NEOBALLAST: seeking for the ballast of the future

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ABSTRACT

During the last decades a lot of research/design/construction/monitoring concerning slab track solutions have been done. In almost each study a comparison with ballasted track[1] appeared as one of the key points leading to interesting conclusions about what should be "the track of the future".

What it seems logical is that the last goal of railways engineers should be to combine the main advantages of the ballasted track and those from the slab track in order to develop an innovative new track system providing the best possible performance. A decade ago the ballast-less track was seen as a far better solution than ballasted track, yet much more expensive, but time and real tests have proved that it is not exactly this way and ballasted track still has big chances for the future.

Thus, ballasted track properties –such as high maintainability at relatively low cost[2], convenient values of elasticity, high drainage capacity, excellent Noise &Vibrations (N&V) behaviour, etc.- should be merged with slab track strengths - low maintenance requirements and hence, high availability, better fixing of geometry, high durability, etc - to obtain the best possible solution.

Furthermore, new challenges have arisen in the time being as high quality ballast - as a natural resource it is - has started to be scarce and not always an available material. As a result, in some specific locations and projects, long transport routes must be done in order to get the right material, which results in an increase of not only cost, but of the environmental burdens associated to track construction.

This occurs in a context where EC policies have increased its strictness in environmental issues, whereas sustainable and durable solutions are each time more encouraged by the EC. In this sense, there has been an increasing awareness of noise and vibration related problems in the last years. For this reason, there should be a migration for the existing situation -*mitigation*- where countermeasures are adopted to comply with the new N&V demands to a new scenario -*prevention*- where the track system is designed to cope with N&V future demands.

Solutions like precast ballast, modified ballast with in-situ polymers[3] or geo-grids[4] have been developed to improve both LCC (Life Cycle Cost) and LCA (Life Cycle Assessment) and performance. Nevertheless, further tests should be carried out to demonstrate that these new solutions are feasible from a technical-economical-environmental point of view.

NEOBALLAST is an innovative project with a focus on developing the “ballast of the future”, as the believe that there is much room for improvement in ballasted track is shared, but at the same time ballasted track still has a long and brilliant future. This enhanced ballast aims to conjoin the advantages of ballasted track –and even improve them-, whilst achieving durability, very low maintenance and other

properties until now only featured by slab track. As an excellent performing ballast, NEOBALLAST will give solution to the scattering of high quality ballast quarries, but at the same time it is designed to improve significantly the N&V behaviour of the whole track system.

The NEOBALLAST Project is currently at the laboratory testing stage. The first stage of the process, which consisted on evaluating the isolated material, has been completed with very favourable results. Currently we are on the second stage of the project, which entails on evaluating the behaviour of the material as a whole. Two types of test typologies have been chosen for this particular stage: one with continuous load and the other one with cyclical loads.

The continuous load tests (Large Size Shear Test) are taking place in the Geotechnical Laboratory of the Technic University of Catalonia, These tests are on their final stages of the process and have yielded very interesting results. Simultaneously, we are beginning **the cyclical load tests**, in combination with the Laboratory of Science and Engineering of the Ground Materials of the University of Cantabria, which are **expected to be completed by early 2015**.

References

[1] CENIT, "Estudio del comportamiento a medio y largo plazo de las estructuras ferroviarios de balasto y placa" Barcelona, España, 2006.
[2] Ubalde Claver, L., "La auscultación y los trabajos de vía en la línea del Ave Madrid – Sevilla: Análisis de la experiencia y deducción de nuevos criterios de mantenimiento" Tesis Doctoral, Universidad Politécnica de Cataluña, Barcelona, España, 2005.
[3] Woodward, P.K., Kennedy J. and Medero G., "Three-Dimensional Track Reinforcement using Polymer Geocomposites" Heriot-Watt University, Riccarton, Edinburgh, UK, 2009.
[4] Fischer, Sz. and Horvat, F., "Superstructure Stabilization of Ballast Bedded Railway Tracks with Geogrids" Szechenyi Istvan University, Hungary, 2011.