I invite readers to this section of the report. In India, bitumen, a material used as binder in Flexible Pavements, is characterized by viscosity grading system. Superpave performance grading is now in practice in many advanced countries. We are still struggling to implement this superior grading system due to prohibitive cost of equipment involved for different experimental protocols.

Bitumen is obtained as a waste product from refineries through fractional distillation and is observed that the binders will not able to perform satisfactorily while addressing three potential failures of flexible pavements namely; stripping at low temperature, fatigue cracking at medium temperatures and rutting at high temperatures regimes and therefore modification is suggested through polymers, acids and minerals. Good number of works was reported in polymer modification and there are agencies who have patented preparation of polymer modified bitumen. However, limited works were reported in the area of acid modification from India and therefore I thought there is a lot of scope for research in the area of acid modification.

Indian VG 30 paving grade bitumen was considered to study effect of poly phosphoric acid modification with a view to explore changes in mechanical, chemical, rheological and micro structural properties due to modification. The fundamental tests were carried out in Mahatma Gandhi Institute of Technology (MGIT), Gandipet, Hyderabad, the institution where I am working at present. The Dynamic mechanical analysis was performed using Dynamic Shear Rheometer to determine high temperature superpave performance grade at GMR Pavement Research Centre, Rajiv Gandhi International Airport, Shamshabad, Hyderabad. The short term aging simulation tests were carried out at VNR Vignana Jyothi Institute of Technology (VNRVJIET) on straight run bitumen and acid modified bitumen. Further, the experimental accessories required for the separation of bitumen to study the effect of modification and aging into oil and solid fraction were procured and carried out at MGIT. X-Ray Diffraction and Scanning Electron Microscope Imaging techniques were used to study the morphology and structure of asphaltenes, the solid fraction of bitumen.
In order to study the thermal behavior of bitumen and asphaltenes, Thermo Gravimetric and Differential Scanning Calorimetry (TG-DSC) studies were carried out at Sophisticated Analytical Instruments Facility (SAIF), IIT Chennai.

The instrumentation required to implement performance grading are prohibitively costly. There is an urgent need to devise instruments indigenously so that the implementation of these advanced grading systems become viable. In this current research activity, attempt was made to devise dynamic shear rheometer and I was not successful. Further, efforts were made to devise Rotational Viscometer and a domestic patent has been filed with title “Measurement of Viscosity of Bituminous Binders in Rotational Mode through indirect measurement of torque”.

Having explored the effects of PPA modification through different investigations, further work was carried out on bituminous mixes for Dense Bituminous Macadam (DBM) and Bituminous Concrete (BC) for use in flexible pavements. Interactive software using C# programming was developed for Job Mix Formulations (JMF) for both DBM and BC. The software will be of great use to the consultants in arriving at aggregate blends required based on the percent passing of aggregate stockpiles. The job mix formula worked out from the developed software was used to investigate for the efficacy of PPA modification through Marshall and Resilient modulus tests.