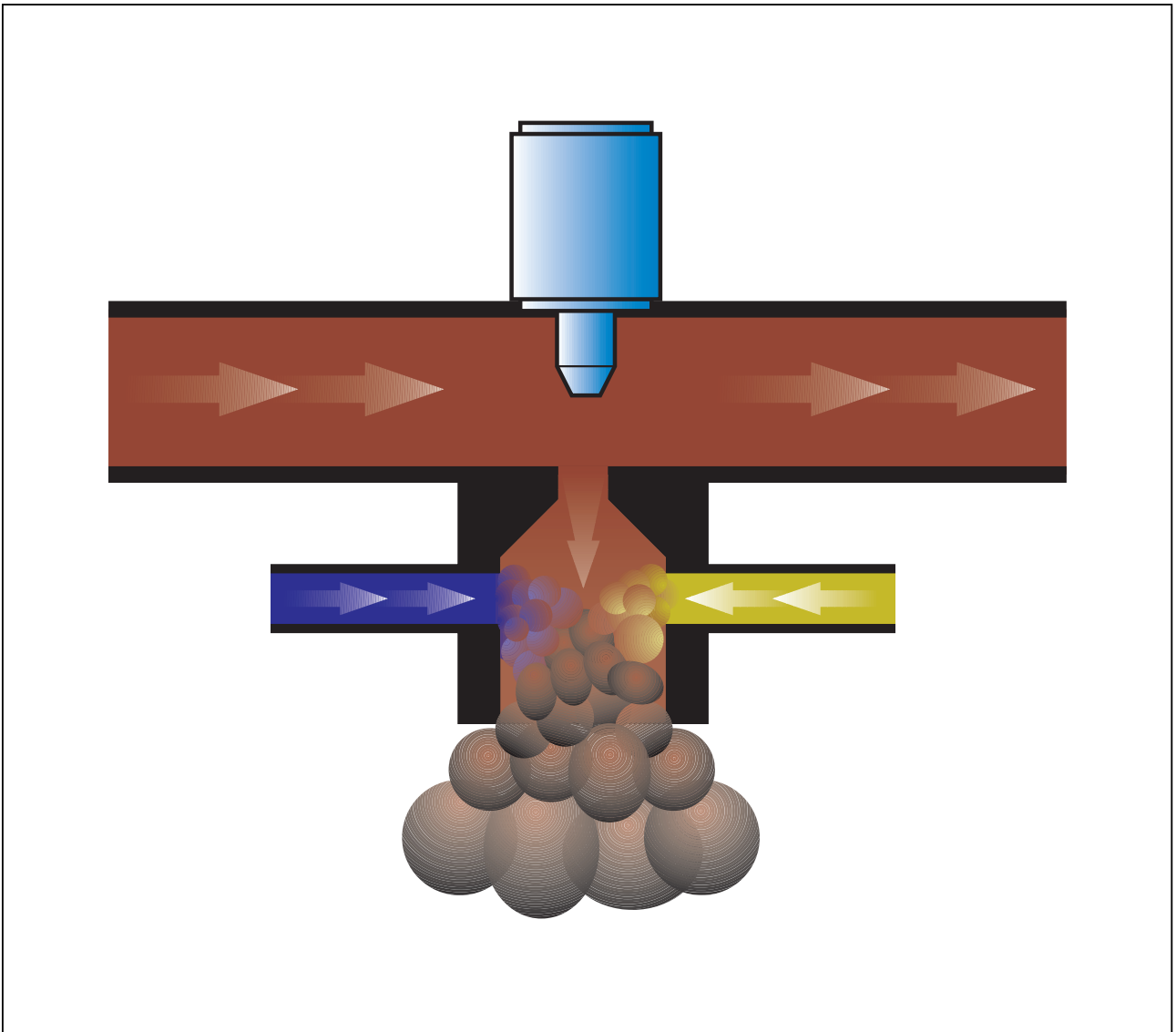


# ***Foamed Bitumen – The Innovative Binding Agent for Road Construction***





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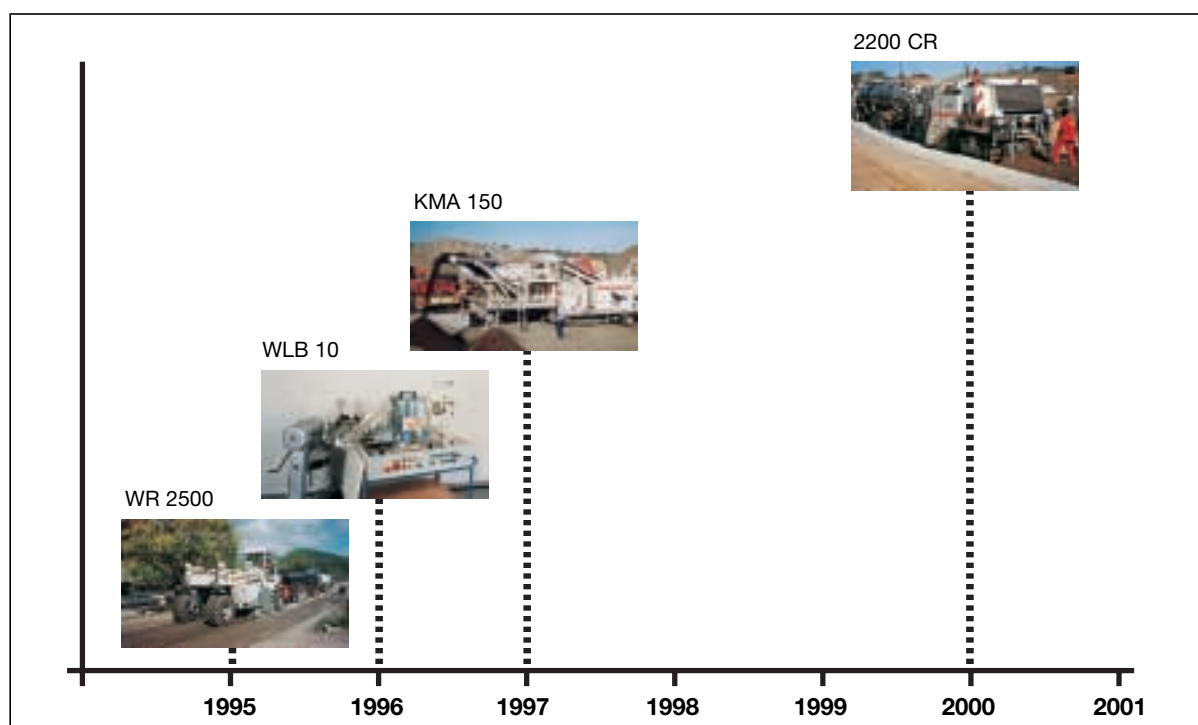


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# Foamed Bitumen – The Innovative Binding Agent for Road Construction

## 1. Milestones in the development of the Wirtgen Foamed Bitumen Technology

With the introduction of the cost-efficient cold recycling process for the rehabilitation of damaged roads, a technology has earned itself worldwide renown which has ecological as well as economical benefits. The reuse of part of the existing road structure which, when treated with binding agents, becomes the foundation of a new road, is the basis for a new recycling method that has meanwhile become a pillar of economical road rehabilitation worldwide. Almost from the beginning of the cold recycling technology, Wirtgen has been actively involved in the development of powerful machinery and equipment. During this period we have established a competence center for cold recycling whose pioneering machine developments have made a crucial contribution towards the success of this technology all over the world.



