

BASEBALL STUDY PERFORMED  
FOR THE  
CLEVELAND PLAIN DEALER

AUGUST 2000

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## INTRODUCTION

Lansmont Corporation was asked to perform Coefficient of Restitution (COR) tests on a number of Major League Baseballs. Many of the balls tested in this study were supplied to Lansmont by the Cleveland Plain Dealer newspaper. Lansmont obtained other balls from the Colorado Rockies. The balls in this study cover years from 1978 to 2000. Unfortunately, there were not enough balls from the various years to clearly define a statistically significant trend. However, for the balls tested, we present our findings.

## SUMMARY

A total of 65 Major League baseballs were tested. The testing was performed on the Lansmont BEST Test System in Sunnyvale, California during the months of July and August 2000. The BEST Test System utilizes state of the art sensors and electronics to provide the most accurate measurements available for ball and bat performance testing. The type and age of the balls is shown in Figure 1. The testing consisted of impacting balls at controlled speeds into a 2-inch thick steel plate and measuring the rebound velocity. The ratio of the rebound velocity over the impact velocity is commonly known as the Coefficient of Restitution (COR). The COR is a measure of the balls elasticity. The value of COR ranges from 0 to 1. A value of 0 indicates no rebound velocity and the ball is said to be inelastic. By contrast, a value of 1 for COR indicates a perfectly elastic ball. The COR is sensitive to a number of factors including the impact speed, the type of impact surface and the temperature and humidity. Generally the COR will decrease with increasing impact speeds and will *increase* with lowering humidity.

Each ball was impacted 6 times. The average of these impacts along with standard deviation and 95% confidence limits were calculated. The impact speeds were 60 MPH (88 f/s), 89 MPH (130.5 f/s) and 140 MPH (205.3 f/s). 56 of the balls were temperature and humidity conditioned at 72 degrees F and 50% RH while the remaining 9 balls were conditioned to 108 degrees F and 15% RH. A separate data sheet for each test ball was produced. The data sheet shows the individual impact and rebound velocities along with the COR calculations. Also included is a small graph depicting these values for each impact.

## DATA SUMMARY

The Test protocol is shown in Figure 1. The largest quantity of balls (36) was from the 2000 season. These balls were from Major League teams, 1 dozen from the Colorado Rockies, 1 dozen from the Cleveland Indians and 1 dozen from the Cincinnati Reds. Data for each team is plotted individually and all data is combined and averaged for comparison to older balls. The data reveals that the COR values for these balls are high at 88 f/s. A value of 0.576 is just within the MLB specification of 0.546 +/- .032. As impact speed increases, the COR value decreases but not in a predictable linear manner. In fact, the Rockies balls decrease less in COR than the Reds balls.

Similar averaging was done for the 1999 season balls and the data is graphically presented. Based on this small sample size, considering the 95% confidence limits, the performance of 2000 balls is essentially the same as year 1999 balls.

For both the 2000 and 1999 balls, tests were run at elevated temperature and low humidity. In all cases the COR increases by as much as 6.4% at 60 MPH impact speed.

The older balls were tested at 60 and 89 MPH impact speeds to generate as much relevant data as possible for comparison to existing specifications and historical data. Two key graphs depict these balls performance levels. The graph labeled "COR Vs Year, 89 MPH" shows the COR of these balls verses year tested at an impact speed of 89 MPH. The graph labeled "COR Vs YEAR, 60 MPH" shows a similar result for an impact speed of 60 MPH. Both graphs show the pre 1982 balls as less lively than the current manufacture balls by a percentage as large as 9%. It is unknown as to the cause of this difference. It may be argued that deterioration due to age may be the cause and it is possible that ball construction differences may have also contributed to the lower performance of these balls.

## **CONCLUSION**

The testing performed on these balls yielded some interesting insights. Statistically significant conclusions cannot be constructed from the data produced however. There are simply not enough samples to define the performance characteristics of the population. The insights gained from this process are as follows:

1. The difference between 1999 and 2000 season baseballs is minimal. This observation supports the claims of the MLB study performed by Prof. Jim Sherwood.
2. The COR for 1999 and 2000 balls is quite high; at or beyond the upper limit as currently defined by MLB.
3. COR values at 89 MPH are quite high in comparison to values obtained (0.46) by Briggs in 1945.
4. Older balls in this study have lower COR values than 1999/2000 season balls.
5. Lower humidity and elevated temperature increases the COR of baseballs by as much as 6.4%.



Ball Description	Quantity	Notes	Test Protocol			
			60 MPH	89 MPH	140 MPH	60 MPH HH
2000 Rockies MLB	12	from Colorado Rockies	3	3	3	3
2000 Reds MLB	12	from Cincinnati Reds	3	3	3	3
1999 National League	6	Rawlings RON	3	3	-	-
1999 American League	6	Rawlings ROA	-	-	3	3
1997 Jackie Robinson	6	Rawlings ROA, RON	2	2	2	-
1991 All Star Game	1	Barry Larkin	1	-	-	-
1982 World Series	1	Ozzie Smith	1	-	-	-
1978 World Series	2		1	1	-	-
1979 World Series	2		1	1	-	-
1980 World Series	2		1	1	-	-
1976 Autographed	2	Rawlings ROA	1	1	-	-
1984 ROA	1	Rawlings ROA	-	1	-	-
2000 Indians MLB	12	from Cleveland Indians	6	6	-	-
	65		23	22	11	9

Notes:

60, 89 and 140 MPH tests performed with balls conditioned at: 72 deg. F, 50% RH

60 MPH HH performed with balls conditioned at: 107 deg F and 15% RH

