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APB VALUATION ADVISORY 5: IDENTIFYING COMPARABLE PROPERTIES IN AUTOMATED VALUATION MODELS FOR MASS APPRAISAL

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APPRAISAL PRACTICES BOARD

APB Valuation Advisory #5

Identifying Comparable Properties In Automated Valuation Models for Mass Appraisal

This communication is for the purpose of issuing guidance on recognized valuation methods and techniques. Compliance with such guidance is voluntary, unless mandated through applicable law, regulation, or policy.

Date Issued: August 14, 2013

Application: Automated Valuation Models in Mass Appraisal

Issue: As part of its ongoing responsibilities, the APB is tasked with identifying where appraisers and appraisal users believe additional guidance is required. One such issue identified by the APB is identifying comparable properties. Comparability analysis is a fundamental study in determining property value. This analysis involves a side-by-side examination of physical and transaction characteristics of the identified comparable properties relative to the subject. The reliability of this valuation technique relies heavily on the proper selection of suitable comparable properties.

The APB discovered in developing guidance on Identifying Comparable Properties that separate guidance on *Identifying Comparable Properties in Automated Valuation Models for Mass Appraisal* was required.

This guidance discusses the terms and definitions associated with a comparable property, the characteristics generally considered for determining comparability; and the degree of suitability of a property as a comparable when using automated valuation and mass appraisal models.

Additionally, a general overview of mass appraisal's automated collateral comparable selection process is included.

The proposed guidance addresses the sales comparison method - direct market models using sales transactions. Model specification and model calibration are discussed. The guidance

provides sample model structures using the direct market method. Comparable sales selection is discussed in detail.

Lastly, the guidance examines appraisal uniformity based on the equity comparison method.

Subject Matter Experts: The Appraisal Practices Board and The Appraisal Foundation wish to express our sincere gratitude to each of the following Subject Matter Experts for volunteering their time and expertise in contributing to this document:

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Identifying Comparable Properties for Automated Valuations in Mass Appraisal Models

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NOTE: This Valuation Advisory includes examples that utilize proprietary software applications. Neither the Appraisal Practices Board nor The Appraisal Foundation endorses or recommends utilization of the particular software applications referenced in this document. They have been included to assist in the illustration of the applicability of such applications.

I. Introduction

The terms Mass Appraisal Models[1] and Automated Valuation Models (AVM)[2] involve the use of comparable properties in their market analysis methods. The term AVM is used in this guideline to represent both mass appraisal and automated valuation models keeping the focus on data requirements used in the development of valuation models. "The development of an AVM is an exercise in the application of appraisal principles and techniques, in which data are analyzed from a sample of properties to develop a value prediction model that can be applied to a similar population of properties that represent subject properties. These may be either individual properties of interest or all properties that meet the requirements of the model."[3]

The Sales Comparison Approach is applied using the AVM via several methods, the two discussed in this guideline are: 1) direct market models; and 2) comparable sales models. A third method used and of interest to appraisers doing ad valorem work is the equity comparable method. The direct market models and the comparable sales models begin with the validation of all transaction data to be used in developing the model. These sales include transactions deemed as arms-length, as they are the most credible. When specific market segments are influenced by "distress" sales (e.g., short sales and foreclosures) these transactions may be used in the model training set. A model training set in this guideline consists of data used to discover predictive relationship in the market place.

Income approach models require analyzing leases (rents and occupancy), expense ratios, and capitalization rates in completing the model specification phase. Validation of the comparable includes verification of the property characteristics for each transaction at the time of its consummation. Readers of this document may also want to review the "sister" document, *Identifying Comparable Properties*, as there is some overlap of definitions and concepts.

Users and readers of this guidance are encouraged to keep the methods and techniques described in context with their specific scope of work, see STANDARD 6, USPAP[4]. An AVM developed for use in collateral, or portfolio valuation will have a different scope of work than an AVM developed for ad valorem use. Awareness of administrative rules, case law, statutory requirements and client request are required.

II. Sales Comparison Method Direct Market Models using Sales Transactions

Primary for developing a direct market model are model specification[5] and model calibration[6]. Model specification involves indentifying all property characteristics to use in the model. These characteristics include features that represent location, physical, economic, and legal interest.

