SOME OBSERVATIONS PERTAINING TO CARCASS MEASUREMENTS AND U.S. BEEF GRADES

by

WILLIAM DUNCAN STALLS

B. S., Texas Technological College, 1949

ABSTRACT OF A MASTER'S THESIS

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MASTER OF SCIENCE

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This study was undertaken for the purpose of procuring information that might lead to the development of objective grade standards for dressed beef.

The present government method of determining beef carcass grade consists of the subjective evaluation of the carcass and comparison of these observations with a set of ideals or merits that have been established as a standard. Subjective evaluation of the beef carcass, although standardized by the government grading service, permits human bias and error to enter into determination of grade. Thus, the establishment of grade standards with measured evaluation of grade would place more reliability and uniformity to all graded beef.

As the beef carcass lends itself well to linear measurement, carcass measurements were considered as a possible method by which grade could be evaluated objectively. Specific carcass measurement and other pertinent data were collected on a total of 155 carcasses at two packing plants. The sample included steer and heifer carcasses, grades ranging from Choice to Utility and weights from 300 to 900 pounds. The carcass measurements included length of carcass, length of hind leg, total carcass length, length of loin, depth of body, width of shoulder, width of the anterior and posterior round, circumference of the round, plumpness index of the round, rib eye muscle area and thickness of the external fat over the eye. Other pertinent data collected included carcass grade, weight,

sex and the government grader's descriptive evaluation of the carcass. The relationship of carcass measurements, weight and grader's descriptive evaluation with grade was determined by statistical analysis. The statistical analysis consisted of simple linear correlation, multiple correlation and multiple regression analysis.

One of the difficulties in making rib eye measurements was the probable interference with packing house routine. Measurements of the rib eye are time consuming and require the ribbing of a large number of carcasses. In order to avoid this major difficulty, a method of photographing the rib cut was developed and from these photographs the desired measurements were made at a later and more convenient time.

The relationship of carcass grade with measurements was determined by simple linear correlation analysis. Carcass grade correlated with weight, plumpness index of the round, width of shoulder, width of anterior round and thickness of external fat over the eye muscle gave correlation coefficients above -0.40. This information indicated that carcass weight and the above mentioned measurements were significant indices of grade.

A multiple regression analysis of grade with weight and thickness of external fat over the eye muscle gave a correlation coefficient of -0.56. Other carcass measurements when introduced into the analysis with weight and thickness of fat over the eye added no significance to the multiple correlation

coefficient.

The analysis of carcass grade with the government grader's descriptive evaluation of the carcass gave correlation coefficients ranging from +0.3 to +0.62.

A multiple correlation coefficient of +0.75 was obtained in analyzing carcass grade with the grader's descriptive evaluation of carcass compactness and thickness of external fat. The grader's description of round plumpness added no significance to this multiple correlation coefficient.

The government grader's descriptive evaluation of the carcass on five factors correlated with actual carcass measurements showed low relationship. The highest relationship existed between the grader's description of round plumpness and the measured plumpness of the round with a correlation coefficient of +0.40.

From these limited data, it might be concluded that certain carcass measurements give promise as serving possible grade indices, which might add more uniformity and reliability to beef carcass grades. However, a much larger carcass sample will be necessary in order to reach definite conclusions.

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TABLE OF CONTENTS

INTRODUCTION

During the progress from producer to consumer of the majority of commodities, it is either inconvenient or impossible for the buyer to inspect personally or through an agent the commodity he wishes to buy. It is then necessary, in order that people may trade for a given commodity, to establish a set of standards by which the commodity may be described and evaluated. It is essential that the buyer and the seller use the same standards to describe a given commodity and that the standards have a definitely fixed and understood value at all markets.

One standardization development has been the establishment of official government beef carcass grade standards. The present government system of determining beef grade consists of subjective observation of carcass characteristics and comparison of these observations with a set of ideals or merits that have been established as a standard. This visual appraisal, although standardized by government grading service, permits human bias and error of the grader to enter into determination of grade.

The beef carcass is a difficult commodity to grade to absolute exactness. This is partially due to the fact that there are no objective measures of grade and individual carcasses differ in certain characteristics, yet may fulfill the requirements of the subjective standard. It, therefore, seems desirable that, if possible, objective measures should be employed in

determination of carcass grade. Such measurements would tend to increase the reliability and uniformity of the grade standards.

This study was undertaken for the purpose of procuring information that might lead to the development of objective grade standards. As the beef carcass lends itself to linear measurement, the relationship of specific carcass measurements with grade was considered. If relationships do exist, carcass measurements could then be employed in the objective determination of grade.

Other factors considered to be of primary importance in connection with this study are:

1. Determination of the relationship existing between carcass measurements and the grader's descriptive evaluation of the carcass.

2. The development of a satisfactory method for photographing rib cuts from which desired measurements could be taken.

REVIEW OF LITERATURE

At one time the slaughter and sale of livestock were a local enterprise in which the butcher or retailer purchased, slaughtered and sold the meat to that local area or community. As the consumer was familiar with the quality of the meat the butcher sold, there was no necessity for grading. When livestock production moved westward and away from the consuming

centers, the packing industry followed production. This increased the difficulty of marketing meat as the wholesaler from the eastern market found it impractical and expensive to travel to a large packing plant to purchase a quantity of beef. This situation led to the general use of certain terms by which meat could be described. The term "native" was applied to livestock from the Corn Belt or grain fattened cattle and "western" applied to cattle from the range states or grass fattened cattle. These broad classifications were then further divided into native and western Choice, Good, and Medium. This system was not completely satisfactory as the terms were not uniformly used in all markets and it became apparent that uniform grade standards for beef carcasses should be established.

The Agricultural Experiment Station of the University of Illinois was the first to collect,define and interpret various trade names and terms of livestock and meats used on the livestock market. From the information gathered in this study by the University of Illinois, "Bulletin 147, Market Classes and Grades of Meat", (1) was issued in 1910. Our present system of beef carcass grading is based largely upon the standards described in this bulletin. Using this information, the United States Department of Agriculture proposed tentative grade standards for dressed beef which were published in mimeographic form in 1923. These standards were revised slightly and Department Bulletin 1246, "Market Classes and Grades of Dressed Beef", (2) was issued in August, 1924. The system set forth in this

bulletin divided beef carcasses into classes and grades which consisted of grouping the carcasses into lots or groups that have similar and uniform characteristics. Class would precede grade and would be determined on the basis of sex condition--bulls, stags, cows, steers and heifers. The classes would then be subdivided into grades and the grades would be determined on the basis of conformation, finish and quality of the carcass.

Conformation applied to the form, shape, outline and general build of the carcass or cut. Under conformation, the characteristics of compactness, thickness of carcass, size of rib eye, thickness of loin and plumpness of round are considered. Finish applied to thickness, color, character and distribution of fat, particularly the outside covering of fat and marbling. Quality referred to the character of the flesh and fat of the carcass. Fineness of grain, firmness and color of muscle tissue and color of fat are considered under quality. The grade terms were expressed as Prime, Choice, Good, Medium, Common, Cutter, and Canner.

In June, 1926, after numerous public hearings and discussions, these standards were adopted as official by the United States Department of Agriculture and put into actual use in June, 1927 on an experimental basis. The experiment was conducted at ten markets and for the first few months, only Prime and Choice carcasses were graded. The grading of Good carcasses was not started until January, 1928. When the experiment ended June 30, 1928, beef grading proved to have sufficient merit and

demand. In July, 1928, Federal grading and stamping of beef by official graders in accordance with the official class and grade standards were made permanent. The services of the grader were put on a fee basis to anyone desiring to use them. With the exception of minor changes, these standards are the same at the present time.

In July, 1939, the standards were revised so that the class of the animal was eliminated from the grade and a single standard was set up for grading and labeling of steer, heifer and cow beef according to fixed quality characteristics. The Prime and Choice grades were limited to steer and heifer beef alone. The revised standards changed the name of two grades; Medium was called Commercial and Common was called Utility. The most recent and most extreme changes in grade standards were made in December, 1950 (3). These changes evolved from the criticism of the grade standards by certain factions of the beef trade. Prime was not considered a good working grade as only one-half of one percent of the cattle slaughtered and Federal graded fall in this category. Choice was criticized for having too narrow a grade range and Good and Commercial were criticized for having too wide a grade range. The Commercial grade included beef from young animals as well as older animals. The objection was that the young animals were of better quality and should go into a higher grade than older animals. After many public hearings and discussion, the grade standards were revised. The changes in the grade standards are as follows:

1. The standard of Prime was lowered sufficiently to include the Choice grade. The carcasses that formerly graded Choice are now graded Prime.

2. The carcasses formerly qualifying for the Good grade are now designated Choice.

3. Beef from cattle which had not reached full maturity and was formerly within the top half of the Commercial is now designated Good.

