

Final Report  
Assessment Performance Analysis of the 2003 Revaluation  
of Residential Properties and Condominiums

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Conducted for  
The Office of Tax and Revenue  
District of Columbia

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by  
Robert J. Gloudemans  
Almy, Gloudemans, Jacobs and Denne

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**Assessment Performance Analysis of the 2003 Revaluation  
of Residential Properties and Condominiums  
Conducted for the District of Columbia Office of Tax and Revenue**

**1. Executive Summary**

The District of Columbia Office of Tax and Revenue asked Robert J. Gloude-mans, Partner in Almy, Gloude-mans, Jacobs & Denne, to perform a ratio study analysis of residential and condominium values developed for the 2003 reassessment. The Office provided data files of all residential and condominium parcels in the District, as well as all sales from January 1999 to the present. In preparation for a phase-in of annual assessments beginning next year, the Office reappraised tri-areas 1 and 2 in the current reassessment (all areas will be reappraised for the next year). The legal valuation date for the 2003 reassessment is market value as of January 1, 2002.

Performance was evaluated by comparing assessments with sales prices. If assessment performance is good, assessments should be reasonably close and bear a consistent relationship to sales prices. Assessment-to-sales ratios that fall consistently short of 1.00 indicate that property is under-appraised and vice versa. Even more important, ratios that vary randomly, exhibit wide dispersion, or vary significantly among property types indicate serious inequities in property assessments and corresponding tax bills. The assessment industry has developed commonly accepted criteria for evaluating assessment performance through assessment-to-sales ratio studies.

Based on a thorough and objective analysis of all sales occurring in the District since January 1999, I conclude that the Office of Tax and Revenue achieved an appropriate and acceptable level of assessment in the areas reappraised (areas 1 and 2) and that equity among tax payers in these areas was substantially improved and also meets industry standards. (Property owners in area 3 received a windfall through the mandated phase-in; implementation of annual assessments should serve to eliminate such inequities in the future).

Two points emerged as exceedingly important during the analysis. First, the Washington, D.C. real estate market has been exceptionally vibrant in recent years, displaying some of the largest increases in home prices in North America. I estimate that residential values in areas 1 and 2 increased at the rate of 1.3% per month from January 1999 through September 2002, and that condominium values increased at the rate of 1.6% per month over the same time period. These unusually high rates of appreciation exhibited high statistical confidence and were confirmed by several independent methods of analysis. Although it is difficult to determine what has occurred since September 2002, the available sales suggest that the market initially dipped, stabilized, and most recently has at least matched its former highs. I have applied no additional appreciation to sales after September 2002.

These unusually high rates of price change complicate both the assessment function in the District as well as the present review. If one were to compare the new assessments in areas 1 and 2 with sales on the same properties in 1999 and 2000, the assessments would, on average, exceed the sales prices. On the other hand, a comparison with 2001 and 2002 sales would reveal that, on average, assessments are slightly conservative, generally equaling or falling somewhat short of sales prices. Against this backdrop, I conclude that the Office of Tax Revenue adopted an appropriately aggressive but responsible approach to tracking market changes in areas 1 and 2. Adjusting sales prices to the valuation date of 1 January 2002 based on the appreciation rates indicated above, I estimate that the overall level of assessments to current market values in areas 1 and 2 is between 85% and 90%. Given the rapid change in market values and questions of sustainability (and the fact that no increases were possible in area 3), I believe this to be a responsible and prudent valuation level. Although values were increased greatly (perhaps 50% on average), the increases are easily justified and warranted.

Second, a detailed sales analysis reveals the real estate market in Washington, D.C. to be complex and difficult. Not only have property values been escalating rapidly, values differ markedly among parts of the city and even within neighborhoods depending on individual features of a property. Properties are generally old, which always complicates the valuation function, and often renovated to various extents. Often seemingly similar properties will sell for highly different prices.

Under such conditions, comparisons of individual assessments to individual sales prices can be difficult. The International Association of Assessing Officers (IAAO) has developed a guideline of an average error or COD ("coefficient of dispersion") of 15% as indicating good performance for older urban areas like Washington, D.C. Using time-adjusted sales from 1999 onward (as described above), it appears that the COD in areas 1 and 2 is approximately 20% for residential properties and 16% for condominiums. However, my analyses also show that, especially for residential properties, much of this dispersion is due to the inconsistency or unpredictability among seemingly similar properties in the same neighborhood. Factoring this volatility out, that is, by comparing current assessments against a stabilized or average price for a property given its location and building features, I estimate the COD to be well under 15%. Further, whether one uses actual or stabilized prices, CODs have improved at least 5 points (e.g., from almost 20% for residential property to well under 15%) as a result of the reappraisal.

The Office of Real Property Assessments did a very good job in bringing property values close (but not over) market value and in improving equity among individual properties in the 2003 reassessment of areas 1 and 2. Much of the reason for improvement in equity can be attributed to the use of differential adjustment factors by neighborhoods, as an analysis using prior values will reveal large disparities in assessment levels among neighborhoods (e.g., one neighborhood at 50% of market value and another at 85%). These disparities have now been largely eliminated in areas 1 and 2. Although the 2003 reappraisal relied heavily on such trending techniques, now that these broad inequities have been addressed, at least in areas 1 and 2, the Office should now turn its attention to improving equity among individual properties.

## 2. Residential Analyses

### 2.1 Sales Data and Edits

The District provided data on available sales occurring from January 1999 through March 2002. The sales were edited to remove the following:

- Multiple parcel sales.
- Sales that no longer represented the most recent sale, e.g., a January 1999 sale for a parcel that resold in February 2001.
- Sales for which the construction year was prior to 1870 or exceeded the sale year, indicating that the parcel may have been vacant at the time of sale.
- Invalid or extreme data, for example, properties without a construction grade or with less than 1 or more than 8 baths.
- Properties with a sale price of less than \$20,000 or greater than \$3,500,000 or with a sale price of less than \$15 per square foot.
- Properties with an extreme price compared to others in the neighborhood, for example, sales of less than \$200,000 or greater than \$2,000,000 in Cleveland Park (only 2.4% of sales were excluded on this basis).
- Sales for which the ratio of the new assessed value to price was less than 0.40 or exceeded 2.00. Since the District's new assessments were, on average, close to market value and since all properties were appraised based on the same tables and schedules, it is likely that sales with ratios this extreme were not valid arm's-length sales or otherwise not representative of market value. In all, 4.8% of sales were excluded on this basis (the IAAO Standard on Ratio Studies, 1999, calls for not excluded more than 5.0% of sales based on ratio edits).

The remaining 12,520 sales were considered usable for performance analysis and were distributed as follows:

PROTOTYPE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 TOWN HOME	7704	61.5	61.5	61.5
	2 DETACHED	3002	24.0	24.0	85.5
	3 2-4 UNIT	1814	14.5	14.5	100.0
	Total	12520	100.0	100.0	

## 2.2 Time Adjustments

Property values have been appreciated markedly and a number of analyses were conducted to determine the appropriate rate of change. Most importantly, a regression analysis for areas 1 and 2 included time of sale as an independent variable (see 2.4 below). The analysis indicated a rate of change of 1.3% per month (compounding) through September 2002 with an exceedingly high level of statistical confidence, indicating a total change in property values since January 1999 of 55% in these two areas. Sales ratio trend analysis and a relatively simplistic value-per-square foot analysis confirmed the reasonability of this figure. For example, median values-per-square foot in areas 1 and 2 increased from approximately \$75 at the start of the period to between \$115-\$120 near the period.