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[1] IAAO. 1997. Glossary for property appraisal and assessment. Chicago: IAAO.
[2] Ibid
[3] IAAO, 2003 Standard on Automated Valuation Models (AVMs) page 5, Chicago
[4] *UNIFORM STANDARDS OF PROFESSIONAL APPRAISAL PRACTICE* (USPAP) 2012-13 Edition page U49
[5] IAAO, 1997. Glossary for property appraisal and assessment. Chicago, IAAO.
[6] Ibid

Accurate property characteristics are important in model development as each sale is processed during calibration via a comparative analysis that relies on measuring price changes as the property characteristics change. The sales used for calibration of direct market models also are used in the comparable sales method, as the adjusted comparables.

Accurate property characteristics and sales validation provide the cornerstone for achieving credible results in the development of an AVM. The purpose of automated valuation models is to estimate a value for many properties by using an iterative process of data and analysis. The influence of market areas and neighborhoods are captured using proximity variables, be it the street level, neighborhood, or market area. Market influences from another city, state, or country, are addressed when specifying the model. When properly specified and calibrated, these variables will identify and account for the influence of physical location on value.

When an AVM is specified using only sales in a specific neighborhood, the model is only applicable to properties within the specific boundaries. If a subject property were located in a neighborhood different from where the comparables are located, the credibility of the AVM suffers due to the fact the AVM may not identify or measure any of the economic influences specific to the subject. The concept of using locational similarities is helpful in identifying all local effects in the marketplace that have influence on a given subject's property value. To draw a distinction, not all neighborhoods or market areas will provide a sufficient sample of transactions for each and every subject property. When the pool of market transactions is insufficient, identification and selection of comparable requires the use of additional physical property characteristics. When market transactions are insufficient in number to provide credible results, selecting transactions from a location outside of the subject's neighborhood, or market area is often required.

The table below provides a focus regarding example proximities that influence the value direction. These proximities variables when specified in the AVM are useful in selecting properties with similar market influences. Adjusting values when the influence is not present or not entirely similar may be required. Markets are dynamic thus any positive can become negative and vise-versa, Table 1 provides an illustration.

TABLE 1: Examples of Location and Proximity Characteristics with a Value Influence

	Sample Proximity Categories									
	Schools	Employment Centers	Shopping	Public Trans	Water Front	Golf Courses	Public Parks	Airports	Rail	Highway
Property Class										
Residential	+	+	+	+	+	+	+	-	-	-
Income Producing				+	+		+	+/-	+/-	+/-
Industrial				+	+			+	+	+

The previous discussion on the development of the AVM focused on specifying the model specifically for variations due to a subject property's proximity or location. Model specification includes the use of physical characteristics as well. The AVM must be capable of valuing a subject that is different in size, age, condition, style, exterior wall type, quality, and utility as

examples. When the AVM is to value vacant land, features such as lot size, frontage, depth, view, topography, ingress, egress, lot shape, lot location, (e.g., corner lot, interior lot) land use, zoning, etc. are characteristics to be considered. Each property characteristic specified in the AVM is calibrated using the known transaction prices as the dependent variable upon which all market adjustments are based for each of the specified property characteristics.

Property characteristics used in an AVM measure the economic influences, and how each contributes to the value of a subject property. User confidence in the credibility of AVM values will suffer when an important property attribute is either missing, incorrectly specified or calibrated during the modeling process. When working with property data it is important for appraisers to learn about data exploration techniques, to avoid problems with missing data, and models that have been mis-specified, resulting in irrational and unexplainable calibration of a variable. The number of subject properties to which the AVM is applicable is the "hit rate."[7] If a subject is outside of acceptable parameter ranges for location or property characteristics, the AVM will not possess sufficient comparability to value the subject property with a high degree of accuracy or credibility.

III. Sample Model Structures - Direct Market Method

Direct market models are expressed in one of three math structures: additive, multiplicative, or hybrid. The skill and experience level of the analyst and software availability are also factors involved with choice of the model structure. The additive model is the most common.

