

# Pandrol

## Florence Tramway: Protecting a UNESCO Heritage Site from the Effects of Vibration

**Customer:** Alstom, as contracted by the Municipality of Florence

**Construction Start Date:** 2015

**Sector:** Light Rail

**Track length:** 18,000 Imst

the concern that the tramway would generate noise that could be heard in the churches nearby, disrupting these sacred spaces. Secondly, was the need to protect the fragile buildings from any cracks caused by vibrations. In light of the above, the noise & vibration attenuation required was 20dBv – an extremely demanding rate.

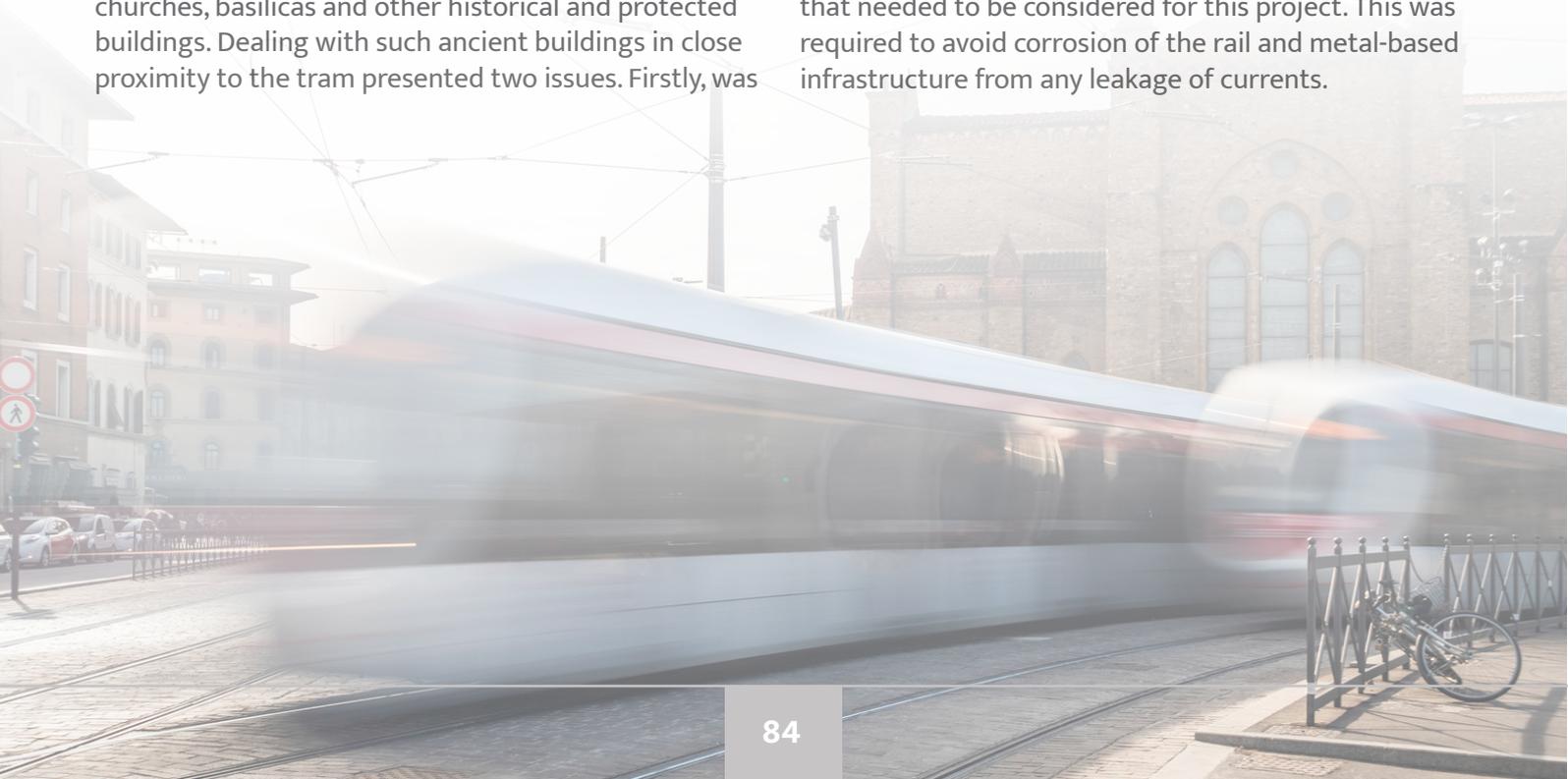
### Customer Challenge:

Florence in Italy, the symbol of the Renaissance, and a UNESCO World Heritage site. Since the city's tram came into operation, locals and tourists alike have been able to make use of this quiet and clean mode of transport.