**Supreme competence for many years: The development stages of Wirtgen's machine technology for cold recycling with foamed bitumen.**

Today, this technology is successfully employed worldwide. In Europe, particularly in Norway, Great Britain and the Netherlands, but also in Eastern European countries, such as Russia or the Baltic Republics, the use of foamed bitumen in cold recycling, as an alternative to conventional binding agents, gains more and more acceptance. In addition, numerous projects are being carried out in North and South America. The foamed bitumen technology is being successfully employed even in countries with extreme climatic conditions, such as Saudi Arabia or Iran, and African states like Lybia, Malawi, Nigeria or South Africa. On the Asian and Australian continents, too, traffic routes have been economically rehabilitated within extremely short periods of time by using the cold recycling process with foamed bitumen.

The worldwide application of foamed bitumen in many countries in almost every climatic zone of the world is once again proof of the excellent suitability of this binding agent under extremely varying construction conditions.



**The Wirtgen Recycler WR 2500 impresses with optimum performance during a cold recycling application with foamed bitumen on a motorway job site in Brazil.**

The production quantities, too, speak for themselves:

In 2000, for example, approximately 100.000 t of various aggregates were treated with foamed bitumen alone in the Netherlands. In Brazil, more than 2.5 million m<sup>2</sup> of road surface have been rehabilitated with foamed bitumen since 1998. In Norway, approximately 3.0 million m<sup>2</sup> of road surface has been recycled with foamed bitumen since 1983. This is sufficient proof of the reliability rightly attributed to this innovative technology.



**The Wirtgen Cold Recycling Mixing Plant KMA 150 can produce storable cold treated materials of the highest quality even in cold weather, with foamed bitumen being added as a binding agent: The mobile plant on a job site near Lillehammer in Norway.**

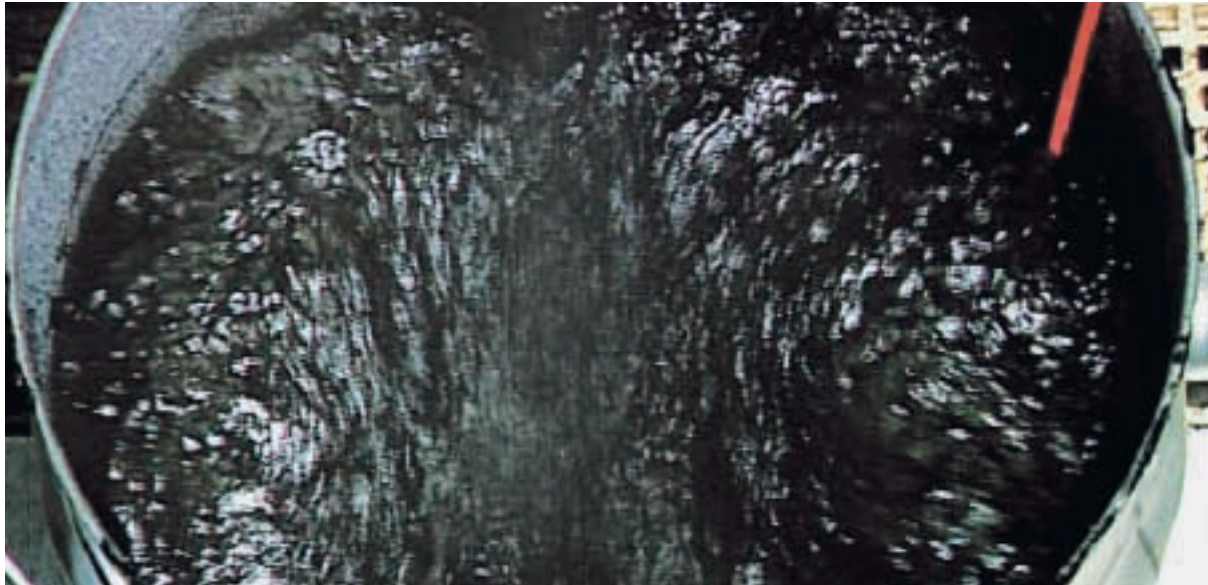
## **2. Foamed Bitumen – An innovative binding agent for road construction**

### **2.1 What is Foamed Bitumen?**

Foamed bitumen is produced by adding small amounts of water (approx. 2–3 % by weight of bitumen) to hot bitumen. The bitumen used for this process is ordinary penetration grade

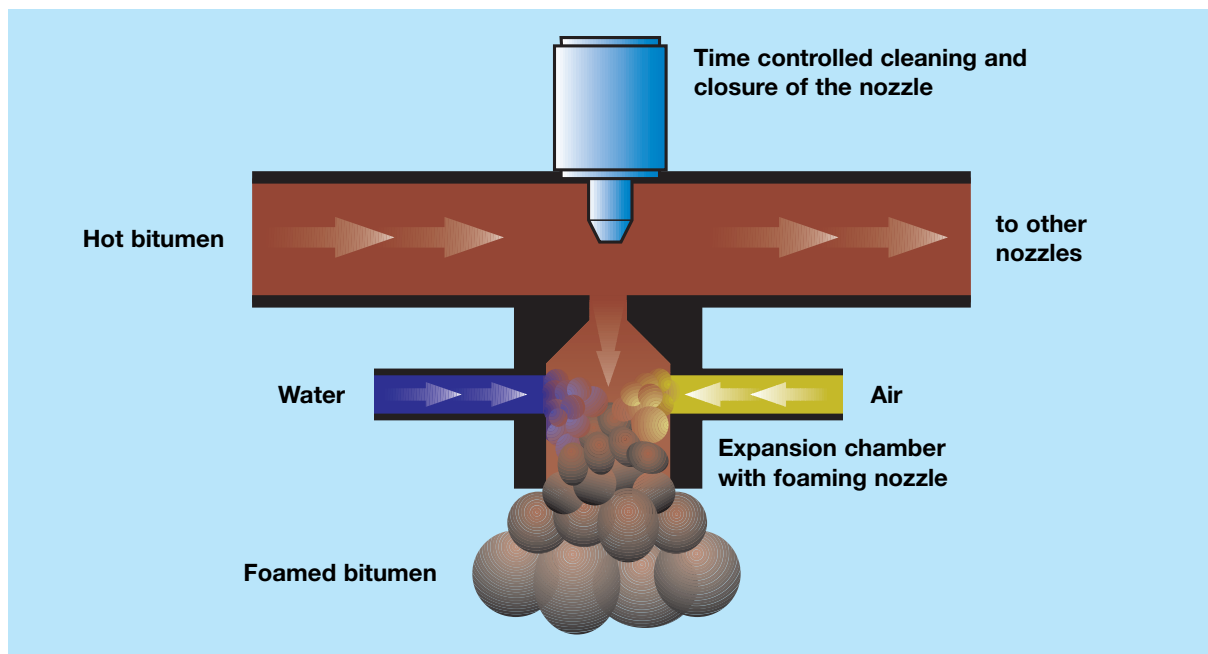
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bitumen, type B60 to B200 which is used for standard hot mix asphalt road construction applications. When injected into the hot bitumen, the water evaporates abruptly, thus causing explosive foaming of the bitumen in the saturated steam. The bitumen thus expands 15 to 20 times its original volume.



