



With two linked vehicles combining for a total working unit of just over 118 feet, the Macrotex shotblasting plant pioneers the use of "wet" steel shot over traditional "dry" shot blasting methods.

'Wet' Steel Shot Blasting for Road Surface Retexturing

Dutch company hopes for American market future

The Dutch retexturing plant specialist, by Klaruw Tilburg, has developed a prototype machine for "wet application" shot blasting believed to be the first of its kind for use on roads and other pavements. The Macrotex (MAT) shot-blasting plant is designed to improve the surface macro-texture and micro-texture of highways, airport runways and racetracks to safe levels.*

Once Klaruw has completed sufficient testing and necessary modifications to the prototype on as many different surface materials as possible, the company will then submit the machine for certification to EU norms and offer the process on a contract service basis. Klaruw executives hope this will happen by the end of the year. The machine will be available in Europe first, but global sales and rentals are planned to respond to demand. Company executive are also considering an American sales plan.

Fully computer-controlled, the machine offers advantages in process control, treatment flexibility and rate of coverage over conventional shot blasting plant. Most significantly, it pioneers the use of "wet" steel shot, allowing retexturing to be carried out in wet weather, even in heavy rain, unlike traditional "dry" shot blasting methods.

The process is carried out by two linked vehicles, each carried on a six-axle tractor-trailer, making a total working unit of just over 118 feet. The main MAT shot-blast vehicle incorporates a steel shot storage and recycling unit, a rear tank for waste water and debris, with the shot blasting mechanism housed in between. For operator safety, the shot blasting unit can be side-shifted either way by circa 23½ inches.

Used shot is reprocessed in the shot storage unit. Remaining arisings are conveyed, via the rear tank, to a closely coupled, dedicated water cleaning machine (WCM) behind the MAT unit. This cleans and recycles water for re-use in the shot blasting treatment, while processing residues to an almost dry condition for disposal. The MAT unit will not work independently of the WCM, but the WCM can be used on its own as a hydro-sweeper.

Working speed is variable, ranging from around 16 feet-plus per minute for heavy-duty, deep retexturing, to in excess of 54 yards per minute, as observed so far during testing. A working speed of at least 22 yards per minute is achievable on concrete, based on the results of trials to date.

Wet Conditions

As a retexturing specialist since the 1950s, Klaruw has been aware of the need for a steel shot blasting machine that can work at a high production rate under wet conditions to increase utilization and minimize traffic disruption.

Traditional 'dry' application shot blasting machines have a number of disadvantages. They cannot work in wet (or humid conditions), limiting opportunities for their use and making them an unreliable element in planning and fulfilling maintenance schedules.

They also exhibit a so-called "hot spot", meaning that the intensity of treatment is not the same perpendicular to the direction of movement. In other words, when the treatment intensity is set to the correct level for the hot spot, the surface next to the hot spot will be treated too lightly. On the other hand, when the intensity is correct for the surface next to the hot spot, the surface under the hot spot will be damaged because the treatment is too severe. In addition, the treatment intensity cannot be varied, for example, to "retexture" wheel track zones more robustly than other areas.

The MAT unit provides variable width control from 9½ inches up to a maximum of almost 75 inches. Few conventional shot blasting machines achieve much more than 47 inch in one pass. This feature alone offers a significant gain in productivity, treating around 50-percent more road surface in one pass for much quicker progression, reduced traffic management time and less disruption to the road user.

The MAT unit also allows unprecedented control of treatment intensity, as well as ensuring consistent intensity as it travels. This has been achieved by the machine's capability to adjust the working speed, the impact speed of the shot and the amount of shot very accurately, combined with the ability to vary the intensity of treatment perpendicular to the direction of movement.

Touch Screen

There is touch screen computer control in the cab for setting and adjusting treatment parameters, monitoring processes, and displaying safety data/alerts. The system provides a detailed log of process and machine data cross-referenced to treated road sections and road types. This provides useful information on effective settings for different road surface types, so that successful results can be reproduced on similar surfaces for clients.



Editor notes:

More on the MAT machine design:

- The water cleaning machine (WCM) has been engineered so that there is minimal build-up of hydrostatic pressure, leaving porous or cracked surfaces undamaged. Arisings are processed to an almost dry state, and can be off-loaded on site to another truck using on-board hoists.
- The MAT is equipped with several diesel engines, with a total combined power rating of approximately 1000 kW. It has a shot storage capacity of approximately 4.5 tons. Three different types of shot can be stored, allowing the shot type to be changed on site, if required. The working hopper can be automatically filled from the storage hoppers during shot-blasting.
- The WCM also has several diesel engines with a total combined power rating of approximately 700 kW. It can store approximately 353 cubic feet of water. After use in the MAT shot blasting process, the water and arisings are pumped to the WCM where the water is filtered and re-used again and again.

