national highways | smp alliance

Case study

M40-M42 Interchange & M42 J4-7 DHS

Where innovation meets environmental sustainability

HILL & SMITH INFRASTRUCTURE

bmJV

Discovering innovation...

Hill & Smith Infrastructure, BmJV and their delivery partners delivered a transformative approach to central reserve Rigid Concrete Barrier (RCB) implementation across two major schemes on the Strategic Road Network: the M40–M42 Interchange and the M42 J4–7 Dynamic Hard Shoulder (DHS) Enhancement project.

Products installed:

- H2 REBLOC RB 80 XA Concrete Barrier
- H1 REBLOC RB 80 XA.2 Concrete Barrier
- Zoneguard Temporary VRS

The approach was developed in direct response to the SMP Alliance's goal of shifting more activity off site. By reducing reliance on in-situ construction, the SMP Alliance aims to improve safety, drive efficiencies, increase productivity, minimise risks and deliver greater programme certainty. The solution – combining precast foundations, above-ground rigid concrete barriers, and a purpose-built, HAVS-free drilling rig – was designed to meet these ambitions head-on.

At the M40–M42 Interchange, this new RCB system was first trialled off site and then proven through delivery for the first time. Using H2 barriers and surface-mounted precast foundations, the team eliminated the need for drainage diversions and delivered the 10.5km installation three months ahead of schedule – setting a new benchmark for safe, efficient delivery.

Offsite rehearsals demonstrated the Rebloc barrier installation process and the high outputs that could be achieved. This evidence was used in further review of the construction programme and subsequent programme reduction. The revised programme identified a risk and a need to increase the output in the creation of foundations to host the barrier. Engineering review was implemented to identify a suitable solution, through further product development, the precast barrier foundation was born.

The learning and developments from that scheme were then carried forward to the M42 J4–7 project, where the methodology was applied at greater scale and further refined. Most notably, the team introduced a newly developed low-carbon H1 barrier, designed to work within the same production environment as the H2 barrier. The two barriers share the same external dimensions and can be seamlessly connected with each other. This allows for performance flexibility without compromising sustainability, contributing to a carbon saving of 129,760 kg CO_2e.

Together, these projects demonstrate the power of early engagement, collaborative learning, and offsite innovation to deliver safer, faster, and more sustainable outcomes across the road network.

Outcomes at a glance

M40-M42 Interchange

A step change in delivery driven by early engagement, collaborative planning, and a lean, offsite-first approach.

/ 3 months ahead of programme

Accelerated delivery through precast foundation and barrier systems, minimising site time and disruption.

/ £940,000 in audited, approved efficiencies

Delivered by replacing traditional slipform construction with a fully precast solution.

/ £1.19 million saved

By avoiding major drainage diversions through an above-ground, surface-mounted foundation system.

/ £189,000 per week saved

Through reduced preliminaries enabled by faster installation rates and streamlined logistics.

/ Improved safety and customer experience

Daytime working and faster installation eliminating night time TM closures, reduced site risk, and impact on customers.

/ No additional traffic management required to accommodate barrier installation process

M42 J4-7 DHS Enhancement

Refining innovation to deliver faster, safer, and more sustainable results through true behavioural change.

/ Delivered 2 months ahead of schedule

Programme certainty achieved through refined sequencing and offsite-led construction.

/ Development of the UK's first low-carbon precast H1 barrier

Designed for high containment performance, reduced material use, and seamless integration with H2 barriers.

/ Consistently high outputs

Up to 400m of foundation and 600m of barrier installed per shift using precast systems.

/ 129,760 kg CO_2e saved

Through use of low-carbon concrete, reduced steel content, and offsite manufacturing.

/ Zero-harm delivery

Achieved through daytime working, rehearsed methods, and reduced site time.

/ Foundation carbon reduced by 50%

Compared to in-situ concrete, using minimal rebar and ultra-low carbon cement.

/ Reduced excavation and transport emissions

By using a surface-mounted system with recycled arisings and no deep foundation works.

/ Improved air quality on site

Through reduced construction emissions, no VOCs, and efficient offsite production.

/ Applied learning from M40–M42

Knowledge sharing and behavioural change led to even greater efficiencies.