Although high, value increases in area 3 have not been as dramatic. For example, while the median per-square foot price also started at approximately \$75, it leveled off toward the end of the period near \$100. An adjustment of 1% per month (compounding) was applied to sales in area 3, again with no adjustments applied after September 2002.

## 2.3 Sale Ratio Analyses

Sales ratios analyses were run comparing both the 2003 and previous assessments with time-adjusted sales prices. Overall results were as follows:

Ratio Statistics for AV / TASP

Group	Mean	Median	Weighted Mean	Coefficient of Dispersion	Price Related Differential	Sales
1	.909	.868	.867	.210	1.049	4049
2	.877	.860	.845	.196	1.038	4574
3	.773	.734	.715	.189	1.082	3897
Overall	.855	.820	.818	.211	1.046	12520

Ratio Statistics for PREV / TASP

Group	Mean	Median	Weighted Mean	Coefficient of Dispersion	Price Related Differential	Sales
1	.768	.734	.703	.225	1.094	4049
2	.597	.565	.552	.235	1.081	4574
3	.736	.702	.674	.201	1.093	3897
Overall	.695	.667	.625	.240	1.113	12520

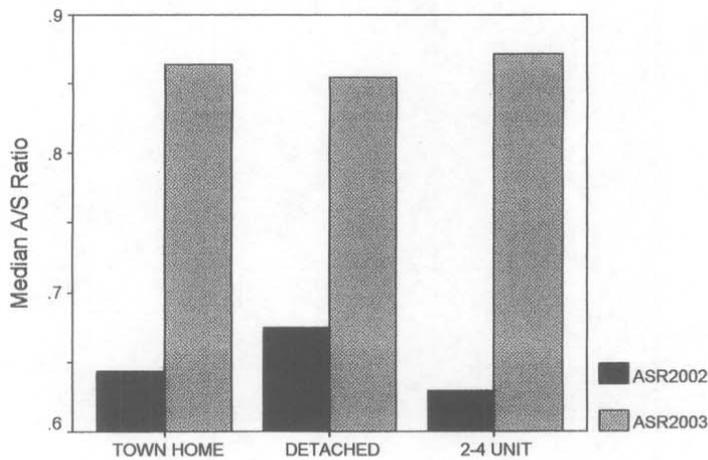
Notice that the measures of central tendency (median, mean, and weighted mean) for areas 1 and 2 are in the high .80s based on the current assessments, whereas they were previously far below market value. In fact, the level of assessment for area 2 had slipped into the mid .50s! Although not good, coefficients of dispersion (which measure the

average percentage deviation about the median ratio) are approximately 20% and improved over previous values. Price related differentials (PRD), which measure equity between higher and lower value properties (the closer the PRD is to 1.00, the better) are also improved. In area 3, which was not reappraised but in which value increases have been more moderate, the level of assessment is in the mid .70s (even though the area was not reappraised, current values often exceed previous values because of the routine pickup of additions and renovations, which are particularly common for sale properties).

Next, values in areas 1 and 2 were evaluated for equity among various property groups. The two bar charts below indicate good equity in appraisal levels between property types and construction grades (the higher the grade, the better the quality of construction). In both cases, the reappraisal largely succeeded in correcting significant prior inequities. In the case of construction grade, poorer quality homes were substantially over-appraised versus mid- and higher quality homes before the reappraisal, perhaps because they had not enjoyed the same high appreciation in values. These inequities have now been corrected.

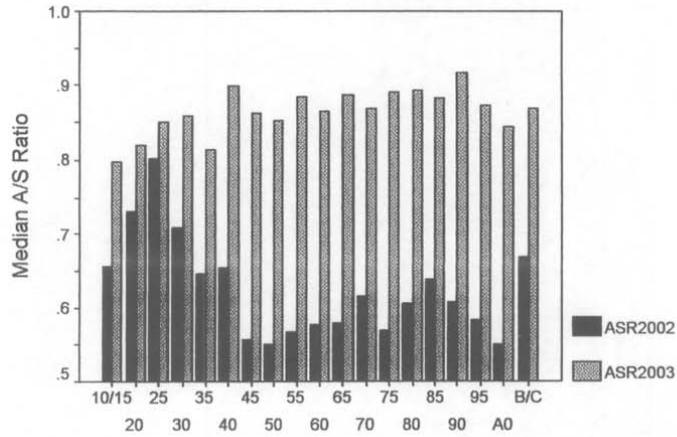
### Median Ratios by Property Type

#### Areas 1 and 2



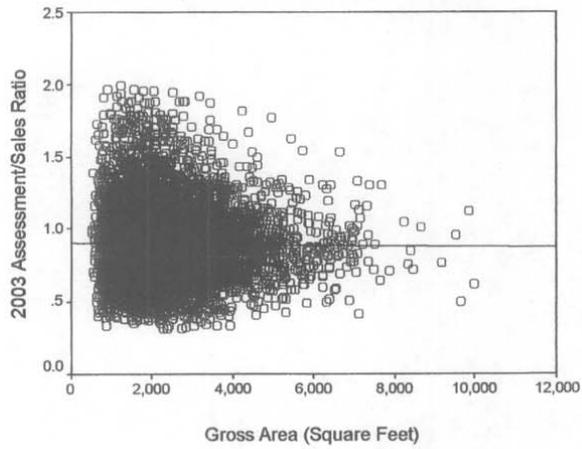
### Median Ratios by Construction Grade

#### Areas 1 and 2



Below is a scatter graph of assessment-to-sales ratios with gross building size in areas 1 and 2. The line of best fit trends neither upward nor downward, indicating excellent uniformity between smaller and larger homes.

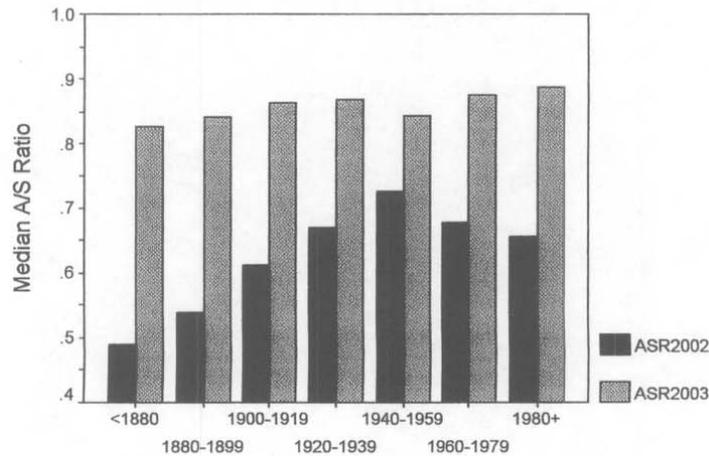
#### Graph of A/S Ratios with Size



Below is a bar graph of assessment-sales ratios by age groups. It indicates serious inequities before the reappraisal and strong equity currently. The cause for the improvement appears to be that older but higher value neighborhoods, which had appreciated strongly, were increased in value more than areas with newer improvements but less valuable locations (many of the most desirable areas in the District have some of the oldest buildings).