More on pavement texturing:

- Surface friction of an existing pavement can be improved through a number of pavement restoration techniques. These fall into two main types:
 - a) More radical correction may involve resurfacing, rehabilitation or reconstruction procedures such as overlay, partial-depth repair or full-depth repair.
 - b) Texturing methods rework the existing road surface and include predominantly diamond grinding, grooving or abrading (shot blasting).
- Pavement surface micro texture – the microscopic roughness of the aggregate surface – interacts with vehicle tires to generate the required forces to provide friction. In wet conditions, the micro texture also has to penetrate the film of water which acts as an additional barrier to contact with the tires. If not, the risk of wet skid crashes increases, and with it, the risk of injury and fatalities.
- At higher speeds (over about 40 mph), the more visible texture of a pavement – the projections, depression and grooves known as the macro texture or texture depth – becomes significant. This provides escape paths for surface water from the pavement contact area of tires to prevent hydroplaning.
- The Klaruwtext190 (K190) "Controlled Mechanical Retexturing" process is a proven and economical method for restoring texture, and hence wet weather skid resistance, to rain slick pavements. Carried out by proprietary plant, the K190 process uses no materials and can be carried out in wet weather. Pavements are treated in one pass as a "moving works" operation with comparatively little disruption of traffic. The mechanism uses 336 no. tungsten carbide tips mounted on pneumatic bush hammers to improve micro texture, and often macro texture as well, to restore skidding resistance to all natural aggregate surfaces. Test data has proven its effectiveness in improving friction numbers to statutory levels.

Machine settings and process data can also be loaded into and extracted from the computer system by modem.

The computer controls in the MAT and the WCM communicate using CAN-bus. This allows the vehicles to drive at exactly the same speed at a set distance. Once the MAT operator has started the process with the "push of a button" on the touch screen, the operators/drivers only have to steer the vehicles in the right path. Everything else is done by the computers.

The flexibility of the MAT process, in terms of treatment width, intensity and speed, means that shot blasting can be tailored and targeted exactly where it is needed. The process works at optimum and, therefore, at the most efficient and most cost-effective levels, assuring a high success rate to reduce potential need for rework. Cost benefits are enhanced by the fact that there is no need for post-treatment work (cleaning or line marking replacement), materials are recycled very efficiently, and there are minimal arisings for disposal.

The MAT process primarily improves the macro-texture – the texture depth that allows surface water to escape to prevent hydro-planing – of most natural aggregate surfaces. Improvements in micro-texture – the surface friction which provides wet weather skid resistance – are a secondary benefit of the process.

Trials

The machine prototype is currently undergoing extensive field trials to evaluate its effectiveness on as many different surface types as possible. The trials are also vital in establishing optimum settings for achieving the required level of treatment – from light cleaning to deep abrading – on different pavements.

So far, tests have been carried out on concrete, porous asphalt, marshall asphalt, SMA (stone mastic asphalt), HRA (hot rolled asphalt) and thin surfacing at trial sites in Europe. These include a number of motorways, a motor racing circuit and military airport.

Tests have produced promising results on most surfaces. An increase in wet skid resistance from 0.33 to 0.64 inches SFC (sideways force coefficient) has been observed during testing. The machine is also proving effective in removing

bitumen residues left on any newly laid surface course to prevent potential "bitu-planing".

Klaruw believes that macro-texture rejuvenation using the MAT machine is set to provide a versatile, cost-effective and highly sustainable solution for addressing aqua-planing and wet skid issues, and improving road safety. By reworking existing surfaces, it extends the service life of structurally sound roads by several years before more costly, disruptive overlay or inlay is needed.

The machine shot blasts and cleans the road surface as one integral unit in one pass, simplifying traffic management and leaving treated sections ready for use immediately. The technique requires no after-treatment or curing time, does not damage markings, leaves no residual deposits and can be used even in heavy rain.

MAT retexturing also has significant environmental benefits. It applies no new material to the road, produces minimal waste, and recycles water and shot used in the process, reducing reliance on virgin material and landfill. This leaves a lower carbon footprint than alternative methods of restoring macro-texture, such as surface dressing or material overlay.

Following further development and certification to EU norms, Klaruw hopes to bring the MAT process to market by the end of the year on a contract service basis. If there is sufficient demand, the company will then consider manufacturing the machine for sale.

The MAT "wet" shot blasting technique complements Klaruw's established bush hammering process, Klaruwtx 190 (K190). Used successfully in Europe since the late '80s, K190 provides controlled mechanical retexturing principally to restore surface micro-texture and improve wet weather skid resistance to above investigatory levels.

Klaruw says the development of the MAT machine is timely as road authorities around the world face tough performance targets for road safety, carbon footprint reduction and cost-efficiency. ❖

More info from www.klaruw.com

** This story submitted to Better Roads by Klaruw*



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