Chapter-XI

CONCLUSION AND FUTURE SCOPE OF THE WORK

Achieving quality in flexible pavements through e-control is an effective method for assuring quality and quantity of work. This system ensures that even after the mixing of the official field staff with the contractual agency, there can be no pilferage of material. Batch mix type fully automated computer controlled Hot Mix Plants with electronic sensor control the quality and the uniformity of the finished product. The other equipment as used with electronic sensors also control the quality automatically. The model for e-quality control system adopted at the various stages of the construction ensures the quality and the quantity of the materials used. The model for economical and efficient use of vehicles through e-control has explored the concept of using VTS with fuel sensors, GPS etc. in the construction of a highway project. This e-control system can play a major role in minimizing the cost of project. It is also quite efficient to check the distance travelled by the vehicle in a day, working hours of vehicles/day, halt hours of vehicles/day, idle hours of vehicles/day and the speed of the vehicles etc. The use of updated machinery for monitoring of quality and quantity of a pavement has explored the concept of use of machinery with electronic sensors in the construction of a pavement for a better control on its quality and quantity. With its use, the various ingredients of the materials used in the construction of a pavement can be controlled within the specified range as specified in the standard codes of pavement. Besides, the use of in-built camera in the equipment enabled with GPS instrument also has a great role in placing live data of each and every activity of machinery on the web site for future record.

The properties of the aggregates can be upgraded with the use of e-control system. The bituminous mixes are designed with a particular size and shape of the aggregates. The variation in shape, size and grading of the aggregates even within the tolerance limits in the specifications may upset a well-designed mix and hence the quality of the end product. There is a negative effect of flaky particles on the properties of the aggregates. With the use of e-quality control system with modern machinery having electronic control such as cone crusher, the aggregates can be well controlled with a grading close to the designed grading in the job mix formula. The e-control system also controls the shape, size and grading of aggregates and thus upgrades the properties of the aggregates such as impact value, crushing
value, water absorption and the angularity number etc. In a system where all the activities are electronically controlled, the tolerance limits prescribed in the codes seems to be on a higher side. These limits were fixed when every activity was not electronically controlled and it has become redundant now. The use of e-quality control system has direct effect on the existing tolerance limits in WMM, DBM and BC. The revision of tolerance limits on a lower side has been recommended which will give the best quality of the finished product to the best of its standards. The standards of riding quality have also been upgraded for high speed corridors. With the use of e-quality control system, the testing system runs parallel automatically in every stage of the construction and controls its quality and quantity. In the case study, the passing of all the test results validates the results of e-quality control system. It is concluded that in the construction of a flexible pavement where e-quality control system is used, no further testing is required for the acceptance of the work. However, to check the proper functioning/working of machinery and e-quality control system, 2-3 tests of each category are recommended to be conducted physically on each day of the work. The use of this model also reduces the manpower, time and as a result saves money.

**Future Scope of the Work**

The thesis opens a future scope of work for the followings:

(i) The present research has been carried out only for the flexible pavements. The scope of research should be further extended and research needs to be carried out on rigid pavements also.

(ii) e-quality control system should be developed to be used in the construction of bridges, flyovers, trumpet junctions, tunnels etc.

(iii) As with the use of e-quality control system the quality and the quantity is assured, so the future research should be carried out to reconsider the design of the flexible pavements as well as of the rigid pavements.

(iv) Future research should be carried out to look into the use of percentage of bitumen contents in the flexible pavements as with full assurance of quantities of material, bitumen can be saved which will be in the national/international interest.

(v) The research needs to be further extended for all the building works including multi-story buildings, railway projects, dams, weirs and all other civil engineering projects etc.
Research needs to be carried out as to what further savings can be achieved in the quantities of materials with the use of e-quality control system. It seems that with lesser quantities and use of e-quality control system, the same design requirements can be met with.