4. All other carcasses qualifying for the Commercial grade remained in that grade.

The qualifications for Utility, Cutter and Canner grades remained the same.

Early work in testing the relationship of carcass characteristics with grade was reported by Hankins and Burk (4). Extensive analysis of data from two thousand and seventy-three cattle was used in which eight characteristics were studied. They found that thickness of external fat, thickness of flesh and uniformity of width of the carcass were the best indices of carcass grade with all three having a coefficient of correlation well above +0.90. Marbling of lean, firmness of fat, firmness of lean, color of fat and color of lean were the other carcass characteristics considered in relation to carcass grade. They ranked in significance in decreasing order as mentioned with the coefficients of correlation being +0.90 to +0.81. Thickness of fat gave a highly significant relationship with degree of marbling having a coefficient of correlation of +0.28. Thickness of flesh

and uniformity of width of the carcass were also highly correlated with fat.

In 1933, United States Department of Agricultural employees (5) working on similar lines and using seven hundred and twenty-eight beef cattle correlated carcass grade with thirty-two other production and quality factors. Some of these factors when correlated with grade had significant values and indicated a relationship of carcass characteristics with grade. The following tabular form shows the factors that were applicable to this paper.

Table 1. Correlation of grade with carcass characteristics.

External fat over eye	+0.87
Internal rib covering	+0.89
Kidney fat	+0.78
Marbling of rib eye	+0.86
Grain of lean meat	+0.81
Firmness of lean meat	+0.83

The annual report of the United States Bureau of Animal Industry (6) stated that in beef carcass grading, the following factors were significant indices of carcass quality and grade:

1. Abundant and extensive marbling of lean
2. High degree of firmness of fat
3. White color of fat
4. Light cherry red or bright pink color of lean

The above named factors decreased in importance according to their numerical order. It was further confirmed that very thick flesh and external fat with uniformity of width of carcass were found to be reliable indications of abundant and extensive marbling. This provides graders with reliable indices as to the quality and marbling of the unribbed carcass.

United States Department of Agricultural workers (7) used standard methods of measurement and grading on three hundred and twenty-two steer and heifer carcasses ranging in liveweight from three hundred and seventy-five pounds to estimate grade from measurements. These workers found that the plumpness index of the round and the liveweight divided by the length of carcass from the first rib to the aitch bone gave the best estimate of carcass grade of any of the factors studied. The ratio of carcass length to width indicated a high relationship to grade.

Hirzel (8), in comparing English show carcasses, set up a series of measurements for the rib eye area, the thickness of fat over the last rib, and the muscling along the rib. With these measurements, he describes the winning carcasses in the English shows and compared the effect of breed, age, weight and the proportion of muscle, fat, and bone. Some of his observations were:

1. The majority of rib eyes lack depth rather than length.

2. With weight increases, depth of rib eye increases more than length.

3. Bone is often too long in a carcass rather than too large.

4. Muscle development in an animal within a breed follows the trend of bone development.

5. The factors influencing marbling, in order of their importance, are fatness, breed, and age.

These concludions tend to indicate the influence of various physical characteristics on the higher quality carcasses.

Hankins et al. (9) accumulated data on one hundred and thirty-five Shorthorn steers of uniform weight and type, representing both beef and dual purpose cattle, to study carcass characteristics in relationship with grade. On all carcass measurements taken with this group of cattle, the average thickness of fat over the eye muscle, measured at three points on the short loin cut, was most closely related to carcass grades. Of somewhat less value, in decreasing order, for estimating grade were average thickness of flesh at the end of the sixth, seventh, and twelfth ribs in the prime cut, distance from the first rib to the back joint per unit of empty body weight and distance from stifle joint to back joint. It was concluded in this study that in cattle varying widely in weight, breeding and feeding, the factor most closely related to carcass

grade was liveweight per unit of body length and fullness of round. It was found that if an extreme variability of fatness in cattle occurred, the relationship of grade and other linear measurements was not as significant. This information tends to indicate that linear measurements were promising as indices of carcass grade in weight and finish constant cattle, but when weight and finish varied widely, measurement or measurement ratios would have to be adjusted.

Hankins (10) reports that objective evaluation measures differences in beef carcasses more accurately and with greater assurance since the beef carcass lends itself well to linear measurement. Much information on carcass characteristics has been obtained by linear measurements of length, depth, width, area of the eye muscle and thickness of overlying fat. In connection with other measurements, another factor of interest is the weight length relationship; that is, the weight of dressed carcasses per unit of length from first rib to back joint. This factor is thought to be very useful in differentiating, not only between grades, but also between weight groups within grades. Marbling is another factor of great importance as it is highly indicative of carcass finish and quality. At the present, evaluation of marbling is measured subjectively and improvement in evaluation technique is desired.

METHODS AND PROCEDURE

It was desirable that the sample include the entire range of physical variations in weight and finish, regardless of the relative number of animals that come to market bearing these variations, in order to test the relationship between carcass measurements and the grade factors of the carcass. Relationship studies are analyzed by regression type analysis and the sample required for a regression type analysis is a stratified random sample. To collect a carcass sample of this nature, the chart suggested in "NCM-3, Beef Procedure 2" (11) was used. This chart includes beef carcasses weighing from 300 to 900 pounds, divided into 50 pound weight groups and carcass grades from Prime to Utility, subdivided into one-third of a grade, Table 2.

The data collected on the carcass sample were those outlined in "NCM-3 Mimeograph, Beef Procedure 2" (11), with the addition of some modifications (Form I). The following outline gives the sampling procedure, handling of the carcass and measurement details.

I. Sampling procedure

A. Sex and age of cattle

Since the relationship existing between grade and objective measurement may differ with the age and sex of cattle, this study is confined to steers and heifers. The sex of each carcass measured was recorded.

B. Eight to ten carcasses were the desired number of carcasses in each cell. However, it was considered probable that some of the extremes would not be filled. For example, a 300 pound carcass could not, except in a rare case, qualify for Prime grade.

C. Hot weights of the carcasses were recorded as it was impractical to obtain cold weights in a commercial cooler.

D. The personnel consisted of four men; one man to record data, two men to make carcass measurements and a United States government grader to establish carcass grade.

II. Handling the carcasses

A. The carcasses selected were identified by attaching a small numbered tag to the carcass. Each carcass had a definite number arranged in numerical order.

B. Each carcass was graded by a government grader to the nearest one-third of a grade.

III. Details of the measurements taken. All measurements were taken in centimeters with the use of a steel tape, transparent ruler and twenty inch outside measuring calipers.

A. Unribbed carcass side

1. Length of body. The length of body was determined by measuring from the anterior edge of the first thoracic vertebra to the anterior point of the aitch bone.

2. Length of hind leg. The length of hind leg was measured from the anterior point of the aitch bone to the middle of the hock at the point where the lower leg was removed.

3. Total length of carcass. The total carcass length was the sum of the measurements obtained in Nos. 1 and 2.

4. Length of loin. The length of loin was determined by measuring from the anterior point of the aitch bone to the middle of the thirteenth thoracic vertebra on the ventral side. The last named point was located by counting down seven and one-half vertebrae from the rise in the backbone.

5. Width of shoulder. The width of shoulder was determined with the use of calipers by measuring from the inside of the carcass at the first thoracic vertebra to the outside of the shoulder. This is done with the calipers held in a median plane to the carcass and parallel to the floor.

6. Width of round (posterior). The width of the round was determined with the use of calipers by measuring from the posterior point of the aitch bone to the outside of the carcass. The calipers were held in a median plane to the carcass and parallel to the floor. The sum of measurements of the right and left side was used.

7. Width of round (anterior). The width of the round was determined with the use of calipers by measuring from the anterior point of the aitch bone to the outside of the carcass. The calipers were held in a median plane to the carcass and parallel to the floor. The sum of the measurements of the right and left side was used.

8. Depth of body. The depth of body was determined by measuring from the dorsal side of spinal canal at the fifth

thoracic vertebra to the ventral side of the sternum. The tape was held parallel to the floor.

9. Circumference of round. The circumference of the round was measured on a line perpendicular to the long axis of the leg from a point sixty percent of the distance from the hock to the anterior point of the aitch bone. The procedure is as follows: With the tape, locate a straight line from the lowest point of the aitch bone to the highest point of hock joint, place a shroud pin on this previously established point sixty percent of the distance from the hock. At this point, a flexible ruler was placed at right angles to the tape and points established on this line with shroud pins on the anterior and posterior sides of the round. The circumference is then measured by placing a steel tape below these three mentioned shroud pins after making sure the tape is taut and touching all three of the pins.

10. Plumpness index of round. This is calculated by dividing the length of hind leg into circumference of round and multiplying the answer by one hundred.

B. Ribbed down carcass

All carcasses were ribbed between the twelfth and thirteenth rib (Chicago style). The face of the twelfth rib was photographed according to the method described at a later point in this discussion. Photographs made it possible to reproduce this cut of the carcass and facilitated measuring at a later date.

a. Measurements made: (See Plate I for illustration of these measurements and for location of points used in the measurements).