The challenge

M40-M42 Interchange

The M40-M42 Interchange scheme presented a range of challenges typical of high-traffic, live network projects, but also offered an opportunity to rethink traditional methods. Key challenges included:

Programme certainty in a live traffic environment

Delivering 10.5km of barrier installation alongside live traffic required a solution that could be deployed quickly and predictably, minimising disruption for road users and reducing the need for extensive traffic management. To meet the ambitious timeframes, the project team would need to deliver up to 600 meters of barrier per shift, which was significantly more than traditional methods. This required not only precise planning but also the deployment of new technologies and lean construction practices.

Avoiding costly and time-consuming drainage diversions

The original barrier design would have necessitated major drainage works, increasing costs and programme risk. A new solution was needed with reduced barrier foundation width to limit impact on existing assets without compromising safety or performance.

Creating a safer working environment

Traditional construction methods involves a prolonged site presence, high-risk plant operations, and working in close proximity to live lanes. The challenge was to find a delivery method that reduced time on site and improved safety for the workforce.

Proving a new approach at scale

As the first scheme to adopt a fully precast barrier and foundation solution, the M40-M42 Interchange needed to demonstrate not only feasibility but also high performance under programme and operational pressures. This included rigorous planning, collaboration, and testing to validate the design ahead of full deployment.

M42 J4–7 dynamic hard shoulder enhancement

Once proven on the M40–M42 project, the team took the same methodology forward to the M42 J4–7 DHS Enhancement scheme, where new challenges emerged:

Scaling the solution across a longer, more complex route

The next scheme required consistent performance and high productivity across varied site conditions. This demanded refinements to sequencing, logistics, and installation processes to sustain outputs and quality.

Enhancing sustainability through materials innovation

With the method proven, the expectation was to demonstrate further gains in sustainability. A possible solution was to reduce the embodied carbon of the barriers themselves – a move that would require close collaboration with supply chain partners and the development of a new, low-carbon barrier system.

Capturing and applying lessons learned

A critical part of the challenge was ensuring that the behaviours, learnings, and technical insights from the M40–M42 scheme were embedded into delivery for M42 J4–7. This required a deliberate shift in mindset: treating continuous improvement and knowledge transfer as core disciplines, not afterthoughts.

The solution

Hill & Smith Infrastructure, working together with BmJV and their delivery partners, developed a new offsite-led approach to central reserve barrier installation. The solution replaced traditional on site construction methods with wet formed products with precast foundations and modular rigid concrete barriers, installed using a purpose-built, precision-drilling rig. This innovation was designed to reduce site time, improve safety, and deliver consistent, high-quality outcomes at scale.

M40–M42 Interchange – proving the concept

The M40–M42 project became the proving ground for delivering central reserve barrier works differently: safer, faster, and more sustainably. H2 REBLOC barriers were installed on 10.5km of central reserve using a fully precast foundation system.

Key components of the solution included:

Strategic planning and early collaboration

From the outset, Hill & Smith Infrastructure and its partners engaged in meticulous planning and collaborative design. Early involvement with stakeholders, including National Highways and supply chain partners, allowed the team to identify potential issues and refine the design to mitigate them before construction began.

The use of digital design and modelling tools enabled a detailed assessment of the site constraints, helping to adapt the barrier installation to avoid existing infrastructure, particularly drainage systems, and ensure compliance with all regulatory standards. This early collaboration also fostered a culture of shared responsibility, driving each partner to contribute their expertise and insight to optimise the project's outcomes.

Innovative and sustainable products

To meet the project's safety, efficiency, and environmental goals, the team used the REBLOC H2 concrete barriers. These barriers are precast Rigid Concrete Barrier (RCB) vehicle restraint systems (VRS) engineered to combine strength, adaptability, and efficiency.

Unlike traditional in-situ poured barriers, which require significant excavation, drainage adjustments, and reinforcement work, the REBLOC barriers use a surface-mounted design. This means the barriers sit directly on prepared surfaces without needing to be embedded into the ground using posts. Stability is achieved through precise interlocking couplings between units, which distribute impact forces effectively while maintaining alignment. By eliminating the need for deep foundations and complex drainage modifications, this design not only reduces construction time and costs but also minimises disruption to existing infrastructure and the environment. Tested to EN 1317 standards, the barriers deliver reliable H2 containment levels, ensuring the safety of road users in a wide range of conditions.

Advanced installation techniques and automation

The project employed advanced installation methods to maximise speed, efficiency, and safety. The REBLOC barriers' surface-mounted design minimised excavation and civil works, reducing construction risks and accelerating installation. Meanwhile, the modular, precast nature of the barriers allowed for rapid deployment in a high-risk, live-traffic environment.

