A STATEWIDE RATIO STUDY
USING MICROCOMPUTERS AND GENERIC SOFTWARE

by

Robert J. Gloudemans

and

Garth E. Thimgan

*****

Prepared for

NEW DEVELOPMENTS IN HARDWARE AND SOFTWARE OPTIONS
AVAILABLE TO SUPPORT COMPUTER-ASSISTED MASS APPRAISAL

Sponsored by

Lincoln Institute of Land Policy

and

International Association of Assessing Officers

November 9-10, 1987

Boston, Massachusetts

A STATEWIDE RATIO STUDY USING MICROCOMPUTERS AND GENERIC SOFTWARE

by

Robert J. Gloudemans and Garth E. Thimgan

I. INTRODUCTION

This paper describes a statewide state-of-the-art sales ratio study performed entirely with microcomputers and generic software. The study involved 32,488 parcels with results reported by county, class of property, size, age, and price ranges. The study calculated all the traditional sales ratio statistics, along with confidence intervals and statistical tests of appraisal performance.

The study was also unique in that it explicitly examined appraisal performance for unsold parcels. The objective was to determine whether unsold parcels were appraised in the same manner as sold parcels.

The study was conducted by W.H. Hoover & Associates under contract with the State of Colorado.

Section II of the paper explains the background and requirements of the project; Section III shows the project

---

The study described in this paper was conducted by W.H. Hoover & Associates, Lakewood, Colorado. William H. Hoover and Garth E. Thimgan are principals in the firm. Mr. Thimgan was project manager. Robert J. Gloudemans is Administrator of the Research and Equalization Section, Division of Property Valuation and Equalization, Arizona Department of Revenue. He was the statistical consultant for the project.

organization; Section IV summarizes the project schedule and tasks; Section V describes hardware and software used in the project; Section VI discusses data entry and edit procedures; Section VII describes the sales ratio analysis; Section VIII explains the analysis of unsold parcels; Section IX describes graphics used in the project; and Section X presents the conclusions.

II. PROJECT BACKGROUND AND REQUIREMENTS

Colorado statutes provide for the biennial reappraisal of property using a "base year" concept. The most recent reappraisal, for the 1987 tax year, reflected the 1985 base year and, by administrative rule, used market data from 1983 and 1984. Through a competitive process, the State contracts for an independent audit of the reappraisals. The auditor reviews the appraisal methods and procedures used by the county assessors, performs a ratio study, and makes recommendations to the State Board of Tax Appeals for mandatory reappraisal when it finds counties to be in noncompliance with the Board's standards for appraisal performance. Currently these standards require an overall level of appraisal of 0.95 to 1.05 for each class of property and a coefficient of dispersion of not more than 15.99 for residential properties and 20.99 for other property classes.

The contract for the 1987 audit study required a comprehensive examination of appraisal procedures and performance

results of all locally assessed real property in each of Colorado's 63 counties, as well as a review of audit procedures for personal property. The study for real property can be divided into two general aspects. The first focused on the valuation procedures and techniques used in the reappraisal. Of particular concern was whether assessors had complied with relevant statutes, directives, guidelines, and manuals in the appraisal of real property. The second aspect of the study, which is the subject of this paper, involved a ratio study of appraisal performance.

The contract required that the ratio study use a sample of at least one percent of properties in each county and in each class of property. The sample was to be representative in terms of economic conditions, geographic areas, age, size, and the like. Furthermore a minimum sample size of at least 30 was required in classes (residential, commercial, vacant) that comprised 20 percent or more of a county's assessed value. Within classes, a minimum sample of 10 was required whenever a subclass (e.g., single family residential, condominiums, etc.) comprised 20 percent or more of the assessed value of the class. The sample was to be drawn from 1983 and 1984 sales to match the period from which assessors used market data in their reappraisals.

All sales were to be confirmed arm's-length sales. To ensure this, the auditor was to review each assessor's sales verification procedures and, if inadequate, independently

verify the sales. When the number of valid sales fell short of the minimum sample size, the contract required the auditor to conduct independent appraisals to achieve the minimum requirements. In the case of commercial properties, the auditor could combine counties into economic areas for analysis.

The contract called for the sales ratio study to be conducted in accordance with the International Association of Assessing Officer's Standard on Assessment Ratio Studies. Required statistics included the median, mean, aggregate mean, coefficient of dispersion, coefficient of variation, price-related differential, and standard error of the estimate. In determining compliance with the State's appraisal performance standards, primary reliance was to be placed on the median and coefficient of dispersion. The contract also required that charts or graphs be used to summarize study results.

Interestingly, the contract further required the Auditor to determine appraisal performance for a random sample of unsold parcels.

III. PROJECT ORGANIZATION

The project staff was organized into four levels of responsibility (Exhibit 1). The audit manager stood at the first level. This individual was responsible for overall planning and coordination of the project.

At the second level of responsibility were the statistical consultant, appraisal consultant, and office manager. The statistical consultant was responsible for designing the ratio studies and related tests of appraisal performance and for developing regression models to estimate market values for unsold parcels. The appraisal consultant was responsible for developing guidelines for the field appraisers, reviewing field appraisals, and approving the final valuations. The office manager supervised operation of the central office and provided technical assistance to data entry personnel.

The third level of responsibility consisted of personnel with experience in specific areas. In the appraisal area this included a residential and commercial property specialist, an agricultural property specialist, and a natural resource and personal property specialist.

At the fourth level of responsibility were the data collectors and field appraisers assigned to the various counties.

IV. PROJECT SCHEDULE AND TASKS

The project was completed over a one year period. Exhibit 2 contains a project calendar. The project tasks can be roughly divided into five parts.

1. Contact and Coordination with Assessors. An introductory letter was sent to all assessors, describing the purpose and

requirements of the project, introducing the project staff, and providing a schedule of regional meeting and approximate dates when each assessor would be contacted regarding data collection and sales verification. Six regional meetings were held. The project staff developed a monthly newsletter to keep assessors informed of the project's progress and upcoming events.

2. Data Collection and Sales Verification. Data collection, entry, and review constituted the most time-consuming aspect of the project. Project staff reviewed the assessor's sales confirmation programs and, when found inadequate, obtained the name and address of the grantor and grantee and mailed confirmation letters. In addition, if appraisals were needed in order to meet minimum sample size requirements, appraisers themselves field verified sales with a party to the transaction.

Besides sales data, property characteristics data were needed for stratification and for the development of models to estimate values for unsold parcels. The following sales and property characteristics data were gathered:

a. Vacant Land -- county, class, sale year and month, sale price, confirmation code, neighborhood, location, site improvements, land size, site amenities, and atypical factors affecting property value.

b. Residential -- county, class, sale year and month, sale price, confirmation code, neighborhood, land size, number of buildings, number of units, square feet of living area, total basement area, finished basement area, garage type and square footage, stories, design type, bedrooms, bathrooms, year built, effective year built, condition, construction quality, exterior wall type, and atypical factors affecting property value.

c. Commercial -- county, class, sale year and month, sale price, confirmation code, neighborhood, land size, number of buildings, number of units, square feet, total basement area, finished basement area, parking garage, stories, design type, year built, effective year built, condition, construction quality, exterior wall type, and atypical factors affecting property value.

