

Continuously Reinforced Concrete Pavements (CRCP) A Long-term Virtually Maintenance Free Service Life Solution for National Highways & Expressways

Transport is a vital infrastructure for rapid economic growth of the country. Speedy transportation of natural resources (such as raw materials), finished goods and perishable materials to all parts of the country including the points of export outlets is basic requirement for economic growth. Economic developments in various important sectors like agriculture; industry, mining, forestry etc. and also international trade is greatly dependent upon efficient transportation network. Road transport has inherent advantages of flexibility, door-to-door service, reliability, speed etc.

Roads do more than mere providing connection between towns and villages. They pave the way for increased commerce, trade and prosperity. **It is often said that a country pays for its roads whether it has them or not. It only pays more if it does not have them.**

Recently there has been a major shift in transportation towards the Road sector. Nowadays about 60% of freight and 87% of passenger transport is met by Road transport in India, which demonstrates the need for development of a good road network. Governments of the day are aware of these needs.

ADVANTAGES OF CONCRETE PAVEMENT VS. BITUMEN PAVEMENT

- Bitumen pavement is a flexible pavement widely used in India due to its lower initial cost, even though in the long run, it turns out to be most expensive proposition for the country.
- Concrete Pavement is a rigid pavement is very economical on LCC basis. There are two types of commonly used rigid pavements such as:
 - i. JPCP—Jointed Plain Concrete Pavement (without main reinforcements but having skin reinforcements and bars at joints)
 - ii. CRCP—Continuously Reinforced Concrete Pavement without Joints also known as RCC road
- The main advantages of concrete road (with or without reinforcement) are
 - i. Durability—life of 30-40 years practically maintenance free
 - ii. Fuel Saving—upto 20% saving in fuel and thus in vehicle operating cost as compared to flexible pavement
- Among the three types of road variants, initial cost of bitumen road comes out to be the lowest, however this is very uneconomical on long term basis i.e. on LCC basis due to shorter life and increased fuel consumption of vehicles.

In concrete pavements, volumetric changes caused by cement hydration, thermal effects, and external drying are restrained by the pavement base layer and longitudinal reinforcement, causing tensile stresses to develop in the concrete. These stresses, referred to as restraint stresses, increase more rapidly than the strength of the concrete at early ages of the concrete pavement, so, at some point, full-depth transverse cracks form, dividing the pavement into short, individual slabs.

JPCP uses contraction joints to control cracking and does not use any reinforcing steel. Transverse joint spacing is selected such that temperature and moisture stresses do not

produce intermediate cracking between joints. This typically results in spacing no longer than about 6.0 m. Load transfer is done using aggregate interlock and dowel bars. For low-volume roads aggregate interlock is often adequate. However, high-volume roads generally require dowel bars in each transverse joint to prevent excessive faulting.

Continuously Reinforced Concrete Pavement (CRCP) contains continuous, longitudinal steel reinforcement without transverse joints, except where required for end-of-day header joints, at bridge approaches, and at transitions to other pavement structures. Continuous reinforcement is a strategy for managing the transverse cracking that occurs in concrete pavements. In CRCP, the continuous reinforcement results in internal restraint and produces transverse cracks that are closely spaced with small crack widths that help to maximize the aggregate interlock between adjacent CRCP panels. The cracking is controlled by using reinforcement steel. Steel reinforcement facilitates load transfer across cracks and holds cracks tightly. The steel requirement will be around 0.6 to 0.8% much higher compared to dowel bars used in JPCP.

**CRCP HAS ALL THE ABOVE GOOD QUALITIES OF CONCRETE PAVEMENT.
ADDITIONAL ADVANTAGES OF CRCP ARE AS FOLLOWS:**

- Jointless smooth riding surface. In CRCP, joints, as available in plain concrete road, are almost eliminated leading to reduced cost due to joint preparation and maintenance. Further for the same loading conditions (axle loads and traffic density), as compared to plain concrete road, the thickness of CRCP is reduced because of the effective increase in strength due to steel reinforcements. The thickness reduction in RCC road compared to plain concrete road further reduces its cost.
- Maintenance is virtually nil in CRCP and vehicle operating costs are much lower due to saving in fuel.
- RCC road is the least cost alternative, if we presume a most conservative reduction in thickness by only 50 mm, which works out to be 16.7% (compared to 40 mm in Spain and 60 mm in USA). However, IRC 118:2015 does not permit thickness reduction and hence it is more conservative and uneconomical.
- The cost calculations are sensitive to actual costs of reinforcement bars, cement cost, stone chips cost etc prevailing in different locations.
- Safe transportation with CRCP. Best visibility, reduced wet spray, best traction grip & reduced accidents and smooth riding surface
- **Use of CRCP is strongly recommended for Bharat Mala Project based on lower Life Cycle Costs and low vehicle operating costs of vehicles in comparison to Flexible Pavement.**

CRCP is quite common abroad particularly in USA & Europe due to low life cycle costs and comfortable riding surface. It is in the long-term interest of our nation that CRCP technology is widely used in construction of national highways and expressways. The concerned authorities may look at the aspect of low LCC, while ensuring hassle free transportation for the public.

Lakshmana Rao Pydi, M.Tech (IITKGP)
General Manager (C&S)
Institute for Steel Development And Growth
793, Anandpur, Kolkata-700 107