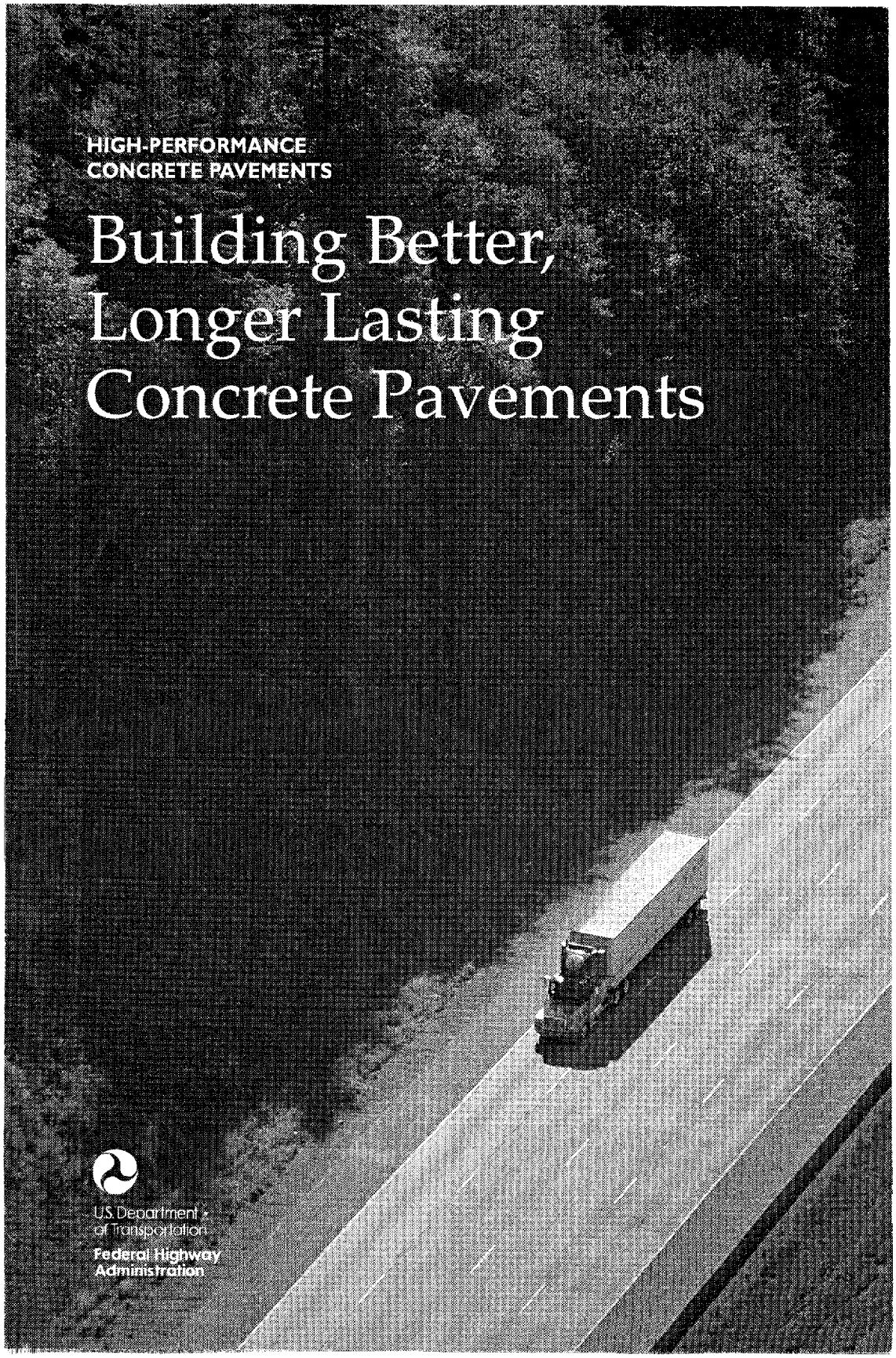
HIGH-PERFORMANCE
CONCRETE PAVEMENTS

Building Better, Longer Lasting Concrete Pavements



U.S. Department of Transportation
Federal Highway Administration

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Q. Why do we need high-performance concrete pavements?

A. Portland cement concrete covers some 208,000 km (129,000 mi) of the Nation's highest volume streets and highways. Although concrete is a very durable material, steadily increasing traffic volumes and loads are beginning to take their toll, and many of these pavements are in need of extensive repair or rehabilitation. When existing concrete pavements are rehabilitated, or when new concrete pavements are constructed, they must be more durable than their predecessors and must therefore be tailored to the traffic, climate, and weather conditions at the project site. At the same time, these pavements must be opened to traffic as quickly as possible; provide smooth, safe, riding surfaces; and be economical to build and maintain.

To meet these needs, engineers are developing a new generation of concrete pavements that build on the fundamental strengths of conventional concrete pavements. These high-performance concrete pavements (also called HPC pavements) take advantage of a wide range of techniques and technologies that are being combined to form a new approach to pavement design and construction.

Q. What are HPC pavements?

A. The term "HPC pavement" refers to concrete pavement built using an integrated approach to design and construction. This approach takes advantage of many innovative techniques and technologies.

