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Track & Infrastructure

Pandrol

Futureproofing Non-Ballasted Track: Pandrol's Common Interface System

By John Porrill, Fastening Systems Technical Director

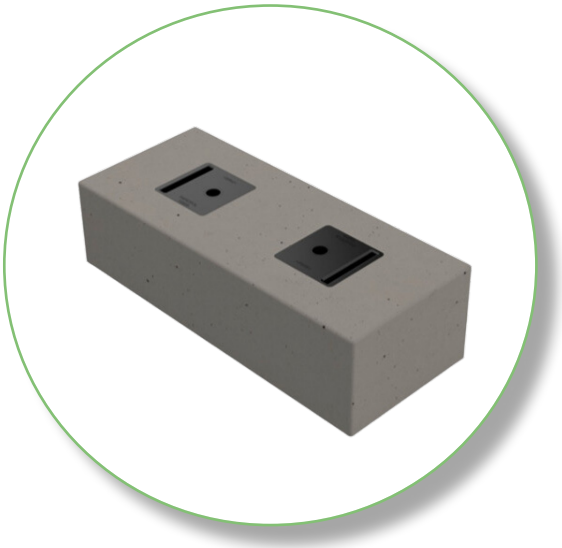
Pandrol's new Common Interface System is a game-changer for the rail industry, enabling slab track to be adapted to meet changing performance needs for the first time.

Very low maintenance requirements and long life are major advantages of non-ballasted track (NBT) over conventional ballasted systems. NBT has a higher first cost than ballasted track and is time consuming to construct, but once in place it provides a stable track system that could still be in use a century later. In theory...

In practice, the rigidity of NBT creates its own set of problems, particularly in urban areas. Once concrete has been installed, it is very costly to adjust the track geometry.

When new housing developments spring up alongside an NBT rail system, residents are prone to complain about noise and vibration. This leads to increased performance requirements. The problem? Without the flexibility to adapt to the new noise and vibration mitigation demands, the whole track has to be modified, or lifted and rebuilt from scratch.

Now, for the first time, Pandrol has a solution to futureproofing NBT. The Common Interface System allows rail infrastructure owners to adapt NBT to meet changes in performance requirements, quickly and affordably.



What Is the Common Interface System?

Currently, the concrete elements used for NBT have interfaces that are aligned to specific fastening systems and anchorages. Pandrol's Common Interface System (CIS) provides a common connection point for a range of different fastening assemblies that can be easily swapped. When vibration and noise mitigation requirements change, rather than having to modify or replace the whole track, the fastening system can simply be swapped to achieve the required performance level.

The Common Interface System consists of two engineering plastic plates with retaining features, as shown. Reinforced plastic dowels sit underneath the plates, enabling anchor screws to be installed. The CIS is compatible with all the main Pandrol fastening range, screwed and non-screwed.

Basic Configuration

Imagine a new metro station is built in an area where few people live and work. With noise and vibration mitigation requirements low, the CIS can be fitted with a simple, medium-resilience fastening solution, such as Fastclip FCA.

The Fastclip SGI shoulders locate into the plastic construction plates and are retained using anchor screws. A plastic insulator is added to the front face of each shoulder and the Fastclips, with integral toe insulators, are installed in a parked position. A resilient rail pad is introduced into the rail seat area before the rail is threaded and the Fastclips are pushed into their installed positions. The Pandrol FCA system can provide vertical adjustment of up to 10mm with the standard shoulder through the addition of shims underneath the rail pad and the shoulder. Further adjustment is possible up to 20mm using a second, taller shoulder.

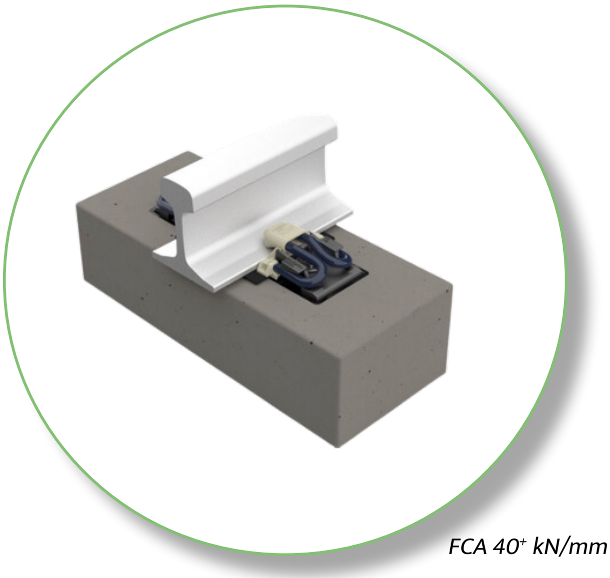
The load applied to the rail is transferred through the shoulders and dispersed into the concrete. The system stiffness is limited to 40kN/mm in the standard configuration, ensuring there is no detrimental effect on dynamic track gauge through excessive rail roll. Although the rail pad contributes to vibration reduction, the resilience limits of a single rail pad still allow transmission of some ground-borne vibration to surrounding structures.