**Small quantities of water cause a reaction within the hot bitumen that leads to an explosive expansion of the bitumen volume.**

The intensity and effectiveness of the foaming process can most effectively be governed by controlled operation of the basic physical conditions, such as pressure and temperature. In the Wirtgen machines, this process takes place in individual expansion chambers where the water is injected into the hot bitumen, which has a temperature of approx. 180 °C and a pressure of approx. 5 bar. The foamed bitumen, thus produced “in-situ”, escapes the expansion chamber through a nozzle and can then immediately be mixed with the mineral aggregate to be treated.



**Taking into consideration pressure and temperature, foamed bitumen of the highest quality is produced in the expansion chamber.**

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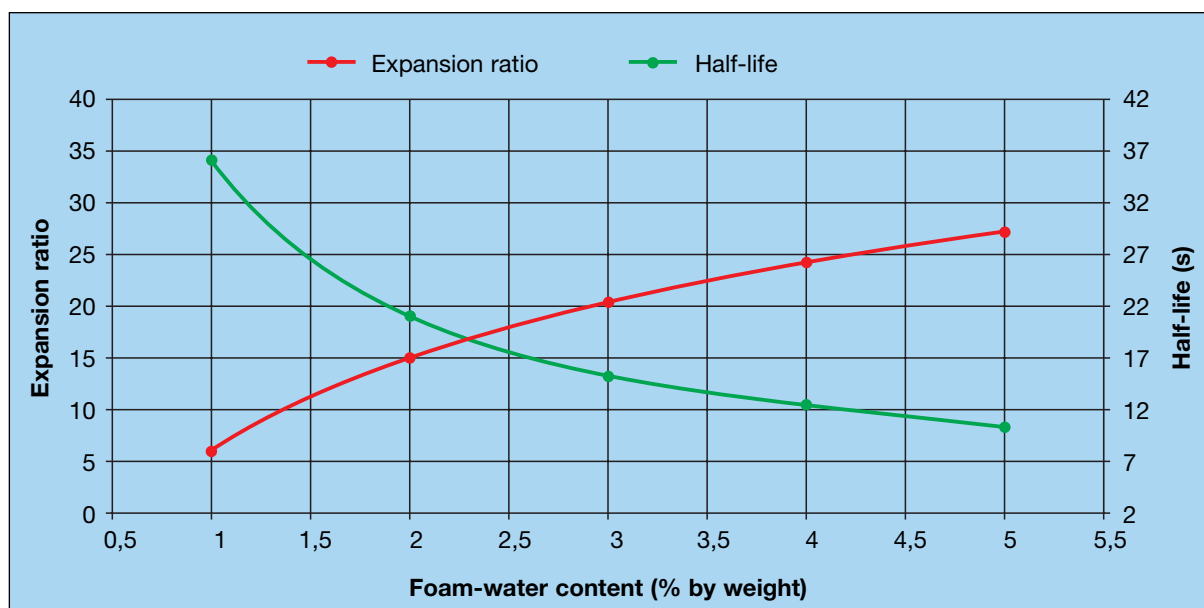
## 2.2 Quality of Foamed Bitumen

The main parameters to determine the quality of the final foamed bitumen product are “expansion” and “half-life”.

“Expansion” is defined as being the ratio between the maximum achieved volume of the foamed bitumen and the original volume of the non-foamed bitumen. As a rule, the expansion of the foamed bitumen is approximately 15 to 20 times the volume of the original bitumen.

“Half-life” is defined as being the time by which the foamed bitumen has reduced its maximum achieved volume by 50%, i.e. half the expansion. After a certain time, the foamed bitumen collapses. The half-life is measured in seconds and usually lies between 10 and 15 seconds.

As a rule: The larger the expansion and the longer the half-life, the better the quality of the foamed bitumen.

