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PhD Thesis Review

Candidate: Salih Serkan Artagan

PhD Thesis: Use of Ground Penetrating Radar in Condition Assessment of Railway Ballast

Reviewer: Prof. Andrea Benedetto PhD, Director Dept. Engineering, University Roma Tre, Italy

Salih Serkan Artagan has investigated during his PhD study the state of the art and novel perspectives of the application of Ground Penetrating Radar technology to railway ballast inspection. This topic is of certain interest in the international scientific community and relevant advancements could have a strong positive impact on effectiveness and efficiency of ballast and railways maintenance.

The dissertation focuses on the description of several experimental setups that have been developed by the candidate during the period of study. The experiments have been carried out from laboratory level to the real scale, consolidating the first evidences toward novel significant results.

The candidate has worked on these experiments in cooperation with different international research teams.

The experiments have been rigorously designed and accurately carried out. Procedures and tools have been selected in order to guarantee the experiments repeatability and reliability as possible. The effectiveness of all the efforts spent in this way are confirmed by the robustness of the results obtained. At this regard it is very impressive the coherence of the Relative Dielectric Permittivity values estimated from signal processing under different experimental conditions (water content, fouling, type of fouling, etc.).

The candidate has tested different equipment both in terms of GPR frequency (from relative low frequency 400MHz, to high frequency 2000 MHz), GPR antenna (ground and air coupled, as well as depowered US antenna), antenna set ups (orientation) and in terms of different manufacturers (IDS, GSSI). Following this hard job, the candidate has acquired a relevant experience and knowhow on this non destructive technology.

The methodological approach under the research progressing is very appreciable and absolutely correct from a scientific point of view. Any calibration at the laboratory scale has been adequately carried out and the needed validation at the real scale has been well performed.

The work is up-to-date and the list of the main references demonstrates that the candidate has considered all the scientific contributions at the state of the art.

The work is well organized. Probably it could have been more readable if the discussions of the outcomes would have directly followed the relative chapter and were not put all at the end of the dissertation. However the thesis is well written and the technical language is always appropriate.

The candidate declares the objectives of the work at the beginning of the thesis. They are absolutely in line with the current stage of the international research. The inspection of railway ballast and the evaluation of fouling by non invasive and effective methods is certainly a challenging topic of the research community. The candidate has studied the presence of fine material and sand inside ballast at different level of contamination, as well as different moisture content. The results obtained as values of Relative Dielectric Constant increasing with the moisture content are really impressive under the point of view of the coherence and stability.

In general the contribution of the work is perfectly in line with the international research and the objectives have been well fulfilled.

The work gives new findings in relation to the prediction of fouling by the evaluation of Relative Dielectric Permittivity by GPR based inspection, that seems to be very robust and coherent.

However I believe that a minor point of weakness is the lack of any theoretical interpretation. This is the consequence of the approach to the research that is very experimental based. The outcomes would have been improved more by a theoretical analysis and modelling that could confirm the obtained results. In any case it can be considered as the line for future developing.

The expected impact at the professional level and for practitioners activities is promising and it could be really very high and impressive.

The candidate during the PhD study period has published an adequate number of papers in relevant international journals and conferences, demonstrating the creativity of his contribution to the research in the field.

Finally I evaluate the dissertation as very good and I deeply support the candidate to be awarded with PhD.

Rome, 21st July 2018

Andrea Benedetto

