ACO Water Management

Hindhead Tunnel, Surrey

ACO KerbDrain® helps meet the demanding highway performance specifications and conservation requirements of the area.

Constructing a road tunnel under the sensitive environment of the Devil's Punchbowl in Surrey has been a major engineering achievement. It has required every element of the project to meet not only the demanding highway performance specifications but also the absolute need to protect and preserve a unique ecological area. The tunnel's carriageway drainage system is no exception.

The improvement scheme for the A3 around Hindhead, Surrey is a project that has been under consideration since the 1980's. Such is the environmental importance of the Devils Punch Bowl – a stunning natural amphitheatre that sits next to the town – that is has taken many years to develop a scheme that strikes an appropriate balance between the needs of traffic using the major arterial route into London and the conservation requirements of the area – one that has been designated a Site of Special Scientific Interest (SSSI).

Improvements to the A3 were necessary to relieve severe congestion, cut journey times and improve traffic safety. With an average of 30,000 vehicles using the existing stretch of single carriageway road through Hindhead every day, the area had become a regional hotspot. In 2006 the Highways Agency received approval from the Secretary of State for Transport to proceed with the tunnel project. Together with partners Balfour Beatty Civil Engineering, major works began on the £371 million project in January 2007.

Project:
A road tunnel under the sensitive environment of the Devil's Punchbowl in Surrey.

Objective:
Provide a highway drainage system which meets the ambitious performance and environmental targets of the project.

Brief:
1. Product to meet tough environmental and low-carbon construction targets.
2. Product to meet Highways agency performance standards.
3. Ability to supply bespoke elements to complete the project.

Solution:
ACO KerbDrain® combined kerb drainage system.

The scheme comprises a new 6.5km stretch of dual carriageway that takes the trunk route away from Hindhead. Where the new road crosses the Special Protection Area around the Devil's Punch Bowl itself, the new 1.8km twin bore tunnel has been constructed to hide the carriageways beneath the landscape, minimising any possible disturbance created by passing traffic.

When complete in 2011, Hindhead Tunnel will be the longest non-estuarial road tunnel in the UK. It will feature many state-of–the-art safety and communications systems, including high quality lighting, fire protection and ventilation together with CCTV surveillance, radar motion detection and a radio-interrupt system that can be used to convey information directly to tunnel users when appropriate.

Key safety role

The tunnels' drainage system will play a key safety role, protecting users in any event where high volumes of liquid are discharged onto the road surface – a tanker spill for example. Ensuring the rapid removal of potentially hazardous chemicals or fuels from the surface and safely moving them away from the site without any leakage into surrounding soil and groundwater were both critical aspects of the drainage system's design specification.

"A high capacity combined kerb drainage system would give us the hydraulic performance we needed, but there were a number of other factors that we had to take into consideration," says Daniel Machnik, Senior Buyer for Balfour Beatty Civil Engineering. "The project's environmental and low-carbon construction targets would need to be met, the system would have to comply with all the Highways Agency's performance standards and, critically, we would need a number of bespoke elements to be manufactured that would allow the system to tie-in seamlessly with the tunnel's below-ground pipe network."

Well researched

Both Balfour Beatty and project design engineers, Mott MacDonald, had worked with ACO Water Management on previous projects and were familiar with its ACO KerbDrain® combined kerb drainage system. "ACO's Design Services team worked closely with Mott MacDonald and ourselves on the proposal and produced a well researched, detailed examination of the system's performance. It gave us the confidence that KerbDrain could handle the worst-case scenario set-out within the specification."

As Daniel Machnik explains, there were other reasons reinforcing Balfour Beatty's decision to select the KerbDrain system: "KerbDrain's one-piece design would give us an advantage on site as it would be easier to handle and quicker to install than a two-piece unit. It would also be more straight forward and more cost effective to seal.

"Environmentally, we would benefit from Vienite® – the recycled and recyclable material that KerbDrain is manufactured from and which uses only locally-sourced materials to minimise its carbon footprint. It carries the BSI Kitemark, giving us absolute assurance that all the products meet the latest Highways Agency requirements and guarantees a minimum Load Class D installed performance.

The 45 degree Splay profile on the ACO KerbDrain 480.

** Work commences on the Miss James footbridge.*

Drop and centre stones at tunnel link passage carry the splay profile to the finished road level.

"We also worked with ACO Technic, ACO's bespoke product development division, to look at developing a number of special components. These included the gully units that would allow the system to connect to the tunnel's carrier pipework. Its team quickly determined that our proposals were feasible and realised designs that could be manufactured to our tight tolerances, delivery schedules and budget."

The KerbDrain runs edge one side of the carriageway in each tunnel. At each of the 16 passageways that link the two tunnels at 100 metre intervals, special drop and centre stones lower the kerb profile to the finished road surface level, enabling easy vehicle access and transfer between tunnels.

Each KerbDrain stone is finished with a Splay profile. This gives a shallow 45 degree upstanding edge to the carriageway, allowing any stationary vehicle to be more easily removed from the flow of traffic than it would be if standard 15 degree 'half battered' kerbs were used. The Splay profile is carried through on all the special units installed at the link passage intersections.

Special containment shaft

Any liquid on the road surface runs onto the front face of the KerbDrain where it quickly enters the sealed internal chamber. Under gravity it passes through the nearest downstream gully base – of which there are 72 in total – and into the main carrier pipe which feeds a Low Point Sump that is situated between the two tunnels 300 metres from the southern entrance. Liquid from the sump is pumped to a special containment shaft adjacent to the Primary Tunnel Service Building at the north end of the tunnel where it is safely treated and removed.

"The KerbDrain units specified were 480mm in height – the largest capacity stones in the range. Their size, though, was no drawback on site and we easily achieved lay rates in excess of 300metres a day," says Daniel Machnik. "This rate put us ahead of schedule for this element of the project – a major advantage when operating in such a restricted space."

Away from the tunnel system, a number of other ACO Water Management products have been used along the new dual carriageway and at its various intersections with the existing road network. ACO RoadDrain, a monocast highway channel drain, has been installed around the Service Buildings at each end of the tunnel, and ACO KerbDrain 280 Splay – the lowest capacity stone in the KerbDrain range - has been used on the northbound carriageway on the approach to the south end entrance.

Significant technical hurdles

Two further sizes of the standard half battered profile KerbDrain - ACO Kerbdrain 480 (equal in height to those used within the tunnel) and the mid-capacity ACO KerbDrain 305 – have been used at the roundabouts and connecting roads close to the tunnel's southern entrance.

** The southbound tunnel.*

** The Hindhead tunnel from above.*

Ease of sealing and handling allow lay rates in excess of 300m a day.

"Tunnel systems always present significant technical hurdles. Coupled with the complexities of working in such a delicate environmental area, the design challenge faced at Hindhead was even more complex," explains Jon Croke, Senior Design Engineer at ACO Water Management. "The success of the system has been down to the close co-operation between all the parties from the outset and in giving the level of assurance needed – both in support of our detailed hydraulic analysis and in providing the strongest possible certification of product performance."

* Photos courtesy of the Highways Agency and Balfour Beatty.

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