CHAPTER 6

CONCLUSION

6.1 INTRODUCTION

Indian two wheeler markets have been witnessing dramatic change in recent years with people preferring motorcycles than scooters, due to riding comfort and better accelerations. Varieties of models of different capacities are being made by Indian manufactures to meet local and export markets. In order to sustain in the market, two wheeler manufacturers are forced to make quality vehicles with higher reliability, at the same time maintaining the cost to competitive level. Hence, two wheeler components also, have to be manufactured to a better quality and reliability to meet the demand of motorcycle manufacturers.

In this context, in order to understand the level quality of existing chain and for possible improvement, a study has been initiated to bring out the problems associated with the existing motorcycle chain and the performance in field operation. The study has been focused and designed with four distinct stages namely preliminary investigation on chain design, analysis of factors that cause chain elongation due to wear, theoretical performance evaluation of chain based on elongation because of wear and make comparison with field performance. Based on the above study, a new proposal for improvement has been made. The research work has been executed in the following manner.

In the preliminary investigation, motorcycle of a particular model of a typical brand has been considered for theoretical chain elongation
evaluation and for elongations study in field. The critical factors namely, dimensions, hardness, finish, lubrication and other relevant factors that influence chain elongation have been considered. It is observed that the initial elongation of existing chain has a higher slope in the theoretical as well as in the field and found that the main contributing factor for this phenomenon is the shrinkage of bush. In order to avoid this problem, a modified design is made with a profile in bush material, which provided better contact of pin with bush thereby reducing the wear in initial running in period.

The theoretical evaluation of chain with modified bush is made and compared with the theoretical evaluation of existing chain, which has been validated with field survey. Also, in order to find out whether the profiled bush has any influence on dynamic characteristics viz. vibration and fatigue properties, modal, harmonic and fatigue analysis are carried out on existing chain components and modified bush. In addition to the above, the possibility of using diffusion heat treatment and increasing the bearing area of pin has been studied. The following conclusion are drawn from the results.

- Generally, mechanical wear is divided into three stages and they are 1) wear in, normal wear and rapid wear. In all the chain elongation study made which have been presented in this research work, it is found this concept is supported in the method of study adopted.

- Theoretical evaluation of existing 100cc motorcycle chain made in this research work is found to closely match the field performance of chain with good as tested by $\chi^2$ and hence the theoretical model is useful to establish the elongation performance of chain in the design stage itself.

- Modified chain with profile bush has an improved life by about 12% than the existing chain due to reduction in
shrinkage of bush and the contact between pin and bush is improved in initial stages due to the profile provided in bush material.

- Modified bushes may be riveted that may cause a small bush projection over inner links due to material flow, which may help in reducing the lateral movements of links making the chain move in an almost straight path than swaying sideways. This phenomenon may reduce chain noise. However, bush projection should not exceed clearance between plates.

- The effect of varying load and speed is demonstrated and plotted for comparison. Chain with typical drive cycle is found to elongate faster due to wear than with chain subjected steady load and speed. From this, it may be inferred that motorcycle usage in city drives and hill station would cause reduction in chain life than those used in highways.

- Lubrication is the main contributing factor for reducing chain elongation, since Archard’s wear constant is significantly less in excellent lubricated condition. Better lubrication is possible in the case of modified chain due to taper profile provided and due to caulking of the bush, which facilitates wax base lubricant to penetrate easily between pin bush clearance, thereby reducing wear of pins and bushes, which causes reduction in chain elongation.

- However, the assumption of 20% percentage improvement in theoretical evaluation due to improved lubrication will have to be estimated by conducting field trials.

- Due to very high contact stress in the case of transmission chain pins, the possibility of chromizing coating is not advised
even though they are successfully used in timing chains due to less contact stress.

- Comparison of existing chain elongation with higher pitch chain indicates that 15.875mm pitch chain has better life compared with 12.7mm pitch chains. This is due to increased bearing area of higher pitch chain pins. However, it is not recommended considering speed fluctuation and the cost of chain and major design change requirement to incorporate in the present design of motorcycles.

- Endurance limit of all the components, are found higher than the operating stress level and hence the components will not fail during operation and have good life. The fatigue strength of roller link plate, is relatively lower than other elements because of bigger hole size in the roller link plate, which reduces effective load.

- This study helps to understand the chain elongation performance under different cycle conditions and establish appropriate drive cycle to evaluate the performance of chain to much better accuracy and to make a bench mark in predicting the life chains at later stages.

- With the help of the present research work, the effect of variations in chain parameters viz. operating load, speed, chain parameters like dimensions, materials, heat treatment etc can be studied and the level of criticality of factors could be found.

- From the slope of elongation curve, approximate time schedule can be arrived for proper relubrication, which will help further enhance the life of chain thereby reducing
maintenance cost, which invariably create better image for the motorcycle and chain manufacturers.

- Overall the study helps to enhance the life of chain, which reduces down time and maintenance cost to certain extent.

- In addition to the above, this study may help chain and motorcycle manufacturers for improving chain performance thereby boasting their products in national as well as international markets and get better market share and enhance the economy of the country.

6.2 SCOPE FOR FUTURE WORK

- Development of modified bush profile chain and performance evaluations both experimentally and in field trial to establish the percentage of improvement and to compare with the theoretical evaluation done in this investigation.

- Establishing a bench mark of theoretical evaluation by comparing with large samples of field trials.

- Effect of increased penetration of grease has to be studied experimentally to establish the claim made in this research work. Possibilities of using multilayer coating on pins with higher hardness to improve wear resistance.

- The possibility of using Teflon coating on pins and rollers of transmission chains may be studied that may help to reduce wear as well as noise generation while meshing with sprockets.