Additive models have the form:

$MV = B_0 + (B_1 X_1) + (B_2 X_2) + (B_{xx} X_{xx})\ldots$

- MV is the dependent variable (Sale Price, or Sale Price per Unit);
- B_0 - is a constant dollar amount;
- X_i - represents the independent variables (property characteristics) in the model: X_i represents X_1, X_2 etc. from above model notation, and
- B_i are corresponding adjustment rates or "coefficients" applied to X_i, B_i represents B_1, B_2 etc. from the above model notation

In the model above **MV** also known as the dependent variable and is either "sale price" or "sale price per unit." When modeling **income** the dependent variable is "income" or "income per unit."

In a *multiplicative* model, the contribution of the variables are multiplied rather than added:

$MV = R_0 * (X_1^{\wedge B1}) * (X_2^{\wedge B2}) * (X_{xx}^{\wedge Bxx})\ldots$

[7] IAAO, 2003 Standard on Automated Valuation Models (AVMs) page 28, Chicago

Multiplicative models consist of a base rate (R_0) and percentage adjustments. Base rates are expressed as dollars, or a percentage (e.g., vacancy rate, expense ratios, GIMs, OARs). The multiplicative model advantages include the ability to capture curvilinear and interactive relationships and to make adjustments proportionate to the value of the property appraised. Multiplicative models can be calibrated using linear regression software; doing so will require the variables to be converted to a logarithmic format for calibration. Non-linear regression can be used also and does not require the logarithmic transformation.

Hybrid models are a combination of additive and multiplicative models. Hybrid models allow specifications that separate value into buildings, land, and "other" components (e.g., outbuildings). The model format is:

$$MV = \pi GQ \times [(\pi BQ \times \Sigma BA) + (\pi LQ \times \Sigma LA) + \Sigma OA]$$

- MV is the estimated market value;
- πGQ is the product of general qualitative terms (e.g., location influences market conditions);
- πBQ is the product of building qualitative terms: (e.g., quality, condition, wall types, and styles);
- ΣBA is the sum of building additive terms; (e.g., total living area, total rooms, baths, FP's);
- πLQ is the product of land qualitative terms: (e.g., view, traffic, topography, egress);
- ΣLA is the sum of land additive terms: (e.g., lot frontage, lot area); and
- ΣOA is the sum of other additive terms: (e.g., pools, out buildings, accessory structures).

A full discussion on the topic of model structures is available in the IAAO Standard on AVMs.[8] Calibration of the models, developing coefficients, or rates of adjustment may be completed using applications like linear multiple regression analysis (MRA) and non-linear MRA.

Automated valuation models require data representative of the full range of transaction prices and associated property characteristics in a defined area. The sold properties used for market comparison, and unsold subjects to be valued must represent comparable segments of the market population. The AVM relies on market data from standardized property coding methods. Collectively all the validated sold properties represent the potential comparables for any known subject.

Model performance and validation is also an important step to having a direct model that will produce credible results. The IAAO Standard on Automated Valuation Models (AVMs) may be referenced for completing this step.[9]

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[8] Ibid pages 10-12
[9] Ibid page 24

IV. Sales Comparison Method – Comparable Sales Selection

As with single property appraisal, Automated Valuation Models (AVMs) rely on arms-length sales primarily to adjust a model to local real estate trends. In market areas where properties have a high degree of homogeneity, the AVM will produce value estimates with a high degree of precision. Areas where the market is heterogeneous the error term of the AVM is usually higher and not as precise. The sales comparison model is a familiar format to appraisers and expressed as follows:

$MV=SP_c + ADJ_c$, where:

- MV = Market Value;
- SP_c = Sale Price of the comparable; and
- ADJ_c = adjustment to the comparable ±.

As the integrity of the data used to calibrate an AVM decreases, the precision and accuracy of the value estimate is often deemed less credible. Using automation to select comparable properties that will produce credible and reliable value estimates is the challenge of the AVM. USPAP compliance is attainable using automated selection methods (see the discussion on data verification). The following will provide the steps leading to selecting the most comparable properties for a single subject.

Step (1) is **selecting the best comparables**. Numerous techniques are used in practice with the "exception, or sorting techniques" being most popular. The most efficient and objective technique is the use of a distance metric that assigns a dissimilarity index to each sale in the file. The more similar a comparable property is to the subject, the lower its metric value "dissimilarity index." Two indexes used frequently are the "Squared Euclidean distance metric"[10] and the "Minkowski metric" (differences are not squared). These distance metrics rely on a selection model or algorithm specified by the appraiser to find the most comparable property (e.g., sales, rents, expenses) used for comparison to a subject.

