

Design of Continuously Reinforced Concrete Pavement

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Abstract- “Continuously Reinforced Concrete Pavement (CRCP)” as the title suggests this type of pavement is reinforced throughout in longitudinal direction. This type of pavement has no transverse joints unless and until there is end of pavement or the pavement comes in contact with some other pavement or bridge. A longitudinal joint exists only if the road is wider than 14 feet. Due to reduction of joints smooth and continuous riding is possible resulting in fuel saving. Also CRCP roads are Maintenance free if properly constructed and care is taken while placement of steel. Once CRCP roads are constructed they need not to be taken care of for the next 50-60 years. The principle behind this roads is that “Let the road crack”, exactly opposite as in case of other type of roads where we avoid crack formation at any cost. The cracks formed are held tightly by the reinforcement, due to which widening and deepening of cracks is restricted. Hence we can conclude that in CRCP controlled cracking is permitted. The initial cost of CRCP is high, but as it is maintenance free, and lasts for decades overall cost of CRCP is less as compared to other type of reinforced concrete pavements.

Study and observations have shown that this type of roads are alarmingly successful, hence CRCP is widely used in USA, GERMANY BRITAN, recently in INDIA and several other developed and developing nations. The method of using reinforcement in rigid pavement is called Continuous Reinforce Concrete Pavement(CRCP). CRCP does not require any contraction joints

Keywords- Reinforced Concrete Pavement, Cement, Geo textile, Crushing Stone.

I. INTRODUCTION

General Transport or transportation is the movement of people, animals and goods from one location to another.

Transportation is a non-separable part of any society. It exhibits a very close relation to the style of life, the range and location of activities and the goods and services which will be available for consumption.

Types of pavements

- Flexible pavements
- Semi-rigid pavements:

The pavement constructed using the waste materials which are more strong, the traditional aggregates may be treated as semi-rigid pavement.

- Rigid pavements

II. LITERATURE REVIEW

1) Mesopotamia roads: The oldest mode of travel obviously was on the foot paths. Animals were also used to transport men and materials. Later simple animal drawn vehicles were developed and this became a common and popular mode of transportation for every long period after Invention of the wheel. This brought of up the necessity of providing a hard surface for these wheeled vehicles to move on. Such a hard surface is believed to have existed in Mesopotamia in the period of about in 3500B.C.

2) Mughal period roads: During path and Mughal periods, the roads in India are greatly improved. Some of the highways either built or maintained by Mughals received great appreciation from the foreign visitors who visited India during that period s.

3) Roman roads: many of early roman roads were of elaborate construction. Some of these roads are still existence after over 2000 years.

The main features of Roman roads are:

- a) They were built straight regardless of Roman roads.
- b) They were built after the soft soil was removed and hard stratum was reached.
- c) The total thickness of the construction was as high as 0.75 to 1.2m at some places.

4) Tresaguet construction: Pierre Tresaguet was the Inspector general of roads in France from 1775 to 1785 and so his method of construction was implemented in that country in 1775.

5) Robert Philips: Philips was the real pioneer of road design .In 1736 he presented a paper to the royal society entitled ‘A dissertation concerning the Present state of the high roads of England .This contained the suggestion that on the clay and gravel roads then existing, a layer of gravel, if resting on a well drained base , would be beaten by traffic into a solid road surface.

6) Metcalf construction: John Metcalf was engaged on road construction works in England .He apparently followed the recommendation of Robert Philips. Metcalf was responsible for the construction of about 290km of road in the northern region of England.

7) Telford construction: Thomas Telford began his work in the early 19th century. He was the founder of the Institute of Civil engineers at London.

8)Macadam construction: John Macadam put forward an entirely of road construction as compared to all the previous methods .He realized that the sub grade should be prepared properly and kept drained so as to carry the load transmitted through the pavement .

Macadam’s method is the first method based on scientific thinking .It was realized that the stress due to wheel load of traffic gets decreased at the lower layers of the pavement and therefore it is not necessary to provide large and strong boulder stones as foundation or soling course at the lowest layer of the pavement .Various subsequent improved methods were based on this Macadam’s construction and some of the methods still in use are known after his name ,such as water bound Macadam ,Penetration macadam and Bituminous macadam constructions.

III. DESIGN CONSIDERATION:

As per clause IRC: 58-1988

Design wheel load , traffic intensity ,foundation strength ,edge temperature , load stresses, modulus of elasticity ,Poisson’s ratio, coefficient of thermal expansion ,steel stresses, steel reinforcement.

Reinforcement calculation:

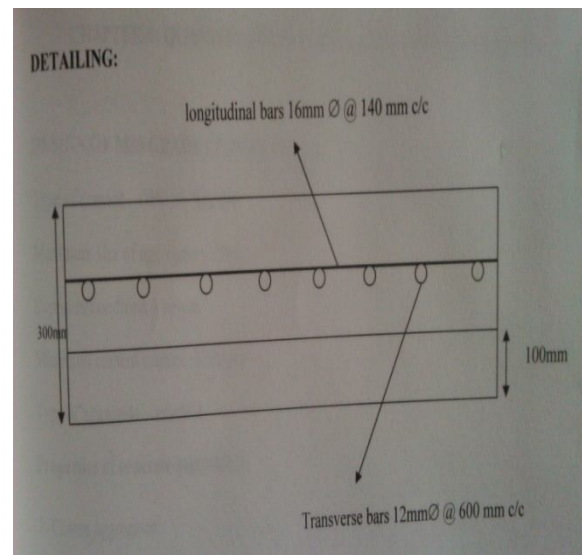
AASHTO’93 gives the spacing of both longitudinal and transverse steel.

Longitudinal spacing-16 mm Ø @140mm c/c

Transverse spacing-12 mm Ø @600mm c/c

By the above condition we can find the area of steel, number of bars, spacing of steel placing.

- 0.5 to 0.7% of steel is used to cross sectional area of pavement.
- Longitudinal reinforcing bars are placed on the transverse bars and then tied to the latter.
- The minimum spacing should be provide 50mm from the surface course and as well as base course.
- Transverse reinforcing bars used to support the longitudinal bars.



SLAB THICKNESS:

The slab thickness can be calculated from the above mentioned design considerations and from the clause IRC: 58-1988

Construction procedure:

- The construction of CRCP is similar to the normal rigid pavement.
- It is important to pay special attention to certain details such as the selection and installation of the reinforcement.
- Here we consider the PCC layer is a base course of pavement.
- Increasing the sub-grade support by over excavation process and filled with unbounded material.
- The life time of pavement is not only depends upon the design aspects but its also depends upon the preparation of soil sub-grade. That’s why we adopt a over excavation process to increase the soil sub-grade stability.
- Here the unbounded material which is used for filing in sub-grade is also acts as sub-base course.

The sub-base in rigid pavement is not a necessary.

MIXING PROPORTIONS:

- M10-for PCC layer
1:4:8(IS 456:2000)
- M35-for wearing course
1:1:2(IS 456:2000)

TEST CONDUCTED:

- California Bearing Ratio (CBR)- 9% for evaluating the stability of soil sub-grade.
- Setting time for concrete
Initial setting time: 30 min
Final setting time 600 min
- Compressive strength of concrete is 46.6 mpa in 28 days curing for M35 mixed proportion.

IV. CONCLUSION

- Compared to flexible pavement and normal rigid pavement CRCP gives additional design of at least 15 years.
- It is maintenance free service.
- Concrete can withstand even under heavy traffic loads.
- Concrete road increases the speed of vehicles and save the money, fuel consumption and time etc.
- Use of CRCP drastically can reduce import of bitumen there by leading to saving of foreign currency.

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