### Median Ratios by Year Built

#### Areas 1 and 2

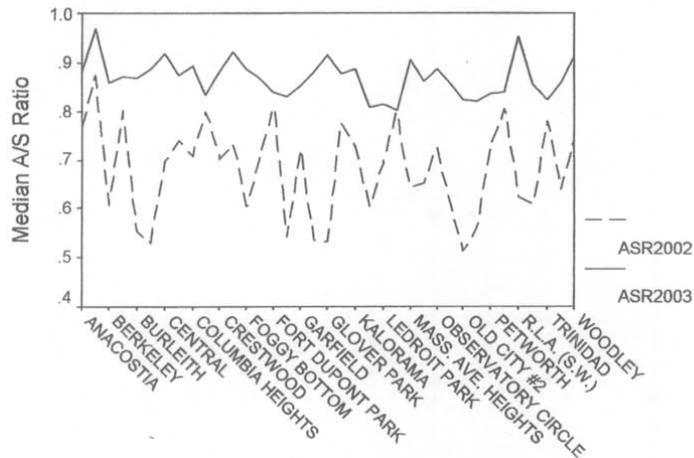


The final graph below compares median assessment-to-sales ratios before and after the reappraisal by neighborhood. Although some disparities still exist, the marked inequities that existed before the reappraisal have been largely corrected without appraising any neighborhood in excess of market value.

The above analyses illustrate particularly good equity among major property types, construction grades, size and age ranges, and neighborhoods. This is not meant to suggest that *individual* properties are necessarily appraised correctly, but the reappraisal did correct the serious disparities among neighborhoods and other property groups that existed before the reappraisal. One of the most important measures of assessment performance is equity in appraisal levels among major property groups, and this the present reappraisal accomplished in areas 1 and 2.

## Median A/S Ratios by NBHD

### Areas 1 and 2



Finally, to conform the reasonability of the above analyses based on 39 months of time-adjusted sales, a supplemental analysis was conducted using only sales from December 2001 through March 2002. These sales occurred after values had been set and thus represent an independent holdout sample. There were 1,180 sales in this period: 808 in areas 1 and 2 and 372 in area 3. Since these sales occurred during a short window near the assessment date, no time-adjustments were necessary. The median sales ratio based on these sales was .869 in areas 1 and 2 and .729 in area 3 (corresponding figures based on previous values were .633 and .711, respectively). These figures are virtually identical to those calculated from the full sample of time-adjusted sales, providing additional confirmation of the time-adjustments used in the analysis and calculated current levels of assessment.

#### 2.4 A Further Look at Assessment Uniformity

The process of analyzing the sales data and attempting to eliminate transfers that for various reasons likely did not represent market value revealed that seemingly similar properties in the same neighborhood and sub-neighborhood often sold for substantially different amounts, much more than could be explained by time of sale. Further, average errors as measured by the COD, while not cause for alarm in a market as complex as the Washington, D.C. area, seem high given the high equity described above among all major property strata. These considerations prompted development of a statistical mass appraisal model using multiple regression analysis (the statistical tool generally used by

appraisers) to estimate a typical or stabilized sale price estimated for each property.<sup>1</sup> Assessments were then compared against these stabilized prices and performance measures recomputed.

Regression models have a dependent variable, which in this case is sale price and a series of independent variables that are expected to predict or explain the dependent variable. Assessors typically employ 15 to 25 location, land, and building characteristics in analyses of this type. In the present case, the data file downloaded for the assessment performance analysis lacked many characteristics that would be helpful in a more complete analysis, but did contain most key characteristics. The available characteristics included neighborhood and sub-neighborhood code, gross building size including basements and garage areas (in a valuation model these areas would be separated), construction quality, number of rooms and bedrooms, number of full and half baths, year built, condition, and number of stories.

In addition to variables for the above characteristics, the regression analysis included a variable for time of sale (January 1999 = 1, February 1999 = 2, etc) capped at 34 months corresponding to September 2001. Interestingly, this variable was the single most statistically significant variable in the model (gross area was second) with a "t-value" of 41.5 (a value of 2.0 indicates statistical significance at the 95% confidence level). The variable indicated that property values were increasing at the rate of approximately 1.3% per month with a margin of error of well below 0.1%. All sales were adjusted to the end of the period at this rate and the model rerun.

The final model after the removal of outliers (those exceeding two standard errors) was able to explain 89 percent of the variation in sales prices about the average price, a relatively good result. The variables behaved pretty much as expected with logical adjustments for size, grade, property type, baths, and condition. Many neighborhood and sub-neighborhoods were particularly strong. Interestingly, the model indicated that (other things equal) property values increase with number of stories, suggesting that multi-story buildings represent more efficient land use (and higher ratios of living area to gross area). While variables for physical condition were highly significant and behaved as expected, actual year built was not significant. For those readers who may be interested, appendix 1 contains the final model and appendix 2 contains the SPSS pseudo-English program file used to produce it, including an explanation of variables used in the model.

Assessments were compared to both time-adjusted sales prices and model-estimated or stabilized sales prices. The results are indicated below. Note that the overall COD based on time-adjusted sales prices is 21.2% but is only 13.2% based on model estimated sales prices (ESP), a notable improvement. It thus appears that, because of the nature of the current market in the District, assessments may be more consistently on target with

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<sup>1</sup> The Statistical Package for the Social Sciences (SPSS) was used to develop the model.

underlying market values than a traditional comparison of assessments with sales prices would suggest.<sup>2</sup>

Ratio Statistics for AV / TASP

Tri-Area	Mean	Median	Weighted Mean	Coefficient of Dispersion	Price Related Differential	Sales
1	.924	.873	.875	.221	1.055	4065
2	.885	.862	.854	.204	1.037	4580
Overall	.903	.867	.862	.212	1.048	8645

Ratio Statistics for AV / ESP

Tri-Area	Mean	Median	Weighted Mean	Coefficient of Dispersion	Price Related Differential	Sales
1	.902	.894	.901	.127	1.001	4065
2	.869	.874	.881	.136	.986	5580
Overall	.885	.884	.889	.132	.995	8645

## 2.5 Application to Unsold Properties

Finally the regression model described above was applied to all single-family properties in tri-areas 1 and 2 (unless the required characteristics were missing or out of range). As the results below show, the COD for 50,119 unsold properties was a very respectable 12.1 percent, versus 19.3% based on values before the reappraisal. Further, the COD for the unsold properties is somewhat better than for the sold properties (13.7%), perhaps because of renovations or other improvements that complicated the appraisal process.

In any case, these results are encouraging because they again strongly indicate that appraisal uniformity is considerably better for individual properties, sold and unsold, than traditional analyses would suggest. The indicated CODs below based on current assessments are well within IAAO guidelines and presumably would be even better if a more complete regression model had been developed. Although there is certainly room for further improvement, the current values are very respectable. Interestingly, regression models, which represent an automated version of the traditional sales comparison approach, may prove helpful in future enhancement efforts.

<sup>2</sup> Another possible explanation is that sales should be screened more thoroughly to eliminate non-arm's length or non-representative transfers.

**Ratio Statistics for AV / ESP**

Sold	Mean	Median	Weighted Mean	Coefficient of Dispersion	Price Related Differential	Parcels
No	.901	.896	.928	.121	.971	50119
Yes	.886	.883	.899	.137	.986	9579
Overall	.899	.894	.923	.123	.974	59698

**Ratio Statistics for PREV / ESP**

Sold	Mean	Median	Weighted Mean	Coefficient of Dispersion	Price Related Differential	Parcels
No	.702	.702	.665	.193	1.057	50119
Yes	.678	.665	.647	.207	1.048	9579
Overall	.698	.695	.662	.196	1.056	59698

**3. Condominium Analyses**

Condominiums were analyzed in a manner parallel to that described above for residential properties. A primary difference, however, is that the market for condominiums appears more predicable, with sales falling into more consistent patterns.

