



High Performance Drainage and Structural Protection
for Critical UK Infrastructure Asset

HS2 Carol Green Underbridge



 **Client:** HS2

 **Sector:** Infrastructure & Transport (inc. Rail)

 HS2 Carol Green Compound, Coventry, CV7 7BW

Project Overview

Geosynthetic Limited supplied Enkadrain™ ST to provide high-performance structural drainage and critical vibration damping for the HS2 Carol Green Underbridge.

Working with Balfour Beatty VINCI, we delivered a geocomposite solution engineered to withstand the “ground vibration boom” caused by high-speed trains.

While protecting the waterproofing membrane, Enkadrain™ ST acts as a cost-effective wave barrier against ground vibrations induced by trains.

By mitigating these pressure waves, the solution manages both hydrostatic loads and ground-borne noise, ensuring the long-term structural integrity of this high-capacity rail node.

Challenge

Engineering for Dual-Corridor Dynamic Loads

The engineering requirements were exceptionally rigorous, demanding a solution that could:

- Manage high hydrostatic pressure against bridge abutments.
- Protect delicate liquid-applied waterproofing membranes from mechanical damage.
- Mitigate complex vibration and fatigue caused by the unique intersection of HS2 lines passing above and West Coast Mainline trains traveling through the underbridge.

Traditional methods like porous blocks or granular stone were deemed insufficient due to their carbon-intensive transport, slow installation, and inability to provide a flexible decoupling layer against structure-borne vibration.

Innovative Solutions:

Geosynthetics Limited worked with BBV to specify Enkadrain™ ST, a multi-functional geocomposite that integrates drainage, protection, and damping into a single vertical layer.

Advanced Vertical Drainage & Hydrostatic Relief: Installed vertically to the external tunnel walls, Enkadrain™ ST creates a continuous drainage path from roof level down to the formation drainage.

Pressure Relief: It efficiently relieves hydrostatic pressure from groundwater and surface infiltration, reducing sustained loading on the underbridge structure.

Load Stability: The high-strength 3D polyamide core maintains a stable drainage void even under extreme earth and surcharge loads generated by over-passing HS2 rail traffic.



Key Benefits Delivered:

1

Protection of Liquid-Applied Waterproofing

Beyond drainage, the geocomposite serves as a robust shield for the bridge's painted waterproofing system. It prevents punctures and abrasions during the aggressive backfilling and compaction phases.

By acting as a sacrificial layer, it ensures the waterproofing remains intact despite the constant ground movement and vibrations induced by dual rail corridors.

2

Integrated Shock & Vibration Mitigation

Unlike stone drainage, Enkadrain™ ST's 3D monofilament structure forms a decoupling layer between the soil and the structure. The core absorbs and dissipates structure-borne vibrations, reducing noise and dynamic stress transfer. The system is particularly effective for the Carol Green site, where train-induced vibrations act simultaneously from inside and above. It reduces long-term fatigue on the concrete without the need for expensive, complex spring or elastomer isolation systems.

Value Engineering and Sustainability

Logistical Efficiency: One full-load delivery of Enkadrain™ ST provides the same flow capacity as over 1,200 wagon loads of drainage stone.

Cost Savings: The project realised an approximate 50% saving in material costs compared to traditional stone, with further savings in installation time and labour.

Carbon Reduction: By eliminating thousands of vehicle movements, the solution directly supported HS2's commitment to a lower carbon construction footprint.