1. Area. This measurement was made with an Amsler compensating polar planimeter. The average of three readings from the planimeter was used to determine the total area of the eye muscle.

2. Length. This measurement was the longest distance across the eye muscle.

3. Width. An average of the three following widths was used to determine width: a line (CD) perpendicular to AB and one-half the distance from A to B. A line (GH) perpendicular to AB and one-half the distance from B to P. A line (EF) perpendicular to AB and one-half the distance from A to P.

4. Thickness of fat was an average of three measurements (LF, MD and NH), measured from the outside of the fat where surface of the fat is perpendicular to these points, F, D and H.

5. Rib eye index. Calculated by dividing rib eye width into rib eye length and multiplying the answer by one hundred.

b. Color of lean was obtained by the use of Munsell A color paddles after the rib eye had been exposed to air for twenty minutes.

IV. Government beef grader's descriptive terms. In addition to the measurements, the grader's descriptive evaluation of the carcass was recorded on a detailed chart, Form II.

One of the major problems in developing this project was the consummation of a satisfactory working agreement with a packing plant handling a sufficient volume of beef to enable the gathering of carcass data. One of the difficulties in making a large number of measurements in the cooler of a packing company is the probable interference with normal packing plant operations. This is particularly true when tracing of the rib eye must be made. Tracing of the rib eye is time consuming and would require the ribbing down of a large number of carcasses at one time in the cooler. The packer is very reluctant to rib carcasses prior to shipping for several justifiable reasons. It may lead to added shrinkage, inconvenience in handling carcasses, color deterioration of the cut surface and bring about a break in routine. This disruption was eliminated by developing a method of photographing the rib cut at the time the carcass was ribbed for shipping. The desired measurements were made from these photographs at a later and more convenient time.

Table 2. Suggested classification of carcasses by weight and grade.

Weight of carcasses	Prime			Choice			Good			Commercial			Utility		
	Upper 1/3	Middle 1/3	Low 1/3	Upper 1/3	Middle 1/3	Low 1/3	Upper 1/3	Middle 1/3	Low 1/3	Upper 1/3	Middle 1/3	Low 1/3	Upper 1/3	Middle 1/3	Low 1/3
300-350															
350-400															
400-450															
450-500															
500-550															
550-600															
600-650															
650-700															
700-750															
750-800															
800-850															
850-900															

Form 1. Chart used in recording carcass measurements.

Carcass number				
Classification				
Carcass weight				
U. S. grade				
Length of leg				
Circumference of round				
Width of round-p				
Width of round-a				
Length of loin				
Length of body				
Total length				
Width of shoulder				
Depth of body				
Plumpness of round				
Ribeye				
area				
width				
length				
Width of fat				
Ribeye index				
Color paddle				

Form II. Chart used in recording the grader's descriptive evaluation of the carcass.

Carcass number			
Conformation			
compactness			
thickness			
ribeye			
loin			
round			
Finish			
thickness			
distribution			
kidney knob			
marbling			
Quality			
grain of lean			
firmness of lean			
color of lean			
color of fat			

The following technique was developed for taking these photographs and making the required measurements. The equipment used consisted of a Kodak 35 camera, econo-flash strobe light, Series VI lens attachment with a one and one-fourth inch adapter ring, +1 portra lens and a frame on which to rest the camera. The lens attachment, adapter ring and the portra lens were required as the photographs were taken at a close focal range of twenty-four inches. The frame was necessary to hold the camera stationary and insure the same focal range in each photograph. The frame was constructed of copper tubing, consisting of a ten by fifteen inch rectangular bottom piece to rest on the ribbed carcass and two uprights which fastened on the camera. The two uprights were adjustable as to focal range and position over the carcass. A transparent ruler was taped across the upper end of the frame so that when the pictures were projected on a screen they could be scaled to actual size. A strip of white cardboard was placed under the ruler to keep the ruler from bending and make the numerals and marks stand out in the photograph (Plate II).

Several tests were conducted to determine the accuracy of the photographic method and to develop a satisfactory technique. In the first test, fine grained Plus X Panchromatic film and a focal range of twenty-four inches were used. The camera lens opening was set at F 8, referred to as the F stop and the exposure time or shutter speed at 1/100. Although these photographs were satisfactory for measuring purposes,

they exhibited a tendency to be slightly overexposed and the optimum amount of desired detail was not present. Further tests were conducted using Panotomic X film, an ultra fine grain film, different F stops and shutter speeds. Most satisfactory results were secured by using Panotomic X film and a camera adjustment of F/16 lens opening and a shutter speed of 1/100.

A Model 3A Kodaslide Projector was used to project the photograph of the rib cut on a sixteen by twenty-five inch frosted glass field. The actual size of the rib cut was obtained by taping a plastic ruler on the frosted glass, adjusting the projector until the ruler in the projected negative coincided with the ruler on the glass. Tracings were made of the rib cut in the projected negative by taping a sixteen by sixteen inch sheet of parchment paper on the rough side of the frosted glass facing the projector and tracing the outline of the rib cut and its component parts on the parchment paper. The desired measurements of the rib eye and external fat were made from this tracing.

The accuracy of the photographic method was checked against measurements made from original tracings. Table 3 gives the measurements and the correlation coefficient obtained. A correlation coefficient of +0.982 between the two methods indicates that the photographic method can be used with confidence. Plate II illustrates the use of the equipment in taking photographs or the rib cut of a beef carcass.

Table 3. Correlation between photographic method and the original tracing.

Carcass number	X: Measurements obtained from projected negative	Y: Measurements obtained from original tracing
	Square inches	
1	9.55	9.39
2	10.46	10.77
3	9.45	9.46
4	8.82	8.97
5	10.17	10.22
6	9.55	9.75
7	7.43	7.73
8	9.26	9.46
9	8.36	8.60
10	10.60	10.33
	$S(X^2)$ 885.5425	$S(Y^2)$ 903.5418
	Coefficient of correlation +0.982	

To further test the accuracy of the photographic method, ten parchment paper tracings and ten photographs were taken of the same rib cut. The error variance and the coefficients of variability of the two methods were determined. The results of this test are tabulated in Table 7. The coefficients of variability are extremely low, rendering both methods equally accurate and highly reputable.

Table 4. Error variance and coefficients of variability of the two methods of measuring the eye muscle.

No. of tracing	X: Measurements obtained from projected negative	Y: Measurements obtained from standard method
	Square inches	
1	12.12	12.26
2	12.06	12.45
3	12.19	12.30
4	12.33	12.18
5	11.97	12.33
6	12.14	12.12
7	12.12	12.18
8	12.30	12.09
9	11.97	12.06
10	12.19	12.00

Error variance = .37
Coefficient of variability = 0.9% and 1.1%

The carcass data were collected in the beef coolers of two packing companies. Selection was limited to carcasses that had been sold and were scheduled to be shipped in a short time. A crew, consisting of three men, was able to collect data on about fifteen carcasses per hour. One man recorded measurements, one man, using a six foot ladder, took measurements that could not be reached from the floor and one man identified the carcass with a numbered tag and assisted in the measurements.

