

PART 2 WINNING the BONUS

MTVS: MASTERS OF MATERIAL



North of Austin, on Highway 130, the Central Texas Tollway, bottom-dump trucks place two parallel windrows of hot mix asphalt, which are picked up by MTVs, remixed and placed in paver hoppers.

This month, *Equipment World* continues its seven-part series on how to optimize pavement construction to win bonuses with a look at material transfer vehicles.

- Part 1: Smooth Pavements through Cold Milling
- Part 2: Smooth Pavements and Material Transfer Vehicles
- Part 3: Smooth Pavements and Asphalt Pavers
- Part 4: Smooth Pavements and Asphalt Screeds
- Part 5: Compaction for Super Smooth Asphalt Pavements
- Part 6: Super-Smooth PCC Pavements with Slipform Pavers
- Part 7: Super-Smooth PCC Pavements with Stringless Controls

For smooth, long-lasting asphalt pavements, the experts agree: eliminate aggregate and thermal segregation in the mix, keep the paver moving, and isolate the paver from the haul truck.

There's one machine that does it all: the material transfer vehicle (MTV).

While not specified for use in all states, MTVs are being used on asphalt paving projects throughout the country, even in states like California, which is evaluating their use, but doesn't require them for most mixes.

Material transfer vehicles were developed to eliminate contact between truck and paver, resulting in smoother mats. Every time a truck bumps a paver during a load, a discontinuity in the mat may form. Essentially, MTVs provide noncontact paving between truck and paver, along with surge capacity to allow the paving process to continue during truck exchanges.

In doing so, a full-function MTV will independently store, remix and deliver mixes from haul truck to the paver.

Some states don't require MTVs on shorter-length jobs. For example, Connecticut requires an MTV only when placing an HMA surface course that is greater than 5,000 feet in length and 28 feet in width.

When hauled from job to job, or used within a job with bridges, weight can pose a problem with large MTVs. Connecticut demands that a load factor rating analysis be obtained for all structures that the MTV may cross during paving.

"The MTV must be a self-propelled vehicle specifically designed for the purpose of delivering the HMA mixture from the delivery truck to the paver," the state says. Contractors must detail what make and model MTV will be used, the axle weights and spacing for each

piece of paving equipment, plus provide a drawing showing the axle spacing. They also must ensure that the MTV has the capability to remix the HMA mix. New-design, lighter-weight MTVs may ward off these requirements.

Fighting mix segregation

In addition to isolating the paver from haul truck, via their remixing capability, MTVs also fight both material and thermal segregation, leading to a more consistent mix when placed as pavement.

Full-capability MTVs remix or agitate the mix as it is lifted, conveyed or stored in the mobile material transfer vehicle. The remixing can be active (using paddles within surge hoppers or ahead of conveyors) or passive, as the mix moves or is dropped within the MTV. This remixing provides a more even temperature within the mix – or reblending of aggregate – that leads to more durable pavements.

Aggregate segregation can also develop at the plant, at the silos

with the way the trucks are loaded and in the paver. It's recommended that the asphalt plant and drivers follow the three-drop system, that is, a drop in the front of the truck body, one in the rear and a final drop in the middle. Segregation also may occur when crews let the paver hopper run too low.

According to the new National Cooperative Highway Research Program synthesis, NCHRP 477, *Methods and Practices on Reduction and Elimination of Asphalt Mix Segregation*, end-of-truck segregation is a type of material segregation that can result in coarse mat finishes.

End-of-truck material segregation is also known as truck-to-truck and truckload-to-truckload segregation and can be reduced by fully raising the truck bed before opening the back gate, according to the report. "When the gate is finally opened, the mix is discharged from the truck bed in mass into the paver hopper. This process rapidly fills the paver hopper and prevents the coarser particles from collecting in the paver wings," the report says.

To fight mix segregation, New Jersey DOT requires the MTV to have a remixing system to continuously blend the HMA before placement. Remixing may occur within the MTV or in the paver hopper.

The Garden State also demands the MTV be equipped with a high-capacity truck unloading system to receive mixtures; a storage system capable of holding at least 15 tons of HMA; and a discharge conveyor capable of slewing to either side to deliver HMA to the paving spreader while allowing the MTV to operate from an adjacent lane. A paver hopper insert with a minimum capacity of 14 tons in the hopper of conventional paving equipment is also required.

What is mix segregation?

Segregation in a mix is two-fold; it can be large stone separating from small stone [material segregation], or temperature variations within the truck body [thermal segregation]. On hauls, measurable discrepancies may occur between the temperature of the mix deep inside the truck body, compared to that around the edges of the body and on top of the mix. And when mix is dropped into the truck bed, or when mix is transported, movement during transport can cause larger aggregate particles to roll to the sides of the load and away from the finer particles.