The Euclidean distance metric is expressed as:[11]

$$\sum_{i}^{k}[W_j(X_{sj} - X_{ij})/\sigma_j]^2$$

Where:

- Σ = the summation of all the weighted squared attribute difference;
- W_j = a weight assigned by the user to the *j*-th attribute;

[10] IAAO Glossary for Property Appraisal and Assessment, IAAO.org
[11] *Fundamental of Mass Appraisal*, IAAO, 2011 p 144

- S_{sj} = the value of the *j*-th attribute for the subject;
- X_{ij} = the value the j-th attribute of the comparable property;
- σ_j = the standard deviation of the *j*-th attribute for the comparables;
- ^{2} = squaring creates an absolute scale of difference; and
- K = the number of attributes over which comparability is defined.

Assigning weights to the selection characteristics is the most difficult aspect of using a dissimilarity index. The higher the weight the greater the importance assigned to the characteristic. As the weight on a characteristic is increased, the algorithm will allow less of a difference in that characteristic.[12]

Tables 2 and 3 on the following page provide an example demonstrating how the metric calculation works:

[12]Ibid144

Table 2: Example of Euclidean Distance Metric -- Comparable No 1								
Attribute	**Subject**	**Comparable #1**	Difference	Standard Deviation	Standardized difference	Appraiser-assigned weight	Weighted difference	Squared weight difference
Living Area	1800	1660	140	225.7	.6203	2	1.2406	1.5391
Age	10	4	6	4.1	1.4634	1	1.4634	2.1416
Quality	3.5	5	-1.5	0.9	-1.6667	1	-1.6667	2.7778
The sum of the standardized, weighted squared differences is 6.4585based on the three selection attributes chosen								6.4585

Table 3: Example of Euclidean Distance Metric -- Comparable No 2								
Attribute	**Subject**	**Comparable #2**	Difference	Stand Deviation	Standardized difference	Appraiser-assigned weight	Weighted difference	Squared weight difference
Living Area	1800	1700	100	225.7	.4431	2	.8861	.7852
Age	10	4	6	4.1	1.4634	1	1.4634	2.1416
Quality	3.5	5	-1.5	0.9	-1.6667	1	-1.6667	2.7778
The sum of the standardized, weighted squared differences is 5.7046 based on the three selection attributes chosen.								5.7046

Comparable No. 2 is closer in size to the subject and has a metric score of 5.7046, lower than the score of 6.4585 for Comparable No. 1. Each sale would require the same number of adjustments but the total adjustment for Comparable No. 2 would be less than for Comparable No. 1.

Minkowski metric differs from the Euclidian, in that absolute differences are used rather than squared differences making a smaller metric scale[13].

Division by the standard deviation also provides the algorithm the ability to standardize the magnitude in data differences that are measured or recorded in different scales, similar to the use of Z-scores.

Once a distance metric is calculated for all potential comparables, the properties are sorted based on their metric. The comparables most similar to the subject are those with the lowest metric value.

