

Continuously Reinforced Concrete Pavement



Roads for this generation and the next

Built today, Continuously Reinforced Concrete Pavement (CRCP) will withstand traffic loads and adverse environmental conditions, decrease maintenance and user delays, and remain in service well into the next generation.



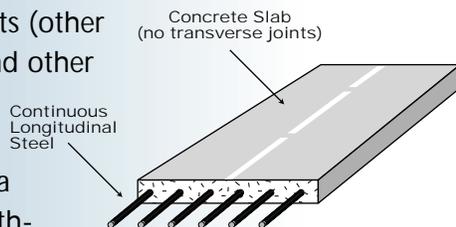
Why Construct Roadways with CRCP?

CRCP can be the optimal solution to the needs and demands of the driving public and road owners. It can handle the heaviest traffic volumes, loads and overloads, without compromising performance. CRCP is unlike any other pavement type because it is:

- **Less costly, in terms of both money and time**
- **Virtually maintenance-free**
- **Longer lasting**
- **Better performing**
- **Smoother.**

What is CRCP?

CRCP is concrete pavement reinforced with continuous steel bars throughout its length. Its design eliminates the need for transverse joints (other than at bridges and other structures) and keeps cracks tight, resulting in a continuous, smooth-riding surface that is virtually maintenance-free.



In a recent study conducted by Marquette University's Center for Mass Media Research and the Wisconsin Department of Transportation, motorists revealed that their number one driving concern was road conditions.

Building Better Roads with CRCP

- **Meeting Motorists' Needs**
- **Road Conditions**

CRCP is an asset for today's and tomorrow's heavily traveled high-speed roadways. With the potential to accommodate any level of traffic, under climatic extremes, CRCP has a longer service life than roads made of other materials. This longevity is advantageous to road owners and drivers and can be the long-term answer to revitalizing today's interstate systems as they reach the end of their service lives.

CRCP offers advantages in the areas of cost, durability, performance, safety and environmental friendliness—allowing road owners to meet the needs of this generation of motorists and the next.

Advantage

Save Money, Time and Resources

■ Road Owners Save

When analyzed over the long-term, CRCP offers the lowest annual cost of any pavement adequate for modern, heavy-duty highways. Cost analyses on CRCP highways in Texas have revealed that as highway agencies, designers and contractors gain experience in its use, CRCP's initial costs become competitive with other pavement types.

Additionally, costs associated with employing road repair crews, maintaining traffic control and purchasing repair materials diminish because CRCP roadways need minimal upkeep and maintenance.

■ Motorists Save

According to a study conducted by The Road Information Program (TRIP), on average, motorists in the United States pay about \$142 per year in added vehicle maintenance expense due to poor road conditions. With CRCP, the need for vehicle repairs due to the wear and tear caused by beat-up roadways is reduced, sparing drivers this cost.

Motorists also enjoy better fuel economy when driving on CRCP roadways because the rigid surface reduces rolling resistance. This results in improved fuel efficiency as revealed in data collected at WesTrack, a pavement testing facility near Reno, Nevada. From 1997 to 1999, four driverless trucks traveled an average of 15 hours per day around a 1.8-mile oval track, simulating more than 10 years of interstate-level traffic loads. Data was taken on the vehicles before and after surface rehabilitation. The result: on average, a 4.5 percent improvement in fuel efficiency as a direct result of smoother roads.

Low Maintenance

CRCP's unique design provides durability and strength, creating a virtually maintenance-free roadway. In fact, according to an article in the April 11, 1999 edition of The Chicago Tribune,

Chicago's Edens Expressway has not required maintenance (reconstruction or major patchings) since it was built with CRCP 20 years ago.

Roadways constructed with CRCP are typically designed to last at least 30 and up to 50 years. This results in marked cost and time savings for motorists and road owners alike.

Materials and Technologies Readily Available

Constructing CRCP does not require the use of specialty materials, construction methods or contractors. This advantage, coupled with the amount and degree of technical information continually being developed, enables engineers and road construction crews to successfully construct roadways using CRCP, achieving optimal highway performance for motorists.

Reduced Traffic Delays

Motorists come out ahead while driving on roadways made of CRCP because the frequency of traffic delays is minimal. With fewer repairs and reconstruction, the likelihood of traffic disruptions and accidents falls dramatically, resulting in shorter commuting time for motorists. Advancements are being made to shorten the construction process, resulting in further time savings.



es of CRCP

CRCP is Built to Last

■ Excellent Load Capacity

With truck loads and traffic volumes continually on the rise, durability is key in deciding which materials to use when constructing or reconstructing highways. CRCP has exceeded expectations time and time again, under a variety of conditions, providing long-term success.

■ Superior Support for Future Overlays

When concrete's surface condition and/or maintenance repairs dictate, CRCP provides a perfect support for future overlays. Since CRCP does not have joints, the reflective cracking typically seen in overlays is eliminated. Overlays can easily bridge the tight CRCP cracks; therefore, the performance and lifetime of an overlay can be prolonged. This, in turn extends the useful life of CRCP, which still supports the traffic load.