Intermediate Configuration

What happens when the area becomes built up and local residents start complaining about noise and vibration?

Instead of having to make costly alterations to the NBT, the FCA system can simply be removed from the Common Interface and replaced with a more resilient set of components.

Here, the two cast iron shoulders are now part of a linked baseplate that sits on top of a highly resilient baseplate pad. Two cast iron clamps complete with nylon bushes attach the system to the Common Interface. The baseplate is able to move vertically about the nylon bush as the resilient pad compresses under load. This protects the clips from excessive deflection and ensures rail roll limits are not exceeded.



FCA 40⁺ kN/mm

This stability means that a higher degree of resilience can be utilised safely to provide greater protection against ground-borne vibration and any associated secondary noise. The more resilient the fastening system the less vibration travels through the track. A stiffness of 22.5kN/mm is typical for this set-up, but it can range from 16kN/mm to 25kN/mm.

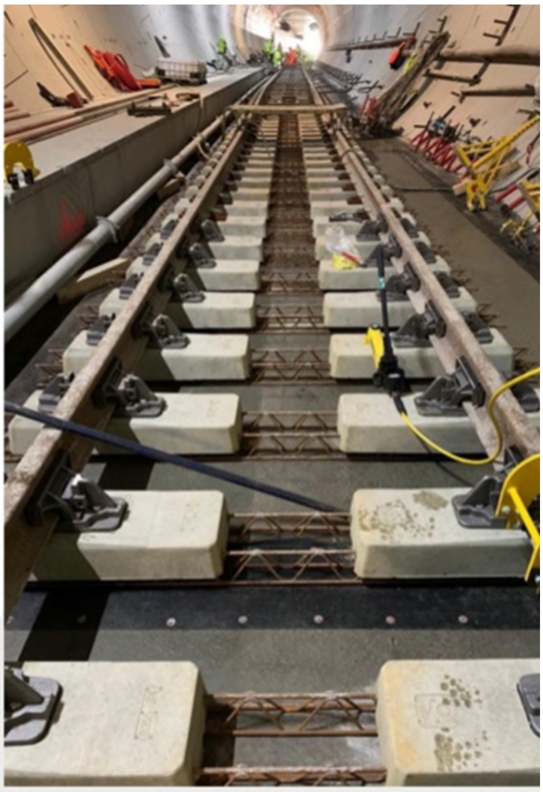
Advanced Configuration

Should noise and vibration mitigation requirements become even greater, say a hospital operating theatre is built over the metro tunnel, the existing system can be removed from the Common Interface and replaced with more resilient components.

For maximum attenuation, the FCA or DFC system can be replaced with the Pandrol Vanguard (or Bonded Rubber DFF) system. Both systems provide a high degree of vibration isolation, reducing transmission to surrounding structures. The Vanguard system supports the rail against the rail web and under the rail head. This allows the rail to be fully supported by resilient elements that attach to a cast iron baseplate. These resilient elements operate in shear, ensuring a high degree of gauge control as the resulting rail deflection is almost entirely vertical.

Rather than sitting on a pad or the baseplate, the rail is held up by the resilient blocks, producing an air gap underneath of approximately 6mm.

This system is extremely resilient, providing a stiffness of as low as 5kN/mm and can reduce ground-borne vibration levels in excess of 10dB.



Versatility in Practice

The Follo Line in Norway connects Oslo and Ski via twin 19.5km tunnels. The tunnels pass through a granite mountain on which people live and work, and it was clear from the outset that vibration attenuation would be needed to limit any impact of the railway on those living in this area.

The Common Interface System was chosen to enable the resilience of the track to be tuned to meet the strict requirements of the noise and vibration (N&V) study carried out. Three different stiffness levels were provided using the system, with post-installation measurements confirming that the N&V hotspots highlighted in the study had been effectively controlled and met the required specification.

The images above show the CIS in the Follo Tunnel with two different fastening systems – Pandrol VIPA DFC (left) and Pandrol Vanguard (right). Sitting on the same common footprint, these provide the intermediate and advanced levels of ground-borne vibration mitigation required at different points in the tunnel. A combination of two DFC assemblies and a de-tuned Vanguard assembly meet the challenging noise limit of 32dB. These systems were able to vary the track stiffness between 22.5kN/mm, 16kN/mm and 11kN/mm using the same interface.

Summary

Pandrol's Common Interface System is set to revolutionise the future of NBT, providing the first-ever solution to the inherent inflexibility of current systems. With the Common Interface System, rail infrastructure owners can adapt the track to changing performance requirements when needed.

The benefits are clear – replacing the fastening system rather than the whole track can save millions. The process is much simpler and quicker, creating less disruption. And with concrete's high carbon footprint, increasing NBT's lifespan has immense sustainability benefits. Once removed, fastening systems can be recycled or, in some instances, reused on another project.

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