**3.1 Sales Data and Edits**

As with residential properties, the District provided data on available sales occurring from January 1999 through March 2002. The sales were edited to remove the following:

- Multiple parcel sales.
- Sales that no longer represented the most recent sale, e.g., a January 1999 sale for a parcel that resold in February 2001.
- Sales for which the construction year was prior to 1870 or exceeded the sale year, indicating that the parcel may have been vacant at the time of sale.
- Invalid or extreme data, for example, properties without a construction grade or with less than one half bath or more than three full baths.
- Properties with a sale price of less than \$20,000 or greater than \$2,000,000, or with a sale price of less than \$25 or more than \$650 per square foot.
- Properties with an extreme price compared to others in the neighborhood (only 15 sales were deleted on this basis).

- Sales for which the ratio of the new assessed value to price was less than 0.33 or exceeded 2.50. Only 31 sales (0.6% were eliminated on this basis).

After the above edits 5,394 condo sales were available for the performance analysis.

### 3.2 Time Adjustments

To the reader's possible chagrin, the market for condominiums in the District has been even stronger than for other residential properties. In areas 1 and 2 the regression analysis (section 3.4 below) indicated a rate of appreciation of 1.6% per month (compounding) through September 2002, a total increase of 71.5% since January 1999. Again the analysis was exceedingly strong statistically, indicating little margin of error (the t-value was ). This seemingly high rate of change was confirmed by the sales ratio trend and value per square foot analyses. In the latter case, median values appear to have increased from just under \$140 per square foot at the beginning of the period to almost \$240 per square foot by the end of the period.

Again, however, the trend was less strong in area 3, where a trend of 1.3% per month appeared appropriate.

### 3.3 Sales Ratio Analyses

The following summarizes the sales ratio analyses comparing both new and previous assessments against time-adjusted sales prices.

Ratio Statistics for AV / TASP

Tri-Area	Mean	Median	Weighted Mean	Coefficient of Dispersion	Price Related Differential	Sales
1	.865	.842	.828	.156	1.045	2232
2	.864	.849	.841	.163	1.027	2751
3	.690	.673	.656	.176	1.051	411
Overall	.851	.836	.824	.168	1.033	5394

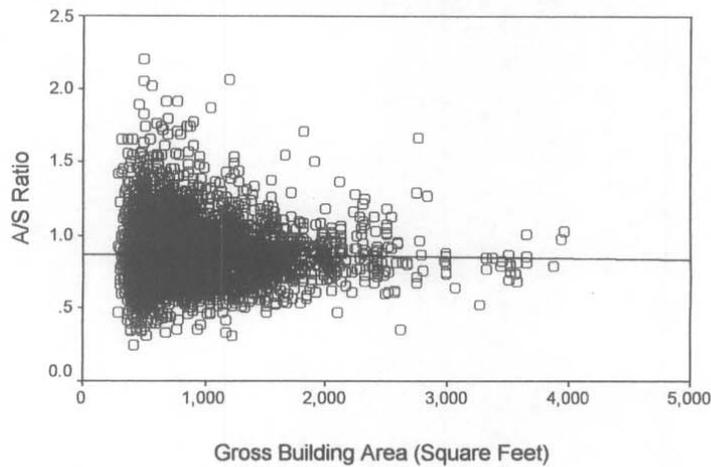
Ratio Statistics for PREV / TASP

Tri-Area	Mean	Median	Weighted Mean	Coefficient of Dispersion	Price Related Differential	Sales
1	.718	.699	.689	.156	1.042	2232
2	.563	.548	.544	.189	1.034	2751
3	.669	.656	.620	.199	1.078	411
Overall	.635	.622	.614	.203	1.034	5394

Measures of the assessment level are in the mid .80s in areas 1 and 2 and less than .70 in area 3. Despite the fact that few outliers were removed, CODs are much better than initially indicated for other residential properties in areas 1 and 2 (where the average COD was near 20%). This is undoubtedly due to the comparatively simpler and consistent market for condominiums.

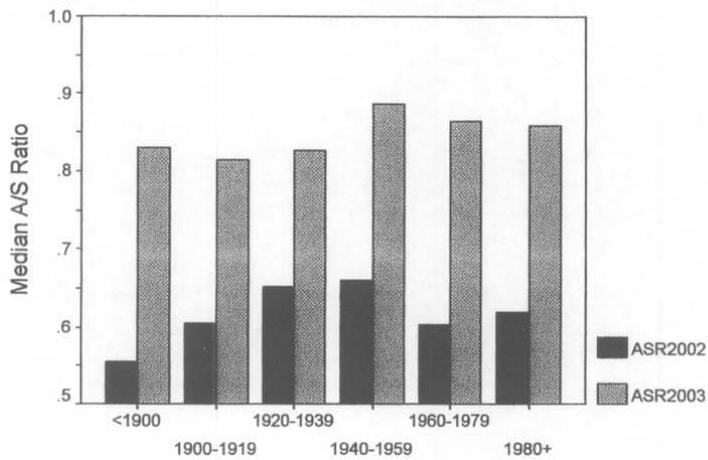
As with other residential properties, the reappraisal appears to have achieved good equity among key property groups. The first graph below indicates strong equity between smaller and larger units, with the line of best fit trending neither upward nor downward.

Graph of A/S Ratios with Size  
Condominiums - Areas 1 and 2

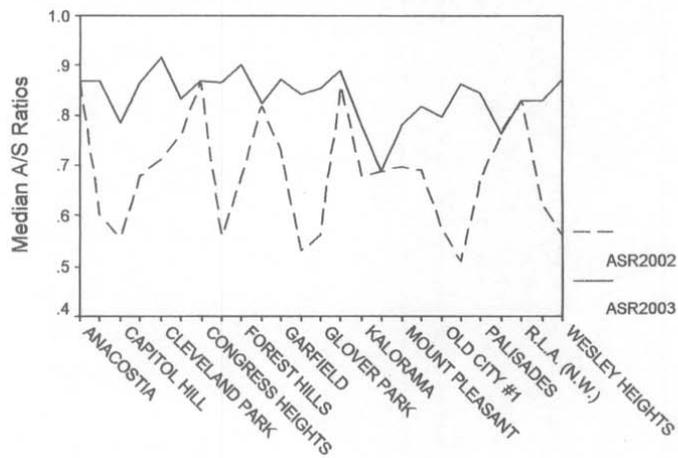


The next two graphs evaluate equity by age groups and neighborhoods (not all neighborhoods are labeled). In both cases, although there is room for further improvement, equity is much improved over prior values.

**Median Ratios by Year Built**  
**Condominiums - Areas 1 and 2**



**Median A/S Ratios by NBHD**  
**Condominiums - Areas 1 and 2**



Finally, assessment levels were calculated using only December 2001 – March 2002 sales unadjusted for time. There were 304 usable sales in this window in areas 1 and 2 but only 34 in area 3. Median and mean ratios were .817 and .842, respectively, in areas 1 and 2 and .677 and .693 in area 3. These results are consistent with those using time-adjusted sales from the full 39-month period and confirm the reasonability of the time-adjustments applied.