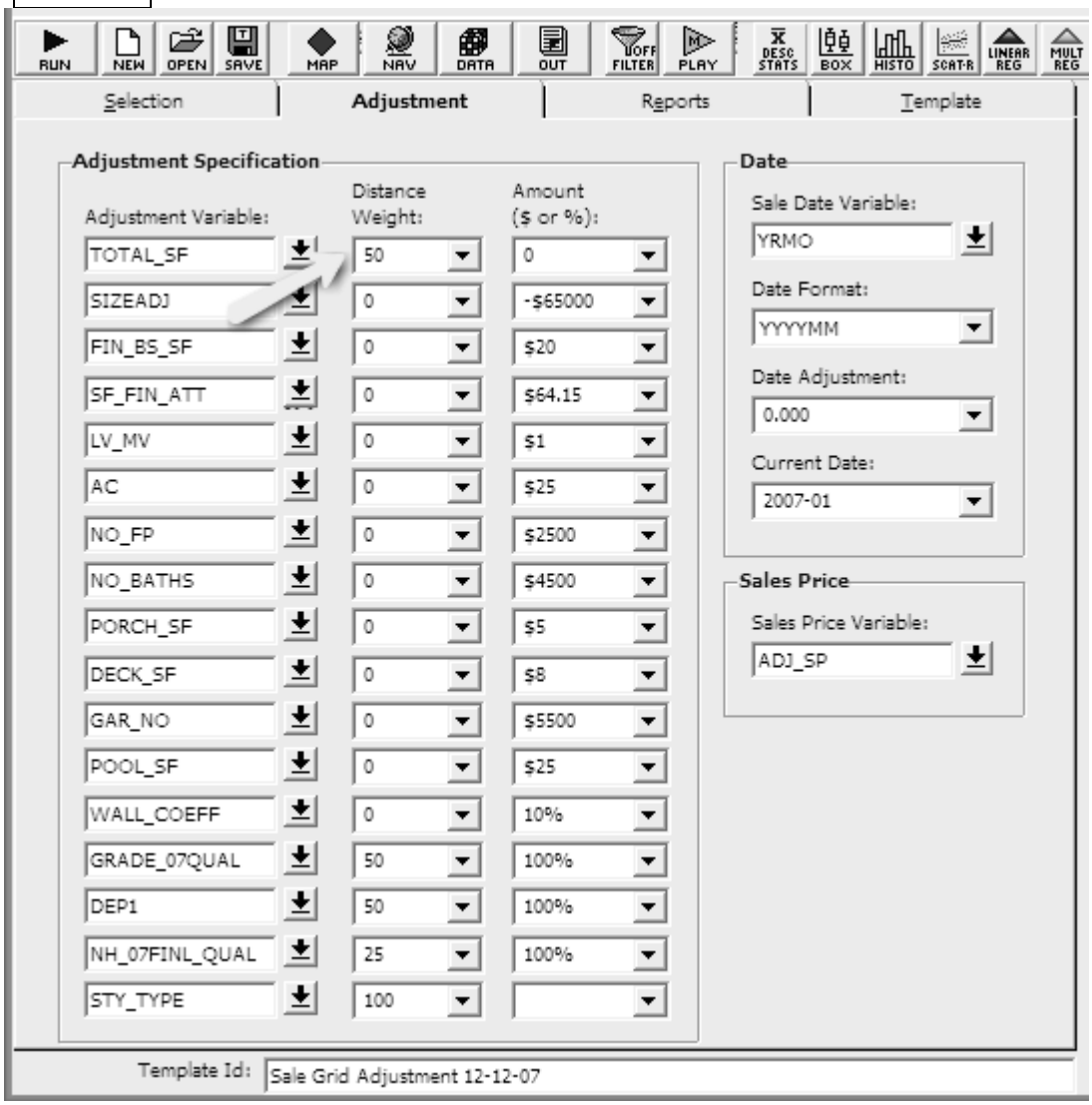
The higher the weight on an attribute the more important that property attribute is in the selecting similar properties. Initially weights are assigned to those property attributes identified as the most influential in explaining why prices change from property to property. Indicators helpful with weighting include; regression coefficients (weights), beta coefficient, correlation coefficients, and T-statistics. Assigning weights forces the algorithm to select comparables whose attributes are most similar to the subjects. The appraisers, skill, knowledge, and experience also play a role in knowing how much weight to assign an attribute. Selecting comparables without disclosing the attribute(s) that are most important has been the practice primarily used by appraisers. Using a dissimilarity index exposes the importance of specific attributes in contrast to attributes considered less important having lower weights or no weight assigned.

[13] Ibid145

Comparable Sales Selection Method

Table 4: Provides a Distance Metric, Weighting Example, from the NCSS Statistical Software[14]

Table 4



The characteristics (variables) Total Square Feet (Total_SF), Quality (GRADE_07Qual), Depreciation (Dep1), Neighborhood, or Location (NH_07FINL_QUAL), and Style, or Story Type (STY_TYPE) are weighted in the selection process. The sales selected for the adjustments have attributes closest in these defined categories collectively and are placed on the adjustment grid. Defining the metric selection model is a skill in attribute importance, and magnitude of the data. Using a distance metric selection will improve the appraiser's impartiality from personal judgment with an objective method.