These characteristics were collected for both sold and unsold properties so that appraisal models developed from sold properties could be applied to unsold parcels. Section VI below describes procedures for the entry and editing of data.

3. Statistical Analysis of Sold Parcels. Once data for sold parcels and final 1987 valuations had been obtained, sales ratio analyses were conducted. As mentioned, sales were supplemented with appraisals as necessary to meet minimum sample size requirements. In such cases, results were re-

ported both for the combined sample (sales and appraisals) and for the appraisals alone. Section VII below discusses the sales ratio studies.

4. Statistical Analysis of Unsold Parcels. Project personnel obtained random samples of unsold parcels in all counties. Multiple regression analysis was used to develop appraisal models based on the sold parcels and the resulting equations applied to the unsold parcels. Ratio studies were then performed on the unsold parcels. Section VIII below explains the process in more detail.

5. Reporting of Results. A report of study results was prepared for each county and distributed to the assessor, Legislative Council, Division of Property Taxation, and State Board of Tax Appeals. The reports contained a narrative description of the results, ratio study statistics for sold and unsold properties, a graphical summary of the findings (Section IX), a listing of all parcels used in the study, and recommendations for reappraisal as appropriate. The State Board held hearings on the reappraisal recommendations in October, 1987.

V. HARDWARE AND SOFTWARE

The project was done entirely on personal computers using generic software. This permitted the rapid implementation of a flexible system at very low cost relative to traditional solutions.

Personal computers used in the project included two Sperry PC/ITs with the 80286 processing chip, 40 Mbytes of hard disk capacity, a 1.2 Mb floppy disk drive, and a 360 Kb floppy drive; one AT&T PC 6300 with 20 Mb of hard disc storage; and three portable Panasonic and two portable Sharp PCs with dual 360 Kb disk drives. Field personnel used the portable PCs for data collection. A 10 Mb Bernoulli box was added to one of the Sperry PCs to further augment storage. In addition, at the peak of the project, three Compaq Portable 286s were leased to aid in model development.

The primary software package used in the project was SPSS/PC+, which is a generic statistical package containing multiple regression and most other commonly used statistical procedures. We found SPSS/PC+ to be generally well-suited to our needs and well-documented. The basic package was supplemented with SPSS-Data Entry, an on-line data entry and maintenance package; SPSS-Tables, which produces customized statistical reports in table format; and MICROSOFT Chart, a menu-driven graphics package. Word processing, including the preparation of the narrative portion of the project reports, was done with MICROSOFT Word. LOTUS 1-2-3 was used in the analysis of agricultural lands, personal property, and natural resource properties. The combined cost of all software was less than $5,000.

VI. DATA ENTRY AND EDITING

As mentioned, the study involved 32,488 parcels from Colorado's 63 counties. Several larger counties were able to "download" data to PCs and produce floppy disks in ASCII format. In most counties, however, data had to be manually input from the assessor's records.

SPSS-Data Entry was used to build customized data entry screens for data input and updating. Exhibit 3 shows the residential property screens. As data are entered in one field, the cursor automatically moves to the next field. Also, with the touch of a function key, the user can convert the screens to a spreadsheet format, which experienced users sometimes found quicker for entering data.

Data Entry builds an SPSS-readable file ready for statistical analysis. The data can, however, be converted to ASCII format as well.

Data Entry also enables the user to construct customized data edits, of which there are basically two types: edit ranges and edit rules. Exhibit 4 contains an example of each. Edit ranges are valid character entries for a given field. In Exhibit 4, for example, valid entries for EXTWALL (exterior wall type) are 1 (frame), 2 (masonry), 9 (unclear), and 0 (not available). If some other character is entered, the system will beep to alert the user.

Edit rules permit the user to specify formulas to check

the internal validity and consistency of data. In Exhibit 4, for example, the edit rule, VALUECK, requires the land value and improvement value to equal the total value. The exhibit shows the various arithmetic operators available to the user in defining edit rules. The user can perform an on-line search for rule violations or print a batch report of violations, either by rule or in parcel sequence.

Data Entry was installed on portable computers and used to input data directly from records in the assessors' offices. The on-line edit features allowed field personnel to correct entry errors immediately. The data were then transferred by floppy disks to larger PCs at the central office for further analysis.

Data Entry made possible the almost overnight development of customized data entry screens at a small fraction of the time and cost normally required for such programming. The generic nature of the software also facilitated modifications to the screens. This proved very important as early field work and testing suggested that certain data items were unneeded and that others should be coded differently. The number of screens was reduced from six to the four shown in Exhibit 4. On the negative side, we experienced occasions when data entered with Data Entry was lost because of an apparent problem in the file saving procedure.

VII. SALES RATIO ANALYSIS

Sales data were edited to remove resales (only the latest sale was used), first time sales (parcels with improvements built in the year of sale or later), and extreme ratios (generally ratios less than 0.50 or greater than 1.50).

Sales ratio statistics included the standard measures of appraisal performance: median, mean, aggregate (weighted) mean, coefficient of dispersion (COD), and coefficient of variation (COV). In addition, the price-related differential (PRD) and standard error were also reported. The PRD, computed as the mean divided by the aggregate mean is a measure of appraisal uniformity between relatively low value and relatively high value parcels. In general, a PRD greater than 1.10 indicates that higher value parcels are under-appraised relative to lower value parcels; a PRD less than 0.90 indicates that higher value properties are relatively over-appraised. The standard error provides a measure of reliability of the calculated measures of central tendency. In a normal distribution, one can be 95 percent confident that the true level of appraisal lies within two standard errors of the calculated mean and median ratios (which are equal in a normal distribution).

All these statistics were relatively easy to calculate with SPSS/PC+ except for the COD. This is because SPSS/PC+ does not provide a function for saving the median, which is

required to calculate the COD, as it does with such other statistics as sample size, the mean, and the standard deviation. Nevertheless, there are at least two ways in which the median can be saved. The first, the procedure used, is to compute the median using the FREQUENCIES procedure, save the computed median as part of a one line print file, and then read the print file back as an input record. The second method is to sort the sales ratios in ascending order and programmatically identify and save the median. This procedure was used in some supplemental analyses.

As required in the contract, sales ratio results were reported by various criteria depending on property class. Exhibits 5A and 5B contain examples for residential and commercial properties in Larimer County. Specifying the desired reporting categories was easy with SPSS/PC+ and one could modify the chosen categories with little difficulty. The sales ratio reports themselves (Exhibits 5A and 5B) were produced with SPSS-Tables. In all, some 400 of these reports were run. As written, the program requires the user to vary only two items of code to produce a desired report: the county name and the appropriate input file name. Typical run time for a sample of 100-200 parcels was approximately 15 minutes on a 286-based machine and 10 minutes with the addition of above-board memory.