### **3.4 Further Analyses**

As with other residential properties, a multiple regression model was built to generate stabilized sales prices with which to compare assessments. However, the exercise proved less rewarding because of the relatively consistent behavior of condo sales and because of the comparatively limited data available. In particular, construction grade was not available and there were generally too few sales to create variables for individual complexes, which can be crucial in condominium valuation. The model succeeded in explaining 81% of the variation about the average sales price, versus 89% for the non-condominium model. Nevertheless, comparison of the new assessments with the model-estimated prices still produced a respectable COD of 15.1%, which establishes an upper bound for the true average error if assessments could be compared against underlying marked values. A more complete regression model would undoubtedly produce a lower COD. A comparison of previous values with the same model-estimated values produced a COD of 17.5%.

### **3.5 Conclusions**

In general, assessors are able to obtain better performance measures for condominiums than for other residential properties due to their relative predictability. Although condos in the District are older (median year built of 1950), often involve conversions, and are affected by more complex location factors than elsewhere, the same is likely true. In any case, appraisal performance for condos is respectable. Levels of assessment are appropriate and prudent for such an uncommonly strong market, and uniformity among major property types and individual properties is reasonably good. Again, there is room for improvement, but values are generally in line.

ROBERT J. GLOUDEMANS - MASS APPRAISAL CONSULTANT (July 2001)

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**ADDRESS** 7630 N. 10th Avenue, Phoenix, AZ 85021  
Ph: 602-870-9368 Fax: 602-861-2114 E-mail: rgloudemans@earthlink.net

**EDUCATION** B.A., Economics, 1969, St. Norbert College, West De Pere, WI  
M.A., Economics, 1972, University of Iowa, Iowa City, IA  
Arizona State University, Tempe, AZ. 30 semester hours (1980-82).  
Areas of concentration: finance, statistics, computer science, real estate.

**EMPLOYMENT HISTORY**

May 91 - Present	<i>Partner - Almy, Gloudemans, Jacobs &amp; Denne (AGJD), Consultants in Property Taxation and Assessment Administration. -- formerly Almy, Gloudemans &amp; Jacobs (AGJ) 7630, N. 10<sup>th</sup> Avenue, Phoenix, AZ 85021. Ph: 602-870-9368</i>
Apr 89 - Present	<i>Independent consultant specializing in property assessment, mass appraisal systems, modeling and quality assurance.</i>
Jan 91 - Jun 97	<i>Principal, Thimgan &amp; Associates, Ad Valorem Valuation Consultants, P.O. Box 668, La Junta, CO 81050. Phone: 719-384-7031.</i>
Jan 87 - Apr 89	<i>Administrator, Research and Equalization, Division of Property Valuation and Equalization, Arizona Department of Revenue</i>  <i>Responsibilities: Supervise ratio studies, equalization programs, computer-assisted appraisal, and property tax research.</i>
Nov 78 - Dec 86	<i>Head, Computer Assisted Appraisal Unit, Division of Property Valuation, Arizona Department of Revenue</i>  <i>Responsibilities: design and supervise mass appraisal models, ratio studies, and property tax research.</i>
Feb 73 - Nov 78	<i>Research Associate, International Association of Assessing Officers (IAAO), Chicago, IL</i>  <i>Responsibilities: conduct research, develop workshops, assist in technical assistance projects.</i>

**TEACHING EXPERIENCE** *International Association of Assessing Officers:*  
COURSE 201, Land Appraisal (FL-85); COURSE 202, Advanced Income

Approach (MI-88, WA-90, MI-91, MI-92, FL-93); COURSE 301, Mass Appraisal of Residential Property (SC-85, AL-89); COURSE 302, Mass Appraisal of Income Property (LA-84, CO-85, AL-85); COURSE 303, Computer Assisted Appraisal Systems (SC-83, MO-84, NM-85, VA-86, NV-87, IL-89, SD-89, TX-93); COURSE 305, Mass Appraisal Model Building (IL-86, IL-87, CO-89, NY-89, KY-89, KS-92, CO-92); COURSE 307, Advanced Model Building for Income Properties (NY-90); Workshop on Depreciation Analysis (ID-84, MT-84, ME-85); Workshops on Assessment Ratio Studies (TX-82, NC-82, AL-82, TN-86, NC-87, LA-88, FL-88, GA-89, IA-89, GA-90, IL-91, SC-91, SASK-93); Workshop on Multiple Regression Analysis (SASK-93, KS-96).

*Lincoln Institute of Land Policy:*

World Congress on Computer Assisted Appraisal (MA-82, 85, 88); Course 224, Computer Methods for the Appraisal of Condominiums (MA-83); Technical Seminar on Contemporary Assessment Issues (CA-86, MA-88); Seminar on Market-Based Taxation of Real Property for a Lithuanian delegation (01).

*Thimgan & Associates, Inc.:*

Workshops on Time Trend Analysis (CO-93, FL-93, KS-93).  
Workshops on Multiple Regression Modeling (93, 95, 97, 98, 99,00,01).

*University of British Columbia:* Intensive (2 week) Course on Real Property Assessment (Feb 96, Oct 96, Feb 97, Oct 98, Dec 98, July 00, Aug 00)

*Arizona Community Colleges:* Workshops on using statistics in property valuation  
(for the AZ Department of Revenue, Jun 98 and Mar 99).

*David C. Lincoln Fellow.* Lincoln Institute of Land Policy (1999-2001)

*Other:*

Customized workshops on sales ratio studies and appraisal performance analysis for the States of Colorado (87), Utah (87), and Georgia (89-90). Workshops on market analysis and modeling with SPSS for Business Records Corporation and clients (94); Brevard County, FL (94-98); Orange County, FL (94); City of Winnipeg (94-95); State of Wyoming (95); Johnson Co, KS (95- 96), Republic of Trinidad (96-97); Shawnee Co, KS (96); Province of Ontario (97-01); City of Calgary (97-01); Republic of Armenia (96-97); City of Edmonton (97-00); Arizona Dept of Revenue (98, 99); Iowa Association of Assessors (97); Province of Saskatchewan (98); Maricopa County, AZ (98); Province of Nova Scotia (98, 99); Cook County, IL (00); State of New York (00, 01); Province of Alberta (01); Pierce Co, WA (01) .

CONSULTING

*International Association of Assessing Officers:*

Development of Standard on Assessment Ratio Studies (80); design of a sales ratio study for the State of Connecticut (80); development of a work plan for

appraisal reform for the City of Philadelphia (81); evaluation of a CAMA system RFP for the State of West Virginia (84); development of an RFP for a PC-based CAMA system for Massachusetts (85); development of Student Reference Manual for the workshop, Fundamentals of Assessment Ratio Studies (85) and for Course 303, Computer Assisted Appraisal Systems (86); evaluation of potential CAMA systems for Dona Ana County, New Mexico (88); development (with Dr. Richard Ward) of Student Reference Manual for Course 307, Advanced Model Building for Income Properties (90); coauthor and technical editor of the IAAO textbook, Property Appraisal and Assessment Administration (88-90); development of Student Reference Manual for Fundamentals of Ratio Studies (91); development of a case study for Multiple Regression Analysis Workshop (93); development of workshop on Mine and Quarry Valuation (with Don Ross, 93); development of student and instructor's manuals (with Thimgan & Associates, Inc.) for Course I, Fundamentals of Appraisal (92), Course 201, Land Appraisal (93), Course 300, Fundamentals of Mass Appraisal (94), Course 4, Assessment Management (94), Course 301, Residential Mass Appraisal (94), and Course 302, Mass Appraisal of Income Properties (95); develop and moderate First Annual Colloquium on Innovation in Mass Appraisal (AGJD, 99); author of IAAO textbook on Mass Appraisal of Real Property (99).