On I-10 in central Oklahoma, a large Roadtec Shuttle Buggy feeds a Weiler hopper insert in a Cat paver placing Kraton highly modified polymer asphalt.



Image: Tom Kuennen

Windrow elevators

A crude form of mix agitation or remixing is provided by the windrow elevator. Out west, given the long distances between jobsites and asphalt plants, hot mix asphalt typically is hauled in large-capacity bottom-dump trailers, which place the mix in a longitudinal windrow down the center of the lane to be paved.

Via a paddle or slat conveyor, a windrow elevator in front of the paver then lifts the mix and places it in the feed hopper of a conveyor, which spews it into the paver receiving hopper. While aggregate segregation can be a problem on long windrows, with larger aggregate tumbling to the sides as the mix is dumped, the lifting and recombining of the hot mix asphalt in the receiving hopper of the paver fights segregation.

However, a windrow elevator is not an MTV. The Federal Highway Administration specifically says so in its specification. Yet they still play a strong role in paving asphalt, especially out west.

Keep the paver moving

In addition to fighting temperature and aggregate segregation, the storage capabilities of the MTV let it feed the paver during truck exchanges. Theoretically, the paver never stops, and that's critical for super-smooth pavements.

The MTV keeps the paver moving forward without the roughness-inducing jolt of truck against paver. This best-practice paving means saying goodbye to old-school wheel locks, which clamp the front of the paver to the rear wheels of the dump truck.

The Asphalt Institute recommends

operating the paver speed and feed gates to keep the augers turning 85 percent of the time, keeping forward motion at least 75 percent of the time, and maintaining feed augers with proper head and uniform flow of material to the screed.

Once the paver is in motion, it should stay in motion. Then, automatic screed and grade controls using averaging skis will attain exceptional smoothness in the final pavement, so long as compaction is executed correctly.

"Continuous paving is a must for smooth pavements," says Roadtec, an Astec Industries company, pioneer in MTVs in North America, and maker of the familiar Shuttle Buggy line of MTVs.

"There will always be occasions where we must stop the paver due to material shortages caused by trucking delays, or operations



Image: Tom Kuennen

that require hand work, or where we might be tying into existing pavements and/or intersections,” Roadtec says. “The number of stops – as well as the length of time we remain stopped – can affect potential roughness. Stops will never be completely eliminated, but they must be minimized.”

Operators can make the mistake of slowing down dramatically to allow trucks to leave or discharge into the paver’s hopper, Roadtec says, adding that these severe speed changes can lead to smoothness problems. Use of an MTV, or focusing on constant speed paving, with rapid stops and starts, is a better approach, Roadtec says.

Defeating truck/paver contact

Today’s free-floating screed is held to grade by five forces: the pull

force (forward), the weight of the screed (downward), the material head (to rear), the reaction force of asphalt beneath the screed (upward) and frictional force against the mat (to rear).

“When in balance, these forces hold the screed in equilibrium, and a constant mat depth is maintained,” says Laikram “Nars” Narsingh, manager, commercial support and development for Vögele in North America. “But whenever you break those forces in equilibrium, you will have a change in grade. To avoid breaking the forces, you have to avoid the truck bumping the paver, or the paver stopping to exchange trucks. The MTV was developed to receive the mix from the truck and deliver it to the paver.”

Loading the paver by using a hopper insert while using an MTV

At the Circuit of the Americas Formula 1 track south of Austin, a single MTV feeds three pavers in echelon, eliminating cold longitudinal joint between three mats, and permitting a super-smooth pavement for the world-class racing course.

is the best solution to keep the paver moving while isolating it from the trucks.

“As the paver approaches the MTV, it is refilled before the MTV moves forward to receive the next truck discharge,” said the late J. Don Brock, then chairman of Astec Industries, in one of his essential guides to HMA production and paving, Hot Mix Asphalt Trucking. “An insert can be installed in the paver, allowing storage of 15 to 20 tons of mix in the paver and providing a



Image: Tom Kuennen

On Ohio's I-71, the operator's platform of a Vögele MT-3000-2i MTV offers panoramic view of jobsite and MTV receiving hopper.



Image: Tom Kuennen

In 2015, Shelly & Sands earned an award-winning smoothness bonus on reconstruction of I-71 in central Ohio via use of a new Vögele MTV.

combined paver and MTV storage capacity of 45 to 50 tons. With storage capacity, the paver can operate continuously."

Then – when an MTV is used – trucks can be stopped 100 to 200 feet ahead of the paver and dump safely without moving. The truck can discharge at a location where there is no danger of the truck bed hitting power lines, tree limbs or other obstacles.