The program also generates a list of sales used in the analysis. This was done easily using the REPORT procedure in

SPSS/PC+. Exhibit 6 shows the first page of the residential report for Larimer County.

VIII. ANALYSIS OF UNSOLD PARCELS

As mentioned, the contract required an evaluation of appraisal performance for unsold parcels to determine whether they were appraised in the same manner as sold parcels. This is a new dimension in appraisal performance analysis, as it is traditionally assumed that results obtained for sold parcels are representative of unsold parcels as well. What, however, if an assessor is selectively reappraising sale parcels to achieve good sales ratio results and perhaps avoid reappraisal orders or other adverse actions?

Determining appraisal performance for unsold parcels, of course, requires an alternative to sale price as a proxy for market value. One approach is the use of independent "expert" appraisals and this, in fact, was the method used when sales were insufficient to meet minimum sample size requirements. But what about the more general case when sales are adequate and the question is simply whether sold and unsold parcels are appraised in the same manner? In this situation the use of narrative appraisals is prohibitively expensive. In addition, the narrative appraisal approach tends to arouse controversy, as one appraisal (the assessor's) is matched against another (the independent appraiser's).

Accordingly, an alternative, mass appraisal approach was

used. Multiple regression models were developed from the sold parcels and used to generate estimated sales prices for the unsold parcels. One very important advantage of this approach is that it is rooted in the market. In fact, the nature of the technique ensures that, for the sold parcels, the average predicted sale price will equal the average actual sale price. Similarly, predicted values for unsold parcels will tend, on average, to equal actual sales prices for similar sold parcels. In other words, although individual predicted values will involve error, on average they will equal market value.

A second major advantage of this approach is that multiple regression analysis contains a battery of statistics that provide feedback on the reliability of the resulting model. Hence, the analyst can modify and refine the model until a satisfactory result has been achieved. In the present case, model stability was enhanced by conducting dual runs for each model specification; the second run excluded that five percent of the sample with the largest prediction errors from the first run.

A third advantage, perhaps most important of all, is that the cost of the mass appraisal approach is a small fraction of what traditional narrative appraisals would cost. Once the data had been edited, we were able to develop satisfactory models in an average time of about three hours each. This included the generation and analysis of descriptive sta-

tistics used in model specification and the testing of three or four alternative specifications. Actual run time for a typical model specification of 10 variables on a sample of 100 to 200 parcels was only several minutes on a 286-based PC.

Model results for residential parcels were generally very good, as reflected by an average COV of approximately 15.0 in the final models after purging that five percent of cases with the most extreme errors. Commercial properties proved much more difficult, due both to the smaller sample sizes and greater heterogeneity. Often counties were combined into economic regions in order to obtain an adequate sample for analysis. In any case, COVs were much higher, averaging about 40.0. Although unsatisfactory for ad valorem tax purposes, the models appeared adequate for the purpose at hand, namely to evaluate the level of appraisal for unsold parcels.

Once the models were built, they were used to generate estimated selling prices for the unsold parcels. Ratio studies were then run in the same manner as for sold parcels. Exhibits 7A and 7B contain examples for single family and commercial properties in Larimer County. The measures of central tendency (median, mean, and aggregate mean) reflect the overall level of appraisal for unsold parcels. As indicated above, the measures of dispersion (COD and COV) will not be meaningful for commercial properties because of

the large errors in the prediction of values for individual parcels. In all, some 100 models were build from approximately 14,500 sales and applied to approximately 12,900 unsold parcels.

Finally, binomial tests were conducted to determine whether the level of appraisal for unsold parcels was: (1) at least equal to 0.95 and (2) at least equal to the median obtained for sold parcels. In the first case, the binomial test counts the ratios above and below 0.95. If there are more ratios below 0.95 than above, the test determines at what confidence level one can conclude that the true level of appraisal is below 0.95. If, for example, given a sample of 20 ratios, 14 are below 0.95 and six above, the binomial test determines that there is only a 2.6 percent chance that the true level of appraisal is at least 0.95. To test the second hypothesis above, simply substitute the median calculated for the sold parcels for 0.95; the test is then performed in the same manner.

The binomial test is one of many "nonparametric" test available in SPSS/PC+. To run the test, the user need only specify the desired "cut point" (e.g., 0.95) and the expected percentage of cases on either side (50% in this case). Exhibits 9A and 9B show test results for single family and commercial properties in Larimer County.

IX. GRAPHICS

As required in the contract, ratio study results were summarized in graphs. Exhibit 10 shows the graph that was included in the final report for Larimer County. The graph was produced with Microsoft Chart, which is available as an additional module to SPSS/PC+. We found the package to be very versatile and well-documented. The charts were quickly produced in black and white on a dot matrix printer.

X. CONCLUSIONS

The ratio study described in this paper, one of the most comprehensive and sophisticated ever undertaken, was performed entirely with generic software on personal computers. In fact, we believe that the study could not have been completed on schedule in any other way without tremendous increases in cost. Furthermore, the programs developed in the project can be easily modified and adapted to similar studies in the future without the aid of professional programming assistance.

The study was a great learning experience. In retrospect, we feel that we made wise choices in hardware and software selection. Although a number of other options may also have proved satisfactory, it is clear that a ratio study of this scope requires a statistical package, such as SPSS/PC+, as opposed to spreadsheet or other more general purpose software. We chose SPSS/PC+ partly because of previ-

ous experience with SPSS on mainframe computers, which greatly reduced the learning curve. In general, development of a system of this magnitude should involve someone with a strong working knowledge of statistics and ratio studies. Experience with a particular software package is certainly helpful, but is not essential.

Finally, while PCs afford many advantages to users over larger computers, one must still carefully consider such traditional data processing issues as file organization, data storage, backup and security, and documentation. Explicitly addressing these issues at the outset of the project can pay handsome dividends down the road. Again, someone with knowledge in this area should be involved or consulted.

REFERENCES

1. Gloudemans, Robert J. "Using Generic Software in Mass Appraisal: Do Your Own Thing." Proceedings of the 1987 IAAO Annual Conference, New Orleans, Louisiana.

