Bachelor Thesis Review

Determination of fouling level change in the railway ballast layer during machine cleaning process by measuring changes of relative permittivity using GPR technology

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The submitted bachelor thesis deals with the determination of the fouling level of the railway ballast layer using GPR technology. This subject is of certain interest in the international scientific community and relevant new findings could have a strong positive impact on the effectiveness and efficiency of ballast and railways maintenance. The time-domain GPR method is used in order to obtain the relative dielectric permittivity values in several stages of track lifecycle, primarily before and after the mechanical cleaning process. The field surveys have been rigorously designed and carried out. Repeated GPR measurements of the ballast layer were performed on selected sections of the railway line. After data processing, changes in relative dielectric permittivity values were determined on selected sections between each survey steps. In conclusion, the relation of the fouling level with the relative dielectric permittivity values of railway ballast is stated.

The author set the partial goals and selected the appropriate method to achieve them. The methodology is very well organized, and the work represents one of the most commonly used tools to evaluate the ballast layer fouling. The structure of the thesis is appropriately designed and contains all parts of the research work. The author has elaborated very extensive literature research, where she has clearly described the issue of the selected topic using up-to-date references. Actually, the candidate used 134 references which is quite a higher number than the one which might be expected in a bachelor thesis. Also, practical measurement represents a great deal of work. I particularly appreciate the combined use of antennas of different frequencies and measurements with different antenna orientations.

I agree, with a minor reservation, with all the conclusions the author presents. The language level of work is very high with a minimum of typing and grammatical errors. I highly appreciate and consider it very beneficial to already have a presentation of the work at an international conference, which certainly provided the author with appropriate feedback for the completion of the thesis.

Questions and recommendations to the submitted bachelor thesis defense:

- Could you describe in more detail the machine cleaning process and how this process affects the relative dielectric permittivity value of the ballast material?
- The level of success of GPR data evaluation depends highly on other information on the subject of the measurement. What kind of knowledge have you gained during the visual observation of the track and how you used it to interpret GPR data and how did you correlate those data?

- The scattering method would present an additional contribution to the used data evaluation methodology- Could you describe this method and explain why it was not used within the scope of the bachelor work?

I found the goals and conclusions of the submitted thesis very topical and robust in terms of railway infrastructure diagnostics. The thesis represents a valuable contribution to the research of the use of GPR for railway diagnostics. Due to the above-mentioned facts, the bachelor thesis can be evaluated as very successful. The submitted thesis completely fulfills the thesis assignment. Finally, I evaluate the bachelor thesis as excellent with a mark **A** and strongly recommend the thesis to be defended.

Eskisehir, 27. 5. 2019 Salih Serkan ARTAGAN