



ADVANCEMENT IN RIGID PAVEMENT

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Abstract

A country can achieve sustainable and rapid growth in all fields by improving its connectivity and transportation system. Connectivity of people to resources by improve transit mechanism results in improve living standards. Apart from other means, the major part of connectivity of any country is through road system. In India all the major road system are design as flexible pavement only, because of their easy of construction and less cost. The major problem with flexible pavement is their design life and high maintenance cost so tackle these problems, rigid pavement can be construct.

Concrete is the most used construction material in rigid pavement. But to construct concrete based rigid pavement require more cost and time. Due to such reason we need to use industrial waste such as tile powder, GGBS, PFA, pulverized polished waste and recron polyester fibre etc. as partial replacement in cement to increase the strength of concrete and also decreases the curing period. In industry about 15-30% production goes as waste thus waste create in problem in society. So use of such type of waste we helps to recycle these material.

Keywords : GGBS (Ground Granulated Blast-furnace Slag), PFA (Pulverized Fuel Ash), OPC (Ordinary Portland Cement).

WHAT IS ADVANCEMENT IN RIGID PAVEMENT ?

- Advancement in rigid pavement is a specialized series of pavement designed to provide several benefits in the construction of pavement structures.
- **Performance Benefits**
- **Cost & Other Benefits**
- **Performance Benefits**
- ease of placement and consolidation without affecting strength
- long-term mechanical properties
- early high strength
- toughness
- volume stability
- longer life in severe environments
- **Cost & Other Benefits:-**
- less material
- fewer beams
- reduced maintenance
- extended life cycle
- aesthetics

INTRODUCTION

Types of Rigid Pavement

- **Jointed Plain Concrete Pavement (JPCP) :**

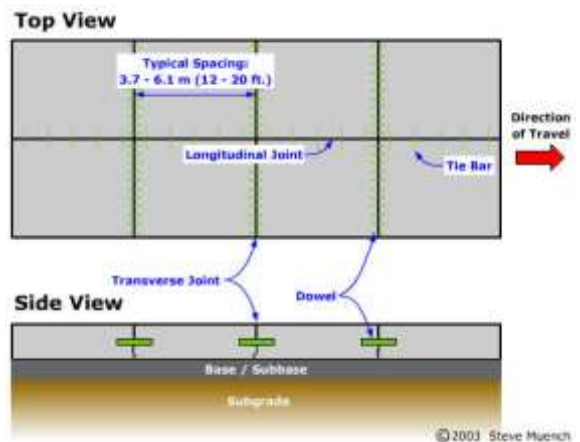


Fig.1:- Jointed plain concrete pavement (JPCP)

- **Continuously Reinforced Concrete Pavement (CRCP) :-**

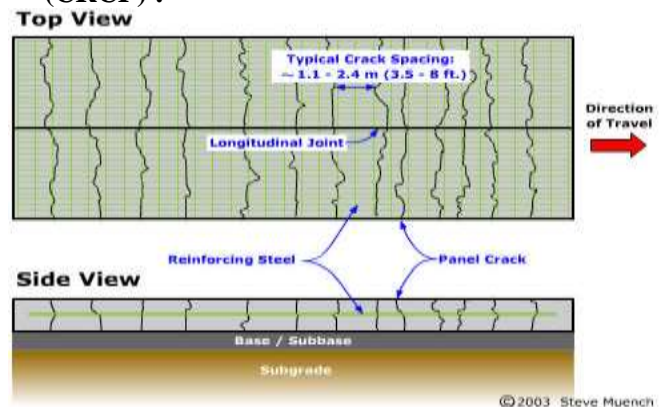


Fig.2:- Continuously reinforced concrete pavement (CRCP)

HISTORY OF RIGID PAVEMENT

• IN THE BEGINNING

- 1879-First concrete pavement in the world in Inverness, Scotland
- 1893-First U.S. concrete pavement constructed (Court Street, Bellefontaine, OH)
 - Two-coarse construction
 - Hard aggregate on top to resist horseshoe wear
 - Grooved in 4-in squares: surface friction of horses!
 - George Bartholomew (builder) posted \$5000 bond for 5-year guarantee
 - Paved other 3 sides of square in 1893

• US CONCRETE INDUSTRY-1910s

Seeding" Roads

- By 1916, there were 10000 autos in the U.S., operating mostly on unpaved roads
- The industry built single lane, 9-ft wide concrete pavements, hoping that motorists would like them and would lobby for more miles of concrete roads

• 1910s to 1950s: Beginning to understand concrete pavement behavior

- Advanced in pavement analysis.
- Early road tests
 - Pittsburg, CA-1921-22
 - Benefits of slab reinforcing
 - Bates (IL) Road Test-1922-23
 - Performance of concrete vs. asphalt, brick, etc.
 - Benefits of longitudinal joints and thickened edges
- Use of joints, load transfer, improved foundations

• 1960 to 1980s – Era of Advancement (US Interstate Highway Construction)

- Improved analysis techniques
- Finite Element Analysis
- Advance design procedures
- Slip-form paving
- Concrete mixture improvement
- Improved design features

• 1990s to present: Modern Concrete Pavement Technology

- Advance M-E Design
- MnROAD
- Concrete Overlays
- Improvement in Construction Technology
- Concrete mixture improvements
- Precast Concrete Pavement

SUBSTITUTE FOR CEMENT

Following substitute material used for advancement in rigid pavement

1) GGBS MATERIAL

- GGBS is a by-product of the iron and steel industry. In the blast furnace, slag floats to the top of the iron and is removed. GGBS is produced through the molten slag in water and then grinding it into a fine powder.

- Study will be based on GGBS (Ground Granulated Blast Furnace Slag) as a substitute of cement in a percentage.
- In industry about 15-30% production goes as waste.
- We use 30-50% GGBS as replacement of cement.
- Finally, the strength performance of GGBS is compared with the performance of OPC Concrete.

2) TILE POWDER

- In the tile industry, about 15%-30% ceramic production goes as waste
- partial replacement of tile powder in cement accordingly in the range of 0%, 10%, 20%, 30%, 40%, and 50% by weight for M30 grade of concrete.
- The compression, split tensile and flexural strength of M30 grade concrete increases when the cement is replaced with tile powder up to 30% and further replacement of cement with tile powder decreases the strength gradually
- By using the replacement materials offers cost reduction and can overcome few environmental hazards.

3) VITRIFIED POLISH WASTE AND RECRON POLYESTER FIBRE

- To reduce the construction cost of rigid pavements by incorporating Vitrified Polish Waste (VPW) as partial cement replacement in proportions of 5% for M40 grade concrete. Further, to enhance flexural properties of pavement.
- Recron fibre is added to optimum VPW in increments of 0.1%, then after C.C pavement is designed for two lane two way national highway and cost benefit analysis is performed.

3. CONCLUSION

- The water, cementitious materials, aggregates and chemical admixtures all need to be proportioned effectively to deliver the mix with the most desirable properties for placement, finishing, curing, and hardened condition.
- If the results are satisfied we can suggest and implement use of substitute material like fly ash, PFA, powder tiles, GGBS etc material in rigid pavement construction.

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