Asphalt Advantages for Port Pavements

By Ed Misajet

As the shipping industry expands, port facilities are being constructed and improved by new asphalt materials and mix designs.

The United States has 361 ports that handle over 5.7 million loaded marine containers every year. Current gross predictions indicate that container cargo will quadruple over the next 20 years.

Facilities Needed

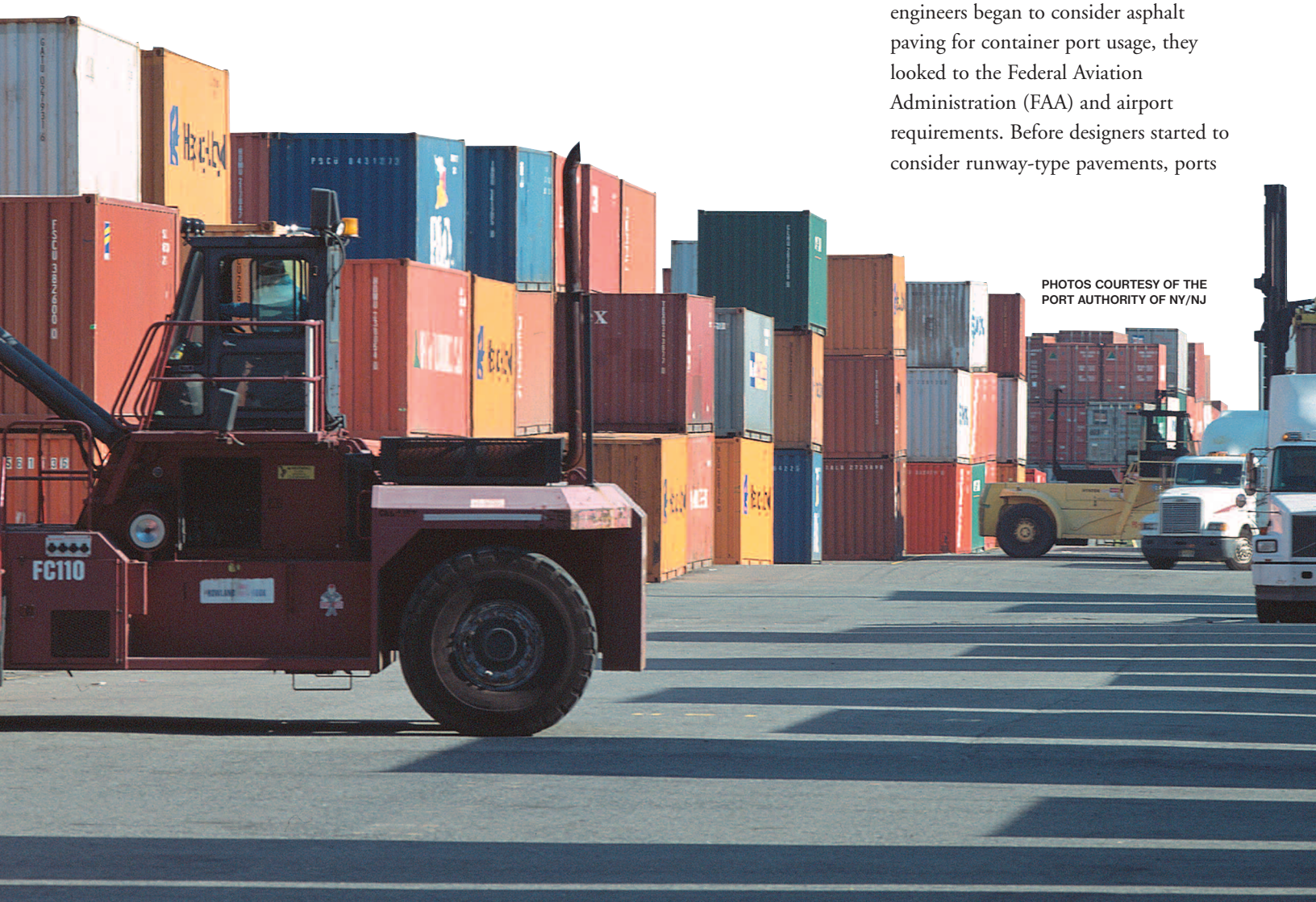
A primary focus for port authorities in recent years has been upgrading facilities and building new ports to facilitate the projected influx of cargo traffic. A key component of this construction effort has been the pavement structure that accommodates the cargo, the wheeled storage areas and intermodal loading pads of the ports. These areas experience the greatest traffic, handle excessive loads and are prone to deterioration of the surface course.

