Taking the Guesswork Out of Compaction

How do you justify the extra cost of Bomag’s intelligent compaction technology? We ask early users what they’ve found.

Intelligent compaction is a concept gaining increasing attention from asphalt paving contractors. It means more sophisticated compaction equipment, but it also means paying more for the machine. So, how do you cost-justify the extra expense? Can those added dollars help the contractor deal with more complex asphalt mixes, meet more demanding specifications, and get the job done better or faster the first time?

To find out, the editors here at Better Roads talked to some of the first users of one specific technology, Bomag’s intelligent compaction application called Asphalt Manager.

“It’s instant gratification,” says Bill Hoffman, vice president of JoB Construction. “This allows the roller operator to know when he reaches density as the work progresses. There’s no guesswork.

“For the contractor to stay in business, you need to have something like this on your side. If everything goes right and the work passes, you get paid what you bid. But if it goes wrong somewhere, it costs you money. There’s no guesswork.

“JoB Construction has used its Bomag BW190AD-4 with Asphalt Manager on a wide variety of work, from parking lots to big highway jobs. The Oklahoma-based contractor used the intelligent compaction technology on Highway 69S, a four-lane paving job from Tulsa into Texas.

“That route carries heavy truck traffic,” says Hoffman. “We were laying a fine asphalt mix comparable to a Type B or C. It’s a tough mix in terms of working it in the tender zone. But we had no problems.”

With changing job conditions and a growing number of high performance asphalt mix designs, proper compaction can be a challenge even for the most experienced contractor. Compaction often determines success or failure. Under compaction means the mix never achieves the physical strength it was designed to achieve. Over compaction can break aggregate and degrade the surface before the first vehicle ever rolls on the new pavement. Either case can lead to pavement failure, costly repairs, or expensive rework.

“I don’t know many people out
One of the keys to Bomag’s Asphalt Manager intelligent compaction system is a microprocessor-controlled manipulation of the front drum’s energy pattern. Values established during sampling and testing at the start of a job can be used by the system to set a density goal, what Bomag calls an EVIB value, which is the dynamic elasticity modulus of the material being compacted. At the start of the compaction process, the soft material is capable of accepting a lot of energy from the roller drum, so the system projects the energy vertically into the material. As compaction progresses, the microprocessor senses the change in material stiffness through the drum’s reaction to it and begins to redirect, or vector, the angle of the drum’s energy to produce more glancing blows. This is accomplished by controlling an exciter system that incorporates counter-rotating eccentric weights to shift compaction force in a defined direction. As the roller works on the material and density builds, the microprocessor continues to vector the output energy, eventually going from fully vertical impact to fully horizontal impact where the drum is skipping back and forth laterally. The material is receiving little added energy at this time, but additional points of density to the goal value are being achieved without over compaction or the damage that can produce. The amount of force the drum produces never changes, but the direction of the force, and thus, the amount of energy absorbed by the material, does change. Asphalt Manager alerts the operator when the goal value has been achieved.
Performance bonuses may provide all the incentive a contactor needs for more sophisticated equipment.

there that have an in-house quality control expert that can sit on the job all day, every day,” says Ken Dobey, Highway Paving Superintendent, United Companies. “These machines offer you assurance that what you think you’re doing is really what you’re accomplishing.

“All of our state work is on bonus — bonus for density and often for smoothness. There are penalties for not meeting specs. Documentation becomes important in proving what happened. We know we’re getting density with these rollers and we can prove it. When we run these units in automatic, we also tend to get a smoother finish.”

United Companies has had a Bomag BW190AD-4 with Asphalt Manager for two years. The company added a second 190 with Asphalt Manager last year so they could run the machines as tandem breakdown rollers on state highway jobs in Western Colorado. They also have used the rollers on county road work and airport paving jobs.

Eliminates guesswork

Intelligent compaction can eliminate guesswork and get the asphalt mat to density with the fewest number of passes, which could mean less time on the job if the process isn’t too difficult to put into practice in the field. How does Asphalt Manager measure up?

“It’s the home run,” says Hoffman. “It’s very simple to operate. It doesn’t take forever to learn what you need to know. You establish a number and then you run with it. It’s not that complicated.”

Bomag’s Asphalt Manager measures material stiffness and redirects drum energy to get proper density.

The number that Asphalt Manager works with is an elasticity modulus, or EVIB value measured in Mega-Newton per meter squared. Accelerometers on both sides of the front drum constantly measure material stiffness during compaction. This information is fed to an in-line microprocessor that evaluates the data, comparing it to the goal EVIB value. As the material approaches density, the Asphalt Manager system alters the direction of drum energy through a process called vectoring.

Vectoring is a key to the success of the automated process. At the beginning of the compaction cycle, the material can accept a lot of energy, so the microprocessor projects the energy vertically into the material, which would be the normal operation of a vibratory drum roller. As optimum density approaches, the microprocessor senses the change in the material stiffness or density and reduces the energy output to the material by redirecting or vectoring the drum energy to produce more glancing or horizontal blows, which is unique to Asphalt Manager.

Bomag’s intelligent compaction system includes asphalt mat temperature sensing directly beneath the roller. A microprocessor calculates the reading and delivers it to the operator. The operator can then adjust the distance between the paver and the roller so that compaction takes place at the right temperature. It’s a feature that can alert the operator to potential problems.

“The plant doesn’t always catch a problem right away,” says Dobey. “Say they get into a wet stockpile for several loads. We get a cooler mix. If you have a roller like this one out there, you’re going to know you have an issue right away.”
On the job, setting up to run Asphalt Manager becomes part of a fairly normal testing and start-up procedure. Based upon specifications, a test strip is laid down and compacted with the intelligent roller. An agency inspector or quality control representative may test this strip with a non-destructive device to establish density. Or, core samples may be taken and analyzed to verify a density number. Once a density number is established, it can be equated to an EVIB value that the roller achieves during compaction. From that point on, wherever the roller operator hits that EVIB value, he knows he has density. Running in automatic, Asphalt Manager rolls to density and documents it every step of the way.

“One of our operators has been rolling for 18 years,” says Dobey. “Sometimes it’s hard to get people to change the way they work. But after seeing what the machine can do with Asphalt Manager, this experienced operator will only run the roller in automatic.”

Asphalt Manager is available on several Bomag rollers, including the BW190AD-4AM, a tandem roller designed specifically for the intelligent compaction application. Components that make Asphalt Manager possible are built into the machine during manufacturing. Rollers with the Asphalt Manager technology carry a 17% to 18% premium compared to standard models.

Other benefits

Both JoB and United Companies say they often can get to density with fewer passes using Asphalt Manager. But they also stress that while quicker helps control costs, getting the right compaction on every job without guesswork is the bigger benefit. Some of the other benefits mentioned for Asphalt
Manager include:

- Use of the roller as a proof machine to document density on base work.
- Excellent compacting of mixes like Superpave.
- Maneuverability and agility of the BW190AD-4 model.
- Less wear and tear on the machine because vectoring reduces the amount of energy reflected back into the machine as the mat reaches density.

The use of more sophisticated and expensive equipment technology really benefits the contractor when it doesn’t require major new learning procedures to use and when it can help extend on-the-job versatility.

Intelligent compaction, and specifically Bomag’s Asphalt Manager, is getting more attention from contractors looking to apply technology as a way to control costs, get the work done right the first time, assure more precise delivery on demanding specifications, document their work, and earn bonus money when it’s out there for best performance. BR