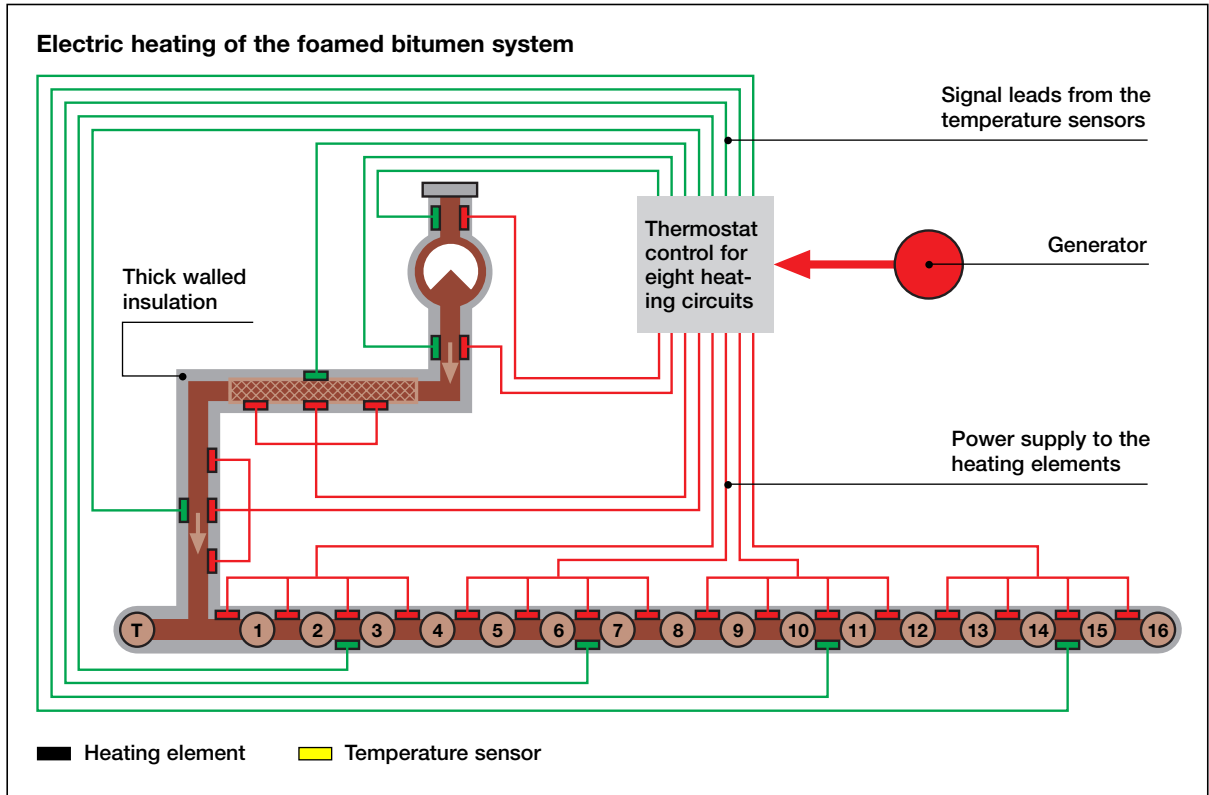


**Important for the assessment of the foamed bitumen quality: As the percentage of added water is increased, the parameters “half-life” and “expansion” develop in opposite directions.**

## 2.3 Production of Foamed Bitumen in the Wirtgen Recycling Machines

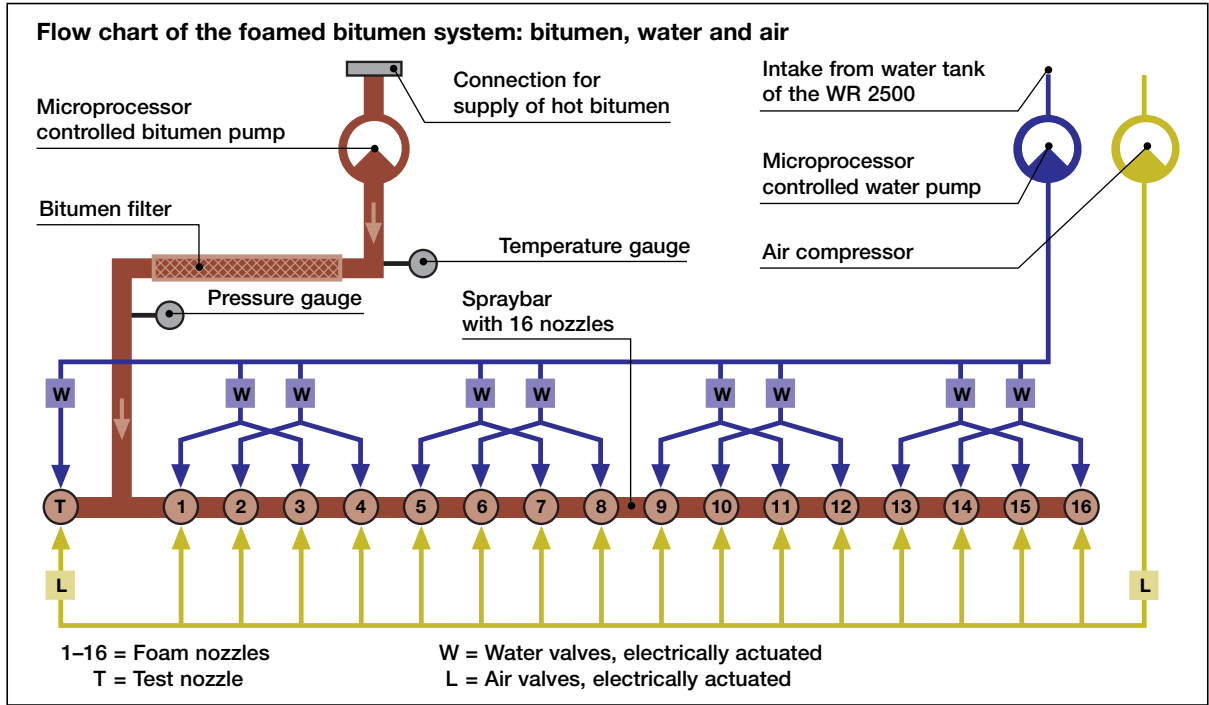
Another crucial parameter for the quality of foamed bitumen as a binding agent is the spraying technology that is used. Particular importance was attached to a number of application-related features when developing the high-quality spraybars that are installed in the Wirtgen machines.

The thermostat-controlled heating unit ensures the optimum operating temperature of the system prior to and during the foamed bitumen production, thus eliminating the need to clean the system when production is interrupted or after the work has been completed.



**Mature technology for foam production:** In the electrically heated tank with its thick-walled insulation, the bitumen is kept at optimum processing temperature at all times.

The bitumen is foamed in a series of individual expansion chambers, with nozzles spraying the bitumen evenly over the complete working width. A microprocessor controls the foaming process and the quantities to be added according to the working width, working depth, rate of advance and material density. Water and air are injected via separate nozzles.

