

# FATIGUE ANALYSIS OF KASHMIR WILLOW CRICKET BAT

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**Abstract** - The design of sports equipment is an interesting task and has been evolving since decades. One such sport is cricket, a very popular game in many countries. The design of cricket bat has been evolving fascinatingly. In present age, cricket bat is made up of two different woods namely English and Kashmir willow woods. In this paper it is intend to carry out fatigue analysis on cricket bat (for a defensive shot only) for Kashmir willow bat at different points on blade of the bat by applying fatigue load obtained from the different ball speeds. The actual speed of the ball at the time of impact is calculated by considering surrounding factors like pitch impact and air resistance and is used to carry out fatigue analysis. The bat is theoretically modeled, where a standard cricket bat is cross checked for its minimum cross section, then life of the bat is calculated for different fatigue load (different speed of ball) cases. The bat was then modeled accordingly in CATIA and was imported to ANSYS Workbench for fatigue analysis. Different load cases were created and fatigue analysis was carried out to predict the life of the cricket bat. Performance of the Kashmir willow cricket bat for various bowling speeds is discussed along with the weak spots.

**Key Words:** Weak Spots. Impact load, Workbench.

## 1. INTRODUCTION

The procedure to calculate the life of Kashmir willow is similar to English willow cricket bat life calculation[1] by using respective material properties.

## 2. MATERIAL PROPERTIES

The Kashmir willow and Cane wood material properties are mentioned in the below table 1.

**Table -1:** Material Properties [2,3]

SL.No	Material	Density (Kg/ m <sup>3</sup> )	Young's Modulus (GPa)	Ultimate Impact Bending Stress (MPa)	Poisson's Ratio
1	Kashmir Willow	535	6.67	108	0.35
3	Cane	498	8.8	121	0.3

## 3. ENGLISH WILLOW CRICKET BAT CASE STUDIES

**Table 2:** Life of Kashmir Willow Bat

CASES	Ball Speed (Kmph)	Force Applied Spots with Life of bat					
		580-Center	580-Edge	465-Center	465-Edge	175-Center	30-Edge
Case I	160	59	40	295	199	10 <sup>6</sup> +	10 <sup>6</sup> +
Case II	130	281	199	1995	1584	10 <sup>6</sup> +	10 <sup>6</sup> +
Case III	90	2511	1023	44668	31622	10 <sup>6</sup> +	10 <sup>6</sup> +

Table 2 shows that, the life of bat is less when ball hits with 160 Kmph compared to other two cases using theoretical calculation. And life of bat is less for 580 edge spot ball impacts for all cases.

## 3. ANALYSIS IN ANSYS WORKBENCH

Kashmir willow cricket bat is modeled in Catia software and fatigue analysis is carried out in Ansys workbench for three cases.

**Table 3:** Life of Kashmir Willow Cricket Bat (Ansys)

CASES	Ball Speed (Kmph)	Force Applied Spots with Life of bat (cycles)					
		580-Center	580-Edge	465-Center	465-Edge	175-Center	30-Edge
Case I	160	151	105	436	264	643930	840460
Case II	130	309	243	2309	1647	728770	915710
Case III	90	5195	3823	45249	33864	10 <sup>6</sup> +	10 <sup>6</sup> +

Table 3, shows that, the life of bat is less when ball hits with 160 Kmph compared to other two cases using theoretical calculation. And life of bat is less for 580 edge spot ball impacts for all cases.

## 4. CONCLUSION

It is observed from the results that Kashmir willow bat performance is better for 175-center and 30-edge ball impacts and weak spots are 580-center and 580-edge. There is difference in life of the bat determined theoretically and ansys, the reason being the minimum thickness of 25 mm is considered for theoretical modeling and actual thickness is considered for FE model.

**REFERENCES**

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