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Automation and Optimising of Sensor Technologies for the Dynamic Comprehension of Infrastructure Objects

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Summary

The exact and complete comprehension and immediate documentation of railway corridors is a significant basis of safety and efficient management of infrastructure plants. This entails high demands on quality particularly of geometric exactitude and currentness. To provide the required bases, primarily manual geodesic test sequences have been used so far. This work requires cost-intensive safety measures and has a temporary impact upon the operative use of the relevant track sections.

On the premise of an “integrative survey of railway infrastructure plants,” ÖBB-Infrastruktur AG, Stab Forschung & Entwicklung (Research & Development Section), has called into life innovative projects since 2007, whose goal is to support rendering an overall image of the infrastructure of a relevant area with a high degree of completeness. The projects integrate sensor technologies for data collection, spatial data bases (Oracle Spatial), and 3D visualisation tools, which correspond, as far as possible, to the state of the art of science and technology, comprised in practically relevant workflows.

The objective of a project by ÖBB-Infrastruktur AG, Stab Forschung & Entwicklung, is to provide geometric object information by means of imaging systems gained from a sensor vehicle that can be lined up with railroad traffic at a corresponding speed without disturbing the course of operations.

In this concept, the positioning and direction of the vehicle, including the sensors connected, as well as the relative localisation of the points of interest, are comprised in one process for data collection, synchronising, and pre-processing. In a second, subsequent process, evaluations are processed, including comprehensive quality control, and a spatial context is established between the results and the existing digital inventory records.

The set-up of the prototype of this modularly structured sensor system was completed and validated in the course of several measurement runs. Currently, the evaluation of the measured data is at the focus of our activities.

1 Initial Situation

ÖBB-Infrastruktur AG is responsible for safe and reliable business operation, customer-oriented line and railway station management along the ÖBB railway network, as well as future-oriented planning, construction and financing of infrastructure. ÖBB-Infrastruktur AG owns and operates the entire railway infrastructure of the Austrian Railways. This amounts approximately to a current 4,800 kilometres of track, including the pertinent infrastructure, such as switches (sets of points), signals, masts, overhead wiring, etc.

The inspection, maintenance and interference suppression at and around the railway track network are core tasks of the enterprise. In addition, ÖBB-Infrastruktur AG is the key contact for non-discriminatory network access of all railway transport enterprises in Austria. The Research and Development Section is the strategic research element of ÖBB-Infrastruktur AG. By way of networking with industries, business and universities, innovations, new technologies and solutions are being developed and tested for the railway system. Both on a national and international level, research projects are being carried out, often co-financed by national and international subsidisers. “Customers” of R&D are various different technical areas of ÖBB-Infrastruktur AG, in need of solutions for their daily business on account of changes in demands, legal framework, or technologies.

Core fields are the wheel-track system, including noise testing, geo-data-collection and processing, track and track position, construction technique and technologies, to name only a few.

1.1 Requirements

The 175th anniversary of railways in Austria at the end of 2012 rendered a clear image of the vast demands upon the Austrian Railways as an owner of infrastructure data. Infrastructural status and changes must be comprehensively and precisely recorded and documented over prolonged periods of time. To give an example, bridges and tunnels, with lives of about 50-100 years, versus new construction projects such as Unterinntal or Vienna – St. Pölten. Here, both the age structure and the availability of metadata on quality documentation are very heterogeneous. Traditionally, measurements are made as needed, e.g. at and around construction sites, and documents already existing are brought up to date with regard to the respective area. The expense on works on

tracks, however, is being considered more and more critically, not only in the light of economic considerations but also on account of extensive safety measures required in the track areas. After all, blocking of tracks inevitably causes undesirable delays in train services.

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