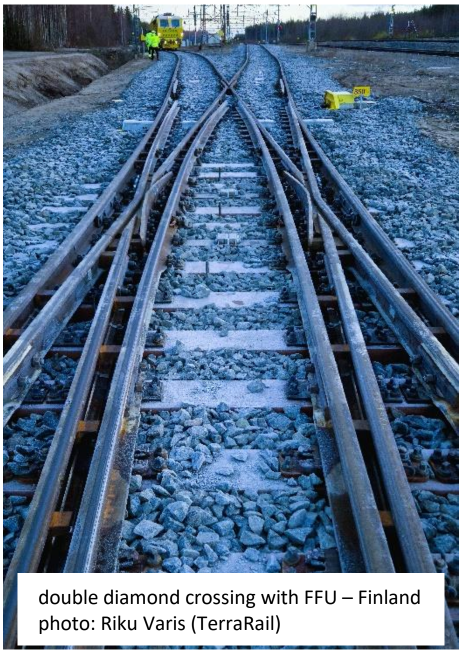
JÄRNVÄGSnyheter.se
Nordisk Järnväg
11/2024 - translated
12/2024 - translated

Safety of plastic sleepers in Nordic climate conditions

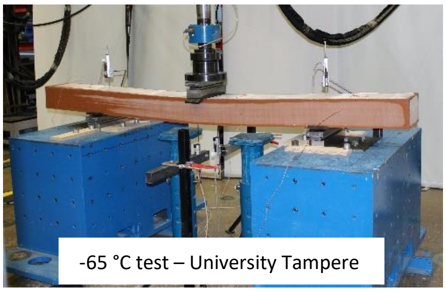

double diamond crossing with FFU – Finland
photo: Riku Varis (TerraRail)

Concrete and wooden sleepers are the most common types of sleepers. Due to its good, elastic and gentle properties, wood was earlier of great importance in switches and was the only material that could be used on open steel bridges.

But with the ban on environmentally harmful impregnations such as creosote, the lifespan of today's wooden sleepers is no longer guaranteed compared to older ones. That is why plastic sleepers are increasingly coming onto the market as replacements. Since not all plastics are the same, the question arises of material stability, safety and lifespan for tough use in the Nordic climate (from -40°C to >30°C).

While lifespan is crucial for overall costs and sustainability, railway safety is the most important criterion for railway managers due to the risk of, for example, sudden sleeper failure or rapid change to track gauge. The risk of brittle fracture increases at very low temperatures. Therefore, to ensure safe use in service, the behaviour of plastic sleepers subjected to cold climatic conditions must be evaluated before such products are adopted for use on live railway infrastructure.

FFU® (Fibre Reinforced Foamed Urethane) sleepers from SEKISUI have been in continuous use since 1980 on the heaviest and fastest trains worldwide in cold and warm regions, without a single sleeper needing to be replaced due to age.


-65 °C test – University Tampere

FFU sleepers are already used in all Nordic countries. A cold test down to -65°C at Tampere University of Technology concluded that "FFU sleeper values are only slightly stiffer in cold temperatures than at temperatures of +20°C. The modulus of elasticity (E) increases by approximately 8% between temperatures of +20°C and ~ -65°C." It was confirmed that no other synthetic sleeper material has been tested at these temperatures so far. FFU survived the breaking test even at the highest force of 250 kN at -65°C. In comparison, according to Tampere University, a wooden sleeper with the same dimensions (240x160x2700) breaks at +20°C with only 80-100 kN.

For example, if rails are welded at +18 to +24°C, deviations of up to 60K and more occur under extreme Nordic winter conditions. Under such conditions, the material shrinkage value of the track (1435 mm) is 0.69 mm for oak and 0.65 mm for FFU. For other types of plastic sleepers, this value can be much higher and exceed the safety value (e.g. 3.5 mm at DB), which poses a risk, especially in switches, due to narrow track and checkrail tolerances.

In Finland, the first double diamond crossing was therefore equipped with FFU, as a more elastic and switch-friendly sleeper material than concrete and a safe alternative to wood are needed.

The use of FFU for bridge, switch and flat sleepers is therefore the best and safest choice, even under Nordic climate conditions.

- **Rot-proof, UV-resistant,** extremely **durable** (lifespan >50 years), **recyclable**
- Adhesion in the ballast, no embrittlement, material + dimensional stability for **safe railway operation**
- **Drinking water safe certified,** no impregnation (compared to standard wooden sleepers)
- Linear elastic for **gentle railway operation** (even at extreme temperatures <-65°C)
- **Axle load > 45 tonnes**, used on high-speed tracks **> 300 km/h**
- In continuous operation **since 1980, type-approved, class A sleepers** according ISO 12856-1 (2014), B
- Minimal maintenance and **low life cycle costs**
- **Fire protection**: flame retardant, self-extinguishing, non-toxic, **low smoke level**

Kontakt: delf@sekisui.de
www.sekisui-rail.com