Pioneering technologies take Brazil by storm.
Cold recycling for the rehabilitation of Ayrton Senna Highway
The SP-070, also known as the Ayrton Senna Highway, is yet another freeway in Brazil where the time-saving, cost-efficient and eco-friendly benefits of the cold recycling process have been put to the test.

São Paulo, with a population in excess of 20 million, is Brazil’s biggest city. It is not only the country’s most important business, finance and cultural center and biggest transport hub but also the largest industrial conurbation in South America. The SP-070 Ayrton Senna Highway that was built in 1978 is one of Brazil’s busiest freeways and connects São Paulo with Rio de Janeiro, Guarulhos International Airport, Campos do Jordão and Vale do Paraíba. Since June 2009 the SP-070 has been operated by Ecopistas, which has a 30-year concession for maintaining the motorway.

Every day, more than 125,000 vehicles swarm onto the SP-070 in each direction, 15% of them heavy goods vehicles. And over the years, it is precisely these high volumes of traffic that have totally destroyed the structure of the road, which includes a 9.8 in (25 cm) cement treated base course and a 3.9 in (10 cm) asphalt wearing course (HMA). Structural repairs have been carried out in both directions on a 28 mile (45 km) section – the stretch between the 11 and 56 kilometer marks – extending from São Paulo in an easterly direction.

**OPTIMUM SOLUTION: COLD RECYCLING IN PLANT**

Ecopistas and the company contracted to rehabilitate the road, Fremix Engenharia e Comércio Ltda., tried out different types of technologies in a wide range of test applications over a long period to find the optimum solution. Finally, they both decided to use the technology that
delivered the best results, the quickest construction time and 100% recycling of the reclaimed material: recycled material with foamed bitumen, produced in Wirtgen’s mobile cold recycling mixing plant KMA 220. The flexible bituminous base course produced using this method guarantees a long service life.

When it came to selecting the optimum rehabilitation method, there was one strict condition that the contractors also needed to fulfill: On weekdays, the construction work on this vital transport route was restricted exclusively to an overnight 7-hour window from 10 p.m. to 5 a.m., since even minor closures for roadworks can cause massive traffic hold-ups on the SP-070 in particular affecting the International Airport.

The tight timeframe meant that a thick asphalt pavement was out of the question right from the start. While the thicker asphalt layers produced in conventional rehabilitation processes need to cool down – and for concrete pavements, setting can even take up to seven days – Wirtgen’s cold recycling technology allowed the pavement to be repaired section by section before being immediately reopened to traffic.

**WHAT IS FOAMED BITUMEN?**

Cold recycling with foamed bitumen is a technology which has become established throughout the world both for road repairs and for the paving of new roads. Cold recycling with foamed bitumen produces flexible and durable base courses, which form the perfect foundation for a final asphalt overlay with a reduced thickness. Foamed bitumen is produced by heating standard bitumen to approx. 347°F (175°C) using state-of-the-art technology. The foamed bitumen is produced and added to an aggregate in a high-precision process using injection systems controlled by microprocessors. The advanced process has many benefits, including durability of the layers, economic efficiency, the conservation of resources, CO₂ emission reductions and shorter construction times.

**WIRTGEN EXPANSION CHAMBER FOR PRODUCING FOAMED BITUMEN**

![Diagram of Wirtgen expansion chamber for producing foamed bitumen.](image-url)
“During the daytime, you can’t close any of the lanes between the São Paulo city limits and the airport due to the high volume of traffic. That’s why the work was carried out at night during the week or at weekends,” explains Elio Cepollina Junior, Commercial Manager at Fremix.

Further advantages of using this process include rapid completion of the works, a thinner asphalt wearing course, a minimal number of transport journeys required and the recycling of all of the reclaimed material. All in all, this adds up to a very cost-effective and eco-friendly process.

1 | With a maximum milling depth of 13 in (320 mm), the cold milling machine W 1900 can remove entire pavements.

2 | The Kleemann MR 110 Z EVO 2 impact crusher breaks down the reclaimed asphalt to a maximum particle size of 1.2 in (30 mm).