2. International Association of Assessing Officers. Standard on Assessment-Ratio Studies. Chicago: IAAO, 1980.

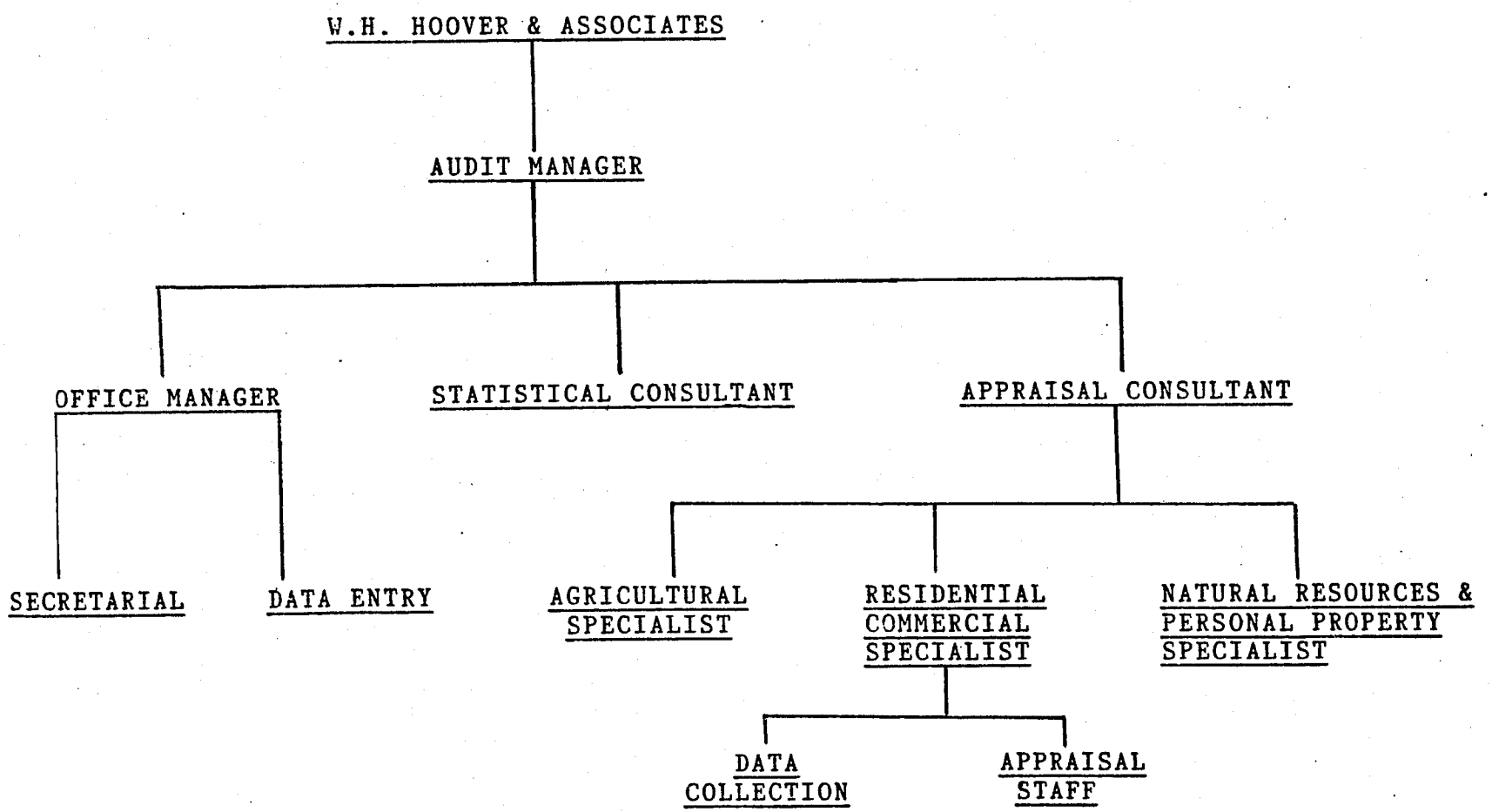
3. International Association of Assessing Officers. Improving Real Property Assessment. Chicago: IAAO, 1978.

4. Siegal, Sidney. Nonparametric Statistics. New York: McGraw Hill, 1956.

5. SPSS, Inc. SPSS/PC+ (User's Manual). Chicago: SPSS, 1986.

EXHIBIT 1

ORGANIZATIONAL CHART



PROJECT CALENDAR

	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
ORIENTATION AND ORGANIZATION INTRODUCTORY LETTER TO ASSESSORS	XX											
REGIONAL MEETINGS WITH ASSESSORS	X											
SALES DATA DEVELOPMENT	XX	X--X	X--X	X--X	X--X	X--X	X--X	X--X	X--X	X--X		
COUNTY SALES CONFIRMATION VERIFICATION AUDIT	X	XX										
SALES VERIFICATION			XX	XXXX								
SALES ANALYSLIS --- ECONOMIC REGIONS		XXXX										
APPRAISALS TO AUGMENT ECONOMIC REGIONS			X--X	X--X	X--X	X--X						
AGRICULTURAL LAND AUDIT		X--X	X--X	X--X	X--X	X--X	X--X	X--X	X--X			
AUDIT OF NATURAL RESOURCE PROPERTIES					X--X	X--X	X--X	X--X	X--X	X--X		
PERSONAL PROPERTY REVIEW					X--X	X--X	X--X	X--X	X--X	X--X		
SAMPLE SELECTION --- UNSOLD PROPERTIES					X--X	X--X	X--X	X--X	X--X			
PREPARATION OF FINAL REPORT									X--X	X--X		
DELIVERY OF FINAL REPORT TO ASSESSORS											XX	
INFORMAL MEETINGS WITH ASSESSORS											XX	X
FINAL REPORT DELIVERED TO DIRECTOR OF LEGISLATIVE COUNCIL												X
FINDINGS AND CONCLUSIONS PRESENTED TO SBOE												OCTOBER 1987

EXHIBIT 3

1	|||	COUNTY	02 ||||||||||||||||||||| PARCEL NUMBER
03	|||||||||	CLASS/SUBCLASS	4-DIGIT CLASS CODE: 9 = UNCLR 0 = N/A
04	|||	SALE-YEAR	83 = 1983 84 = 1984 0 = N/A
05	|||	SALE-MONTH	1 = JAN, 2 = FEB, ETC. 0 = N/A
06	||||||||||||	REPORTED-S-PRICE	0 = N/A
07	||	A-CONFIRM-IND	Y = CONFIRMED N = UNCONFIRMED 9 = UNCLR 0 = N/A
08	|||||||||	NEIGHBORHOOD	ASSESSOR`S NBHD CODE (0 = NONE)
09	|||	LAND-SIZE-IND	SF = SQ FT AC = ACRE FF = FRONT FT BU = BUILDABLE UNITS 9 = UNCLR DU = DENSITY UNITS 0 = N/A
10	|||||||||	LAND-SIZE	NUMBER OF SQ FT, ACRES, ETC. (ENTER DECIMAL FOR FRACTIONS, E.G, 2.75 ACRES) 99998 = UNCLR 0 = N/A

Create/Edit Form

11	|||	BUILDINGS	0 = NONE 98 = UNCLR 99 = N/A
12	|||||||||	UNITS	0 = NONE 99998 = UNCLR 9999 = N/A
13	||||||||||	SQUARE-FEET	0 = NONE 8 = UNCLR 9 = N/A
14	||||||||	TOT-BSMT-AREA	0 = NONE 8 = UNCLR 9 = N/A
15	||||||||	FIN-BSMT-AREA	0 = NONE 8 = UNCLR 9 = N/A
16	||	GARAGE-TYPE	0 = NONE 1 = DTCH 2 = BLT.IN 3 = ATCH 5 = OTHER 8 = UNCLR 9 = UNKNOWN
17	|||||||||	GARAGE-SQFT	0 = NO GARAGE 8 = UNCLR 9 = UNKNOWN
18	||||||||	STORIES	1, 1.5, 1.75, 2, 98 = UNCLR 99 = N/A
19	|||	DESIGN-TYPE	1 = ONE STY 2 = TWO STY 3 = SPLIT LEV 4 = 1 1/2 FIN 5 = 1 1/2 UNF 6 = 3 STY 7 = 2 1/2 FIN 8 = 2 1/2 UNF 9 = 3 1/2 F 10 = 3 1/2 UNF 11 = BI-LEVEL 12 = UNCLR 99 = TOWNHOUSE

