

**INTRODUCTION OF PERFORMANCE BASED  
SPECIFICATIONS FOR ASPHALT BINDERS IN PAKISTAN**

By

**Qazi Aurangzeb**

(2004-NUST-TfrPhD-Tn-26)

A thesis submitted in partial fulfilment of

the requirement for the degree of

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In

Department of Civil Engineering

**National Institute of Transportation**

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This is to certify that the

thesis entitled

**INTRODUCTION OF PERFORMANCE BASED  
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Submitted by

**Qazi Aurangzeb**

has been accepted towards the partial fulfilment

of

the requirements

for

**Master of Science in Civil Engineering**

**(Specialization in Transportation Engineering)**

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of

**National University of Sciences and Technology**

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In partial fulfilment of the requirements

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**Master of Science in Civil Engineering**

**(2007)**

**DEDICATED  
TO  
MY PARENTS**

## **ACKNOWLEDGEMENT**

First of all, I am grateful to Almighty Allah who enabled me to accomplish this thesis. I acknowledge the enabling role of the Higher Education Commission (HEC) Islamabad, Pakistan and appreciates its financial support through “Merit Scholarship Scheme for PhD Studies in Science & Technology (200 Scholarships).

I am grateful to Brigadier Dr. Tayyeb Akram for his extended guidance and supervision. I greatly appreciate his encouragement and facilitation throughout the study period. I am highly obliged to my co-advisor Dr. Syed Waqar Haider of Michigan State University (MSU), USA. It would have been a very difficult task without his direction and continuous guidance.

I also owe a lot of thanks to my respectable teachers and committee members Dr. Sajjad Haider and Dr. Kamran Ahmed for their support and help during my research. I am also thankful to the administration and laboratory staff of National Institute of Transportation for their extended help in the research work. I would like to pay my gratitude to all my colleagues for assistance and encouragement throughout this process.

Finally, I appreciate the cooperation, encouragement and prayers of my parents and other family members, without which it would have been impossible to complete the task.

## ABSTRACT

Premature asphalt rutting, due to high temperatures and heavy loads, has been a major distress on flexible pavements in Pakistan. One of the main causes of this early rutting is the available asphalt binders, which are still graded by using penetration grading system. The primary objective of this study is to study the high temperature susceptibility of the available asphalt binders in Pakistan. This was accomplished by collecting the temperature data from twenty-one meteorological stations from several geographical locations in the country. Based on the temperature variations, the country was divided into different climatic regions. The Superpave procedure was adopted to establish PG grade requirements for these regions. The country was then divided into different PG grade zones. Subsequently, it was observed that PG grades 70-10, 64-10, and 76-10 were the three critical binder grades required in Pakistan. Later, all available asphalt binders, typically used in the highway construction, were obtained from two refineries —Attock Refinery Limited (ARL) and National Refinery Limited (NRL). The binders were then subjected to performance testing using the state-of-the-art equipment to determine the critical high temperatures. It was found that the ARL binders having a penetration grade 60/70 is being used in PG 76-10 and PG 70-10 zones and have a high temperature performance grade of only 58. Moreover, NRL 60/70 and NRL 80/100 grades were found to have same high temperature PG grade. To characterize the rheology of available binders, master curves were developed by using dynamic shear rheometer (DSR) and performing frequency sweep tests. The rheological parameters from the developed master curves showed the superiority of polymer modified binder ARL60/70 (P) over rest of the asphalt binders. These results show that the existing asphalt binder grades will be very susceptible to high temperatures as being used in Pakistan. It is therefore recommended that harder asphalt binder should be used in the country and the PG grading systems should be adopted to mitigate asphalt-related rutting in Pakistan.

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