*Boulder County, CO:* Evaluation of mass appraisal techniques (85).

*Tulsa County, OK:* Review CAMA system and provide expert witness testimony in an assessment discrimination case (85).

*Colorado Division of Property Valuation:* Recommendations on performance standards for rural residential parcels (87-88).

*Oklahoma County, OK:* Recommendations on design of a CAMA system for residential properties (86)

*Utah State Tax Commission:* Review sales ratio procedures and provide recommendations (87).

*Guilford County, NC:* Ratio study assistance in an assessment discrimination case (87-88).

*Durham County, NC:* Review of sales ratios and time trends in an assessment discrimination case (88).

*Connecticut Conference of Municipalities:* Preparation of a white paper and expert testimony on treatment of software for property taxation (89).

*Florida Dept of Revenue:* Expert witness on litigation with railroads under the federal 4-R Act (88-89).

*Georgia Department of Revenue:* Development of sales ratio rules and a PC-based sales ratio system (89).

*Mississippi State Tax Commission:* Recommendations on sales ratio procedures and software design (89).

*Shelby County (Memphis), TN:* Recommendations and review of RFPs for a CAMA system (89).

*Arizona Attorney General's Office:* Consulting assistance in an assessment tax discrimination case (89).

*Arizona Fiscal 2000 Study Committee:* Analyses and recommendations re state's property tax system (89).

*Polk County (Des Moines), Iowa:* Residential modeling assistance (90).

*Georgia Attorney General's Office:* Consultant and expert witness assistance in a federal 4-R case (90).

*Virginia Department of Taxation:* Expert witness on federal 4-R case (90).

*Maricopa County (Phoenix, AZ) Attorney General's Office:* Consultant/expert witness in valuation and tax discrimination cases (90-92).

*City of Yuma, AZ:* Subcontractor on project to estimate incidence of substandard housing (90).

*West Virginia Department of Tax & Revenue:* Consultant & expert witness on litigation filed by railroads under the 4-R Act (91).

*Alabama Department of Revenue:* Review property appraisal system and equalization procedures (Thimgan & Associates, 91).

*Georgia Department of Revenue:* Review assessment ratio rules and procedures (91).

*Peoria County, IL:* Review of appraisal procedures and recommendations for a reappraisal program and CAMA system (AGJ, 91).

*Arizona Dept of Revenue:* Consultant & expert witness in 4-R Act case (91).

*Shelby County (Memphis), TN:* Develop market and income models for

apartment and commercial properties for the 1991 reappraisal (90-91).

*Washtenaw County (Ann Arbor), MI:* Develop SPSS sales ratio software and provide staff training (92).

*Florida Dept. of Revenue:* Recommendations for redesign of "in-depth" study procedures (AGJ, 92).

*Mississippi State Tax Commission:* Recommendations for ratio studies (92).

*Saskatchewan Assessment Management Agency:* Review assessment system and make reappraisal recommendations (AGJ, 92).

*Peoria County, IL:* Evaluation of responses to a CAMA RFP (AGJ, 92).

*Washington Attorney General's Office:* Consultant and expert witness on litigation filed by railroads under 4-R Act (89-92).

*Iowa Department of Revenue:* Consultant and expert witness in a 4-R Act case (90-92).

*Tennessee Division of Property Assessments:* Consultant and expert witness in 4-R Act cases (91-92).

*Colorado Legislative Council:* Conduct ratio studies by county and class and make reappraisal recommendations (Thimgan & Associates, 86-92).

*Shelby County (Memphis), TN:* Defense of commercial appeals over \$1,000,000 (92-93).

*Arizona Department of Revenue:* Recommendations for sales ratio and equalization methods (92-93).

*Johnson County, KS:* Modeling assistance and development of a sales ratio system using SPSS (92-93).

*Employer's Mutual Casualty Company:* Review a state personal property appraisal system and provide litigation assistance (92-93).

*Adams County, CO:* Assistance the county at State Board hearings regarding compliance with ratio study standards (93).

*Kent County (Dover), DE:* CAMA system review and recommendations (AGJ, 93).

*City of Portsmouth, NH:* Evaluate proposals for a reappraisal and CAMA system (AGJ, 93).

*Teller County, CO:* Litigation assistance regarding the appraisal of gaming properties (92-93).

*Shelby County (Memphis), TN:* Develop market and income models for apartment & commercial properties; prepare value defense materials (92-93).

*Broward County, FL:* Litigation assistance (93).

*Jefferson County, CO:* Recommendations for an improved mass appraisal system (93).

*Massachusetts Dept. of Revenue:* Review the state=s CAMA system and provide and recommendations (AGJ, 93-94).

*Henry County, GA:* Expert witness in an assessment discrimination case with Bell South (93-94).

*Kentucky Revenue Cabinet:* Recommendations for redesign of equalization studies (AGJ, 94).

*Connecticut Office of Policy and Management:* Develop requirements for a statewide CAMA system (AGJ, 94).

*New Castle County (Wilmington), DE:* Mass appraisal system review and recommendations (AGJ, 94).

*Mesa County, CO:* Modeling training and assistance (94)

*Kansas Dept. of Revenue:* Develop appraiser certification exams (Thimgan & Associates, 94).

*Washington Attorney General's Office:* Expert witness regarding the level of personal property assessment in a discrimination case filed by airlines (94).

*Nebraska Dept. of Revenue:* Ratio study recommendations (AGJ, 94).

*Johnson County, Kansas:* Modeling assistance (94).

*Kentucky Revenue Cabinet:* Expert witness assistance in cable TV case (94).

*Oregon Dept. of Justice:* Expert witness in discrimination case filed by the airlines (94-95).

*City of Winnipeg:* Revaluation planning and assistance (AGJ, 94-95).  
*Las Animas County, CO:* Time trend analyses (95).

*Minnesota Department of Revenue:* Review the state=s ratio studies and provide recommendations (AGJ, 95).

*Douglas County, CO:* Time trend analysis and vacant land modeling (95).

*Kentucky Revenue Cabinet:* Review county assessment systems and property appraiser budgets (AGJ, 95).

*Johnson Co, KS:* Develop a bootstrap program for calculating confidence interval for the COD (95).

*Lancaster County, PA:* Review a reappraisal contracted for by the county for compliance with professional standards (AGJ, 95).

*Oregon Dept. Revenue:* Ratio study design and litigation assistance (94-96).

*New York State:* Expert witness assistance in a 4-R case (94-96).

*Greenwich, CT:* Review city=s assessment system & operations (AGJ, 95-96).

*Arizona Dept of Revenue:* Assist with a county audit and equalization procedures (95-96).

*Republic of Trinidad and Tobago:* Design of an ad valorem assessment and CAMA system (AGJ, 95-96).

*Mississippi State Tax Commission:* Ratio study assistance (96).

*Rhode Island Office of Municipal Affairs:* Review state=s property tax system and equalization methods and provide recommendations (AGJ, 96).