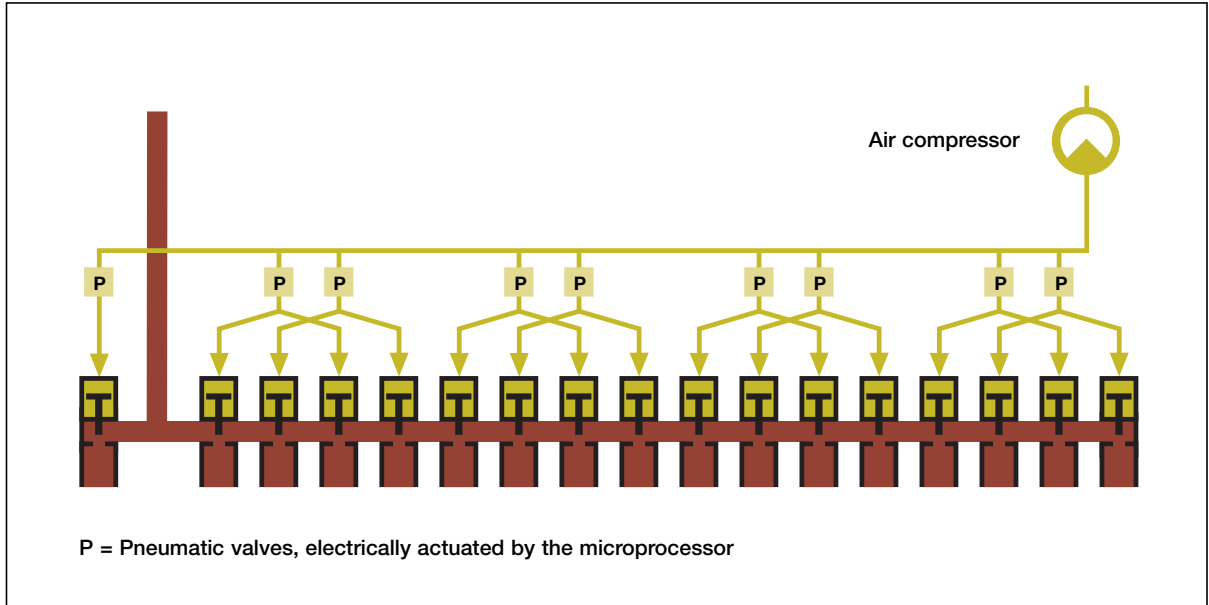


The microprocessor controlling the production of foamed bitumen in the Wirtgen machines accurately meters and sprays bitumen, water and air.



The spraybar directly above the milling and mixing chamber of the Wirtgen Recycler WR 2500 consists of 16 nozzles with expansion chambers in which the hot bitumen is foamed and then evenly sprayed as foamed bitumen over the complete working width.

Pneumatically actuated, pulse controlled pistons clean each nozzle regularly during the spraying operation, thus avoiding clogging by contamination. At the same time, the nozzles can be closed in order to reduce the spraying – and thus mixing – width.



Operating safely at all times by means of pneumatically actuated pistons: The pulse control ensures an undisturbed flow of the hot bitumen.

Bitumen nozzles can be closed from the operators cabin for quick automatic reduction in spraying width. This is an essential requirement for overlapping purposes. Note that as nozzles are switched off the microprocessor automatically reduces the binder addition to ensure that the percentage of added binder remains constant.



During the foaming operation, foam samples can be taken from the external test nozzle in order to check and optimise the foaming properties (expansion and half-life).

## 2.4 Testing the foaming characteristics with the Wirtgen Laboratory Plant

In order to optimise the foaming characteristics, tests can be carried out to check the suitability of the bitumen with the Foamed Bitumen Laboratory Plant WLB 10 prior to starting the construction work. In order to determine the optimum conditions during the foaming process, a series of tests is carried out in which the bitumen temperature and added water quantities are varied. After the foaming characteristics have been optimised, the foamed bitumen can be injected directly onto aggregate which has been placed into a laboratory mixer. This foamed bitumen treated material is used for the production of test briquettes in order to verify its suitability.



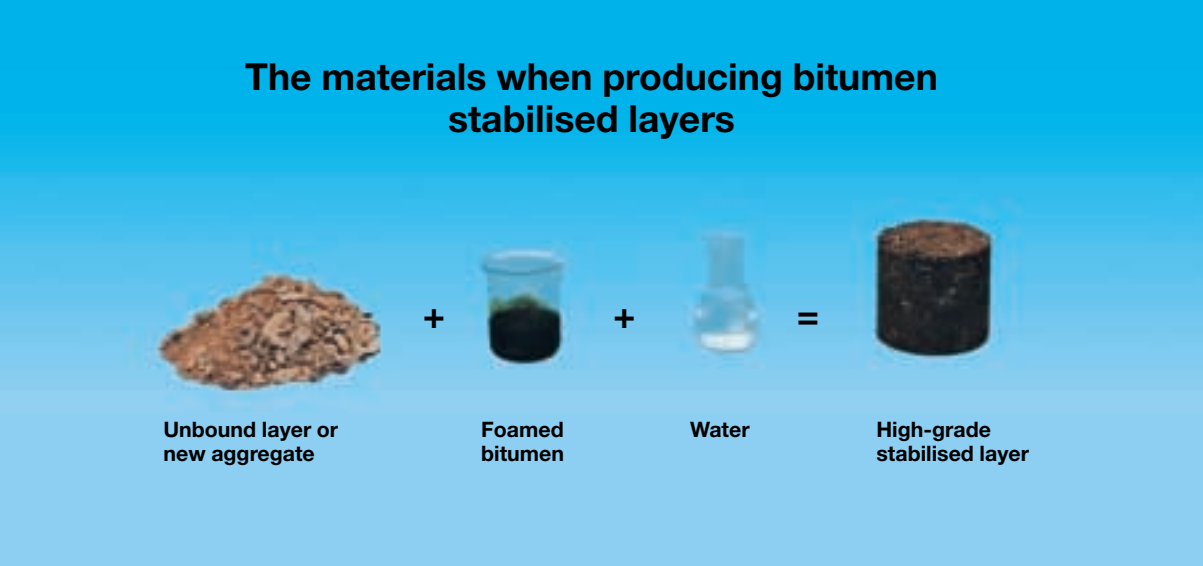
With the mobile Foamed Bitumen Laboratory Plant WLB 10 made by Wirtgen, the foaming properties of the bitumen can be tested prior to starting the project.

### 3. Using foamed bitumen as a binding agent in cold treated materials

#### 3.1 Types of application

Foamed bitumen is a versatile binding agent which can be used for a large variety of mineral aggregates of different types and origins. Milled asphalt, crushed tar contaminated road material or natural gravels can be treated with foamed bitumen and used for road construction or road rehabilitation. Roads consisting of unbound gravel surfaces, impairing traffic due to considerable dust development and becoming soggy during rain, can successfully be treated with foamed bitumen.

Cold processing with foamed bitumen is an economical alternative to new construction. A cold recycling machine blends the foamed bitumen into the unbound gravel layer, thus not only improving the road's load-bearing capacity but also increasing its service life. The recycled pavement should be sealed by means of a surface treatment or a thin asphalt layer.