Attaining smooth pavements

The Roadtec SB-2500e Shuttle Buggy MTV helped achieve a high degree of paving smoothness (required by Federal Aviation Administration specs) during a recent paving project at the Meeker, Colorado, airport in the Rocky Mountains. The SB-2500e maintained hot mix asphalt at the

appropriate temperature and mix, then delivered it to the paver at consistent levels.

The MTV and the asphalt paver worked in conjunction with three PZL-1A lasers provided by United Companies (the company responsible for the project) to pave a 100-by-6,500-foot runway at the airport.

A pair of Shuttle Buggies also helped two Super 2100-2 Vögele pavers attain astonishingly smooth placements of HMA on segments of Highway 130 for the Central Texas Regional Mobility Authority south of Austin. The road received national attention when a top speed limit of 85 mph was permitted on those southern sections, so extraordinarily smooth pavements were a must.

The two pavers placed a 2-inch wearing course. Bottom-dump trucks placed two parallel windrows of hot mix asphalt, which were then picked up by two MTVs, which fed the two pavers operating side-by-side.

Pavers were used in echelon to get a hot joint between the two lanes, as specified by the owner. The contractor placed a 40-foot-wide pavement, with a 22-foot pull outside and an 18-foot pull on the inside, including a 6-foot inside shoulder and 10-foot outside shoulder.

Specs required an IRI of 60 or below, but the ride was well below that threshold, with readings in the 20s and 30s. Smoothness was being augmented by the Vögele Niveltronic grade and slope control system using 50-foot skis. Two skis were used on the 18-foot paver, and one on the 22-foot paver.

Winning the bonus in Ohio

In Summer 2015, the new MT 3000-2i material transfer vehicle from Vögele was helping an Ohio contractor attain the kind of ride numbers it needed to win the maximum smoothness bonus for an interstate highway reconstruction.

Shelly & Sands, Zanesville, Ohio, used its new Vögele MT 3000-2i MTV to completely reconstruct more than nine miles of I-71 between Mansfield and Columbus in the central part of the state.

The Ohio DOT took the opportunity of widening I-71 from two lanes to three to completely

rebuild the highway from the base up. This project represents the last stage of "three-laning" the busy interstate from Columbus to Cleveland, and the segment between Columbus and Cincinnati is also being widened to three lanes.

The MT 3000-2i fed an innovative insert mounted in the hopper



CRITICAL PREHEATING FROM EBERSPÄCHER

Don't let winter conditions keep you from getting the job done. Trust Eberspächer Climate Control Systems to keep your jobsite running smoothly.

Eberspächer Climate Control Systems offers the most comprehensive range of idle-free fuel operated air and coolant pre-heaters available in the marketplace. By using a pre-heater from Eberspächer, you can expect reliable engine starts on equipment, instant heat and defrost, and pre-heated critical fluids, even in the worst conditions winter has to offer.

To learn more about Eberspächer's climate control systems and what they can do for you, visit www.eberspaecher-na.com or call 1-800-387-4800



A WORLD OF COMFORT

150 YEARS OF INNOVATION SINCE 1868
Eberspächer

of a Vision 5200-2 paver with VF 600 screed, both from Vögele.

"The MT 3000-2i was used only on the surface course," said Shelly & Sands' quality control manager Ed Morrison. "For paving at night, state spec requires an MTV for any work over a continuous mile, but we used one whether paving day or night. We do it to fight segregation, and it helps us get density and smoother pavement."

That's important, as this project carries a \$500,000 bonus if all IRI specifications are met. "This MTV helped us get there," Morrison said. "The main advantages are No. 1, smoothness, and No. 2, density. Regarding smoothness, we have better truck exchanges because the MTV acts as a buffer. And we keep a consistent head of material in the paver hopper. Consistency is the big thing for smoothness; it takes error out of the equation. And the reduction in segregation helps us maintain density." **EW**



▲ MTVs are for rural roads, too; a large Roadtec SB 2500D Shuttle Buggy feeds a Roadtec paver placing warm mix asphalt containing recycled asphalt shingles.



PIONEER BRIDGES

A division of Bailey Bridges, Inc.



Prefabricated Steel Truss Bridges
Pedestrian & Light Vehicular Spans up to 250'

866-708-5778

www.pioneerbridges.com



QUALITY CERTIFICATION
MAJOR BRIDGE
SIMPLE BRIDGE

256-845-7575
256-845-7775 fax
119 40th Street NE
Fort Payne, AL 35967



BAILEY BRIDGES, INC.

Portable Bridges — Rent or Buy — Bridge Decking & Grids



Mobile Barriers MBT-1 now available with Crane & Bucket

**MOBILE
BARRIERS®**
www.mobilebarriers.com