*Ontario Ministry of Finance:* Litigation assistance regarding time trends and assessment discrimination re waterfront properties (96).

*Saskatchewan Assessment Management Authority (SAMA):* Conduct reappraisal quality control studies (96).

Robert J. Gloudeans (July 01)

*Johnson County, KS:* Modeling training and assistance (96).

*Wyoming State Board of Equalization:* Sales ratio system review and recommendation (Thimgan & Associates, 1996).

*Navajo County, AZ:* Assistance in an assessment discrimination case (96).

*State of Tennessee:* Assistance with litigation involving equalization of personal property (96-97).

*Alberta Assessment Standards Branch:* Review of reappraisal preparedness of selected municipalities (AGJ, 97).

*New York Office of Real Property Services (ORPS):* Review and provide recommendations for improved equalization procedures (AGJ, 97).

*City of St. Albert, Alberta:* CAMA system review and recommendations (97).

*Hernando County, FL:* Provide expert witness assistance in an assessment equalization appeal (97).

*Ware County, GA:* Assist with sales ratio system design (97).

*Bermuda Ministry of Finance:* Review property tax system and make recommendations (AGJ, 97).

*Connecticut Office of Policy and Management:* Recommendations for value review and certification (AGJ, 97).

*Public Service Company of New Hampshire:* Assistance with assessment equalization issues (AGJ, 96-97).

*Ontario Ministry of Finance:* Assistance with standards, procedures, training, and modeling in a province-wide revaluation (96-97).

*Oklahoma Tax Commission:* Review of equalization procedures (AGJ, 97).

*Republic of Armenia (through ICMA):* Assistance in market analysis and ad-valorem tax implementation (96-97).

*Pierce County, WA:* Assistance in a tax discrimination case with Kaiser Aluminum (96-97).

*Alberta Dept of Municipal Affairs, Assessment Standards Branch:* Review

equalization processes and provide recommendations (AGJ, 97).

*Cook County, IL:* Assist in CAMA model design, sales ratios, evaluating responses to a CAMA RFP, and assessment policy/procedures (AGJ, 91-97).

*City of Winnipeg:* CAMA, modeling, and litigation assistance (97-98).

*Alberta Assessment Valuation Steering Committee:* Assist in development of a property assessment handbook (AGJ, 98).

*Cook County, IL:* Review and recommendations re State of Illinois commercial/industrial ratio studies (with Alan Dornfest, 98).

*Pima County, AZ Attorney=s Office:* assessment litigation assistance (98).

*Johnson County, KS:* Development of an SPSS feedback program (with Chris Devadason, 98).

*Lubbock Central Appraisal District, TX:* Review MRA models (98).

*Douglas County, CO:* CAMA design and modeling assistance (96-99).

*Vermont Division of Property Valuation:* Review equalization system and provide recommendations (AGJD, 1999).

*New York Office of Real Property Services (ORPS):* Recommendations for regional time trend analyses and equalization procedures (AGJD, 99).

*City of Two Rivers, WI:* Modeling assistance (99).

*Wyoming Department of Revenue:* Review and recommendations regarding computer-assisted appraisal systems (AGJD, 99).

*Alberta Department of Municipal Affairs, Assessment Standards Branch:* Assist in preparing assessment audit and equalization manuals (AGJD, 98-00).

*New Hampshire Coalition of Municipalities:* Conduct a sales screening audit; provide expert assistance with equalization issues (AGJD, 99B00).

*Idaho State Tax Commission.* Review of assessment operations (AGJD, 00).

*Florida Department. of Revenue:* On-going ratio study and equalization assistance (AGJD, 92 - present).

*Brevard County, FL:* Develop a long-range plan and provide on-going help with CAMA systems design and modeling (93-present).

*Jefferson County, CO:* CAMA system design, time trend, and modeling assistance (94-present).

*Kavoussi & Associates (Texas):* Ratio study assistance (95-present).

E. Jeannie Navarro, Attorney (Texas): Ratio study assistance (95-present).

*City of Calgary Assessment Department:* Revaluation planning; modeling training and assistance; assessor competency exams (AGJD, 96- present).

*City of Edmonton Assessment Department:* Revaluation planning, staff training, and modeling assistance (AGJD, 96-present).

*Arizona Dept. Revenue:* On-going assistance with mass appraisal system design, modeling, and assessment issues (97-present).

*Pima County, Arizona:* Mass appraisal systems design and modeling assistance (98Bpresent).

*Cook County, IL:* Assistance with CAMA systems enhancements, land valuation, commercial models, and related training (AGJD, 98Bpresent).

*Ontario Property Assessment Corporation (OPAC):* Training, revaluation, modeling and litigation assistance (AGJD, 98-present).

Vermont Division of Property Valuation: Litigation assistance (00-present).

New York Office of Real Property Services (ORPS): Assistance with equalization, time trend, and modeling issues (00-present).

Pierce County, WA: CAMA systems, design of commercial models, and staff training (01-present).

Arlington County, VA: litigation assistance (01-present)

Shawnee County, KS: modeling assistance (01-present)

**EXPERT  
TESTIMONY**

**Alberta, Arizona, Colorado, Connecticut, Florida, Georgia, Iowa, Kentucky, Manitoba, Nebraska, New Hampshire, New York, Oklahoma, Ontario, Oregon, Tennessee, Texas, Vermont, Virginia, Washington, West Virginia.**

- MEMBERSHIPS** International Association of Assessing Officers, American Running & Fitness Association, American Association of Individual Investors.
- NATIONAL COMMITTEES** IAAO Assessment Standards Committee (1981-90 and on-going assistance); IAAO Computer-Assisted Appraisal Committee (1988-90).
- AWARDS** IAAO's Distinguished Assistance Award for research/development (1980); Arizona Administrators Association's Professional Excellence Award (1982); IAAO's B. L. Barnard Award for the best article in the Property Tax Journal (1982); IAAO's Member of the Year Award (1983); Arizona Dept. of Revenue's Division Employee of the Year Award (1984); IAAO Presidential Citation for development of professional standards (1986); First Annual Distinguished Award in Applied Research sponsored by the National Tax Association and Wichita State University Public Utility and Transportation Taxation Committee (1989); David C. Lincoln Fellowship (Lincoln Institute of Land Policy, 99 and 00).
- TEACHING ACCREDITATION** Arizona Community Colleges: June 98 - May 2000.
- PUBLICATIONS** Use-Value Farmland Assessments: Theory, Practice, Impact. Chicago: IAAO, 1974.
- Regression Analysis Applied to Residential Property: A Study of Structural Relationships over Time.* Decision Sciences, April 1976 (with Dennis Miller).
- The Record of Assessment Performance in the United States.* International Property Assessment Administration, vol. 8. Chicago: IAAO, 1977.
- Nonparametric Statistics and the Measurement of Assessment Performance.* Analyzing Assessment Equity. Chicago: IAAO, 1977.
- Improving Real Property Assessment: A Reference Manual. Chicago: IAAO, 1978; principal author of chapters on Evaluating Existing Practices, Analyzing Sales Data, Measuring Assessment Performance, The Sales Comparison Approach, and The Income Approach.
- Multivariate Modeling of Assessment Performance.* Proceedings of the 1978 Western Regional Meeting of the American Institute of Decision Sciences.
- The Potential of Income Multipliers in the Mass Appraisal of Commercial and Industrial Properties.* Computer Assisted Mass Appraisal of Commercial and Industrial Properties. Cambridge, MA: Lincoln Institute of Land Policy, 1978.
- Confidence Intervals and Evaluation of Regression Based Appraisal Models.*

Journal of the American Real Estate and Urban Economics Association, (Spring, 1979).

