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Pavement Maintenance Product Guide

**Dykes paving of Atlanta uses
Perma Flex™ to prevent reflective
cracking on major truck terminal**

Contractor flexes his pavement maintenance muscle

Dykes Paving uses innovative overlay system to pave major Atlanta trucking terminal, church parking lot

By Tracy D. DeStazio

We all know how it happens: A tiny fissure manifests itself way down deep within an asphalt pavement, growing each day with the pounding of heavy truck traffic, the introduction of a little water and the passage of time. The fissure spreads, traveling upward, until one day it reaches the surface where it suddenly appears — a huge crack in the asphalt. Soon, that crack meets up with another crack, and before you know it, you have a pattern of cracks resulting in plates of damaged asphalt, also known as alligator cracks.

For the most part, there are two methods of dealing with cracked asphalt. One is to mill up the existing pavement layer and repave with new asphalt. The other solution is to pave an overlay right over the damaged asphalt. There again, though, you risk having those same deep-rooted cracks migrate their way right back up to the new asphalt surface, creating reflective cracks.

Jim Dykes, president of Dykes Paving and Construction Co. Inc., Norcross, Ga., thought of a way to design an overlay system that would seal the cracked surface, prevent future cracks from ever reaching the surface, and eliminate the cost and time involved in a full removal and replacement effort. What he came up with was an asphalt mix design system called Perma Flex™. Dykes Paving manufactures the mix, installs it and provides licensing to more than 15 other paving contractors in Georgia and North Carolina.

With this pavement maintenance system, Dykes Paving overlaid 138,890 square yards (116,130 sq m) of the Old Dominion Freight Lines trucking terminal in Conley, Ga., just outside of Atlanta. The contract also

included a five-year warranty against any future potholes.

The Old Dominion facility is basically a distribution terminal, with one huge building surrounded by 227 loading docks, each with a 10-foot (3-m) wide loading stall. The building itself spans 120 feet (37 m) wide by 0.25 miles (0.4 km) long. Nearly 600 trucks come to the site each day to drop off and pick up trailers to deliver goods. The project involved resurfacing the entire terminal, and any adjacent lots, with the Perma Flex asphalt and overlay system to rehabilitate the pavement and stop reflective cracking. The project also included constructing elevated loading ramps all the way around the building, again using the Perma Flex asphalt.

The existing terminal, which had been paved with asphalt, had large cracks, broken plates and severe wear and tear. Says Lee Young, project manager for Dykes Paving, "The terminal had punctures from the trailers' landing gear in the pavement and several other areas that had exposed dirt — that was its level of damage. It was starting to have a lot of deterioration."

Jamie Price, maintenance superintendent at the Old Dominion facility, says that the terminal is close to 30 years old, being built in the early 1970s. "The existing pavement was in pretty bad shape," says Price, "and I'm not even sure if it had ever been overlaid in all those years."

The existing loading ramps, which had been paved in concrete, were equally deteriorated. Says Young, "Originally, we (Dykes Paving) were going to overlay the asphalt areas and Old Dominion was going to bring in a subcontractor to saw cut and remove the bad areas on the loading ramps, then replace and elevate them with new concrete. We were able to engineer asphalt ramps and an asphalt elevation strip that were more cost effective than doing

it in concrete. We used the Perma Flex to elevate their ramps and to pave over the deteriorated concrete, without removing any of the existing material."

Young says that the end result was one sheet of asphalt that runs through the parking lot areas all the way up to the side of the loading docks and building. Doing it this way meant that Dykes Paving could eliminate the seam where the asphalt used to meet the concrete all the way around the loading area. "We were able to cover the entire concrete surface (with asphalt) for (a lesser cost) than it would have been to remove and replace the bad areas," says Young.

Figure 1: The Perma Flex overlay system involves four layers

- 1. Liquid asphalt bonding agent and crack sealer (CRS-2H tack coat)** — fills the cracked asphalt to prevent water penetration into the base
- 2. Layer of Perma Flex asphalt mix** placed at a minimum thickness of 1 inch (25 mm) — the aggregates in the mix get wedged into the cracks in the existing pavement, locking everything together to prevent movement and to prevent cracks from reflecting back up into the asphalt topping
- 3. Another layer of liquid asphalt bonding agent and crack sealer (CRS-2H tack coat)** — bleeds into small cracks that may develop and blocks any capillary action that may begin in the surface topping; provides a self-sealing function
- 4. Asphalt topping** of type E or F mix asphalt placed at a minimum thickness of 1 inch (25 mm) — serves as a surface course

These two photos demonstrate the extent of damage and the size of the pavement fractures at the Old Dominion Freight Lines trucking terminal in Conley, Ga., just outside of Atlanta. Dykes Paving and Construction Co. Inc., Norcross, Ga., used an innovative overlay system to rehabilitate the existing asphalt pavement and to prevent future reflective cracking. Right, notice the trucking terminal in the background and the fractured pavement in the foreground.