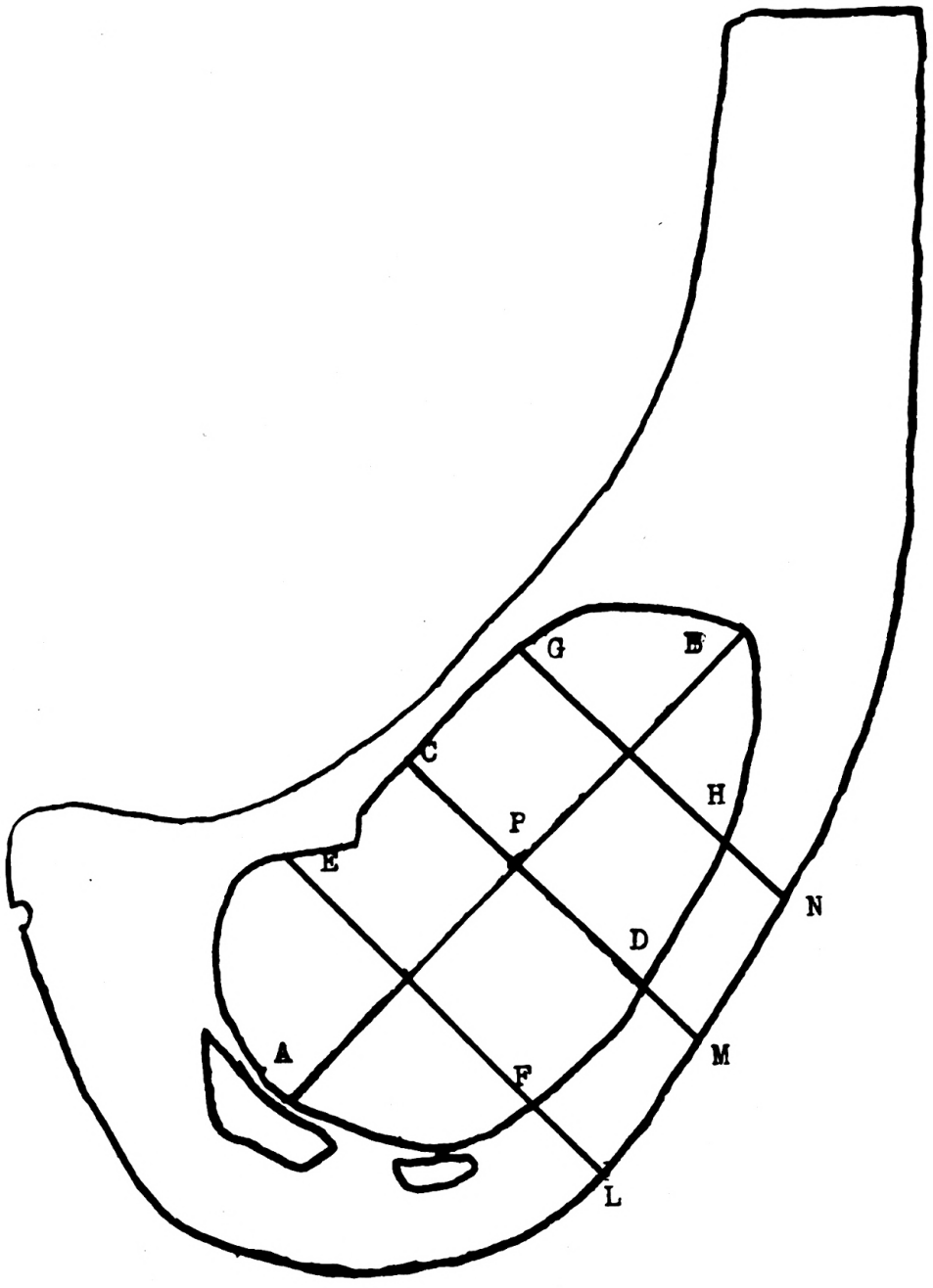
All points measured were marked with shroud pins to facilitate the measuring process. The carcasses were ribbed as soon as it was convenient to do so. Photographs of the rib cuts, color readings of the rib eye, carcass grade and the grader's descriptive evaluation of the carcass were obtained at this time. The procedure of collecting carcass data was modified from time to time to meet the convenience of packing house routine.

Data were collected from one hundred and fifty-five carcasses, ranging in grade from top Choice to average Utility. Rib eye and fat width measurements were not obtained on eight carcasses due to camera failures. The carcass data collected appear in the Appendix. International Business Machine equipment was used to facilitate the analysis of the carcass data. In order to use International Business Machine equipment, it was necessary to use a coding system that would identify the carcass data. The outline used for coding the data is given in Form III.

EXPLANATION OF PLATE I

Illustration of the measurements taken of the rib cut and location of the points used in taking the measurements.

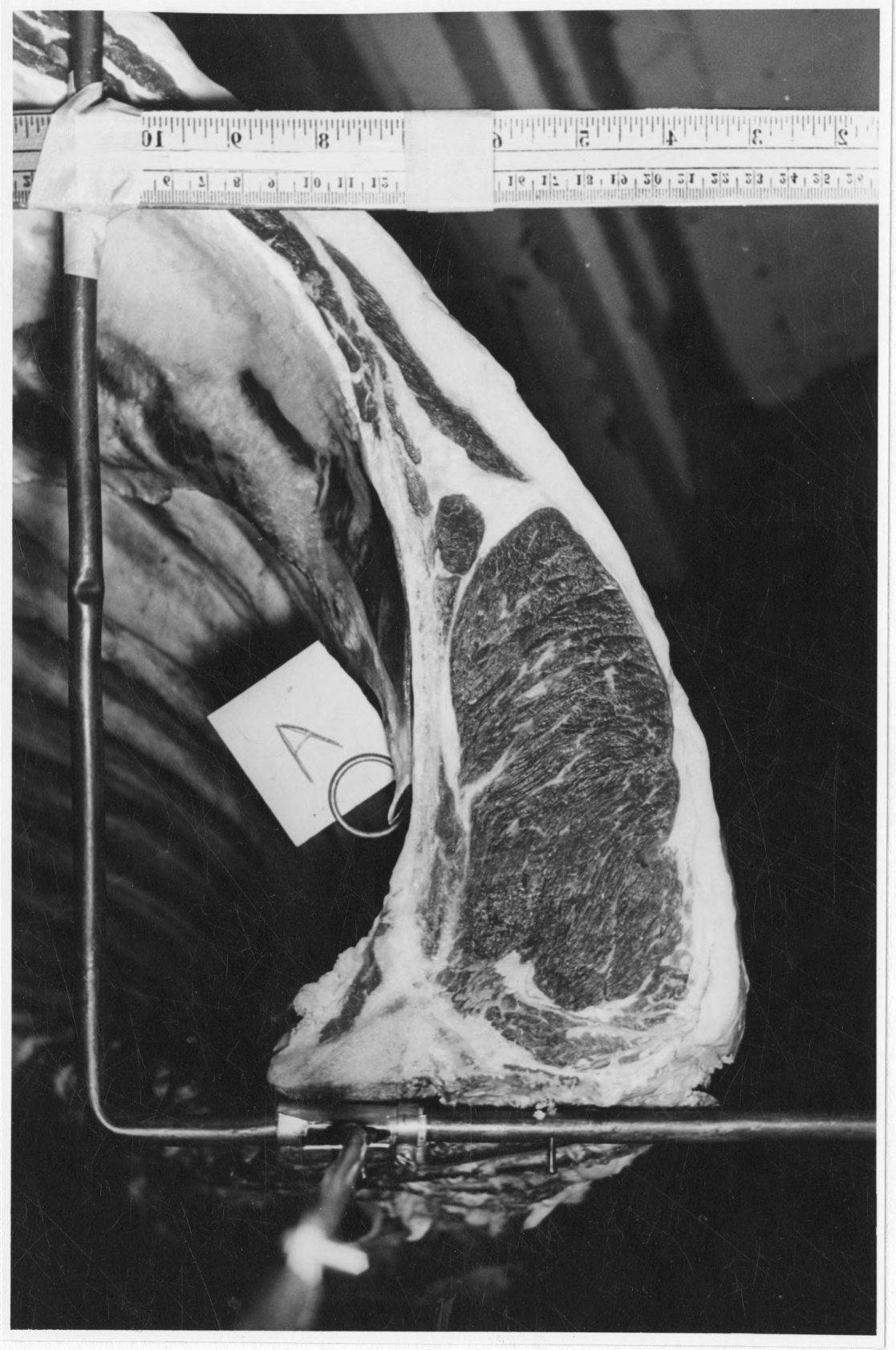
PLATE I



EXPLANATION OF PLATE II

One of the photographs taken of the rib cut of a beef carcass.

PLATE II



EXPLANATION OF PLATE III

Illustration of the use of the equipment in taking photographs of the rib cut of a beef carcass.

PLATE III

Form III. Outline used in coding the carcass data for analysis.

Item	Numerical values assigned to the data	Col. No.
Number of Carcass	Actual number	1,2,3,4
Sex		
Steer	1	5
Heifer	2	
Grade		
Prime - High	02	
Average	04	
Low	06	
Choice - High	08	
Average	10	
Low	12	
Good - High	14	
Average	16	
Low	18	
Commercial - High	20	
Average	22	
Low	24	
Utility - High	26	
Average	28	
Low	30	
Weight	Actual Weight	8,9,10
Length of Leg	Actual Measurement	11,12,13
Length of Body	Actual Measurement	14,15,16
Total Length	Actual Measurement	17,18,19
Length of Loin	Actual Measurement	20,21,22
Width of Shoulder	Actual Measurement	23,24,25
Depth of Body	Actual Measurement	26,27,28

Width of Round (posterior)	Actual Measurement	29,30,31
Width of Round (anterior)	Actual Measurement	32,33,34
Circumference of Round	Actual Measurement	35,36,37,38
Plumpness of Round	Actual Measurement	39,40,31,42
Ribeye		
Area	Actual Measurement	43,44,45,46
Width	Actual Measurement	47,48
Length	Actual Measurement	49,50,51
Thickness of Fat	Actual Measurement	52,53
Ribeye Index	Calculation	54,55,56
Color Reading		57,58
A1	01	
A2	02	
A3	03	
A4	04	
A5	05	
A6	06	
A7	07	
A8	08	
A9	09	
A10	10	

Conformation

Compactness 59

Very Compact	1
Compact	2
Moderately Compact	3
Modestly Compact	4
Slightly Rangy	5
Rangy	6
Very Rangy	7