Create/Edit Form

EXHIBIT 3 - (continued)

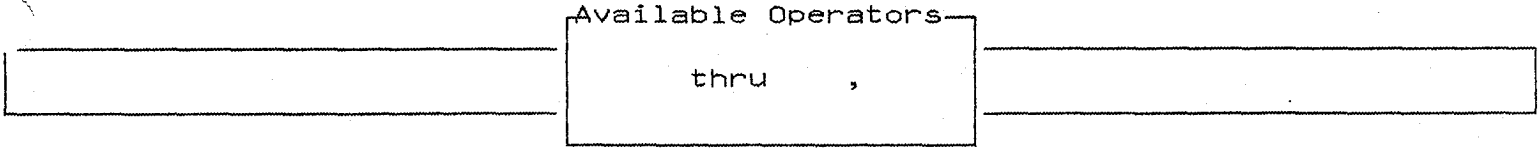
20	ROOMS	0 = NONE	998 = UNCLR 999 = N/A
21	BEDROOMS	0 = NONE	998 = UNCLR 999 = N/A
22	BATHROOMS	0 = NONE	998 = UNCLR 999 = N/A
23	YEAR-BUILT	1880 (MIN) TO 1986:	9 = UNCLR 0 = N/A
24	CONDITION	1 = POOR 2 = FAIR 3 = AVG 4 = GOOD 5 = V.GOOD 6 = EX 9 = UNCLR 0 = N/A	
25	EFF-YEAR-BLT	1880 (MIN) TO 1986:	9 =UNCLR 99 = N/A
26	EXT-WALL-TYPE	1 = FRAME 2 = MASONRY	9 = UNCLR 0 =N/A
27	CONST-QUALITY	1 = LOW 2 = FAIR 3 = AVG 4 = GOOD 5 = V.GOOD 6 = EX 9 = UNCLR 0 = N/A	
28	PROP-FLAG	PRESENCE OF ATYPICAL FACTOR(S) THAT SIGNIFICANTLY (10% OR MORE) AFFECT THE VALUE OT THE PROP: 1 = NEG FACTORS 2 = POS FACTORS 9 = UNCLR 0 = NONE	

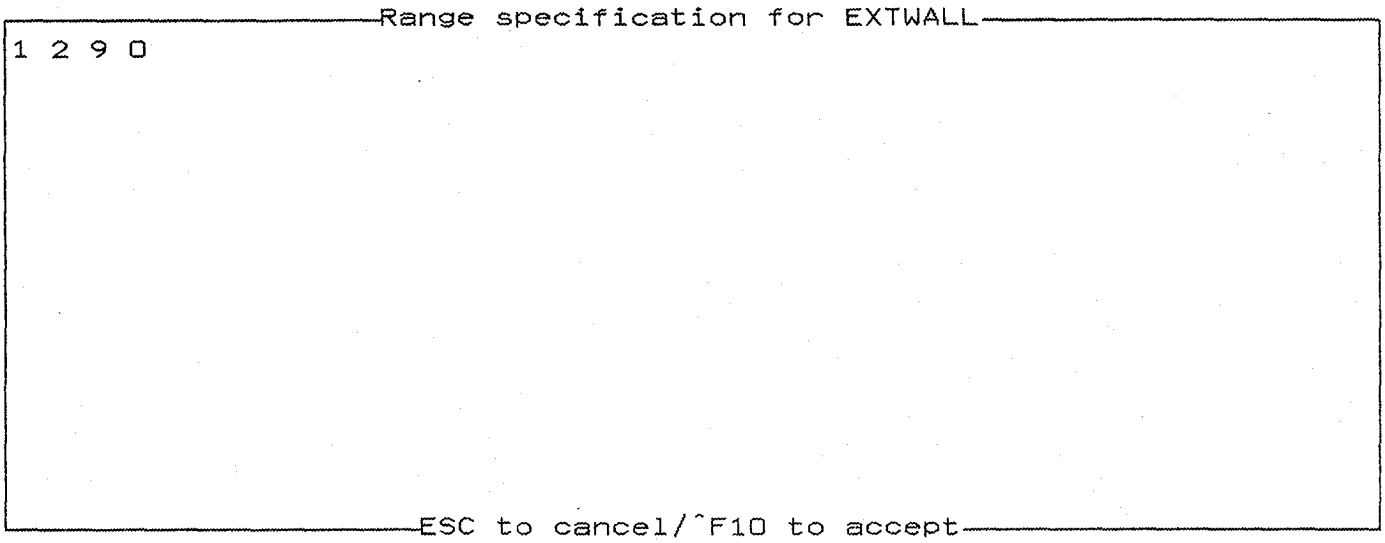
Create/Edit Form

29	INCOME-DATA-IND	Y = YES N = NO 9 = UNCLR	
30	P-P-VALUE	0 = N/A 1 = AVAILABLE	
31	P-VALUE-SRC	1 = SALE 2 = APRAISAL	9 = UNKNOWN
32	P-VALUE	PROJ SALE PRICE OR APPR	9 = UNKNOWN
33	1985-LAND-VALUE	9 = UNCLR 0 = N/A	
34	1985-IMPR-VALUE	9 = UNCLR 0 = N/A	
35	1985-TOTAL-VALUE	9 = UNCLR 0 = N/A	