Left, notice the apparent layering of the Perma Flex overlay system: the existing, deteriorated pavement sprayed with tack coat, then covered by the 1-inch (25-mm) layer of Perma Flex asphalt, followed by another application of tack coat, then the 1-inch (25-mm) layer of type F asphalt topping.

How Perma Flex works

• **Concept** — The name Perma Flex refers to Jim Dykes' proprietary asphalt mix, as well as the whole system of applying the mix. The basic principle behind the Perma Flex mix itself is fairly simple: It takes into account how cracks migrate and employs the use of a no-fines paving system. "Cracks don't travel through the granite rock," explains Young, "they travel through the fines. If you take the fines out, you have almost eliminated, or definitely minimized, reflective cracking — as long as you have a fairly stable, existing surface."

By using a mix that has 15 percent air voids, as opposed to the 5 percent of a more traditional asphalt mix, Dykes has designed a method that actually allows the cracks to dissipate, without penetrating the new surface. "You are basically creating release points for that crack (to escape)," explains Young.

• **Composition** — The Perma Flex mix is made up of graded-asphalt-coated 0.75-inch (19.05-mm) aggregate, a percentage of liquid asphalt and, in this case, a latex polymer additive. The latex additive was incorporated to produce a tougher mix to handle the frequency of truck traffic and the steady pounding the lot would have to endure. "The latex polymer we used is similar to that used in some Superpave mix designs for highways," explains Young. "We borrowed the idea to add some strength to the mix."

The Perma Flex application system, then, uses three components — a CRS-2H (a cationic, rapid setting, hard base emulsion) tack coat from Koch Materials Co., the Perma Flex mix and a traditional type E or F hot mix asphalt (HMA) topping.

• **Construction** — The Perma Flex system includes four distinct layers that work as a sandwich to overlay an existing asphalt pavement (See Figure 1, page PMPG-3). The whole application process begins with the broken pavement being swept clean with a power broom. On the Old Dominion project, Dykes Paving used a Champion model broom. Then the CRS-2H tack coat is sprayed over the entire area. "We use this first tack coat as a construction sealer," explains Young. "It seals off the cracks of the existing asphalt to prevent water intrusion."

On the Old Dominion project, Dykes Paving used an Etnyre 2,000-gallon (7,571-L) tack truck with adjustable spray bars to apply the tack coat, which gets sprayed all over the cracked surface. Prior to spraying the tack coat, Dykes Paving did remove and replace a few isolated areas of severe deterioration as a precaution. "In a traditional overlay situation, though, you would have had to remove 20 times the amount of material we actually removed prior to our overlay," explains Young. "We only removed 650 of nearly 140,000 total square yards (543 of 117,058 sq m) of old asphalt because

it was in such bad shape. Otherwise, we just paved right over the cracks." Dykes' paving crews saw cut and removed the deteriorated asphalt areas, replacing them with new HMA.

Next, Dykes Paving crews placed the 1-inch (25-mm) layer of Perma Flex mix using a Blaw-Knox 3200 paver. Between 25 and 30 haul trucks brought the mix from Dykes' asphalt plant in Norcross, Ga., each day. Due to the makeup of the mix, it tends to be very sticky and difficult to pave. Says Young, "The mix is extremely gooey and can be very hard to work with and clean up. You have to factor in a little additional time for your crews."

Once the Perma Flex was put down, a steel-wheeled roller compacted it; but, because the material is basically a stone matrix, open-graded mix design, it doesn't actually receive any compaction. What does happen is that the aggregates in the mix get pushed down and wedged into the existing cracks, thus tightening the asphalt plates.

It was at this point in the project that the terminal was opened back up to truck traffic. "We let the trucks run on half the (Perma Flex) system," explains Young. "They could drive on the 1-inch (25 mm) layer of Perma Flex mix. Normally, if you overlay a lot like that and have to do it in layers, you don't want to open it up to traffic because the tractor trailers will twist and turn on it. This mix is



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The PMPG cover and the above photo provided by Brett Neal, Atlanta.

tougher and can withstand being driven on right away."

