

The Al Haramain railway was opened to the public in 2019. It is a railway system connecting Mecca and Medina in Saudi Arabia and can make the trip in 2 hours and 20 minutes¹. The construction of the line between these two cities is very significant because the route is part of a holy pilgrimage performed by people of the muslim faith. The railway is intended to make the pilgrimage more efficient and is designed to serve up to 20,000 people per hour¹. The stations are made from a tree-like steel structure that supports a flexible vaulted roof. The roof is designed in modular shaded pavilions that take their form from the indigenous architecture.

The roof follows a modular design that was chosen so the stations could be expanded easily as demand increased. Across the four stations, there is over 160,000 meters squared of FRP paneling in the roof. Panels could be repeated, allowing for efficient use of molds and assembly⁵. Panels could be molded using the CNC router and brought on site in pieces and then assembled in a uniform fashion. Ease of fabrication expedited the construction process and allowed the stations to be built consecutively with the railways. Each roof module is made of FRP (Fiber reinforced polymer) and is assembled in a sandwich construction format. This material has high strength and stiffness properties in comparison to its weight, making it strong and lightweight at the same time⁵. This and coupling panels together in sandwich format helps to reduce loads on the steel structure and makes construction/assembly easier⁵. FRP can also be formed into complex shapes easily, spanning up to 30 ft at a time in the Haramain roofs particular geometry.

Each station is designed to be a canopy, protecting the passengers from the sun while also providing adequate ventilation. The light being let into the space is controlled through holes in the roof panels and orientation of the stations in comparison to the sun. Daylight mapping allows the light to illuminate the space while minimizing direct effects on the temperature. All entrances are hidden behind external mashrabiya and deeply set overhanging canopies⁴. The stations are designed to follow felt temperature reduction principles and keep the temperature in the station at 28 degrees celsius. The stations are further kept cool using fans and misting devices².

Stations are designed on a 27 square meter grid of free standing structural trees. Each tree stands at 25 meters, while the trees closer to the platforms stand at 9 meters high³. The trees connect at the top to form the distinctive vaulted ceiling.

Sources:

- 1) <https://www.fosterandpartners.com/projects/haramain-high-speed-rail/>
- 2) <https://www-engineeringvillage-com.ezproxy.lib.utexas.edu/search/doc/abstract.url?SEARCHID=f262ea0207849fab1cf0350968aeba7&DOCINDEX=2&database=2097155&pageType=quickSearch&searchtype=Quick&dedupResultCount=null&format=quickSearch&usageOrigin=recordpage&usageZone=detailedtab&toolsinScopus=Noload>

- 3) <https://www.dezeen.com/2019/06/14/foster-partners-haramain-high-speed-stations-saudi-arabia/>
- 4) <https://www10.aeccafe.com/blogs/arch-showcase/2012/01/14/al-haramain-high-speed-rail-station-s-in-kingdom-of-saudi-arabia-by-foster-partners/>
- 5) <https://www.gurit.com/de-de/News--Media/Media-Releases/Media-Release?newsid=%7B986C04BA-8AC7-4AB9-8A9D-E134151AE3C1%7D>