[14]Hintze, J. (2012). NCSS 8. NCSS, LLC. Kaysville, Utah, USA. www.ncss.com. Comparable – Sales Price

Table 5 below, indicates five (5) property characteristics that are used in the selection process. Story Type receives the most weight, while Quality, Condition and Location were each given equal weights. The following Table 6 provides a look at the metric scale that is automatically calculated using the formula provided.

Table 5: Example of Characteristics used in comparable selection				
Variables	**Weight**	**Mean**	**Standard Deviation**	**COV**
TOTAL_SF	10	1847.1	760.0	41
Grade_07Qual	25	1.1	0.2	17
Dep1	25	0.8	0.1	14
NH_07FINL_Qual	25	1.0	0.1	9
STY_TYPE	200	6.5	4.5	69

Of the 18917 properties on the database, 1 was a subject property and 16988 were excluded by the selection variable(s), leaving 1928 comparables for consideration.

Distance Report for Subject = 14-25-103-031

Table 6: PARCEL_ID	**Distance Metric**
14-25-103-031	Subject
14-25-103-022 – **Comp 1**	**0.00187**
15-31-176-024 – **Comp 2**	**0.01199**
14-25-103-037 – **Comp 3**	**0.01741**
14-25-102-011 – **Comp 4**	**0.02305**
14-25-103-011	0.02519
15-30-155-001	0.02913
15-30-152-013	0.03246
15-31-128-009	0.03501
15-31-128-007	0.03550
20-13-276-007	0.03842

The NCSS software allows the user to display the metric report for (n) comparables, in this example. Of the ten (10), the top four move to the grid for adjustment.[15]

Step (2) – **adjustment methods for the selected sales.** Ideally, adjustments to the selected comparable are based on market parameters derived from a direct market model calibration process used in the AVM development. Using and adjusting comparables from the sales file provides a level of detail and precision pertaining to the subject that exceeds what is available by using only the direct market model values. Since the coefficients (adjustment rates) are derived from the transactions and have been tested using various statistical methods within the modeling process, the appraiser is presented another level of independence, impartiality, and objectivity.

[15] Ibid

In the prior example of the automated comparables, the third column holds the rate of adjustment for the specific property attribute. The rates of adjustment are the same coefficients used in the direct market model and were derived from a non-linear calibration method shown in Table 7. If a direct market model does not exist, other "market intuitive" adjustments are substituted. In an article on the use of automated comparables method, the author addressed the matter of adjustments noting, "It appears that appraisers prefer to say that an adjustment is their opinion confirmed by market research rather than to be responsible for explaining the research itself."[16] Appraisers have stated that the adjustments on the market grid in the sales comparison approach are market derived without further explanation. Automating the comparable selection process does nothing to defuse that claim. Comparables selection must be emphasized over the adjustment process; the importance of finding comparables that are as similar as possible to the subject greatly reduces the need for making many (sometimes controversial) adjustments to the sales prices.

Table 7 provides an explanation of the property attribute's on the grid, and the adjustment process.

Table 7

Adjustment Variables	Adjustment Value	Adjustment Explained
YRMO	-0.003	% Market Change Rate based on study of resale's
TOTAL_SF	$0	**See SIZEADJ**
SIZEADJ	$-65000	Base rate per total sq.ft. using size curve
FIN_BS_SF	$20	Finished basement sq.ft. rate
SF_FIN_ATT	$64	Finished attic sq.ft. rate
LV_MV	$1	Land value established; adjust comparable to equal value.
AC	$2500	Lump Sum Adjustment-Air Conditioning
NO_FP	$2500	Lump Sum Adjustment-Fire Place
BATH_COEFF	$4500	Lump Sum-per 3 fixture bath
PORCH_SF	$5	Square foot rate for porch
DECK_SF	$8	Square foot rate for deck
Gar_NO	$5500	Lump Sum Adjustment-per garage stall
POOL_SF	$25	Base rate for pool square feet
WALL_COEFF	75%	Percentage adjustment for difference in Exterior Wall Type
Grade_07Qual	$50000	Percentage adjustment for difference in quality, a 5% difference is a $2,500 adjustment
Dep1	50%	Percentage adjustment for difference in condition
NH_07FINL_Qual	10%	Percentage adjustment for difference in location
STY_TYPE	$0	Style or Story type forced to be identical in selection or nearly identical, no adjustment.