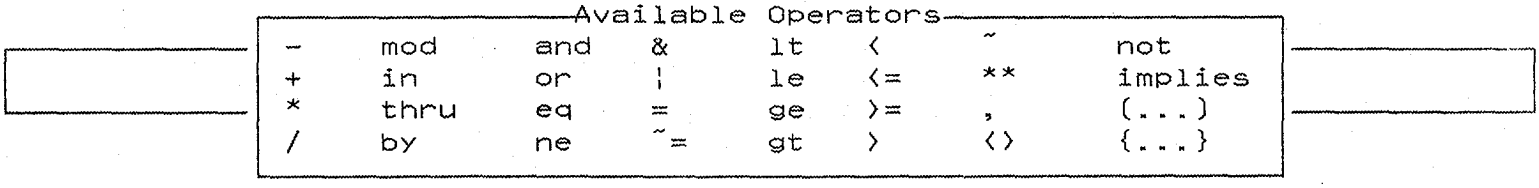
Create/Edit Form

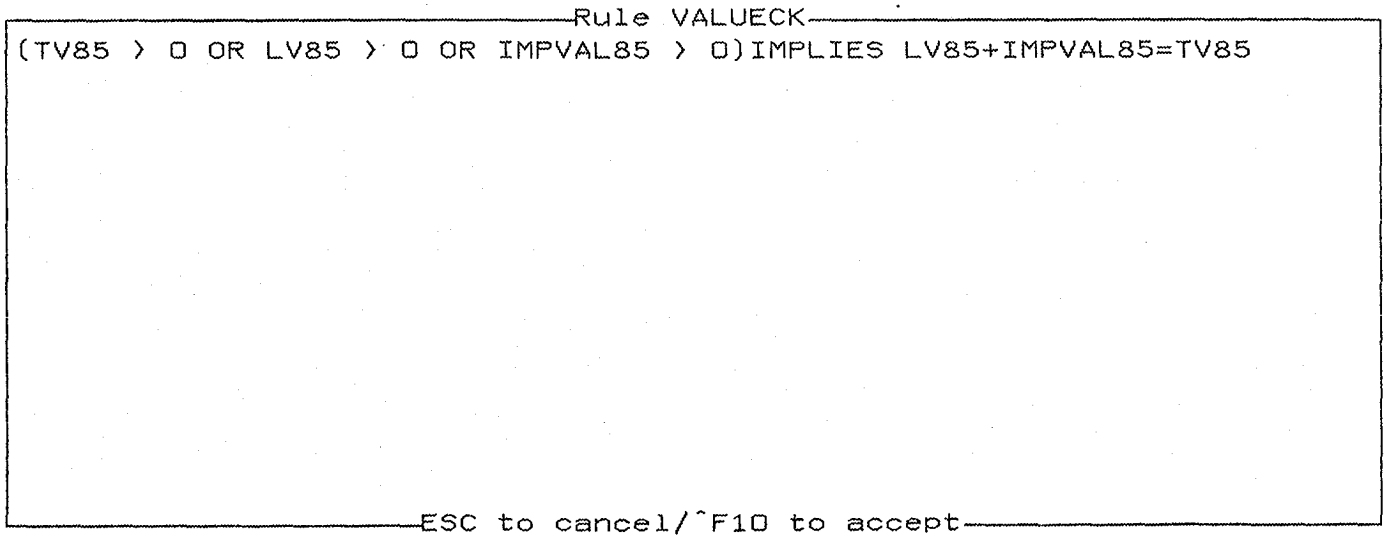
EXHIBIT 4





RANGES Create/Edit Cleaning Specs





RULES Create/Edit Cleaning Specs

EXHIBIT 5-A

SINGLE FAMILY SALES RATIO STATISTICS
FOR THE COUNTY OF LARIMER

CATEGORY	ALL SINGLE FAMILY PROPERTIES							
	SALES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
SINGLE FAMILY	616	1.009	1.007	1.007	9.9	12.9	100.0	.005

CATEGORY	SINGLE FAMILY PROPERTIES BY SQUARE FOOT RANGE							
	SALES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
800 S.F. OR LESS	21	.917	.886	.878	12.1	15.9	100.9	.031
801 - 1200	239	.976	.982	.977	10.5	13.4	100.6	.009
1201 - 1600	175	1.019	1.016	1.014	8.6	10.9	100.3	.008
1601 - 2400	158	1.040	1.047	1.041	8.8	11.4	100.5	.010
2401 OR MORE	23	.986	1.038	.998	14.1	17.1	104.0	.037

CATEGORY	SINGLE FAMILY PROPERTIES BY CONSTRUCTION QUALITY							
	SALES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
BELOW AVERAGE	50	.935	.922	.911	12.3	15.9	101.3	.021
AVERAGE	477	1.007	1.008	1.004	9.5	12.4	100.3	.006
ABOVE AVERAGE	89	1.059	1.053	1.041	9.4	11.4	101.2	.013

CATEGORY	SINGLE FAMILY PROPERTIES BY YEAR BUILT RANGE							
	SALES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
BUILT BEFORE 1945	56	.911	.923	.911	15.0	18.3	101.3	.023
1945 - 1959	46	.925	.957	.968	13.6	16.3	98.9	.023
1960 - 1974	140	1.004	1.016	1.017	10.6	13.5	99.9	.012
1975 OR LATER	374	1.016	1.023	1.019	8.3	10.7	100.4	.006

CATEGORY	SINGLE FAMILY PROPERTIES BY SALE PRICE RANGE							
	SALES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
$24,999 OR LESS	1	1.105	1.105	1.105			100.0	
25,000 - 49,999	54	.953	.988	.983	14.2	17.4	100.5	.023
50,000 - 74,999	327	1.001	.998	.998	9.2	11.9	100.0	.007
75,000 - 99,999	157	1.028	1.034	1.035	9.8	12.7	100.0	.010
100,000 - 149,999	67	1.008	1.008	1.006	9.6	12.8	100.2	.016
150,000 OR MORE	10	.918	.964	.950	10.6	15.3	101.4	.047

EXHIBIT 5-B

COMMERCIAL SALES RATIO STATISTICS
FOR THE COUNTY OF LARIMER

CATEGORY	ALL COMMERCIAL/INDUSTRIAL PROPERTIES							
	SALES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
TOTAL	36	.997	.986	.958	10.3	14.8	103.0	.024

CATEGORY	COMMERCIAL/INDUSTRIAL PROPERTIES BY SUBCLASS							
	SALES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
MERCHANDISING	15	.963	.944	.941	10.2	12.7	100.4	.031
OFFICE	8	.984	1.004	.975	11.2	16.5	103.0	.059
SPECIAL PURPOSE	11	1.031	.994	.969	6.2	11.4	102.5	.034
WAREHOUSE/STORAGE	2	1.181	1.181	1.050	20.2	28.6	112.5	.239

CATEGORY	COMMERCIAL/INDUSTRIAL PROPERTIES BY YEAR BUILT RANGE							
	SALES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
BUILT BEFORE 1945	2	.928	.928	.938	6.6	9.3	98.9	.061
1945 - 1959	3	1.034	1.042	1.035	1.5	2.3	100.7	.014
1960 - 1974	22	1.026	1.014	.994	9.6	14.8	102.1	.032
1975 OR LATER	9	.942	.910	.901	11.5	16.3	101.0	.049

CATEGORY	COMMERCIAL/INDUSTRIAL PROPERTIES BY SALE PRICE RANGE							
	SALES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
$49,999 OR LESS	2	1.245	1.245	1.187	14.1	19.9	104.8	.175
50,000 - 99,999	5	.982	1.001	1.005	5.4	6.9	99.6	.031
100,000 - 149,999	9	1.004	.972	.972	7.4	11.9	100.0	.038
150,000 - 249,999	10	1.041	1.030	1.021	8.5	12.9	100.9	.042
250,000 OR MORE	10	.902	.895	.922	12.5	14.9	97.0	.042

