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, which, with a population in excess of 20 million, is Brazil’s biggest city, 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 the early 1970s is Brazil’s busiest freeway and connects São Paulo with Campos do Jordão, Vale do Paraíba, Rio de Janeiro and Guarulhos International Airport. The SP-070 has been operated by Ecopistas, which has a 30-year concession for maintaining the motorway, since June 2009.

Every day, more than 100,000 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 consists of a 25-cm base course, 6% of which is comprised of cement-bound material (CBT), and a 10-cm asphalt wearing course (HMA). Structural repairs have been carried out in both directions on a 35-km section – the stretch between the 11 and 46 kilometer marks – extending from São Paulo in an easterly direction.

**OPTIMUM SOLUTION: COLD RECYCLING IN SITU**

Ecopistas and the company contracted to rehabilitate the road surface, Fremix Engenharia e Comércio Ltda., tried out different types of technologies in a wide range of test applications over a period of 12 months 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 8-hour window from 9 p.m. to 5 a.m., since even very minor closures for roadworks can cause massive traffic hold-ups on the SP-070. 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 for about four days – 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. 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 much to recommend it, including durability of the layers, economic efficiency, the conservation of resources, CO₂ emission reductions and shorter construction times.
“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 Cepol-lina Junior, Commercial Manager at Fremix.

Further advantages of using this process include rapid completion of the works, the 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.

WIRTGEN COLD MILLING MACHINES AND KLEEMANN JAW CRUSHER CLEAR THE WAY

The two damaged courses consisting of 25 cm of hydraulically bound material (HGT) and 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 - 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 point set up in close proximity to the job site, where it is crushed using a state-of-
the-art Kleemann MC 110 Z EVO mobile jaw crusher to obtain an optimum granulometric composition. 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 20 mm.

WIRTGEN KMA 220 RECYCLES RECLAIMED MATERIAL ON SITE

Using two KMA 220 mobile cold recycling mixing plants, the reclaimed material was then recycled into a top-quality cold mix (BSM).

The Wirtgen KMA 220 is easy to transport and can be quickly set up on site. Both plants were installed right next to the freeway. Close proximity to the job site greatly reduces the number of material transfers 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 binding agents and supplementary materials to deliver a pavement with a very long service life and optimum material properties.”
PRECISION METERING OF BINDERS

Loudon International and its engineer Dave Collings were in charge of putting together the correct mix of binding agents. Working with technicians from JBA Engineering and Consulting Ltda., he 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 compulsory mixer WLM 30 – was precisely defined before construction work commenced. The formula finally selected comprised 1% hydrated lime and 2% bitumen.

Hot bitumen is foamed in the expansion chamber 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. The KMA 220 then conveyed the recycled material via a crawler track onto waiting trucks which then took it back to the job site. The material was paved in two layers: the 20 cm-thick first layer was compacted by a 14-t Hamm 3414 compactor and a 9-t Hamm HD 90 tandem roller, and then the HD 90 completed the compaction of the 13 cm-thick second layer. The Vögele SUPER 1300-3 compact tracked paver was used to apply an extremely thin 2-cm surface course, followed by a Hamm GRW 280 rubber wheeled roller to complete the final compaction of the road surface.
AN EXCELLENT RESULT EVERY TIME

Valmir Bonfim, is highly satisfied with the result: His own experience has now corroborated the acclaim cold recycling technology has been enjoying worldwide. Indeed, he now sees further 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 had been deliberately selected by Bonfim: “On a construction site of this size, where the rehabilitation of the various sections has to be completed within one day, 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 June 2013 and was completed on schedule in November 2013. Based on the excellent results obtained, Ecopistas is planning to make further investments in this technology in the coming years.