Material gain

The importance of high-performance steels for road restraint systems, according to **José F Papí**

A multinational research consortium comprising seven specialist organisations from industry, academia and research (Centro Sviluppo Materiali, Italy; CIDAUT Foundation, Spain; Copro, Belgium; Gonvarri Steel Services, Spain; Luleå University of Technology, Sweden; SSAB, Sweden; Smart Transportation Alliance, United Kingdom) has explored the development of safer and more competitive Road Restraint Systems (RRS) by using High-Performance Steels (HPS). The research project has spanned from 2014 to 2017 under the name HIPEBA ("High-Performance Steel for Safer and more Competitive Safety Barriers") and has been co-funded by the EU's Research Fund for Coal and Steel (RFCS).

The European Union, a world leader in the steel industry, is facing increasingly fierce competition from non-EU producers. Advanced research is essential for European industry to remain competitive, as well as a deeper understanding of the paramount importance of high-performance steel within the everyday needs of the road safety sector.

With the purpose of supporting this leadership, HIPEBA has led a groundbreaking initiative relevant to the maintenance and new construction of EU road infrastructures, as the latest and safest technology must become available to European road users. The project has assessed how HPS can increase RRS containment levels while reducing the industrial production costs of such systems.

HIPEBA's key research objectives have been i) assessing the technical advantages of using enhanced steels in new RRS, basing such analysis on barrier design criteria, manufacturing processes and real-life operation under impact conditions; ii) developing a complete RRS life-cycle cost model bringing better cost-benefit ratios; iii) developing conceptual prototype demonstrators in order to validate the findings and evaluate concept designs; iv) applying computational mechanics (simulation) for parametric studies and assessing their predictive capability; and v) providing input into standardisation activities to allow improvements in RRS certification processes.

HIPEBA has performed a series of material behaviour tests in order to rank different steel grades (S500, S700 and S960 steels) based on tensile, strain and formability stress performance. The tests performed (Hopkinson Bar tests, Nakazima tests, Dynamic tests, Test of bolted unions, Three-point bending tests, Corrosion tests) have demonstrated that i) the S500 steel grade performs slightly better when compared to the S355 and S960 steels; that ii) the S960 steel grade performs worse, mainly due to the lower impact toughness and higher price; and that iii) the S700 steel grade ranks halfway brings a lower resistance to brittle failure and impact toughness during the Charpy Impact Test. This lab research paved the way for successful real scale crash demonstrations, in cooperation with international industrial partners able to manufacture HPS systems.

The crash tests performed during the project cycle demonstrated how, by using HPS, RRS average weight is dramatically reduced by 23-25 percent, while energy absorption capability is increased by 40 percent compared to conventional systems. The HPS developed by the HIPEBA Consortium ensure safe redirection of truck weighting up to 44 tons hitting the barriers at a speed up to 70 km/h. Finally, HPS has the potential to allow a reduction of 8-10 percent in price and ensure life cost reduction of 4-5 percent. These are quite remarkable results to be taken into consideration in current and future research and innovation exercises.

I particularly recommend to watch the end-of-project videoclip available in the homepage of the project's website (www.hipeba.eu). You will not regret it; the crash-test shown there is pretty spectacular.

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