EXHIBIT 6

RESIDENTIAL PARCEL NUMBERS USED FOR RATIO STUDY: LARIMER COUNTY

CLASS		PARCEL NUMBER	SALE DATE	TOTAL 85 VALUE	SALE PRICE	SALE RATIO
1212	1	2529205033	12/84	$148,000	$145,000	1.021
	2	2530320004	07/83	$49,620	$66,000	.752
	3	2530406045	12/84	$100,920	$87,500	1.153
	4	2531116001	04/84	$80,810	$73,000	1.107
	5	2531207007	02/83	$157,150	$130,000	1.209
	6	3522106002	06/84	$115,950	$100,000	1.160
	7	3525109010	12/83	$31,770	$30,000	1.059
	8	3525200007	05/84	$119,720	$102,000	1.174
	9	3526316004	08/83	$57,360	$57,800	.992
	10	3534100012	10/83	$79,340	$71,500	1.110
	11	3535000013	05/84	$52,970	$55,000	.963
	12	3535405042	08/83	$91,710	$105,000	.873
	13	3536307005	09/84	$112,500	$95,000	1.184
	14	8507209002	03/84	$84,290	$75,500	1.116
	15	8507209019	11/83	$69,700	$73,500	.948
	16	8507211005	03/84	$59,750	$64,500	.926
	17	8507308009	11/83	$72,740	$64,500	1.128
	18	8507322002	07/83	$78,180	$84,000	.931
	19	8507328009	02/83	$67,780	$66,000	1.027
	20	8518305003	02/84	$46,720	$39,500	1.183
	21	8518305029	04/84	$41,780	$47,500	.880
	22	8518307002	05/83	$36,110	$34,500	1.047
	23	8518309005	10/84	$49,070	$46,200	1.062
	24	8518324002	04/83	$47,930	$38,500	1.245
	25	8519214003	04/83	$62,030	$53,000	1.170
	26	8519214017	04/83	$65,430	$59,500	1.100
	27	8521405037	08/83	$161,090	$185,000	.871
	28	8524000006	09/83	$140,120	$145,000	.966
	29	8528205001	08/84	$145,200	$136,000	1.068
	30	8607207011	12/84	$115,020	$132,500	.868
	31	8622307015	04/84	$37,250	$30,000	1.242
	32	8622317006	07/83	$60,120	$53,900	1.115
	33	8622318035	01/83	$52,900	$47,500	1.114
	34	8622318039	05/83	$60,360	$58,900	1.025
	35	8706135003	11/83	$85,740	$75,000	1.143
	36	8706205021	01/84	$127,110	$142,000	.895
	37	8706212005	05/84	$118,790	$104,900	1.132
	38	8710405022	04/84	$123,180	$114,000	1.081
	39	8715000011	09/83	$208,610	$170,000	1.227
	40	8716207007	08/83	$65,430	$68,000	.962
	41	8716211001	04/83	$62,120	$59,000	1.053
	42	8716213017	11/83	$58,990	$60,000	.983
	43	8717105002	10/83	$71,930	$64,000	1.124
	44	8717113030	01/84	$44,460	$47,500	.936
	45	8717116069	05/84	$62,510	$55,100	1.134
	46	8717116098	04/84	$46,440	$49,500	.938
	47	8717205197	07/83	$56,220	$60,300	.932

EXHIBIT 7-A

SINGLE FAMILY RATIO STATISTICS
UNSOLD PROPERTIES FOR THE COUNTY OF LARIMER

CATEGORY	ALL SINGLE FAMILY PROPERTIES							
	CASES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
TOTAL	471	1.009	1.019	1.032	9.3	12.3	98.7	.006

CATEGORY	SINGLE FAMILY PROPERTIES BY SQUARE FOOT RANGE							
	CASES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
800 S.F. OR LESS	15	.896	.913	.920	10.8	13.3	99.3	.031
801 - 1200	166	.970	.987	.992	9.3	12.4	99.5	.010
1201 - 1600	146	1.036	1.038	1.044	7.9	10.8	99.4	.009
1601 - 2400	122	1.025	1.040	1.043	8.1	11.0	99.7	.010
2401 OR MORE	22	1.075	1.084	1.095	13.0	17.7	98.9	.041

CATEGORY	SINGLE FAMILY PROPERTIES BY CONSTRUCTION QUALITY							
	CASES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
BELOW AVERAGE	36	.849	.874	.876	9.2	11.0	99.8	.016
AVERAGE	354	1.014	1.022	1.026	8.2	10.8	99.6	.006
ABOVE AVERAGE	81	1.053	1.069	1.075	10.8	14.0	99.4	.017

CATEGORY	SINGLE FAMILY PROPERTIES BY YEAR BUILT							
	CASES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
BUILT BEFORE 1945	50	.931	.935	.953	11.9	14.9	98.1	.020
1945 - 1959	48	.999	1.000	1.001	10.4	12.8	99.9	.018
1960 - 1974	133	1.012	1.027	1.039	9.2	12.4	98.9	.011
1975 OR LATER	240	1.022	1.035	1.045	8.3	11.0	99.1	.007

CATEGORY	SINGLE FAMILY PROPERTIES BY PRICE RANGE							
	CASES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
25,000 - 49,999	39	.912	.914	.918	11.7	14.3	99.6	.021
50,000 - 74,999	217	.989	1.002	1.004	8.3	10.9	99.9	.007
75,000 - 99,999	142	1.034	1.043	1.044	7.8	10.9	99.9	.010
100,000 - 149,999	67	1.059	1.072	1.074	9.5	12.6	99.8	.016
150,000 OR MORE	6	1.140	1.126	1.121	13.5	21.3	100.5	.098

EXHIBIT 7-B

COMMERCIAL RATIO STATISTICS
UNSOLD PROPERTIES FOR THE COUNTY OF LARIMER

CATEGORY	ALL UNSOLD COMMERCIAL/INDUSTRIAL PROPERTIES							
	SALES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
TOTAL	29	1.006	1.011	1.115	28.2	36.7	90.7	.069

CATEGORY	UNSOLD COMMERCIAL/INDUSTRIAL PROPERTIES BY SUBCLASS							
	SALES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
MERCHANDISING	7	.805	.838	.914	25.6	30.3	91.7	.096
OFFICE	4	1.123	1.152	1.284	18.2	23.2	89.7	.134
SPECIAL PURPOSE	15	.957	.982	1.037	31.5	41.6	94.7	.105
WAREHOUSE/STORAGE	3	1.497	1.377	1.503	13.6	23.4	91.6	.186

CATEGORY	UNSOLD COMMERCIAL/INDUSTRIAL PROPERTIES BY YEAR BUILT RANGE							
	SALES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
1945 - 1959	4	.635	.699	.657	19.0	28.1	106.4	.098
1960 - 1974	15	1.006	.989	1.099	27.2	36.9	90.0	.094
1975 OR LATER	10	1.050	1.171	1.249	26.8	31.4	93.7	.116