*Evaluating Alternative Use-Value Farmland Assessment Laws. Appraisal of Farmland: Use-Value Assessment Laws and Property Taxation*. Washington, D.C.: American Society of Appraisers, 1979.

*Property Tax Limits Legislation: An Evaluation. Property Tax Journal*, vol. 14, no. 3 (Sep 1979) (with Richard R. Almy and Stuart W. Miller).

*Simplifying MRA-Based Appraisal Models: The Base Home Approach. Property Tax Journal*, vol. 16, no. 4 (Dec 1981).

*Sales Ratio Analysis for Equalization. Paper presented at the 50th Annual Meeting of the National Association of Tax Administrators, 1982 (with Harold Scott).*

*Simplified Sales-Based Models for Condominium and Townhouse Valuation. Paper presented at the First World Congress on Computer Assisted Valuation, sponsored by the Lincoln Institute, Cambridge, MA, Aug 1982.*

*The Base Home Approach to Explainability in Mass Appraisal. Paper presented at the Colloquium on Mathematical Methods in Computer Assisted Valuation, sponsored by the Lincoln Institute, Cambridge, MA, May 1983.*

*Impact of Creative Financing on Rental Residential Property. Property Tax Journal* (Dec 1985; with Alex Chizewsky and James Walcutt).

*Base Home Methodology. Introduction to Computer Assisted Valuation*. Cambridge, MA: Lincoln Institute of Land Policy, 1985.

*Standard on Application of the Three Approaches in Mass Appraisal. IAAO, 1983 (with the IAAO Assessment Standards Committee; principal author).*

*Standard on Mass Appraisal of Real Property. Chicago: IAAO, 1984 (with the IAAO Assessment Standard Committee; principal author).*

*Fundamentals of Ratio Studies. Student Reference Manual. Chicago: IAAO, 1986.*

*Standard on Contracting for Assessment Services. Chicago: IAAO, 1986 (with the IAAO Assessment Standards Committee; principal author).*

*Computer Assisted Appraisal Systems. Student Reference Manual for IAAO*

Course 303. Chicago: IAAO, 1986 (principal author).

*Adjustments for Financing in Commercial Property Valuation.* Property Tax Journal (Dec 1986; with Alex Chizewsky and Sherry Beck).

Standard on Urban Land Valuation. IAAO, 1987 (with the IAAO Standards Committee; principal author).

*Using General Purpose Software in Mass Appraisal: Do Your Own Thing.* Assessment Digest (July/Aug 88).

*A Statewide Ratio Study Using Microcomputers and Generic Software.* Paper presented at the Conference on New Developments in Hardware and Software Options For CAMA sponsored by the Lincoln Institute of Land Policy and IAAO, Boston, MA, 1987 (with Garth Thimgan).

*Using Generic Software for Mass Appraisal Performance Evaluation.* Paper presented at the Third World Congress on Computer Assisted Appraisal sponsored by the Lincoln Institute, Boston, MA, August 8-12, 1988

*A Feasibility Study of CAMA for Apartment and Commercial Property.* Property Tax Journal (March 89; with Cecilia M. Fruitman).

Standard on Computers, Equipment, Facilities, Supplies. Chicago: IAAO, 1989 (with the IAAO Assessment Standards Committee; principal author).

*Adjusting for Time in Mass Appraisal.* Property Tax Journal (March 90).

*Quantifying the Potential Accuracy of the Income Approach in Railroad and Utility Valuation.* Proceedings of the Annual Conference on Appraisal of Utilities and Railroads sponsored by Wichita State University and the National Tax Association, 1990.

Standard on Ratio Studies. Chicago: IAAO, 1990 (with the IAAO Assessment Standards Committee; principal author).

Property Appraisal and Assessment Administration. Chicago: IAAO, 1991. Senior technical editor and author of chapters on Land Valuation, Mass Appraisal, Mass Appraisal Model Building, Model Calibration, Computers in Mass Appraisal. Co-author of chapters on Data Collection and Management, The Cost Approach, The Income Approach, Sales Analysis and Mass Appraisal Performance Evaluation.

*The New IAAO Standard on Ratio Studies: Development, Changes, and Implications.* Assessment Digest (Jan/Feb 91; with Alan Dornfest).

*Modeling Commercial Property Under Various Economic Conditions.* Property Tax Journal (March 91).

*MRA and the Valuation of Public Service Companies.* Property Tax Journal (March 1991).

Assessments Practices: Self-Evaluation Guide. Chicago: IAAO, 1991 (with Richard Almy and Garth Thimgan).

Fundamentals of Ratio Studies: Instructor's Manual. Chicago: IAAO, 1992.

*The State of the Art in Computer Systems for Large Urban Assessment Jurisdictions.* Background paper prepared for the Cook County Assessor's Office (Almy, GlouDEMans & Jacobs, 1992).

*Survey of Personal Property Valuation Methods.* Paper presented at the Annual IAAO Conference on Assessment Administration, 1993.

*Time Trend Analysis in Mass Appraisal.* Paper presented at the IAAO Conference on Assessment Administration, 1993 (with James R. Thimgan).

*Minimum Sample Sizes for Assessment and Reappraisal: Comment.* Assessment Journal (March/April 1994).

*An Empirical Study of the Determinants of Assessment Performance.* Journal of Property Tax Assessment and Administration, vol. 1, no. 1 (1994).

*State-of-the-Art PC Sales Ratio System.* Annual IAAO Conference on Assessment Administration (1994).

*An Evaluation of the Minnesota Sales Ratio System.* Equal Eyes (Summer 1995).

*Effective Appraisal in Hot Real Estate Markets.* Presented at the 1995 Annual Conference of the Western States Association of Tax Administrators; also published in Assessment Journal (Nov/Dec 1995).

*The Valuation of Residential Property Using Regression Analysis.* Computer-Assisted Mass Appraisal: An International Review. Hampshire, England: Ashgate press, 1997 (with Richard Almy, Marjorie Cusack, and John Horbas).

Robert J. Gloude-mans (July 01)

*Apartment Valuation with Multiple Regression Analysis.* Proceedings of the 1998 IAAO Conference on Assessment Administration, 1998 (co-author).

*Modeling Vacant Land B Multiplicative MRA.* Proceedings of the 1999 IAAO Conference on Assessment Administration, 1999.

*Mass Appraisal of Real Property* (Chicago: IAAO, 1999).

*An Empirical Evaluation of Central Tendency Measures.* Assessment Journal (Jan/Feb 2000).

*Implementing a Land Value Tax in Urban Residential Communities.* Journal or Property Tax and Assessment Administration, vol. 5, no 4 (2000).

*Condominium Modeling Using Multiple Regression Analysis.* Assessment Journal, Jan/Feb 2001 (with Leonel St. Amand).

*Confidence Intervals for the COD: How, Pros, and Cons.* Proceedings of the 2001 IAAO Conference on Assessment Administration, 2001 (forthcoming).

*Key Issues in Urban Land Valuation.* Proceedings of the 2001 IAAO Conference on Assessment Administration, 2001. With Patricia Pidruchney, Mike Warwa, and Sheldon Handel (forthcoming).