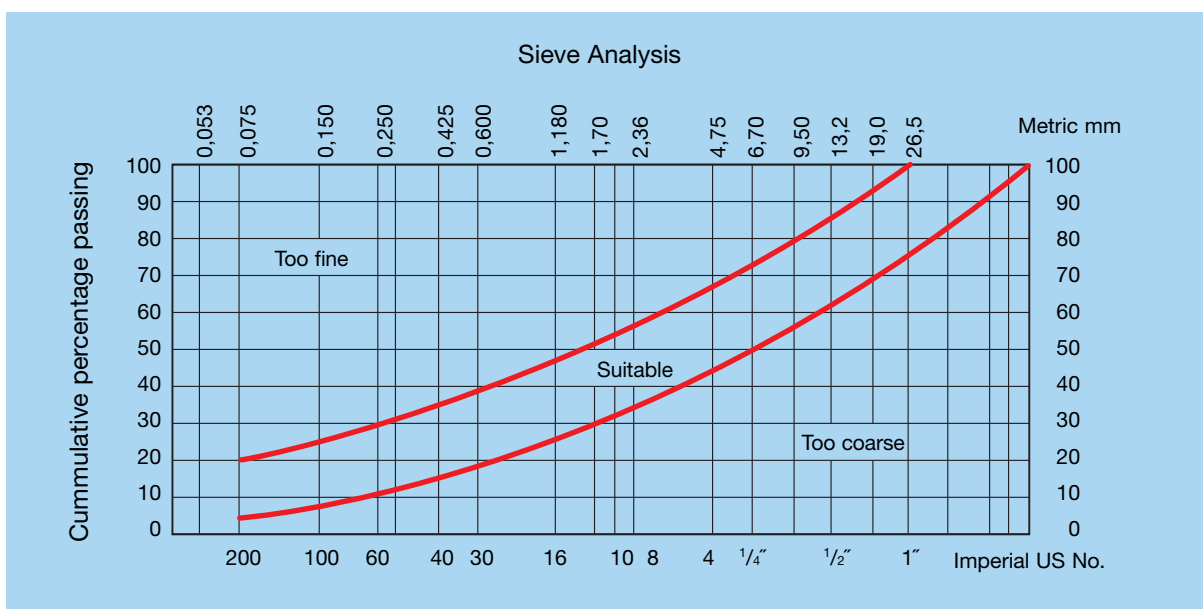
## The materials when recycling existing pavement materials with foamed bitumen and cement



There is a large variety of suitable mineral aggregates. Through the addition of foamed bitumen, aggregates of various types can be converted into a high-quality base layer material.

### 3.2 The suitability of the aggregates used in the process

Well graded material with a satisfactory distribution from fine to large grained aggregates is required for the treatment with foamed bitumen. The sieve analysis will aid to draw conclusions as to whether additional aggregates will have to be added. If the mineral aggregates are deficient in fines (minimum 5 % passing the 0.075 mm sieve), crushed sand 0/2 with a high filler content can, for example, be added. When using foamed bitumen as a binding agent, the content of fines in the mineral aggregates is very important. The foaming process results in a surface expansion of the bitumen and a simultaneous reduction of its viscosity. The dispersing properties thus improved ensure that the fines in the mineral aggregates are coated. The filler and the foamed bitumen together produce a mortar binding the coarse aggregates.



Example of the sieve analysis of a mineral aggregate which is suitable to be used with foamed bitumen as a binding agent.

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### 3.3 The properties of the cold treated material

The suitability of cold treated material bound with foamed bitumen is generally tested by the indirect tensile strength test on Marshall manufactured briquettes. The briquettes are dry cured and consequently tested in a dry and water soaked state.

Characteristic values resulting from the tensile strength tests are usually within the following ranges (addition of approx. 1.5 – 4.5 % foamed bitumen and 1 - 2 % cement):

a) Milled asphalt material (RAP)/crushed stone (50/50 blend)	350 – 800 kPa
b) Crushed stone	400 – 900 kPa
c) Natural gravel	250 – 500 kPa

Typical values of the resilient modulus of material stabilised with foamed bitumen and cement are as follows:

a) Milled asphalt material (RAP)/crushed stone (50/50 blend)	2,500 – 5,000 MPa
b) Crushed stone	3,000 – 6,000 MPa
c) Natural gravel	2,000 – 4,000 MPa

## 4. Examples of road rehabilitation projects using Foamed Bitumen worldwide

### 4.1 Job sites using the Wirtgen Recycler WR 2500

#### 4.1.1 Saudi Arabia – A desert road for heavy traffic

The dual-lane Shaybah Access Road, with a total length of more than 380 km, leads from the Batha main route to the Saudi Aramco Shaybah area in the Rub Al Khali desert. The construction of a reliable traffic route was imperative for the development of an oil field with affiliated refinery, and for the heavy-duty traffic to be expected in connection with the transport of components for the processing plant weighing up to 200 t. Originally built from marl as an unbound gravel road only, the total length of the Shaybah Access Road was therefore recycled within 180 days only using the foamed bitumen technology.

During the main construction phase, three Wirtgen Cold Recyclers WR 2500 and Mobile Slurry Mixing Plants WM 400 were in operation on site. With the addition of 5 % foamed bitumen and 2% cement slurry, a daily average of approximately 35,000 m<sup>2</sup> of existing pavement could be scarified and recycled with the binding agents down to a depth of 20 cm. In order to optimise the workability and compaction properties of the existing sub-base, which consisted of marl and sand, approximately 4 % water were added. In addition to the Wirtgen machines WR 2500 and WM 400, motor graders as well as vibrating rollers and pneumatic tired rollers were employed to profile and compact the treated material.

In order to ensure an optimum work pattern and to achieve the highest possible quality, two recycling trains worked staggered behind one another, thus ensuring good adhesion between the individual machine passes and an optimum profiling of the complete lane. This also enabled the heavy-duty traffic to pass the ever moving job site during the whole duration of the rehabilitation project.

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Finally, a bituminous surface treatment, in the form of a slurry seal, was applied on the recycled base layer.

In an inspection report, road construction experts praised the good suitability of foamed bitumen as a stabilising agent even under these extreme climatic conditions, as well as its high economic efficiency. The original plans involving conventional construction methods with imported crushed aggregate and hot mix asphalt had been rejected as these would have met neither the economical nor the time frame of this project.



**In operation 24 hours a day despite extreme climatic conditions: One of the three Wirtgen recycling trains consisting of a WR 2500 and a Slurry Mixer WM 400 during the economical rehabilitation of the Shaybah Access Road.**

#### **4.1.2 Rehabilitation of the canal road network in the Los Baños District /U.S.A.**

Maintaining the roads along the canal network is the responsibility of the San Luis & Delta-Mendoza Water Authority in California. These roads are not only trafficked by the Authority's inspection vehicles, but also by farmers of the surrounding area. Particularly during the harvesting season, vehicles with high payloads are travelling on these roads. The roads' sub-base originally consisted of no more than the clayey material excavated from the canals, and their asphalt wearing course was deeply cracked. Subsequently penetrating water had led to further damage and erosion.

The Authority decided to use the Wirtgen foamed bitumen technology and the Wirtgen Recycler WR 2500 to rehabilitate the damaged road network.

As a first step, the existing road was granulated over its total width of approx. 4.3 m. Then a motor grader and a compaction roller carried out preliminary profiling and compacting of

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the homogenised sub-base layer. As a second step, the binding agents, consisting of 1.5 % cement and 3 % foamed bitumen, were blended into the existing material by a recycling train which, in addition to the Wirtgen Recycler WR 2500, included a water and a bitumen tanker.