At their most basic level, high-performance concrete pavements are composed of the same materials as conventional concrete pavements—portland cement and aggregates—and are built using the same construction techniques. These pavements also, however, take advantage of a wide range of advanced technologies, including improved joint designs, high-quality construction procedures, smoother riding surfaces, improved surface textures (higher friction and lower noise), and strong pavement foundations. They often use high-performance concrete mixes, which are proportioned to be more durable and to cure faster than conventional concrete mixes. These high-performance concrete mixes may employ specialized additives and highly durable aggregates.

The pavement designer uses these technologies to design a pavement that best meets the needs of a particular project. For example, a rehabilitation project on a road that carries extremely high traffic volumes may call for the use of a concrete mix proportioned to cure extremely quickly so the road can reopen to traffic as soon as possible. And new lanes on a rural Interstate highway may necessitate the use of a variety of techniques and technologies to ensure that the pavement will hold up to heavy truck traffic and provide motorists with a smooth ride.

Q. Why should we switch to high-performance concrete pavements?

A. By using the HPC approach to pavement design and construction, highway agencies can build pavements that are better in many ways than today's concrete pavements.

The biggest benefit of HPC pavements is their improved durability, which translates into a longer service life. Until now, the typical design life for a concrete pavement was 20 years, which was the normal design life of highways on the Interstate system. But high-performance concrete pavements could perform well for 30 to 50 years, depending on traffic volumes and loads.

Because of their durability, HPC pavements will require less maintenance. This not only will mean savings for highway agencies, but also fewer highway work zones that disrupt the flow of traffic and increase the risk of crashes.

For some projects, HPC pavements will offer additional benefits. For example, new construction techniques and concrete mixes can allow an HPC pavement to be built and opened to traffic sooner than a conventional concrete pavement. Some HPC pavement projects will also incorporate new surface textures to provide motorists with an exceptionally smooth, safe, and quiet ride.

Q. Are high-performance concrete pavements more expensive than ordinary pavements?

A. Not necessarily. In some cases, the initial costs may be up to 10 percent higher than conventional concrete pavements. This will not, however, be true for all high-performance concrete pavements, as some of the advanced materials and techniques that are part of the HPC pavements concept do not increase initial costs. And over the long term, highway agencies will definitely save money on pavement maintenance and rehabilitation, thanks to the improved durability of HPC pavements.

Q. Can high-performance concrete pavements be used on *all* roads?

A. All concrete pavements can benefit from the HPC approach of identifying the requirements and objectives of a particular project and then designing the pavement to meet those objectives. But pavements that serve under demanding conditions, such as areas with high traffic volumes and few alternate routes, will reap the biggest benefits. This could include urban freeways and the principal freight routes in the National Highway System. HPC pavements would also be beneficial at sites with extreme climate conditions.

Q. Are HPC pavements new?

A. Elements of HPC pavements have been around for many years, but until recently conventional concrete pavement technology was more than adequate—pavements with sufficient strength and appropriate slab thickness were able to meet their 20-year design life goal. Today's increasing traffic volumes demand pavements that are able to serve far longer and with minimal maintenance.

Q. Where have HPC pavements been built?

A. The first HPC pavement project in the United States was built in 1993 on Interstate 75 in Detroit. The project, sponsored by the Michigan Department of Transportation and the Federal Highway Administration (FHWA), involved the use of construction techniques based on German and Austrian practices.

Since then, FHWA has provided support to several State highway agencies that have built HPC pavements. These projects illustrate the wide range of technologies being evaluated for their ability to improve

the durability, smoothness, cost-effectiveness, and other characteristics of concrete pavements. The technologies highway agencies are evaluating as part of these projects can all be used in the HPC approach to pavement design and construction.

In 1996, South Dakota constructed a thin fiber-reinforced concrete pavement. Wisconsin is evaluating alternate pavement cross-sections, as well as new dowel materials and dowel spacing options. Illinois is testing the use of fiber-reinforced plastic dowel bars. Kansas DOT has built an HPC pavement that is being used to evaluate several construction techniques, including using reclaimed asphalt pavement as the base for the concrete pavement and incorporating a more durable surface course.

Ohio is experimenting with alternate dowel materials and joint sealing options, as well as with using ground granulated blast-furnace slag in concrete. Incorporating what are commonly considered to be waste by-products into pavement can improve the quality of the pavement and provide an environmentally friendly means of disposing of these materials.

HPC pavement projects are also being built in Iowa, Missouri, and New Hampshire.

Q. Will HPC pavements become the standard?

A. That's the goal. Many HPC pavement techniques could be added to almost any paving project, but making HPC pavements standard practice would ensure that the highway agencies implement—and benefit from—the full system.

Q. Where can I get more information on HPC pavements?

A. To learn more about high-performance concrete pavements, visit the HPC pavements section of the FHWA Web site (ota.fhwa.dot.gov/tech/struct/te36.html) or contact Suneel Vanikar at FHWA (phone: 202-366-0120; fax: 202-366-7909; email: suneel.vanikar@fhwa.dot.gov).

Information is also available from the Lead States team for high-performance concrete. The team, which was established in fall 1996 by the American Association of State Highway and Transportation Officials (AASHTO), is made up of States that are ahead of the curve in implementing HPC and have volunteered to help other States catch up. The team's members are Missouri, Nebraska, New Hampshire, Texas, and Washington. For more information, contact the team's leader, James Moore of New Hampshire DOT (phone: 603-271-2731; fax: 603-271-7025).

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