WIRTGEN COLD MILLING MACHINES AND KLEEMANN IMPACT CRUSHER CLEAR THE WAY

The two damaged courses consisting of 9.8 in (25 cm) of cement treated material and 3.9 in (10 cm) of asphalt were milled out separately and conveyed onto trucks. For this task, Fremix used two Wirtgen large milling machines – the W 1900 and the W 200. The W 200 can be operated with three different milling drum widths – 4 ft 11 in, 6 ft 7 in and 7 ft 3 in (1.5 m, 2 m and 2.2 m) – to cover a wide range of applications.

The trucks take the reclaimed asphalt to the recycling plant set up in close proximity to the job site, where a state-of-the-art...
Kleemann MOBIREX MR 110 Z EVO 2 impact crusher breaks down lumps of asphalt. The mobile crusher can be used for a variety of applications, including the preparation of both natural stone and asphalt or materials that have been quarried or mined, and consistently delivers top quality grain sizes. In this case, the maximum size laid down in the specification was 1.2 in (30 mm).

WIRTGEN KMA 220 RECYCLES RECLAIMED MATERIAL ON SITE

Using a KMA 220 mobile cold recycling mixing plant, the reclaimed material was then recycled into a top-quality bitumen stabilized material (BSM).

The Wirtgen KMA 220 is easy to transport and can be quickly set up on site. The plant was installed right next to the freeway. Close proximity to the job site greatly reduces the haul distance and is of inestimable benefit in terms of time, cost and energy savings.

As Juliano Gewehr, Product Specialist at Ciber explains “The cold recycling mixing plant allows us to re-use all of the reclaimed material. We optimize it by adding stabilizing agents and supplementary materials to deliver a pavement structure with a very long service life and optimum material properties.”
PRECISION METERING OF BINDERS

Loudon International was consulted for the project. Working with technicians from JBA Engineering and Consulting Ltda., they provided support for the preliminary investigations and for carrying out the works. Using the Wirtgen laboratory-scale plant WLB 10 S, the quality of the foamed bitumen and the optimum composition of the mix - obtained in combination with the Wirtgen laboratory-scale twin-shaft pugmill mixer WLM 30 – was precisely defined before construction work commenced. The formula finally selected comprised 1% hydrated lime and 2.2% bitumen.

Hot bitumen is foamed in the expansion chambers of the KMA 220 by adding air and water. This produces foamed bitumen which is 20 times the volume of the original product. The foamed bitumen was mixed with the hydrated lime and the reclaimed material before being loaded onto waiting trucks which then took it back to the job site. The material was paved with a Vögele paver in two layers: the 7.8 in (20 cm) thick first layer was compacted by a Hamm compactor with padfoot drum followed by a Hamm 16-t compactor with smooth drum. The 5.1 in (13 cm) thick second layer was compacted by a Hamm 3414 compactor and finally by a Hamm HD 90 tandem roller. The Vögele SUPER 1300-3 compact tracked paver was used to apply a 0.8 in (2 cm) thick asphalt wearing course, followed by a Hamm GRW 280 rubber wheeled roller and the Hamm HD 90 tandem roller to complete the final compaction of the road surface.
AN EXCELLENT RESULT EVERY TIME

The contractor, is highly satisfied with the result: His own experience has now corroborated the acclaim that cold recycling technology has been enjoying worldwide. Indeed, he now further sees huge potential for cold recycling in Brazil: “There is no doubt that this project will set a precedent for future roadworks in Brazil.”

Ten different Wirtgen Group machines were involved in this challenging project, and all of them deliberately selected by the contractor: “On a construction site of this size, where the rehabilitation of the circa 1,148 ft (350 m) long section of single lane has to be completed within one night, we couldn’t afford to take any risks. That’s why we decided to use the Wirtgen Group’s reliable machines and its state-of-the-art technologies and application processes.”

End-to-end assistance from Wirtgen Group experts and service technicians gave him an additional assurance that the project would be a success. The work started in November 2011 and was always on schedule until completed. Based on the excellent results obtained, Ecopistas already planned annual investments with this technology.