Illinois Freeway System Performance

Concrete Thickness	Mean Cumulative ESALs (millions)		Mean Life (years)		ESALs/Life (millions/year)	
	Design	Actual	Design	Actual	Design	Actual
7" CRCP	2.1	14.8	20	20.6	0.11	0.72
8" CRCP	4.8	15.6	20	21.4	0.24	0.73
9" CRCP	10.0	28.5	20	26.3	0.50	1.08
10"+ CRCP	21.0	39.1	20	22.0	1.05	1.78

Studies conducted on Illinois highways have revealed that CRCP, independent of thickness, has carried more traffic and lasted longer than originally intended. Axles of varying mass are represented as 18-Kip equivalent single axle loads, or ESALs.



Safety with CRCP

CRCP reduces exposure to roadway safety hazards in a variety of ways, including:

- **Great traction in wet and dry conditions.**
- **Excellent light reflection, providing good visibility day or night.**
- **Decreased traffic disruptions, accidents and road workers' exposure, due to minimal maintenance and repair operations.**

Smoother pavements create safer, more comfortable riding surfaces, making the task of driving less stressful.

“Roughness is widely regarded as the most important measure of pavement performance... CRCP pavements appear to maintain their initial roughness over a long period of time.”

Source: Long-Term Pavement Performance program

CRCP Offers Better Performance

For more than 50 years, highways across the United States that were built with CRCP have proven to be extremely sturdy and first-rate. CRCP has required low lifetime maintenance. Because of its low rate of deterioration, CRCP has reduced the frequency or need for repair and subsequent motorist inconvenience. The Long-Term Pavement Performance program, a 20-year study of in-service pavements across North America, has shown that CRCP's original, smooth-riding surface is maintained over time, sustaining the ride comfort for motorists.

Environmentally Friendly

Constructed of concrete and reinforcing steel, CRCP is the kindest pavement type to the environment because:

- **Reinforcing steel is composed of 100 percent recycled material and is 100 percent recyclable.**
- **Recycled materials are commonly used as concrete mix constituents and can be used as a subbase for CRCP construction.**
- **Concrete's light color reflects heat, helping to reduce the thermal heat in cities that causes increased energy use and air pollution.**



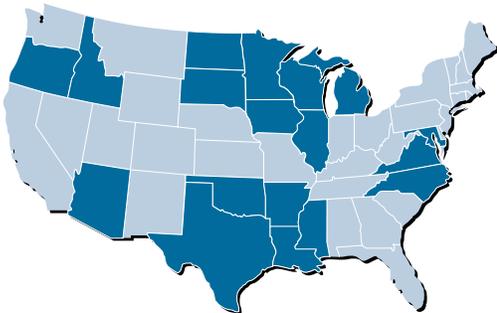
Paving the Future with CRCP

CRCP can be the most efficient and cost-effective means to achieve the results that road owners and users seek.

- CRCP means less cost to owners because it requires minimal maintenance.
- CRCP means less time in traffic delays for motorists because of fewer road repairs and reconstruction.
- CRCP means improved performance because its smooth surface enables a more comfortable ride and better vehicle fuel efficiency.
- CRCP means increased environmental benefits because it is made of 100 percent recycled material, is 100 percent recyclable and reduces the thermal heat in cities.

A Brief History of CRCP Usage in the United States

CRCP was first used in the United States more than 75 years ago. By the 1940s and 1950s, states began conducting extensive studies to determine the opportunities available with CRCP construction by analyzing the effects of various design and construction factors on its performance. CRCP use began gaining momentum in the 1960s and 1970s with the construction of the U.S. Interstate Highway System, with many important stretches built of CRCP. Several are still in use today. In fact, CRCP makes up a majority of the original concrete pavements built for the Interstate System in states including Illinois and Texas. These highways have outperformed and outlived their original design life and loadings and have surpassed the performance of other pavement choices.



To date, CRCP has been built in more than 35 states and is used to construct roadways, airport runways, railway tracks and warehouse floors. Currently, CRCP is being used to construct highways in Oregon, Oklahoma, Virginia, North and South Dakota, Illinois and Texas, among others. CRCP is used throughout the world.

For More Information

To learn more about Continuously Reinforced Concrete Pavement, contact the Concrete Reinforcing Steel Institute's transportation program manager at (847) 517-1200 or visit www.crsi.org.

Concrete Reinforcing Steel Institute

Since 1924, the Concrete Reinforcing Steel Institute (CRSI) has fostered the continued growth of reinforced concrete construction through marketing and direct promotion, technical support, research, and code and specification development. CRSI industry members consist of reinforcing steel producers, fabricators, epoxy coaters, distributors, placers, and related industry suppliers. Professional members include designers, engineers and contractors.

CRSI

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Bar and Rod Market Development Group

Under the auspices of the American Iron and Steel Institute, the Bar and Rod Market Development Group strives to grow the market for value-added steel bar and rod products. The group pursues this goal through two task forces committed to developing innovative solutions to the challenges facing their customers and the steel industry.

These task forces include:

- Automotive/Heavy Equipment
- Construction/Infrastructure



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