Proof of Concept

To ensure this new approach could be delivered safely and reliably, the team conducted full-scale offsite installation rehearsals before the project commenced. These physical trials played a critical role in fine-tuning working methods, identifying potential safety risks, and establishing a safe system of work before operatives entered the live site. They also confirmed the feasibility of achieving consistent production rates of up to 600 metres of barrier installation per shift on the M40-M42 Interchange project – four times faster than conventional slipform methods.

Investing time to develop the appropriate construction methodologies in a controlled environment through off-site trial supported effective production/ delivery on site. This meant that the barrier and foundation units could be installed during normal day time operation, eliminating night time TM closures resulting in reduced customer impact, improved safety (public, TM operatives and workforce), efficient working windows and increased productivity.

Central to this approach was the use of automated, precision-drilling rigs capable of drilling two connection points per minute, allowing for rapid and secure attachment of barrier units to the foundation slabs. These rigs, designed with a hands-free, vibration-free system, enhanced worker safety while achieving precise alignment and consistency across the barrier line.

Safety protocols and zero-harm methodology

Safety was a key consideration. The team implemented a zero-harm approach, focusing on reducing risks to both workers and the public. Exclusion zones and precise handling protocols were established to protect workers operating near live traffic lanes. As the precast foundation units could be installed without additional groundwork, the risk of incidents related to excavation and heavy lifting was significantly reduced. The purpose-built drilling rig not only accelerated the works but eliminated the risk of HAVs for the workers.

M42 J4–7 – Scaling and Refining the Approach

The M42 J4–7 DHS Enhancement scheme provided the opportunity to further refine the methodology. The same precast foundation and drilling rig system was used, but the team went further, working with their supply chain partners to introduce a newly developed low-carbon H1 barrier.

Key components of the refined solution included:

Embedding lessons from the M40–M42 scheme

Early engagement and detailed design coordination ensured that learnings from the previous scheme directly informed delivery. This knowledge transfer resulted in a more streamlined approach, with improved sequencing, resource allocation, and logistics planning.

Developing a low-carbon H1 barrier

The team worked together to develop a new H1 barrier system with a precast foundation solution, based on the original H2 barrier but with key refinements. The foundation slabs were redesigned to minimise rebar, reducing potential clashes with fixing bolts and allowing for faster, more consistent installation.

These innovative H1 barrier units required 50% less steel and 20% less cement than the original H2 units. These savings were then invested into reducing emissions by a further 33%, achieving a reduction of 64,796kg CO2e for H1 barrier and 30,935kg for H2 barrier by using ultra-low carbon concrete. This way, a low carbon barrier alternative could be provided at no extra cost.

The H1 barrier introduced on the M42 J4–7 project is the first precast rigid concrete barrier in the UK specifically designed to achieve H1 containment. It shares the same external profile as the H2 barrier, enabling both to be produced using the same moulds – avoiding the need for additional tooling and eliminating the associated carbon and material waste. The two barrier types can be seamlessly joined within the same system, without requiring transition units, providing performance flexibility while maintaining installation efficiency.

Improved productivity and safety

To further streamline the process, a just-in-time delivery system was implemented, ensuring that precast barrier units arrived at the site exactly when needed, reducing onsite storage requirements and minimising traffic disruption. Forklifts with modified grabs were used to place the barriers directly from delivery trucks to the installation location, eliminating unnecessary handling and speeding up the installation process. This approach decreased site time, limited traffic disruption, and provided significant cost savings while maintaining the highest safety and quality standards.

The team also developed a traffic management strategy that minimised the need for night-time lane closures, which are associated with higher risks due to reduced visibility and driver fatigue. By achieving high installation rates during regular working hours, they were able to maintain a safer environment for workers and road users alike.

Installation outputs reached up to 400m of precast foundation and 600m of barrier per shift – matching or exceeding the benchmarks set in the previous scheme.

The outcome

Together, the M40–M42 Interchange and M42 J4–7 schemes represent a step change in how central reserve barriers are delivered on the Strategic Road Network. Across both projects, Hill & Smith Infrastructure, BmJV and its partners demonstrated the power of early collaboration, offsite manufacturing, and continuous learning to drive measurable improvements in programme certainty, cost, safety, and sustainability.