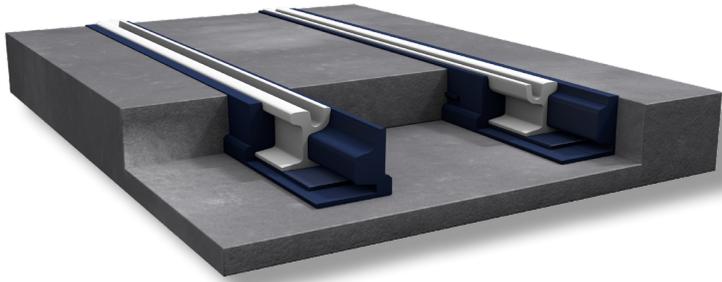
For the installation of Lines 2 and 3 of Florence's tramway, track vibration was a serious concern. The track passes just a few metres away from beautiful churches, basilicas and other historical and protected buildings. Dealing with such ancient buildings in close proximity to the tram presented two issues. Firstly, was

One other challenge of this project was the presence of historical ruins below the track. With the city having been built in Roman times, there are many architectural artefacts beneath the modern city. This dictated the excavation depths when carrying out civil works. Furthermore, installation needed to be quick and efficient due to the tramway's placement in a central area so construction time needed to be kept to a minimum.

Finally, stray current protection was one other element that needed to be considered for this project. This was required to avoid corrosion of the rail and metal-based infrastructure from any leakage of currents.



Q Track® CAD



Floating Slab Mat CAD

## Pandrol's Solution:

Pandrol was selected as we provided a solution that could solve all of the project's challenges. Rather than needing to go to multiple different companies, the customer could benefit from our solutions in noise & vibration as well as stray current protection.

The customer could also benefit from tried and tested solutions, both proven in past projects such as Athens, but also demonstrated in modelling through our innovative Track Elastic Model (TEM) software which we developed to simulate the conditions and monitor the effectiveness of our solutions. Through relying on Pandrol's knowledge, experience and theoretical modelling, it was clear we were experts who could rise to the challenge – not only through the supply of world-leading products, but also through our engineering knowledge on noise & vibration.

We proposed using our Floating Slab Mat (FSM) in combination with our fully embedded rail system, Pandrol QTrack®. Our floating mat is designed to give dependable performance in noise & vibration reduction. By building the track on the mat of encased resin-bonded rubbers, this isolates the vibration by keeping it within the system. Both systems together allowed for decreased depths of the excavation whilst still keeping high vibration attenuation.

Pandrol QTrack® provides vertical and lateral support to the rail, reducing vibration transmission from the rolling stock to the surrounding structures, and granting control of the electrical flow out of the rails (stray currents). As it is a continuously supported system, fully bespoke for each project, the elastic rubber profiles decrease the phenomenon of

corrugation or surface waves that cause vibration. All of this results in less vibration, less noise and fewer cracks.

To tackle the project's demanding tight construction deadlines, our system's prefabricated concrete beams or slabs suited the need for quick installation and minimum traffic disruption. With this type of installation, we weren't restricted by climate or weather that could have disrupted the progress, and could be more efficient by having work done in parallel.

## Results:

After the installation of Lines 2 and 3 were finished, we were pleased to see excellent results from third-party measurements and monitoring. The calculations we had estimated from our TEM modelling were accurate and we received certification to confirm that the systems showed complete compliance and satisfaction in terms of rail stability, electrical insulation and noise & vibration levels with zero structural damage along the whole track length.

In 2023, we were awarded the new phase based on the excellent performance of our system.

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Click [here](#) to watch our project film and to find out more about UNESCO World Engineering Day

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## Solving your noise & vibration problems

The global leader in rail infrastructure technology for 70 years, we've created infrastructure in over 100 countries. That means we've experienced just about every situation, problem, question and solution before. We share our global knowledge with your business so you can reach your objectives quickly and efficiently.

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