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Editorial: Best Practices on Advanced Condition Monitoring of Rail Infrastructure Systems

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Editorial on the Research Topic

Best Practices on Advanced Condition Monitoring of Rail Infrastructure Systems

COVID-19 has just proven that transportation systems are not immunized and are vulnerable. The coronavirus causes severe consequences including step changes in travel behaviors, risk perception and avoidance, transportation operations, network policies, and real capabilities to track, monitor, and contain the virus through social distancing, quarantine, and isolation within the transport networks. These too affect the standard and practice for managing infrastructure systems. We can no longer consider or treat resilience simply for better responses to environmental hazards as a business as usual. Societal, economic, and engineering resilience has become more underlyingly critical than ever. In fact, the virus underpins the necessity to manage temporal and spatial risks through advanced condition monitoring across transportation networks, modalities, and systems. Such needs have been the key theme in this special Research Topic that is emphasized on rail infrastructure systems designed to cope with multi hazards and extreme events.

This special topic is particularly interested in understanding the role of advanced condition monitoring for transportation assets and operations and the connections between multi hazards, infrastructure capacity, and real-time evaluation of measures to monitor the vulnerability, risks, uncertainties, resilience, and robustness of rail infrastructure systems and networks. These capabilities are fundamentally the technological enablers to enhance social and economic connections, and communities can quickly take up the opportunities offered by increased mobility (Kaewunruen et al., 2016). In other words, the technological enablers are the precursor to (i) promptly and effectively respond to any crisis; (ii) assure the quality of everyday life; and (iii) leave no one behind.

This Research Topic presents a set of novel findings stemming from the H2020 Marie Skłodowska-Curie Actions (MSCA)'s RISEN Project (Rail Infrastructure Systems Engineering Network). This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 691135 (www.risen2rail.eu). The collaborative researches are aligned with United Nation's Sustainable Development Goals (SDGs) as well as European Directive's Plan S for Open Science. This Research Topic brings together the research and innovation associated with rail infrastructure systems issues related to advanced condition monitoring. Taken together, these following papers help to build knowledge for actions that will strengthen response and recovery from multi hazards and extreme events (including COVID-19) as well as other hazards and threats to transportation systems and the communities they support.

Despite the fact that rail system demands active interaction between inspection, operation, and maintenance, never been transparent nor fully open have the flows and sharing of critical data among stakeholders and the public. This Research Topic thus focuses on the advanced condition

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monitoring, which can play an important role in providing open and novel methodological approaches optimizing reliability, availability, and asset management.

Along this line, De Melo et al. reviewed systemically and comprehensively state-of-the-art methods to monitor and evaluate the deterioration of a railway track and its components in operational settings. More than 100 methods related to track deterioration monitoring and inspections have been highlighted and compared to enable new technological gaps and practical insights. The insights provide better understanding into the advantages and disadvantages of each method in practice, which will help engineers and managers manage rail infrastructure systems during disruptions and crises.

Sauni et al. developed a novel technique to diagnose the root causes of railway track geometry deterioration in the underlying track structures. Monitoring and predicting the degration are important as is investigating the root causes contributing to the deterioration. Without knowing the causes, assigned remediation and recovery actions might not result in a long-lasting correction. A new association rule data mining method, General Unary Hypotheses Automaton (GUHA), has been adopted. This method has been proven to be a suitable method for investigating the root causes of track geometry deterioration from comprehensive railway track structure data.

Reis and Almeida shared a new model for evaluation of increasingly significant freight transport. More specifically, the focus is placed on intermodal transport, which has arisen as a desirable alternative to long-haul road transport, as it creates opportunities for cost reduction and to decrease both polluting emissions and road congestion. As a case study, the capacity evaluation of the Freight Village of Turin has been demonstrated. This has been motivated by future changes in traffic demand, related with the neighboring Port of Savona-Vado. The model has highlighted inefficiencies of both rail and handling processes, as well as identified parameters influencing business resilience of intermodal freights.

Rosell et al. demonstrated the application, on a real scale, of an inertial system capable of determining track irregularities and their position through the recording of vertical accelerations. This application supports a maintenance work programme to comply with safety and comfort limits required by railway legislation. This application system has been implemented on a train on a regular service on the San Antonio-Los Lirios line (Chile) to validate correct operation. It has been proven that the track geometry parameters obtained from this novel application are in a very good agreement with the traditional measurement method.

Li et al. highlighted the effects of time-dependent phenomena on railway prestressed concrete sleepers. The authors investigate and compare the influences of creep and shrinkage on railway prestressed concrete sleepers. The comparison between prediction models underpinned by European Standard Eurocode 2, American Standard ACI, and Australian Standard AS3600-2009 enables the new practical insight into the time-dependent performance of railway concrete sleepers, which can be used in railway constructions in diverse continents. The outcome of this study will help rail track engineers to better design and maintain railway infrastructure, improving asset management efficacy.

These papers provide exciting new insights and state-of-the-art knowledge for actions toward smarter and more resilient railway systems. The topic editors are grateful to the review editors and associated editors. Finally, we encourage everyone to take part in the prestigious TRA VISIONS Competitions. The prestigious TRA Visions Competitions run every 2 years and the next one will be in 2022 (European Union, 2020). The awards recognise and celebrate the very best and brightest researchers who are or have recently been contributing to excellence in transport research and development in road, rail, waterborne, airborne, and cross modality.

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All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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