Thickness of Carcass 60

Very Thick	1
Thick	2
Moderately Thick	3
Modestly Thick	4
Slightly Thin	5
Thin	6
Very Thin	7

Ribeye (lean) 61

Very Large	1
Large	2
Moderately Large	3
Modestly Large	4
Slightly Small	5
Small	6
Very Small	7

Loin 62

Very Thick	1
Thick	2
Moderately Thick	3
Modestly Thick	4
Slightly Thin	5
Thin	6
Very Thin	7

Round 63

Plump	1
Full	2
Moderately Full	3
Modestly Full	4
Slightly Deficient	5
Deficient	6
Very Deficient	7

Finish

Thickness of Fat (external) — 64

Very Thick	1
Thick	2
Moderately Thick	3
Modestly Thick	4
Slightly Thin	5
Thin	6
Very Thin	7

Distribution of Fat (external) — 65

Very Uniform	1
Uniform	2
Moderately Uniform	3
Modestly Uniform	4
Slightly Uneven	5
Uneven	6
Very Uneven	7

Kidney Knob — 66

Very Large Amount	1
Large Amount	2
Moderately Large Amount	3
Modestly Large Amount	4
Slightly Deficient	5
Deficient	6
Very Deficient	7

Marbling (Ribeye) — 67,68

Very Abundant	1
Abundant	2
Moderately Abundant	3
Slightly Abundant	4
Moderate	5
Modest	6
Small Amount	7
Slight Amount	8
Traces	9
Practically Devoid	10
None	11

Quality

Grain of Lean		69
Very Fine	1	
Fine	2	
Moderately Fine	3	
Modestly Fine	4	
Slightly Coarse	5	
Coarse	6	
Very Coarse	7	
Firmness of Lean		70
Very Firm	1	
Firm	2	
Moderately Firm	3	
Modestly Firm	4	
Slightly Soft	5	
Soft	6	
Very Soft	7	
Color of Lean		71
Dark Pink	1	
Very Light Cherry Red	2	
Light Cherry Red	3	
Slightly Dark Cherry Red	4	
Moderately Dark Red	5	
Dark Red	6	
Very Dark Red	7	
Color of Fat		72
White	1	
Creamy White	2	
Creamy	3	
Slightly Yellow	4	
Yellow	5	
Very Yellow	6	
Fiery	7	

OBSERVATIONS AND DISCUSSION

The statistical treatment of the data consisted of simple correlation and multiple correlation and regression analysis as outlined by Snedecor (12).

A summary of the correlation coefficients between carcass measurements and grade is given in Table 5. The width of the anterior round indicated the highest relationship of any of the measurements taken with a correlation coefficient of -0.56. Width of shoulder, weight, plumpness index of the round and fat thickness over the eye muscle, decreasing in significance in the order named, indicated a significant relationship with grade. These correlation coefficients indicate that carcass width, as determined by width of round and width of shoulder measurements, weight, plumpness index of the round and fat thickness over the eye muscle may be useful indices of carcass grade. The depth of body had a lower value as an index of carcass grade with a correlation coefficient of -0.28. Total length, length of loin and width of posterior round were not considered useful indices of carcass grade since these measurements had very low correlation coefficients. It is probable that these low correlation coefficients were the result of such a small inconsistent spread existing in the measurements as compared with a much greater consistent spread existing in the grades. This is particularly true in the case of total carcass

length which had a very inconsistent variation of measurements.

A summary of the correlation coefficients between the grader's descriptive evaluation of the carcass and grade is given in Table 6. All of the descriptive evaluations exhibited a high relationship with grade except the kidney knob, which had a correlation coefficient of +0.30. The highest relationship existed between grade and carcass compactness with a correlation coefficient of +0.62. It is probable that the higher correlation coefficients of the grader's descriptive evaluation over the carcass measurements were the result of the descriptive evaluations having a wider consistent spread with an equally wide consistent spread in the grades. Another factor considered to have a bearing on the higher correlation coefficients obtained in the grader's descriptive evaluation was the observed tendency of the grader to score each individual carcass characteristic in relation to the predetermined grade rather than strictly on its actual development. This resulted in the carcass evaluation being grouped around the grade with a resultingly high correlation coefficient obtained.

The carcass measurements which had given the higher correlation coefficients with grade were tested with multiple regression analysis to determine which combination of the carcass measurements served as the best indices for estimating grade. A multiple regression analysis of weight and fat thickness over the eye muscle gave a correlation coefficient of -0.56. When the plumpness index of the round was introduced

into the analysis with weight and fat thickness over the eye muscle, a correlation coefficient of -0.59 was obtained. Width of the anterior round when analyzed with weight and fat thickness over the eye muscle gave a lower correlation coefficient of -0.56. Hence, by using plumpness index of the round, rather than width of the anterior round, with weight and fat thickness over the loin a higher relationship with grade was found. This is due to a simple correlation coefficient of +0.86 existing between weight and width of the anterior round as compared with a simple correlation coefficient of -0.36 between weight and the plumpness index of the round. However, it was noted that neither the plumpness index of the round nor width of the anterior round added significance to the correlation coefficient.

The relationship of grader's descriptive carcass evaluation with grade was determined by multiple correlation analysis. The descriptive evaluations that were comparable with carcass measurements were used. The grader's descriptive evaluation of carcass compactness and thickness of external fat gave a correlation coefficient of +0.74. When descriptive evaluations of plumpness of round were analyzed with descriptive evaluations of carcass compactness and thickness of external fat, a correlation coefficient of +0.75 was obtained. Thus, as in the correlation coefficients obtained with carcass measurements of the round, the grader's descriptive evaluation of the plumpness of the round did not add significantly to the correlation

coefficient.

The correlation coefficients obtained between the grader's description of the carcass and the carcass measurements are given in Table 7. The highest relationship was between the grader's description of plumpness of round and the plumpness index of the round, calculated from measurements, in which a correlation coefficient of -0.42 was obtained. The low correlation coefficient of -0.33 between the grader's description of thickness of external fat and the measured thickness of fat over the eye muscle indicates that probably the grader does not distinguish between small changes in thickness of external fat. The width of shoulder measurement and the anterior and posterior width of round measurements had a nonsignificant relationship with the grader's description of carcass width. However, carcass compactness is a relative factor in which width in proportion to length is considered and so length alone is not indicative of carcass compactness.

Table 5. The coefficient of correlation between carcass measurements and grade.

Carcass measurement	: Correlation coefficient
Weight	-0.48
Total body length	-0.15
Length of loin	-0.15
Width of shoulder	-0.49
Depth of body	-0.28
Width of round (posterior)	-0.17
Width of round (anterior)	-0.56
Plumpness of the round	-0.42
Width of fat	-0.42

Table 6. The coefficient of correlation between the grader's descriptive carcass evaluation and grade.

Carcass evaluation	: Correlation coefficients
Compactness	+0.62
Thickness of carcass	+0.58
Ribeye (lean)	+0.45
Thickness of loin	+0.60
Plumpness of round	+0.54
Thickness of external fat	+0.65
Distribution of external fat	+0.55
Kidney knob	+0.30
Marbling	+0.61
Grain of lean	+0.47
Firmness of lean	+0.47

Table 7. The coefficients of correlation between carcass measurements and grader's descriptive evaluation.

Carcass measurements	Grader's descriptive carcass evaluation	Correlation coefficients
Width of fat	Thickness of external fat	-0.33
Plumpness of round	Round plumpness	-0.42
Width of shoulder	Thickness of carcass	-0.20
Width of round (anterior)	Thickness of carcass	-0.03
Width of round (posterior)	Thickness of carcass	-0.19
Total length	Carcass compactness	+0.03

SUMMARY

1. The measured width of round, width of shoulder, weight, plumpness index of the round and thickness of fat over loin, decreasing in significance in the order named, gave the most significant relationships when correlated with grade.

2. The measured depth of body, length of loin, total length and width of the anterior round gave a low relationship when correlated with grade.

3. The grader's descriptive carcass evaluation gave a higher relationship than carcass measurements when correlated with grade. This was apparently the result of a consistent wider range in the descriptive evaluation and the grader's grouping of the descriptive evaluations close to the predetermined grade.

4. Weight and measured thickness of fat over the loin gave a significant correlation coefficient, indicating that they are useful in estimating grade.

5. The plumpness index of the round gave a higher correlation coefficient than measured width of the anterior round when analyzed with weight and thickness of fat over the loin. However, neither measurement added a significant amount to the correlation coefficient.

6. With the exception of plumpness of round, there was a low relationship between the grader's description of the

carcass and carcass measurements.

7. A satisfactory method of photographing the rib cuts of beef carcasses was developed. From these photographs, the desired measurements were made.