After final compaction of the foamed bitumen treated base by vibratory and pneumatic tired rollers, the pavement was sealed by means of a surface treatment.

In this case, too, the rehabilitation of the existing road network was a fast and efficient maintenance method not requiring the importation of any imported aggregates.



The recycling train including the WR 2500 working along the canal network in the Los Baños District. In future the canal roads can easily be trafficked again even with heavy-duty agricultural vehicles.

#### **4.1.3 Powerful and reliable even under extreme climatic conditions: The Wirtgen WR 2500 rehabilitating a motorway in Iran**

Some years ago, construction work had begun on a six-lane motorway in Iran, the Teheran-Qom Highway. Unfortunately, the road's wearing course had never been completed, leaving the base course open and unprotected for several years. The prevailing climate and heavy-duty traffic had, during the course of these years, caused heavy damage to the road's base course. Therefore, prior to completing the construction of this motorway, the complete road structure had to be rehabilitated.

In order to maintain the existing final road level, part of the existing asphalt was milled off down to a depth of 10 cm. The remaining asphalt and part of the underlying granular base

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layer was then recycled to a depth of 25 cm with a recycling train consisting of the Wirtgen Recycler WR 2500 and the Cement Slurry Mixing Plant WM 1000. 3.5% foamed bitumen and 1.0% cement slurry were added. A total of 800,000 m<sup>2</sup> of base course material in both directions of the dual highway was thus rehabilitated swiftly and economically.

The base course layer was overlaid with a 6 cm thick binder course and a 4 cm thick asphalt wearing course before the rehabilitated motorway could be opened to traffic.



**Cold recycling “to perfection”:** The Wirtgen WR 2500 demonstrating its power during the rehabilitation of the Teheran-Qom Highway job site.

#### **4.1.4 Convincing rehabilitation with Foamed Bitumen: New life for a heavily trafficked highway in Brazil**

Since the introduction of the cold recycling technology in Brazil, the rehabilitation of the important Anhanguera Highway has been one of the largest projects in which foamed bitumen was used as a stabilising agent. The traffic volume on this highway connecting Sao Paulo with the State of Ribeirão Preto, exceeds more than 15,000 vehicles per day, 60% of which can be classed as being “heavy-duty traffic”.

The existing road structure consisted of a 20 cm thick gravel layer beneath an asphalt binder course and a wearing course of 6 cm thickness each. Here, too, the WR 2500 was able to demonstrate what stuff it is made of: During the summer of 1999, within only a few months, approximately 400,000 m<sup>2</sup> of road were cost-effectively rehabilitated with the Wirtgen Recycler WR 2500. With the addition of 2.5 % foamed bitumen and 1.5 % cement, the asphalt layers were recycled down to a working depth of approx. 12 cm. An asphalt wearing course of 6 cm thickness completed the rehabilitation project.

This, too, was a moving job site which allowed rehabilitation “under traffic”. Traffic obstruction was thus reduced to a minimum. Today, the traffic flows freely on this motorway which

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was rehabilitated with foamed bitumen very economically and within an extremely short period of time.



The work proceeds rapidly even under traffic: Fast recycling “in-situ” with the WR 2500 also means minimising traffic obstructions.

#### **4.1.5 Maximum performance using Foamed Bitumen in a rehabilitation project in Norway**

Low temperatures in winter and frequent frost and thaw changes place great demands on road construction in Norway. Besides all other factors, cost-effective rehabilitation and maintenance methods are necessary in order to keep the road network in a usable condition.

Thus the company Veidekke A/S, who have successfully employed various cold recycling methods for several years, have, within six months, rehabilitated more than 800,000 m<sup>2</sup> of road surface with the WR 2500, using foamed bitumen as a binding agent.

Milled asphalt or new mineral aggregates are spread on the road prior to recycling in order to equalize uneven surfaces or to strengthen existing pavement layers. The WR 2500 blends these materials into the existing pavement when granulating the road structure.

Soft bitumen grades, preferably B 370, are used for the recycling process in Norway to ensure the required flexibility of the pavement structure at low ambient temperatures in winter.

The WR 2500’s microprocessor control governs the foaming process and the added quantities of the binding agent. At the special request of Veidekke, the Recycler was equipped with an additional proportioning unit for the addition of additives into the hot bitumen in order to improve the cohesive properties of the binding agent.

With added quantities averaging 3.5 % of bitumen, up to 100 t of hot bitumen are processed

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per day. This equals a daily performance of the WR 2500 of approx. 10.000 m<sup>2</sup>, or the rehabilitation of a road in its full width over a length of approx. 1.5 km.

The rehabilitation is carried out under traffic. After profiling by a grader and subsequent final compaction, the recycled lanes are reopened to traffic. Depending upon the traffic load, the road will be overlaid with one or two layers of asphalt at a later date.



The WR 2500 demonstrating its power: On this job site in Norway, the store of binding agent in this bitumen tanker was sufficient for the rehabilitation of 2,500 m<sup>2</sup> in just under two hours.

## **4.2 Producing cold treated material with the Wirtgen Cold Recycling Mixing Plant KMA 150**

### **4.2.1 Storable cold treated material produced from crushed aggregate and Foamed Bitumen in Norway**

The Norwegian Road Authority of Oppland, whose main residence is in Lillehammer, is operating a mobile Cold Recycling Mixing Plant KMA 150 that is mainly using crushed aggregates to produce cold treated base material.

For the base layers of rural roads, the plant operator uses a crushed aggregates blend, consisting of 80 % aggregates smaller than 22 mm and 20 % aggregates smaller than 8 mm.

Due to the climatic conditions in Norway – extreme temperature fluctuations over the seasons – very soft bitumen of grade B 370 is used for road construction.

The required hot bitumen is usually supplied in insulated tankers. The electrical, thermostat-controlled heating unit of the KMA 150's spraying system ensures an optimum operating temperature. The bitumen is foamed, by the addition of water and air, at the individual expansion chambers on the integrated spraybar, and sprayed directly into the pugmill mixer.

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For the production of high-quality base layers, 3 % foamed bitumen is added to and homogeneously blended with the crushed aggregates. Optimum water content is achieved by adding approx. 3 % water. The mobile mixing plant has a production capacity of 140 t to 155 t per hour.

The processed material is often stockpiled and placed by a conventional road paver at a later date, as and when required. Due to the excellent stability of the mixed material, an asphalt overlay is not required. As a rule, the road pavements are therefore sealed with a surface treatment only.



The mobile cold recycling mixing plant KMA 150 adds foamed bitumen to the pre-crushed and stockpiled aggregates and homogeneously mixes it with an hourly capacity of approx. 150 t.

