

## HARAMAIN HIGH SPEED RAILWAY



**The Haramain High Speed Rail project is a new high speed rail line in Saudi Arabia, running between the holy cities of Makkah and Medinah, with additional stations at Jeddah and the King Abdullah Economic City. The stations, designed by a joint venture of Fosters and Partners and Buro Happold, have a modular arrangement, with a steel main structure supporting structural FRP roof panels that have panel spans of up to nine metres. In total there is over 160,000 m<sup>2</sup> of FRP panels across the four stations.**

Gurit and Premier Composite Technologies worked closely with the design team during the concept and tender design stages of the roof to develop the concept of using FRP panels in the station roof. The lightweight nature and inherent insulation achieved with advanced FRP sandwich panels, combined with the accuracy obtained by moulding panels using CNC machined tooling and the durability of advanced composites offered significant advantages to the project. The large panel spans made feasible by the use of sandwich construction also enable rapid installation of the roof without requiring any secondary structure, and the modular design of the station meant that there was a large degree of repetition of panels which allowed efficient use of moulds.

Following award of the detailed design and fabrication of the roof of Medinah station to Premier Composites Technologies by main contractor Yapi Markazi, Gurit has carried out the structural analysis and optimisation of the roof panels for this station, which has a surface area of around 28,000 m<sup>2</sup> (300,000 square feet). The weight of the composite is approximately 720 tonnes, which makes the station roof one of the most extensive uses of advanced composites in the architectural industry.

Materials chosen for the laminating of the panels were Ampreg 21FR, a fire retardant epoxy laminating system, Spabond 340LV structural adhesive and G-PET 75 FR LITE, a lightweight, fire retardant, closed cell structural foam core.

Lamination of the panels is now well underway at Premier Composite Technologies premises in female moulds, and a trial installation of part of the roof has been erected and tested. The correlation between the deflections of the full scale test and those predicted by the FE model developed by Gurit engineers was very good, with a difference of less than 2% between the two. Installation of the roof panels will be carried out by Premier Composite Technologies during 2013 once the steel supporting structure erection has been completed in Medinah.