Due to the difficulty encountered in arranging a satisfactory working agreement with a packing plant and other conditions beyond control, the carcass sample collected was not as large as desired. Therefore, the conclusions made in this study are drawn with extreme reservation.

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APPENDIX

Tabular form of the carcass data

Tabular form of the carcass data
Refer to form III for explanation
' - denotes position of decimal

Carcass Number	Sex	Grade	Weight	Length of Hind Leg	Length of Carcass	Total Length	Length of Loin	Width of Shoulder	Depth of Body	Width of Round (posterior)	Width of Round (anterior)	Circumference of Round	Plumpness of Round	Ribeye Area	Ribeye Width	Ribeye Length	Width of Fat
1	1	10	846	900	139	229	670	470	450	475	560	1060	1177	7153	60	138	19
2	1	10	742	850	132	217	650	465	480	430	505	945	1111	6817	60	137	21
3	1	14	718	790	130	209	670	420	470	440	480	835	1055	8030	51	158	10
4	1	14	734	810	129	210	670	400	460	415	530	850	1049	7694	59	[illegible]	11
5	1	12	602	740	124	198	660	485	430	380	485	760	1026	6450	61	134	16
6	1	12	648	800	129	209	665	395	440	395	485	815	1018	5334	48	127	13
7	1	14	802	850	137	222	750	450	490	455	525	855	1006	7701	61	147	12
8	1	14	601	790	124	203	670	400	430	425	465	770	973	6198	53	131	13
9	1	14	676	810	126	207	670	435	440	470	470	805	995	5824	53	145	18
10	1	14	616	810	128	209	680	385	470	405	475	775	956	4985	43	136	9
11	1	10	790	790	128	217	650	475	450	450	545	910	1150	6798	57	143	14
12	1	12	744	830	130	213	640	435	450	430	530	880	1060	5714	49	129	11
13	1	12	941	870	135	222	710	470	490	470	580	925	1178	8636	72	143	14
14	1	12	731	780	126	204	660	450	430	425	500	880	1128	6256	53	128	14
15	1	14	636	810	127	210	625	405	460	420	485	790	975	5392	54	126	8
16	1	12	631	760	122	198	630	435	430	385	475	6780	1026	6662	61	130	14
17	1	12	810	830	130	213	680	445	470	430	525	875	1018	7075	59	136	18
18	1	12	804	840	135	219	700	445	470	410	465	835	994	6366	54	135	18
19	1	12	786	850	133	218	700	435	490	425	515	880	1035	6469	56	141	16
20	1	12	696	830	131	214	690	410	450	415	510	850	1024	5682	55	124	17
21	1	12	776	810	136	217	680	465	490	445	510	860	1601	7578	62	149	19
22	1	12	834	790	134	213	750	480	460	445	525	905	1145	7230	62	133	19
23	1	16	538	750	117	192	600	390	410	375	430	795	1060	5437	48	122	17
24	1	14	681	810	126	207	690	420	470	415	490	820	1012	6017	53	128	11
25	1	14	616	830	131	214	680	415	445	390	480	860	1035	5921	52	129	14
26	1	12	728	825	131	213	650	435	460	390	500	815	987	6075	54	128	15
27	1	14	676	810	135	216	690	415	460	390	485	735	907	6624	62	136	10
28	1	12	683	800	127	207	655	450	450	405	500	835	1043	6469	61	133	10
29	1	12	708	830	131	214	670	410	450	410	505	820	988	6920	61	138	18
30	1	12	696	780	127	205	670	425	460	415	490	845	1085	6837	61	135	15
31	1	12	744	790	128	207	680	455	430	445	515	900	1265	6140	56	131	15
32	1	14	767	820	134	216	700	435	440	415	495	820	1000	7211	63	142	15
33	1	12	728	790	123	202	650	425	460	440	520	930	1177	7914	65	142	12
34	1	10	731	810	124	205	650	450	450	385	495	840	1037	7423	62	127	18
35	1	12	706	800	127	207	680	440	450	400	510	850	1062	5611	54	122	9
36	1	14	602	750	123	198	650	405	430	395	475	790	1053	5547	54	123	12
37	1	14	584	760	121	197	640	375	420	360	470	820	1078	5179	47	129	15
38	1	12	724	820	124	206	590	430	440	405	510	885	1079	6147	57	132	14
39	1	12	676	810	129	210	650	390	450	380	490	810	1000	6166	52	133	12
40	1	12	596	760	124	200	660	410	470	370	465	790	1039	6604	62	128	14
41	1	14	611	760	122	198	640	420	430	375	475	780	1026				
42	1	14	626	800	123	203	650	405	450	375	470	790	987	6211	53	138	14
43	1	12	711	790	127	206	680	425	440	380	495	810	1025	6314	57	126	16
44	1	12	676	765	126	202	690	450	410	410	505	840	1019	6740	60	127	17
45	1	12	651	800	125	205	680	415	450	360	465	800	1000	6056	58	132	13
46	1	12	708	790	131	210	700	445	430	410	495	835	1057	6192	59	125	10
47	1	12	764	820	130	212	670	455	460	400	485	830	1012	7914	63	145	12
48	1	12	626	780	128	206	670	430	440	360	490	805	1032				
49	1	16	626	800	128	208	650	405	450	375	485	790	987	6430	54	142	9
50	1	10	687	790	130	209	680	465	440	405	500	825	1117	6856	58	137	10
51	0	12	621	790	128	207	670	395	440	390	485	840	1063	6353	57	138	9
52	0	10	666	800	127	207	650	425	430	415	490	880	1100	7327	63	138	11
53	0	14	718	830	132	215	670	435	450	405	490	860	1036	6391	59	133	10
54	0	12	888	850	139	224	730	465	500	420	565	930	1094	7140	63	130	7
59	0	14	596	790	127	206	660	350	440	375	480	810	1025	4431	[illegible]	[illegible]	[illegible]
71	1	24	485	760	124	200	610	365	440	315	435	710	934	5572	52	129	3
72	1	24	492	780	122	200	630	355	430	330	435	760	974	6056	51	133	4
73	1	12	648	800	127	207	670	425	440	375	485	785	981	5605	52	127	7
74	1	12	579	750	120	195	640	440	410	335	460	765	1020				
75	1	12	578	750	121	196	630	420	430	355	470	810	1080	6662	58	134	12
76	1	18	586	790	126	205	650	400	440	365	460	795	1006	6228	55	132	10
77	1	10	500	730	111	184	570	400	370	365	455	790	1082	6533	67	126	13
78	1	10	528	730	117	190	610	420	410	340	465	820	1123				
79	1	10	596	770	122	199	640	420	430	335	460	770	1000	6954	60	133	16
80	1	24	532	760	121	197	630	385	450	340	445	765	1006				
81	1	16	534	750	118	193	620	385	430	355	460	760	1013				
82	1	10	560	750	118	193	610	415	415	375	470	785	1046	5314	44	127	14
83	1	10	515	730	116	189	600	395	400	360	450	795	1088	4927	49	115	10
84	1	22	563	750	123	198	640	395	430	350	450	760	1013	5863	53	123	8
85	1	16	529	760	121	197	630	395	410	350	445	750	987	5153	49	123	12
86	1	18	630	770	127	204	660	435	430	355	490	795	1032				
87	1	22	556	760	123	199	650	390	425	365	460	755	993	5605	55	133	7
88	1	20	477	750	119	194	630	365	420	345	440	720	960	5114	47	124	6