Antiquated Processes versus Innovative Thinking

Conventional wisdom has always been to use concrete pavement for ports. Particularly in hot climates, concrete pavement was thought to be superior to asphalt pavement. But recent changes in mix designs and binder improvements have raised the stock of asphalt for port pavements. Mark Smallridge, a project engineer for Nigle, Nixon & Partners, a large engineering firm responsible for the design of many container ports throughout the United States, says, "There was a time when some believed that concrete pavement would outperform asphalt in every category, but today, with the new binders and high performance mixes, asphalt has become a more cost-effective alternative."

Asphalt Improvements Abound

Asphalt is now the material that is normally used in U.S. ports. When project engineers began to consider asphalt paving for container port usage, they looked to the Federal Aviation Administration (FAA) and airport requirements. Before designers started to consider runway-type pavements, ports



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used standard, local DOT highway mixes. However, these mixes were designed for relatively fast moving traffic with no heavy loads. Some proved ineffective for port usage. P-401, a typical FAA mix designed for aircraft loads, was a suitable pavement for port traffic. It held up better to the slow moving traffic, tight turns and the much heavier weight concentrations typical to container ports.

Asphalt industry leaders, however, were not content with standard state mix designs or FAA approved mixes. They envisioned asphalt pavements that could rival other pavement types. Superpave and stone matrix asphalt (SMA) are typical of these improved mix types. Superpave binders, such as PG 82-22 and PG 76-22, are utilized to resist rutting and indentation.

Eliminating Rutting

While totally eliminating rutting is difficult, high performance asphalt mixtures have performed well. "Historically, the problems can typically be seen in the high traffic areas, or where lifts, containers and trailer loads are operated or in the wheeled load areas where the chassis and containers are stacked and stored during the loading and unloading process. Under these very heavy loads, the new asphalt can hold up very well," says Smallridge.

Heat Deformation and High Temperature Bleeding

One variable in the consideration process is climate. Hot weather regions have to be considered when choosing a pavement type. Port authority officials have expressed concerns over the detrimental effect high temperatures have on asphalt pavements. These conditions can sometimes lead to heat deformation, high temperature bleeding and fatigue cracking but they can be overcome with proper design. "It's a legitimate concern," says

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Smallridge. "Obviously, asphalt has more flexibility than concrete, but the same characteristics that set asphalt apart from concrete provide a more rideable surface and reduced maintenance costs. If pavement designers take into consideration the regional climate issues, mixes can be formulated so that the pavement will have longevity regardless of where it's located."

Typical Port Pavement Sections

Asphalt pavements for ports are typically designed with a thick pavement cross-section for the high traffic areas. For instance, in the Port of Los Angeles Pier 300 Project, designed by Nigle, Nixon and Partners, the storage area pavement consists of a 3-inch surface course with an AR-8000 asphalt and a 3/4-inch nominal maximum size aggregate, and a 4-inch base course with an AR-8000 asphalt and a 1-inch nominal maximum size aggregate over 17 inches of crushed material on a subgrade with a CBR of 15.

Intermodal yards, which experience much heavier contact loads, use a much different thickness design. For example, the Port Ivory Intermodal Yard Project is comprised of a 3-inch asphalt top course with a PG 76-22 binder and a 3/4-inch nominal maximum size aggregate. This layer was placed on a 4-inch base course with a PG 76-22 binder and a 1-inch nominal maximum size aggregate over a 6-inch plant-mix macadam base course using a PG 64-22 and a 1-inch aggregate on 22 inches of dense graded aggregate base course on a subgrade with a CBR of 7.

Lower Cost—Smart Investment

Perhaps the single most important factor in choosing asphalt pavement is cost. Asphalt can be half as expensive as Portland cement concrete and is much easier to construct. Concrete can cost as much as $400,000 per acre and asphalt can match the lifespan when proper conditions, aggregates and binders are employed correctly. The payoff? With the cost savings that can be realized by choosing asphalt pavement, port authorities can use much more space—paving 50 percent additional area for the same price.

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