetic factor on IQ was that twin observations find that identical twins (came from a single fertilized split egg) IQ's are more identical than those of fraternal twins (developed from 2 distinct eggs fertilized by 2 distinct sperm cells) [13]. Another evidence was siblings raised together in the same environment have IQ's that are more identical than those of adopted children reared together in the same home [14]. Meanwhile, proof of the influence of environmental factors on IQ was Identical twins raised in distinct locations got IQ's that are less identical than identical twins raised in the same home [15]. However, in this particular study, instead of IQ, we will use Grade Point Average (GPA) of the final year of Civil Engineering students as GPA is a more direct and relevant indicator. Moreover, according to Kumar [16] IQ alone can explain the variance in GPA for only about 8.6% of the cases.

Instead of only assessing intelligence, we will also assess personality, whether someone is suitable for road safety auditing tasks. Kemboi et al [17] observed 399 participants of students in Kenya. The process of selecting future profession begins when the students select courses that would direct them to a certain career. Prior to the last year in high school, the students select the higher education classes they would take in the future. Following the issuance of final school year test decisions, they can change their selections. On enrolment to the University, they are given another chance to choose inter-department revision. As a consequence, there is a likelihood that students are in a job that is not suitable for their character types. Results showed that there was a correlation between character types and profession selection. The research revealed as well that most of them (73.3%) are happy with their university study. According to Ongore [18], there was an association between the character and profession commitment of the higher education staff. An observation was applied to a higher education academic and administrative staffs. Relevant information was retrieved from more than a hundred staffs. It was found that there was a significant association between character and professional commitment. Extroverted disposition, amiability, faithfulness, and broad-mindedness to experience were positively associated but nervousness was negatively correlated to tangible, passionate and cognitive engagement. Openness to Experience was the significant prognosticator of tangible, passionate and cognitive engagement. Amiability was the prognosticator of passionate and cognitive engagement. As a higher-order factor profession commitment was associated with big 5 factors. Broadmindedness to experience and amiability were the only significant prognosticator of professional commitment. The results of this research imply that the 5-factor model is useful for observing the characteristics of professional involvement.

Delucchi [19] utilized a pretest-posttest plan to survey student learning in undergraduate statistics. Information was revealed from almost two hundred students enrolled in a social statistics class taught 7 years by the same lecturer. The pretest-posttest mechanism indicates statistically meaningful additional knowledge. The findings show that pretests can describe students' previous knowledge at the start of the class, while posttests describe learning when the course

was completed. Therefore, pretest-posttest additional knowledge was affected by the content and delivery of the social statistics class than by students' statistical ability or test-taking skills before the course.

PROPOSED METHOD RECRUIT SUCCESSFUL ROAD SAFETY AUDITOR

The followings are five phases which will be developed in further research to recruit successful road safety auditor:

- **Phase 1: Recruitment of participants.** Participants will be recruited from final year civil engineering undergraduate student who has already passed Introduction to Transport Planning, Traffic Engineering, Road Pavement Design, Road Geometric Design and Drainage Design with minimum grade of B. To assess the effect of GPA, 50% of participants will be from group of students with GPA less than 3.00 (on 0.00 to 4.00 scale) and another 50% of participants will be from group of students with GPA at least 3.00.
- **Phase 2: Psychotests.** The participant's personality will be assessed in psycho-tests conducted by a professional agency who conducts various psychological testing for various purposes. We will inform the agency regarding the expected personality of a successful road safety auditor, e.g. accurate, careful, comply with standards, able to work in a team, etc.
- **Phase 3: Pre-test of road safety auditing tasks.** The participants should conduct road safety auditing tasks relying on their knowledge which have been taught in the class during their study at the university so far. This is to assess, whether short term training will improve the participant's ability in road safety auditing. Their achievement will be evaluated based on the road safety audit result which has been conducted by senior road safety auditor beforehand.
- **Phase 4: Training.** The participants should attend short term training with a 100% attendance rate. The trainers will be senior road safety auditors, senior transport planners, senior, traffic engineer., senior road geometric designers, senior road pavement engineers, and senior road drainage engineers. The training will be started with sessions that are developed to refresh their knowledge they gained in the university. Further, they will receive possibly new knowledge regarding traffic/ transport safety, the method to identify hazards, a method to overcome hazards and off-course the process of road safety audit including, required drawings and reports. During the training, participants will be taught with illustrations of road safety audit applications in every design step, as well as on actual roads using real illustrations. In the practical part, the training will involve case studies and site visit(s) (or at least video recording of the site conditions), where the participants will have the possibility to get real experience and apply in the real life what they have been trained in the class.
- **Phase 5: Post-test of road safety auditing tasks.** After completing the attendance of the training, the participants will be asked to conduct another road safety audit for the same cases which has been audited in the pretest phase. Therefore the impact of short term training can be assessed.