89	1	14	592	770	121	198	630	430	415	325	445	780	1013	6856	60	134	17
90	1	22	479	790	124	203	660	340	460	315	410	690	886	7482	59	150	4
91	1	22	551	790	127	206	670	365	450	345	455	740	937	6121	56	125	7
92	1	22	503	790	125	204	660	370	430	315	435	670	848	5559	49	126	7
93	1	14	543	770	122	199	640	375	450	340	430	725	942	5101	42	114	10
94	1	22	545	790	125	204	650	395	390	365	450	750	949	5927	53	125	11
95	1	22	511	790	126	205	660	380	435	345	445	740	936	5327	50	122	13
96	1	16	557	760	120	196	620	400	430	335	455	770	1013	5198	49	124	10
97	1	12	541	730	118	191	620	420	410	370	445	780	1068	5198	48	120	12
98	1	14	587	750	121	196	650	415	420	370	480	780	1040	7643	60	144	9
100	1	08	617	730	118	191	620	240	410	370	485	910	1245	6385	56	120	21
101	1	18	387	670	107	174	560	355	350	315	395	840	1251	5076	47	124	7
102	1	10	639	770	124	201	660	435	420	365	480	855	1111	6717	57	141	12
103	1	24	460	760	116	192	620	360	430	335	455	793	1046	6037	53	134	3
104	1	10	708	810	127	208	660	470	440	370	495	890	1098	6921	56	142	11
105	1	08	760	790	128	207	660	455	410	390	500	915	1158	6390	48	143	8
106	1	10	612	740	121	195	640	440	405	335	490	870	1175	5040	56	126	20
107	1	10	602	780	125	203	640	425	390	390	475	880	1128	6952	59	137	10
108	1	24	515	750	125	200	650	385	435	340	455	760	1001	6779	56	144	3
109	2	24	364	600	110	176	600	330	360	305	410	680	1030	5892	54	131	6
110	1	16	606	770	122	179	650	430	420	360	450	820	1064	5568	49	126	23
111	2	16	618	730	120	193	630	450	380	400	485	930	1273	6133	49	131	16
112	2	14	380	700	113	183	600	345	370	315	405	670	957	3476	37	101	9
113	2	24	348	690	112	181	590	330	360	320	405	660	956	3650	37	101	10
114	2	12	406	690	111	180	630	350	380	320	400	640	927	4295	40	101	11
115	2	12	350	660	106	172	560	325	340	310	395	650	984	3870	42	102	8
116	2	14	340	650	109	174	570	305	350	315	395	650	1000	4177	43	109	13
117	2	18	358	680	107	175	560	320	360	335	400	680	1000	5411	52	116	8
118	2	16	408	690	111	180	610	360	390	335	410	680	987	5380	54	116	5
119	2	16	386	680	110	178	570	340	350	325	395	670	976	5350	53	120	8
120	2	14	335	650	107	172	560	325	350	305	390	630	969	5176	46	123	10
121	1	18	460	790	120	199	640	375	400	310	430	670	848	4338	40	125	3
122	1	16	391	670	108	175	560	350	350	290	405	700	1044	5179	54	115	7
130	1	12	570	750	121	196	640	410	410	360	480	830	1106	5843	51	[illegible]	20
131	2	24	389	710	114	185	610	330	370	345	435	695	978	6218	55	132	6
132	1	14	460	750	147	222	640	335	420	330	425	720	960	5843	51	131	8
133	1	12	698	820	137	219	680	390	455	405	510	800	975	6585	55	135	14
134	2	08	346	660	108	174	560	320	360	275	365	620	906	3811	40	109	14
135	2	10	446	680	109	177	590	370	360	315	410	740	1096	5330	51	114	13
136	1	16	610	760	120	196	630	425	420	415	475	850	1118	6140	48	138	20
137	1	20	568	760	121	197	640	390	420	370	475	800	1052	5882	51	134	17
138	1	18	602	760	124	200	650	420	400	365	445	820	1078	7856	64	143	9
139	1	14	584	740	117	191	620	415	400	370	460	810	1094	5592	48	125	15
140	2	22	380	720	111	183	600	330	390	320	405	710	986	4341	45	114	15
141	2	10	442	660	108	174	560	365	350	340	430	750	1106	4225	49	110	22
142	1	12	492	730	114	187	590	385	400	370	445	790	1082	6070	52	126	11
143	2	12	467	670	113	180	590	385	370	340	425	750	1119	5290	51	125	11
144	2	12	453	660	111	177	600	380	360	370	435	720	1090	6415	56	125	13
145	2	12	469	680	100	178	580	390	370	360	445	760	1147	6134	49	120	11
160	1	28	343	710	113	184	605	305	370	375	280	690	971	4638	46	112	6
161	1	24	393	730	117	185	620	325	370	425	295	680	931	4825	40	130	13
162	1	28	360	720	113	185	605	325	335	390	220	670	931	4670	47	115	6
163	1	18	431	730	118	191	630	360	360	415	295	730	1000	5276	49	121	8
164	1	24	370	710	114	185	615	340	345	410	290	710	1000	5096	44	116	23
165	1	24	396	750	115	190	610	315	340	400	275	670	893	4341	40	116	9
166	1	18	534	740	116	190	620	410	355	450	375	810	1094	6268	54	125	12
167	2	18	445	710	114	185	655	335	360	425	340	690	972	5573	52	119	11
168	1	18	570	750	125	200	640	400	380	460	370	830	1106	6346	55	131	12
169	2	16	599	730	125	198	655	415	370	495	370	830	1106	5999	55	124	24
170	2	16	552	700	123	193	645	395	350	460	335	790	1128	5431	52	119	14
171	2	16	445	700	117	187	605	345	345	410	335	730	1042	4315	44	103	12
172	2	22	474	720	116	188	605	375	350	450	350	780	1083	6153	54	135	12
173	2	20	434	730	114	187	600	345	350	410	320	730	1000	5573	47	117	13
174	1	16	653	790	125	204	650	440	400	380	490	820	1038	5979	49	122	11
175	1	18	643	790	128	207	660	420	410	360	480	770	974	5715	46	132	13
176	1	16	640	780	128	206	670	410	400	350	485	820	1050	6585	53	136	9
177	1	16	655	770	127	204	670	430	410	370	495	820	1065	6940	58	132	12
178	1	18	651	770	123	178	640	410	440	365	505	810	1052	5863	53	125	7
179	1	18	546	750	122	197	640	370	410	335	440	730	973	6024	53	139	10
180	1	18	673	820	131	213	670	420	420	400	490	830	1012	7295	61	138	13
181	1	10	624	740	120	194	635	435	390	380	485	830	1121	6334	59	122	19
182	2	08	630	740	122	196	660	430	400	375	460	840	1094				
183	1	18	553	780	126	204	650	380	395	370	440	780	1000	6211	55	134	15
184	1	16	558	780	125	203	660	370	395	345	465	780	1000	5882	49	133	10
185	1	16	580	770	119	196	630	425	420	340	450	760	987	8250	61	155	14
186	1	18	594	790	123	202	650	410	420	360	470	780	987	6711	57	131	10
187	2	08	402	680	108	176	570	370	340	340	405	710	1044	4296	43	105	15
188	2	08	375	650	106	171	550	340	370	320	410	730	1123	4222	42	114	12
189	1	10	673	790	127	206	630	410	430	370	495	810	1025	8082	65	132	11
190	1	12	630	780	128	206	640	425	390	395	445	800	1025	5118	50	127	10
191	1	12	612	790	124	203	640	415	420	350	475	840	1063	5621	47	125	18
192	1	10	623	770	120	197	640	430	420	355	470	810	1052	6179	51	133	10