Key outcomes include:

Early completion

The M40–M42 Interchange project was completed three months ahead of schedule, thanks to the successful deployment of the new precast foundation and barrier system. The use of full-scale rehearsals and automated drilling enabled consistent outputs of up to 400m of foundation and 600m of barrier per shift – significantly exceeding what would have been possible using traditional methods.

Building on these proven methods, the M42 J4–7 project achieved even greater programme confidence, completing two months early with the same offsite-led approach.

Significant cost savings

Through innovative design choices and efficiency improvements, the projects delivered considerable financial savings. On the M40-M42 Interchange scheme, the avoidance of new drainage installations alone resulted in savings of £1.19 million, while the accelerated schedule reduced preliminary costs by £189,000 per week. In total, the project achieved £940,000 in audited and approved efficiencies by selecting the precast barrier system over traditional slipform methods.

The approach proved to be scalable and repeatable, delivering further time and cost benefits on the follow-on M42 J4–7 project.

Substantial carbon reduction and environmental benefits

The newly developed low-carbon H1 barrier achieved significant carbon savings on the M42 J4–7 project. Designed to work with the same moulds as the H2 barrier, this H1 RCB solution reduced steel by 50% and concrete by 20%, enabling a total carbon saving of 129,760 kg CO_2e. This included:

- 64,796 kg CO_2e from the H1 barriers
- 30,935 kg CO_2e from the H2 barriers
- 34,029 kg CO_2e from the precast foundations

The projects' methodologies reduced excavation requirements and incorporated recycled excavation materials, further lowering transport emissions and construction waste. The decision to conduct work during daylight hours minimised the need for additional traffic management and associated carbon, artificial lighting, reducing both energy consumption and light pollution.

In addition to the carbon savings, there were wider environmental benefits. By eliminating the need for in-situ pours, the approach removed the risk of ground or watercourse contamination from wet concrete. The factory-cured units also emit no volatile organic compounds (VOCs), ensuring a cleaner construction process and improved air quality on site.

The REBLOC barrier system's durability and resistance to weathering and corrosion also ensures minimal maintenance and repair. The Rebloc RCB meets the criteria of CD 377, it has a minimum life of 50 years and in the event of road traffic impact to the tested performance criteria, the RCB does NOT require realignment, repair or replacement, removing the cost and carbon burden of future maintenance.

Enhanced safety and zero-harm execution

The projects' zero-harm methodologies and safety-focused designs ensured that worker and public safety remained paramount throughout the construction process. The use of exclusion zones, advanced handling protocols, and automated drilling rigs minimised risks associated with manual labour and working adjacent to live traffic. By avoiding extensive night-time closures, the team also mitigated hazards linked to reduced visibility and fatigue, creating a safer environment for both workers and road users.

Positive client and public feedback

The early completion achieved on both projects, coupled with minimised disruption and a focus on safety and sustainability, led to highly positive feedback from both the client and local stakeholders. On the M40-M42 Interchange scheme, National Highways representatives commended the team for their collaborative efforts and commitment to delivering improvements well ahead of schedule. Local businesses and road users also expressed appreciation for the efficiency and professionalism with which the project was executed, particularly noting the reduced impact on daily commutes and traffic flow.

Knowledge sharing and industry impact

The innovations and lessons learned from both projects have been shared with National Highways, the SMP Alliance, and the wider infrastructure industry. Through participation in the SMP Alliance and collaboration with the LEAN team, Hill & Smith Infrastructure has contributed to advancing best practices across the sector. These knowledge-sharing efforts are helping to drive a shift towards more sustainable, efficient, and collaborative approaches in infrastructure projects nationwide.

> *"It's been a great collaborative piece of work, and we are delighted to be completing these improvements so far ahead of schedule."*
>
> – Nick Wells, National Highways Project Sponsor

“Please pass on my congratulations to the team working on the installation of the new concrete central barrier. They appear to be well ahead of schedule. In my experience, this is an exceptional project.”

– Managing Director, Dennis Eagle Ltd

Find out more

For more information on Vehicle Restraint Systems (VRS), including our innovative REBLOC solution, contact **info@hillandsmithinfrastructure.com.**

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Awards & Achievements

The M40/M42 Interchange and M42 J4-7 DHS projects have been recognised with 2 nominations and an award win!

Highways Awards: Finalist of the ‘Product Of The Year’ category
New Civil Engineer Awards: Finalist of the ‘Impacts In Roads’ category
SMP Alliance 7ogether Awards: Winner of the ‘Production Excellence’ category