CATEGORY	UNSOLD COMMERCIAL/INDUSTRIAL PROPERTIES BY SALE PRICE RANGE							
	SALES	MEDIAN	MEAN	AGG MN	COD	COV	PRD	SE MN
50,000 - 99,999	4	.909	.885	.903	14.7	18.1	98.1	.080
100,000 - 149,999	5	.957	.933	.938	27.7	46.2	99.4	.193
150,000 - 249,999	8	.635	.677	.672	21.0	25.3	100.8	.061
250,000 OR MORE	12	1.225	1.309	1.300	18.1	20.2	100.7	.076

EXHIBIT 8-A

'SINGLE FAMILY PROPERTIES - LARIMER COUNTY'

Number of Valid Observations (Listwise) = 471.00

Variable	Mean	Std Dev	Minimum	Maximum	N	Label
TV85	79412.14	30825.16	27564	260390	471	1985-TOTAL-VALUE
LV85	15067.07	5710.89	4080	45240	471	1985-LAND VALUE
PRICE	76986.02	24759.36	31732.69	207245.4	471	
RATIO	1.02	.13	.648	1.477	471	
SQFEET	1442.51	516.35	542	3909	471	SQFT-LIV-AREA
EFFAGE	17.64	19.80	-1.00	96.00	471	

- - - - - Binomial Test

RATIO

Cases

133	Le .950	Test Prop. = .5000
338	Gt .950	Obs. Prop. = .2824

471	Total	Z Approximation
		2-tailed P = .0000

- - - - - Binomial Test

RATIO

Cases

		Test Prop. = .5000
235	Le 1.009	Obs. Prop. = .4989
236	Gt 1.009	

471	Total	Z Approximation
		2-tailed P = 1.0000

EXHIBIT - 8-B

Page 1 OF PREDICTED VALUES FOR LARIMER COUNTY' 7/6/8
'COMMERCIAL PROPERTIES - LARIMER COUNTY'

CLASS PROPERTY CLASS

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	2212	7	28.0	28.0	28.0
	2220	4	16.0	16.0	44.0
	2230	11	44.0	44.0	88.0
	2235	3	12.0	12.0	100.0
	TOTAL	25	100.0	100.0	

Valid Cases 25 Missing Cases 0

Number of Valid Observations (Listwise) = 25.00

Variable	Mean	Std Dev	Minimum	Maximum	N	Label
TV85	271504.00	274108.24	41620	1123540	25	1985-TOTAL-VALUE
PRICE	260826.67	195471.10	51704.70	920070.8	25	
RATIO	.93	.27	.506	1.497	25	
SQFEET	6178.80	5097.85	915	20580	25	SQFT-LIV-AREA
EFFAGE	14.44	10.22	0.0	33.00	25	

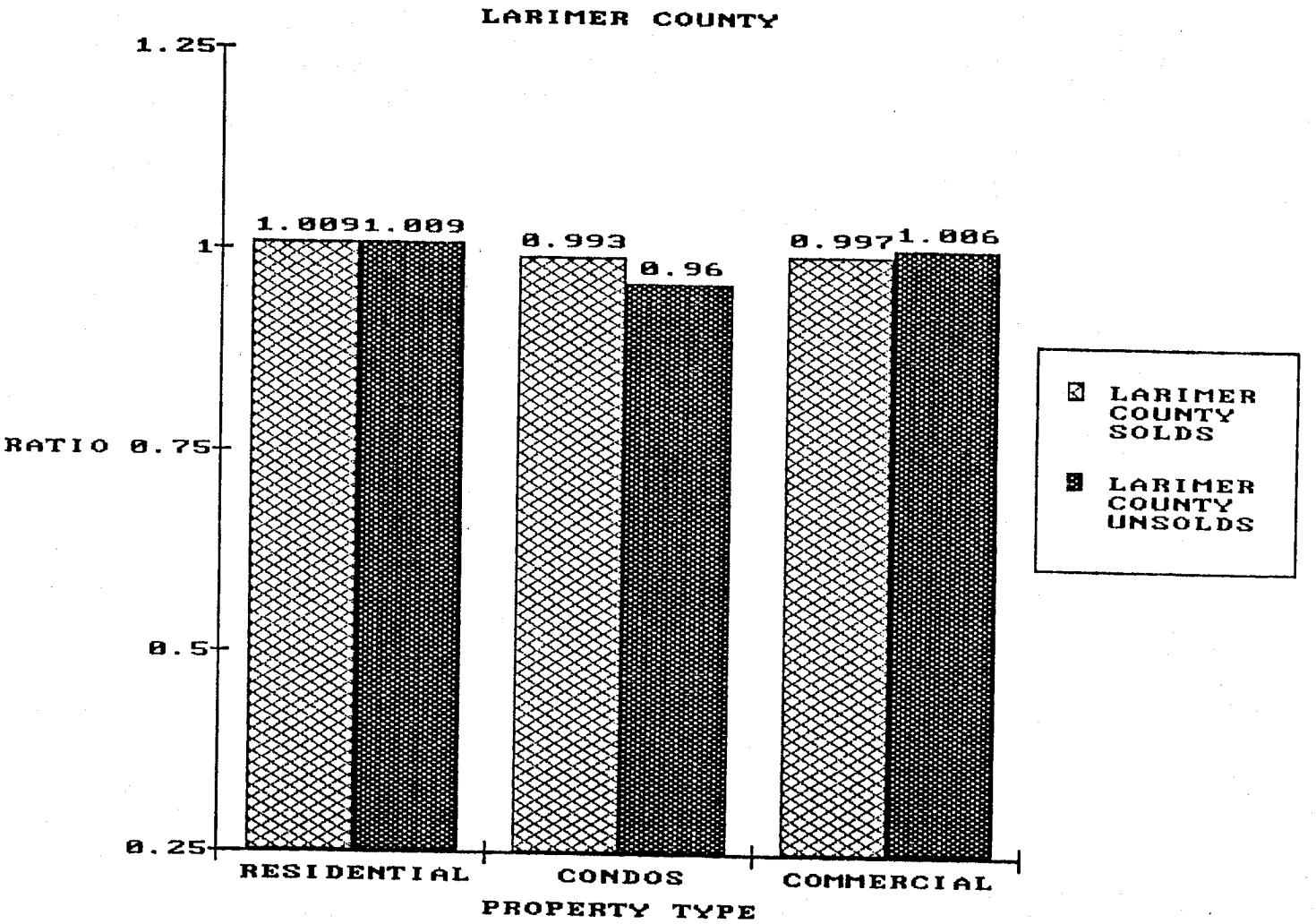
- - - - - Binomial Test

RATIO

Cases

12	Le	.950	Test Prop. = .5000
13	Gt	.950	Obs. Prop. = .4800
--			Exact Binomial
25	Total		2-tailed P = 1.0000

EXHIBIT 9


LARIMER COUNTY
1.25
1
0.75
0.5
0.25
RATIO
1.009
1.009
0.993
0.96
0.997
1.006
RESIDENTIAL
CONDOS
COMMERCIAL
PROPERTY TYPE
LARIMER COUNTY SOLDS
LARIMER COUNTY UNSOLDS