Another layer of tack coat was then applied, followed by a 1-inch (25-mm) layer of type F asphalt topping. This topping course was rolled as usual and the paving was complete.

• **Results** — The end result of this overlay system, then, is a flexible, yet hard, crack-retardant, waterproof barrier. "With this method, you prevent any water from getting into the sub-base, which is what causes the asphalt plates to move in the first place," explains Young.

"And then you stabilize those loose plates of asphalt by wedging rock into all the cracks. That 15 percent air voids allows for the dissipation of any fractures that might try to migrate up through the mix." In addition, explains Young, the tack coat that goes in between the layers can bleed up into any small cracks that may develop.

"An analogy of this system would be that of a cracked windshield," continues Young. "If you drill a hole in the edge of the crack, the crack will stop because you have relieved the pressure inside of the crack. The same is true with cracked asphalt: Wedging the mix's aggregates into the cracks relieves some of the pressure that is taking place within the pavement. The crack will hit the Perma Flex layer and stop."

Trucking terminal benefits from overlay system put down in 2000

"Our terminal here (in Atlanta) is the second largest of 100 terminals owned by Old Dominion," explains Price.

"We have tractor trailers coming in and out of here 24 hours a day, seven days a week — so we can never shut down."

With that in mind, it was helpful that the trucks could run on the pavement halfway through the application of the whole overlay system. "We just gave up maybe 40 to 50 loading doors at a time (out of 227) while they paved," says Price. "And we just stayed off of it until they were done paving. But as soon as 10 minutes after they were done paving a section, we were able to drive on it. Our truck traffic wasn't impeded at all."

It was also helpful that a firm mix had been chosen to withstand the heavy weights of the trucks. "We run trucks through here that weigh between 20,000 and 44,000 pounds (9,072 and 19,958 kg) each," explains Price. "We needed something that was going to be pretty durable. If anyone is going to put a mix to the test, it will be us."

And Price seems pleased with the product so far: "That Perma Flex seems to be pretty tough. And Dykes did an excellent job — they got in here, got the job done and got out."

In the end, Dykes Paving placed about 6,300 tons (5,714 Mg) of the Perma Flex mix and 7,640 tons (6,929 Mg) of the asphalt topping. Even though both were placed at 1-inch (25-mm) thicknesses, the Perma Flex mix weighs less than conventional mixes, due to its higher amount of air voids.

The elevated loading ramps Dykes Paving built brought the edge of the docks 4 inches (100 mm) up to the loading doors. They were constructed using 3 inches (75 mm) of the Perma Flex asphalt and 1 inch (25 mm) of the type F asphalt topping. "The end result," says Young, "was a 40-foot (12-m) wide by 2,365-foot (721-m) long ramp that went all the way around the whole loading facility, tapering down as you head away from the loading doors."

The ramps taper so well, in fact, that Price says it's hard to tell there is a 4-inch (100-mm) slant heading upward toward the loading door. "Dykes set their paving machine so that it would lay out a thicker asphalt mat at the door," explains Price. "It looks like a flat surface, though. You can't even

tell by just looking at it that it slopes upward."

Church benefits from overlay system put down nearly 20 years ago

What convinced Price that Dykes' Perma Flex process would be the best solution to his cracked pavement problem was seeing a past project Dykes Paving had overlaid. "They showed me a project that they had paved 20 years ago and it was still holding up," says Price. "That's one of the reasons we went with it (Perma Flex)."

In 1981, the parking lot at Norcross First Baptist Church in Norcross, Ga., was overlaid using the Perma Flex system. Dean Stringer, a member of the church serving on the church's properties committee and a general contractor himself, explains the condition of the existing parking lot: "The parking lot was broken up pretty bad. The lot had been there since 1962 and it had deteriorated over the years, exhibiting severe alligator cracks."

Stringer's father was on the church's properties committee back in 1981 and he, along with others on the committee, chose Dykes Paving and their Perma Flex process, which, at the time, was fairly new. "The people of the church were convinced that this would be a good product," says Stringer, "and they were willing to give it a try."

Forty thousand square feet (3,716 sq m) of paving and 20 years later, the parking lot is still holding up. "It has performed extremely well over the years and we have not had to resurface it since then," says Stringer. "It has a few little cracks in it, and it doesn't look brand new anymore, but it is also 20 years old."

"Compared to other parking lots I've seen of the same age, it has held up very well," continues Stringer. "I am very pleased with the product. In fact, Dykes paved a few more parking lots for us since then, one using Perma Flex. It has been a good product for us." ■

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