#### **4.2.2 Reclaiming milled asphalt material with the Wirtgen KMA 150 in Great Britain**

The future-oriented mixing plant design of the KMA 150 provides our customers with new opportunities to dispose of material accumulated during milling operations. A construction company in Scotland, operating a fleet of various Wirtgen milling machine models which carry out milling contracts in the area of Glasgow, could thus use the milled material to produce high-quality cold treated material. The milled material is transported to a stockpile area and sieved according to size and consequently reused in road sub-bases as a substitute for gravel.

The addition of foamed bitumen makes it possible to produce high-grade base layers, the quality of which almost equals that of asphalt base layers. To produce cold treated material from the sieved milled aggregates, foamed bitumen is added in small quantities of only approx. 2 %.

When required, the material thus produced can immediately be loaded onto the individual customer's tip trucks. The cold treated material can be used for a large scope of different

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applications, e.g. for the base layers and wearing courses of secondary roads and traffic routes, for the reinforcement of parking lots and storage areas, or for the base layers of more heavily trafficked roads. The mixed material is partly stockpiled in order to economically satisfy even customers that require only very small quantities.



Stockpiling the milled material blended with foamed bitumen. Production of the KMA 150 can be started and stopped from the wheel loader via a remote control unit.

### **4.3 Job sites using the Wirtgen Cold Recycler 2200 CR**

#### **4.3.1 The Wirtgen 2200 CR rehabilitates an urban road in South Africa**

The rehabilitation of a heavily trafficked urban main road had to be carried out in the vicinity of Durban on the East coast of South Africa. Heavy cracking in the asphalt surface had, in the past, always been tackled by partial repairs only. Reasons of cost-effectiveness then led to the decision to rehabilitate the complete road over its total length. Preliminary examinations showed that the road structure was inconsistent – the result of a previous widening operation.

It was therefore decided first to granulate the complete road structure so that it could subsequently be homogenised with a motor grader.

After homogenisation, one side of the 12.5 m wide road was recycled, using foamed bitumen and cement as a binding agents. The other side remained open to traffic. With the addition of 1% cement and 3% foamed bitumen, the granulated material, consisting of a mixture of crushed asphalt and gravel, was recycled to a depth of approx. 20 cm in the machine's mixing chamber. The material was then compacted by a combination of vibratory rollers and pneumatic tired rollers.

When the first lane was completed, it was reopened to traffic, and rehabilitation proceeded on the other half of the road. After completion of the rehabilitation project, the road was opened

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to traffic for some days before it received an overlay consisting of a 4 cm thick asphalt wearing course.

Thanks to the recycling technology used, this heavily trafficked road section could be rehabilitated swiftly, economically and permanently.



**The road structure was recycled with the Wirtgen Cold Recycler 2200 CR to a depth of 20 cm and with foamed bitumen as a binding agent. The new base course was profiled by a grader.**

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## **5. At a glance: The advantages of the innovative Wirtgen Foamed Bitumen technology**

The rehabilitation of roads with the cold recycling method using foamed bitumen as a binding agent, has the following advantages when compared to conventional binding agents, such as cement or bitumen emulsion:

- Foamed bitumen can be produced from standard penetration grade bitumen. Abundant availability is ensured.
- Relatively small quantities of bitumen and water are needed to produce foamed bitumen, resulting in lower transport and material costs.
- After placing and compacting, the cold treated material can be trafficked immediately, thus reducing traffic obstruction to a minimum.
- Fluctuations of the in-situ moisture are less critical when using foamed bitumen, as the quantities of water added to the process can be accurately metered.
- With the use of foamed bitumen as a binding agent, no time is required for breaking times or setting times of the binder.
- As very small binder quantities are needed, foamed bitumen is a very cost-efficient binding agent.
- Foamed bitumen can be produced quickly and easily directly in the Recycler or the Mixing Plant. Additional plants are not required.
- Cold treated material produced with foamed bitumen as a binding agent has excellent storage properties.

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## 6. Picture gallery of projects worldwide



Reliable operation in South Africa during the rehabilitation of an urban road: The Wirtgen Cold Recycler 2200 CR is a machine that can be used for cold recycling as well as cold milling applications.



The Wirtgen foamed bitumen technology is a reliable rehabilitation method even in the desert: The recycling train is in continuous operation in Saudi Arabia on a total road length of more than 380 km.



The rehabilitation of a traffic route in South Africa is an easy exercise for the WR 2500: Flexible hoses supply the recycler with hot bitumen and water which are sprayed into the mixing chamber in precisely metered quantities.

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**A road rehabilitation project in the Netherlands: The Recycler WR 2500 pushes the insulated bitumen tanker truck in which the hot bitumen is stored.**



**Cold treated material with excellent storing capabilities thanks to a binding agent called foamed bitumen: Here in Malaysia, high-quality base course material was produced with the KMA 150.**



**On this job site, cement was spread on the road surface prior to the WR 2500 starting its work. The machine's well dimensioned engine enables it to easily push the tanker trucks for hot bitumen and water during the recycling process.**



**In South America, too, the Wirtgen foamed bitumen technology is gaining ground: In the air-conditioned operator's cabin, the machine operator is at ease even at extreme temperatures – as on this job site in Brazil.**



**A truck is filled within a very short time: The mobile mixing plant KMA 150 impressively demonstrates its power here in Colombia.**



**During the rehabilitation of a motorway in Iran, the WR 2500 could once again demonstrate its power: The machine went to work after parts of the base course had been milled off.**



In accordance with the individual job site requirements, cold treated material from new aggregate material is produced in this Scottish quarry, adding, for example, foamed bitumen as a binding agent.



If required, the mobile KMA 150 can always be transported to the most convenient mixing location. Here, high-quality cold treated material is produced in Australia with the addition of foamed bitumen as a binding agent.



A rather cramped urban job site in Bogotá/Colombia: Here, too, the Wirtgen recycler WR 2500 feels at home and recycles the existing road structure swiftly and economically with foamed bitumen.



Recycling “in-situ” under traffic is no problem for the WR 250: The “moving job site” minimises traffic obstruction and leaves behind a high-quality base course layer.



Road rehabilitation in Norway: The WR 250 is coupled to the insulated tanker truck, and hot bitumen is foamed and homogeneously mixed in the Recycler's mixing chamber.



In this African Game Park, the network of traffic routes was rehabilitated with the WR 250 without disturbing the natural environment.



The WR 2500 is in operation in the New World, too: Customers in the U.S.A. benefit from the advantages of the Wirtgen foamed bitumen technology.



The cold treated material produced by the mobile KMA 150 is loaded onto trucks: In Texas/U.S.A., too, the good quality of material produced with foamed bitumen is well-known.



Environmentally friendly road rehabilitation with foamed bitumen in Sweden: The recycling train with the WR 2500 vouches for the swift rehabilitation of damaged traffic routes.

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