Carcass Number	Ribeye Index	Color Reading	Compactness	Thickness	Ribeye (lean)	Loin	Round Plumpness	Fat Thickness	Distribution	Kidney Knob	Marbling	Grain of Lean	Firmness of Lean	Color of Lean	Color of Fat
1	230	05	4	3	4	5	3	4	4	4	06	4	4	0	3
2	228	05	4	4	4	3	3	4	4	4	06	4	4	0	1
3	309	08	4	4	4	3	3	5	3	3	08	6	5	0	0
4	261	07	3	3	4	3	3	3	3	3	08	5	5	0	0
5	219	03	2	3	3	3	3	3	3	3	05	2	3	0	0
6	264	06	4	4	3	4	3	3	3	3	05	2	3	0	3
7	241	05	3	3	3	4	3	3	3	3	08	6	5	0	3
8	247	06	4	4	4	4	3	3	3	3	08	3	5	0	3
9	273	06	4	4	4	3	4	3	3	3	08	3	5	0	3
10	316	08	4	4	4	3	4	3	3	3	09	3	5	0	3
11	251	05	2	4	6	3	4	3	3	3	08	5	4	0	1
12	263	04	3	3	3	3	2	3	3	3	08	3	4	0	1
13	198	05	3	3	3	3	3	3	3	3	04	2	3	0	3
14	241	05	3	3	3	3	3	3	3	3	08	2	5	0	3
15	233	02	4	4	4	4	5	4	4	4	07	4	5	0	1
16	214	05	4	4	3	4	3	3	3	3	09	2	5	0	3
17	230	07	3	3	3	3	3	3	3	3	07	3	5	0	3
18	250	06	4	4	3	4	3	3	3	3	08	2	3	0	3
19	251	06	3	3	3	4	3	3	3	3	06	4	3	0	1
20	225	04	3	3	3	3	3	3	3	3	07	1	4	0	1
21	240	[illegible]	3	3	3	3	3	4	4	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	214	08	3	3	3	3	4	4	4	4	07	4	4	0	3
23	254	07	5	5	6	5	5	5	3	5	09	5	5	0	3
24	241	05	4	4	3	3	3	4	4	4	06	4	4	0	3
25	247	07	4	4	3	4	3	3	3	3	09	4	6	0	3
26	236	06	3	3	3	3	5	3	3	3	07	2	4	0	3
27	219	04	5	3	3	5	5	4	3	3	06	5	2	0	3
28	218	05	3	3	3	3	3	4	3	3	06	2	2	0	3
29	226	04	4	4	3	4	3	3	3	3	05	4	2	0	3
30	228	06	3	3	3	4	3	3	3	3	06	2	2	0	3
31	234	08	3	3	3	3	3	3	3	3	06	2	2	0	3
32	225	06	5	5	3	5	5	3	3	3	07	2	4	0	3
33	202	05	4	5	3	3	3	3	3	3	07	2	4	0	3
34	205	05	4	3	3	3	3	3	3	3	08	4	2	0	3
35	225	03	4	4	3	4	3	3	3	3	07	2	5	0	3
36	227	05	4	4	3	4	3	3	3	3	07	4	5	0	3
37	274	07	4	4	4	3	3	3	3	4	08	2	5	0	3
38	231	06	3	3	4	3	3	3	3	3	06	4	4	0	3
39	255	05	4	4	3	5	3	4	3	3	06	2	2	0	1
40	206	04	4	4	3	5	5	3	3	3	04	2	2	0	3
41	000	05	4	4	3	5	5	3	4	3	04	2	2	0	3
42	262	08	4	4	3	4	3	3	4	3	06	4	2	0	3
43	221	06	4	4	3	3	3	3	4	3	06	4	2	0	3
44	211	06	4	4	3	3	3	3	3	3	06	2	5	0	3
45	227	06	4	4	3	3	5	3	3	3	04	4	2	0	3
46	212	06	4	4	3	4	3	3	3	3	04	2	2	0	3
47	230	06	3	4	3	5	3	3	3	3	06	4	2	0	3
48	000	06	4	3	4	5	3	4	3	3	09	2	5	0	3
49	263	07	4	4	4	4	5	3	3	4	09	2	6	0	3
50	236	05	3	3	3	3	3	3	4	3	04	2	2	0	3
51	238	05	4	3	3	3	3	3	3	3	06	2	2	0	3
52	218	05	3	3	3	3	3	3	3	3	06	2	2	0	3
53	225	05	4	4	4	5	4	4	4	3	06	2	2	0	1
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59	[illegible]														
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72	261	07	5	6	3	5	5	5	6	4	08	6	5	0	4
73	244	05	3	3	3	3	3	3	2	4	05	3	2	0	2
74	000	05	3	3	4	3	3	3	5	3	05	3	2	0	3
75	231	04	3	3	4	3	1	3	2	3	06	3	2	0	2
76	240	00	4	4	3	4	3	4	2	3	06	5	2	0	4
77	188	05	2	2	2	2	1	3	2	3	05	2	2	0	1
78	000	06	3	3	3	3	3	3	2	3	05	2	2	0	1
79	221	06	3	3	3	3	3	2	5	3	05	3	2	0	3
80	000	07	5	4	5	5	4	4	3	5	10	6	6	0	3
81	000	05	4	4	3	4	4	3	5	3	05	5	2	0	3
82	288	04	3	3	3	3	3	3	2	4	05	2	2	0	3
83	234	07	3	3	3	3	3	3	2	3	05	2	2	0	3
84	232	06	5	5	4	5	4	4	5	4	07	5	5	0	4
85	251	00	3	3	3	3	4	3	2	4	06	2	2	0	3
86	000	00	3	3	3	3	4	3	2	4	06	3	2	0	3
87	241	00	5	5	4	5	4	4	6	4	10	6	5	0	3
88	264	00	4	4	4	3	4	4	5	4	08	6	2	0	4
89	224	00	3	3	3	3	4	3	3	3	05	5	5	0	3
90	254	00	5	4	4	4	5	5	6	3	10	3	3	0	3
91	223	07	3	3	3	3	4	4	2	3	07	5	3	0	3
92	257	00	5	4	4	5	4	4	6	4	06	3	3	0	3
93	269	00	3	3	3	3	3	3	2	3	05	3	2	0	2
94	235	07	4	4	4	4	3	4	5	4	08	3	3	0	3
95	244	00	4	4	5	3	4	4	4	4	08	5	3	0	3
96	253	07	3	3	3	3	3	3	2	3	06	3	3	0	2
97	250	05	3	3	4	3	3	3	5	3	05	3	2	0	3
98	240	06	4	3	3	3	3	3	3	4	05	5	2	0	3
100	214	03	2	2	2	2	1	2	2	3	04	2	1	0	3
101	263	07	5	4	4	4	3	5	4	4	07	5	5	0	3
102	247	03	2	2	2	2	3	3	2	3	04	2	2	0	3
103	252	06	[illegible]												
104	253	05	2	2	2	2	3	3	2	3	04	2	2	0	3
105	293	04	2	2	3	2	3	3	2	2	03	2	2	0	3
106	225	06	3	3	2	2	3	3	2	3	04	5	2	0	3
107	232	07	3	3	2	2	3	3	2	3	05	5	2	0	3
108	257	05	5	5	4	5	3	4	6	3	10	2	6	0	5
109	242	00	5	5	4	4	4	4	3	3	07	2	5	0	5
110	257	06	3	3	3	3	4	4	3	3	06	2	3	0	3
111	267	08	3	3	4	3	4	3	3	3	05	6	5	0	1
112	273	03	5	4	5	4	4	4	4	3	04	2	2	0	3
113	273	06	4	4	5	4	4	4	4	3	08	2	3	0	3
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115	243	06	3	3	3	3	3	3	3	2	05	2	3	0	1
116	253	04	3	3	3	4	3	3	4	3	05	2	5	0	2
117	223	07	3	3	2	3	3	5	3	3	08	5	5	0	2
118	215	06	3	3	3	3	3	5	3	3	06	2	2	0	3
119	226	05	3	3	3	3	3	5	3	3	06	5	3	0	1
120	267	07	3	3	3	3	3	5	3	3	06	2	2	0	4
121	312	06	5	4	4	4	5	7	3	4	05	2	3	0	3
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133	245	04	4	4	4	4	4	4	3	2	02	1	1	0	4
134	272	04	3	3	3	3	5	2	2	2	02	2	1	0	3
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136	287	05	5	4	5	5	5	5	2	6	08	2	5	0	3
137	262	07	4	4	3	4	5	4	2	6	08	6	5	0	4
138	224	06	3	3	3	5	5	5	6	6	05	6	1	0	1
139	260	04	3	6	3	5	3	6	2	2	07	2	2	0	4
140	253	05	6	5	3	5	5	5	3	6	08	5	3	0	3
141	224	03	3	3	3	3	3	3	2	3	05	2	2	0	1
142	242	04	4	4	4	4	4	4	2	7	08	1	2	0	3
143	245	04	3	3	4	3	3	4	3	6	08	1	4	0	3
144	223	05	3	3	3	3	3	3	3	6	08	1	2	0	3
145	245	03	3	3	3	3	3	3	3	6	08	2	1	0	1
160	243	09	5	5	6	5	5	6	6	6	11	5	5	5	3
161	325	08	5	4	6	5	5	5	4	4	09	3	5	4	3
162	240	10	5	5	6	6	5	6	6	4	10	6	6	6	4
163	247	09	4	4	4	5	5	4	2	3	06	2	3	3	3
164	263	07	4	4	4	5	5	5	6	5	10	5	3	4	5
165	290	08	5	5	6	6	5	5	6	4	09	5	5	5	4
166	231	05	3	3	3	3	3	5	6	4	09	3	5	5	4
167	229	07	3	3	3	3	3	3	5	5	08	5	3	4	4
168	238	06	3	3	4	3	3	5	2	3	06	3	5	4	7
169	225	04	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	06	3	5	2	3
170	225	05	3	3	4	5	3	3	5	3	06	2	3	6	4
171	234	07	3	3	3	3	3	3	2	3	08	2	2	4	4
172	250	07	3	3	3	4	3	5	2	4	09	5	5	3	4
173	249	06	5	4	4	4	5	4	5	3	09	5	5	3	4
174	249	05	3	3	4	4	4	4	3	6	09	3	3	0	4
175	300	10	4	4	4	4	4	4	3	6	04	6	6	0	4
176	256	09	3	3	4	4	3	3	2	6	07	5	6	0	2
177	227	05	3	2	3	3	3	3	3	6	05	3	3	0	2
178	235	05	4	4	4	4	3	4	3	6	05	3	2	0	2
179	262	03	4	4	4	4	5	4	4	3	06	3	5	0	4
180	226	06	4	4	3	4	4	5	5	3	06	5	5	0	4
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183	254	06	5	4	4	5	4	4	3	3	06	5	5	0	1
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185	231	07	3	3	2	3	3	4	4	6	09	3	5	0	4
186	229	08	4	3	3	4	4	4	3	4	05	5	6	0	2
187	244	06	1	2	3	2	3	3	2	3	07	3	4	0	1
188	271	06	2	2	4	2	3	2	2	6	06	2	2	0	1
189	203	06	4	3	2	4	4	4	5	3	03	1	3	0	7
190	254	06	3	3	5	3	4	4	4	6	06	2	2	0	4
191	266	05	3	3	5	4	3	5	3	6	04	5	5	0	4
192	261	06	4	4	4	3	4	3	4	6	05	3	3	0	4