Assessment Of Quality Control Measures in Flexible Pavement Construction for Enhanced Durability

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***Abstract*— Flexible pavements are widely adopted in highway construction due to their cost effectiveness, ease of maintenance, and riding comfort. The durability and performance of flexible pavements largely depend on proper quality control measures during construction. This study evaluates quality control practices adopted in embankment, subgrade, granular sub-base (GSB), wet mix macadam (WMM), dense bituminous macadam (DBM), and bituminous concrete (BC) layers. Laboratory and field investigations were conducted according to MORTH and IS specifications. Tests such as CBR, compaction, gradation, moisture content, Atterberg limits, aggregate impact value, and bitumen tests were analyzed. Results revealed that effective quality control practices significantly improve pavement strength, durability, and service life. The study emphasizes the importance of systematic testing, inspection, and adherence to standards for achieving durable and sustainable pavement infrastructure.**

***Index Terms*— Bituminous Concrete, Flexible Pavement, GSB, Pavement Durability, Quality Control, WMM.**

I. INTRODUCTION

Flexible pavements are extensively used in highway projects because of their structural flexibility, economical construction, and ease of maintenance. However, pavement failures such as rutting, cracking, potholes, and deformation occur mainly due to poor construction practices and lack of quality control. Proper inspection, testing, and monitoring during pavement construction are essential to achieve long-term performance and enhanced durability.

In pavement engineering, quality control refers to the operational techniques and activities used to verify that materials and construction procedures satisfy specified standards. The present study focuses on the assessment of quality control measures adopted during the construction of flexible pavements in accordance with MORTH specifications and IS codes.

II. LITERATURE REVIEW

Several researchers highlighted the importance of quality control in pavement construction. Khan (1998) emphasized the significance of California Bearing Ratio tests for evaluating subgrade strength and pavement suitability. Brajesh Mishra (2015) reported that bitumen quality tests such as penetration, ductility, and softening point are essential for ensuring durability of flexible pavements.

Previous studies also concluded that systematic inspection and laboratory testing improve the performance of granular sub-base and wet mix macadam layers. Proper compaction and moisture control were identified as critical factors influencing pavement life.

III. MATERIALS AND METHODOLOGY

The study was conducted on a highway pavement project executed under NHDP Phase-IV on NH-65 in Andhra Pradesh. The pavement structure consisted of Subgrade (500 mm), Granular Sub-Base (200 mm), Wet Mix Macadam (250 mm), Dense Bituminous Macadam (110 mm), and Bituminous Concrete (40 mm).

Laboratory and field tests were conducted to assess quality control requirements for different layers. Tests such as Free Swell Index, CBR, moisture content, compaction, aggregate impact value, gradation, bitumen penetration, ductility, and field density tests were performed.

Table I: Flexible Pavement Layer Details

Layer	Material	Thickness (mm)
Bituminous Concrete	BC	40
Dense Bituminous Macadam	DBM	110
Wet Mix Macadam	WMM	250
Granular Sub Base	GSB	200
Subgrade	Soil	500

Table II: Quality Control Test Requirements

Test	Code	Requirement	Frequency
CBR Test	IS 2720 Part 16	Min 6%	1/3000 m3
Density Test	IS 2720 Part 8	>1.75 g/cc	2/3000 m3
Moisture Content	IS 2720 Part 2	OMC ±1%	1/250 m3
Gradation	MORTH	Specified Limits	1/200 m3
Field Density	IS 2720 Part 28	97% Compaction	1/1000 m2

IV. RESULTS AND DISCUSSION

The results obtained from laboratory and field tests demonstrated that proper quality control practices significantly improve pavement durability and structural performance. The subgrade compaction achieved densities greater than 97% of Standard Proctor Density, while the granular sub-base and wet mix macadam layers satisfied gradation and moisture content requirements

Bituminous layers exhibited improved stability and durability due to proper temperature control, mix design, and rolling operations. Testing frequencies and systematic inspections ensured that all pavement layers complied with MORTH specifications.

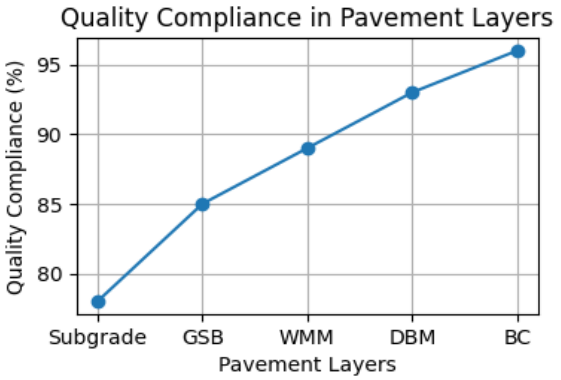

Fig.1 Quality Compliance in Pavement Layers

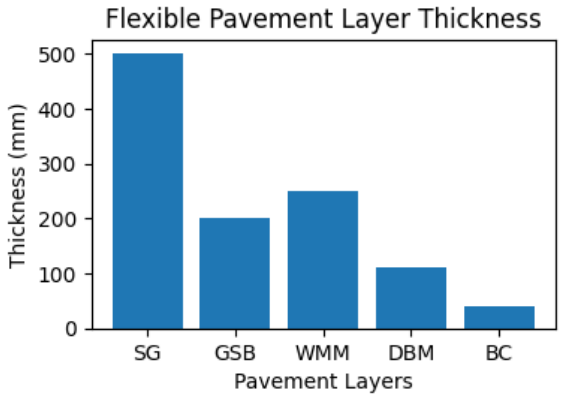

Fig.2 Pavement Layer Thickness

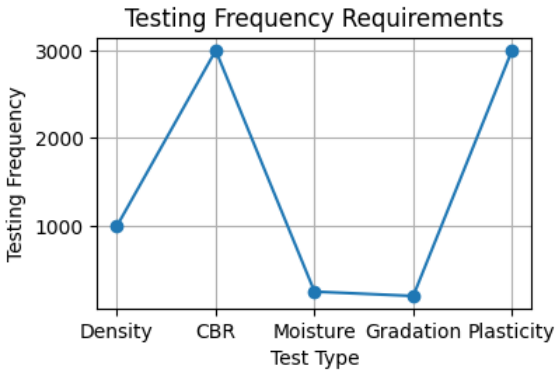

Fig.3 Testing Frequency Requirements

V. ADVANTAGES OF QUALITY CONTROL

Effective quality control practices reduce pavement failures, improve load carrying capacity, enhance riding quality, and increase service life. Proper testing and inspection minimize maintenance costs and ensure safe and durable transportation infrastructure.

VI. CONCLUSION

The present investigation concludes that quality control measures play a crucial role in the successful construction of flexible pavements. Proper testing, inspection, and adherence to specifications significantly improve pavement performance and durability. The implementation of systematic quality assurance procedures ensures sustainable pavement infrastructure and reduces maintenance requirements. The study highlights the necessity of adopting standardized quality control techniques for embankment, subgrade, granular sub-base, wet mix

macadam, and bituminous layers in highway construction.

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