From the result of those five phases, we could then conduct a comprehensive analysis regarding the following matters:

- To evaluate suitable training sessions and materials which be able to support the development skills and knowledge of new road safety auditors.
- To evaluate the effectiveness of the participant recruitment criterion, psycho-tests, pre-test, and post-test.
- To evaluate different road safety audit results between the participants and senior road safety auditors.
- To evaluate whether GPA affects the success of road safety auditor candidates.
- To evaluate whether gender affects the success of road safety auditor candidates.
- To recommend to the relevant the stakeholders regarding the method of recruitment road safety auditor, along with the required training sessions and materials
- Etc.

CONCLUSIONS AND RECOMMENDATIONS

From the above discussions it can be concluded that to improve road safety, it is required to conduct a road safety audit including in Indonesia. Therefore, massive efforts should be done to audit the whole road network in Indonesia. One of the requirements if the availability of a sufficient number of competent road safety auditors. This paper

provides a proposed method to recruit successful road safety auditors. It will consist of five phases, i.e. recruitment of participants, psycho-tests, pre-test of road auditing tasks, training and post-test of road safety auditing tasks.

Considering the potential benefit of road safety improvement through professional road safety audit, it is recommended that Indonesia immediately conducted road safety audits in a more comprehensive network throughout Indonesia.

REFERENCES

1. Indonesian National Police. *Integrated Road Safety Management System* (2016).
2. Mulyono, A.T., Berlian K., Gunawan, H.E. Audit Keselamatan Infrastruktur Jalan (Studi Kasus Jalan Nasional KM 78-KM79 Jalur Pantura Jawa, Kabupaten Batang). *Jurnal Teoritis dan Terapan Bidang Rekayasa Sipil ITB* **16(3)** (2009).
3. Treat, J.R. Tumbas, N.S. McDonald, S.T. Shinar, R.D. Hume, R.E. Mayer, R.L. Stansifer, N.J. Castellan. Tri-level study of the causes of traffic accidents (No. DOT-HS-034-535-77-TAC(1)). Bloomington, IN Institute for Research in Public Safety – Indiana University
4. Nitsche, P., Stutz, R., Saleh P., and Maurer, P. *Procedia - Social and Behavioral Sciences* **48** 1022–1032 (2012).
5. Ryan, R., Hosking, J., Wilkinson-Meyers, and Ameratunga, S. *Journal of Pediatrics and Child Health* **54**, 365-369 (2018).
6. Taylor, J. *Self-Regulating Streets*. Available at <https://www.slideshare.net/JasonTaylor11/self-regulating-streets>. March (2013).
7. _____. *National Road Safety General Plan (2011-2035)* (National Planning Agency, Jakarta, 2010).
8. Vardaki, S., Bekiaris, E. and Kanellaidis, G. *Congent Engineering* **5** 1-19 (2018).
9. Vardaki, S., Papadimitriou, F., and Kopelias, P. *European Transport Research Review* **6(4)**, 387–395 (2014).
10. University of New Brunswick Transportation Group. *Road Safety Audit Guidelines*. New Brunswick, Canada. (1999). Available at <http://www.unb.ca/research/transportation-group/resources/pdf/rsa-guidelines.pdf>.
11. Ram, S.A. *An industry view on road safety auditing* in Proceedings of the 2013 Australasian Road Safety Research, Policing & Education Conference 28th – 30th August, Brisbane, Queensland.
12. Oommen, A. Factors Influencing Intelligence Quotient. *Journal of Neurology & Stroke* **1(4)**, 1-5 (2014).
13. Kovas, Y., Haworth C.M., Dale P.S., Plomin R. The genetic and environmental origins of learning abilities and disabilities in the early school. *Monogr Soc Res Child Dev* **72(3)**: 1-144 (2007).
14. Bouchard TJ. The Wilson Effect: the increase in heritability of IQ with age. *Twin Res Hum Genet* **16(5)**, 923-930 (2103).
15. Weinberg RA). Intelligence and IQ: Landmark issues and great debates. *American Psychologist* **44(2)**, 98-104 (1989).
16. Kumar, R. A Correlational Study of MATScore, IQ, and GPA of MBA students. *The IUP Journal of Management Research* **10(1)**, (2011).
17. Kemboi, R.J.K., Kindiki, N., Misigo, B. Relationship between Personality Types and Career Choices of Undergraduate Students: A Case of Moi University, Kenya. *Journal of Education and Practice* **7(3)** (2016).
18. Ongore, O. A Study Of Relationship Between Personality Traits and Job Engagement. *Procedia - Social and Behavioral Sciences* **141**, 1315 – 1319 (2014).
19. Delucchi, M. Measuring student learning in social statistics. *Teaching Sociology* **42(3)**, 231–239 (2014).