[16] Commercial/Industrial Property and Sales Comparison Approach, IAAO 1986

The SIZEADJ is used to capture the economy of scale built into the model instead of actual square footage. The adjustment for size is non-linear and transformed on the grid to make the correct adjustment in an additive fashion, and in the proper direction.

Step (3) – **Opinion of value from the selected sales after adjustment:** "It is important that the appraiser consider the strengths and weaknesses of each value indication derived, examining the reliability and appropriateness of the market data compiled and the analytical techniques applied."[17] Appraisers are provided little guidance to help them with what the **"most comparable property"** actually means. Words like "reliability" and "appropriateness" are subjective terms and add nothing to the appraiser's independence, impartiality, or objectivity.

As AVMs become more universal, the idea of using statistical measures to evaluate comparability will be an acceptable alternative to the previous manual and subjective method. When comparable selection is based on distance metrics of each attribute compared to the subject, user - assigned weights provide added influence actual differences. In turn, the weighting of an attribute implies greater importance on specific attributes. The first comparable on the adjustment grid is typically the most comparable property available. The remaining comparables are scaled based on similarity to the subject and overall comparability. A comparability index may be assigned giving the appraiser an objective measure for each sale on the grid prior to adjustment. The single point estimate can then be based on:

- Closest – the comparable property that is closest in proximity to the subject property.
- Min |$| Change - a comparable property that had the smallest absolute dollar value change. This property received the smallest dollar adjustment amount.
- Simple Average - adjusted prices of the M comparables that have the smallest distance. User chooses M as number of comparables in average.
- Weighted Average. - Use the weighted average of the adjusted prices of the M comparables that have the smallest distance to the subject property. The weights are proportional to the distance from the comparable property to the subject property.

These choices are programmed into the reporting function chosen by the appraiser in the final analysis. The use of closest, and Min|$| Change tend to put weight on a single adjusted value, while the simple average and weighted average base the value conclusion on more than a single property as instructed by the appraiser.

Disclosure - It is possible to use a spreadsheet in order to customize the comparable selection and display. The guideline presents a comparable selection application already deployed that can also be fully customized to the user's needs. Many vendors of appraisal reporting software also include various selection methods. The APB does not endorse any specific software; the NCSS used here is simply available to all as are other off-the-shelf applications.

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[17] *The Appraisal of Real Estate*, 13th ed, p 428

See Table 8: Automated Comparables Report, on the following page for a full example of the output from an automated comparables program:[18]

[18] Generated using, NCSS 2007 Ver.07.1.18 Comparable – Sales Price, released June 29, 2009, J. Hintze

Table 8: Automated Comparables Reports

Page/Date/Database	1 4/24/12 /AVMCOMPS_V3
Filter	FLAG=1,2,3;YRMO=>200901;land_use=1;sale_use=3

Comparative Sales Price Adjustment Report for Subject = 14-25-103-031

	Subject	Comparable No. 1		Comparable No2		Comparable No 3		Comparable No 4	
PARCEL ID	14-25-103-031	14-25-103-022		15-31-176-024		14-25-103-037		14-25-102-011	
	Value	Value	$Adj	Value	$Adj	Value	$Adj	Value	$Adj
ADDRESS	2501 KARA CROSSING	30 HODGEHAVEN CIR		38 CONWAY CR		2513 KARA CROSSING		7 HODGEHAVEN CIR	
Neighborhood #	65	65		79		65		65	
SF CRAWL	0	0		0		0		0	
SF SLAB		-						-	
Story Type	2 Story	2 Story		2 Story		2 Story		2 Story	
Wall Type	Brick Front	Brick Front		Alum/Vinyl		Brick Front		Alum/Vinyl	
Quality Name	B+5	B+5		B+5		B+5		B+5	
Year Built	1998	1997		2001		1997		1996	
Lot square feet	17,919	10,583		10,557		10,767		10,920	
Year month sale	199804	200901		201003		201103		201104	
Direct Model Val	$ 296,951	$ 295,114		$ 296,989		$ 286,463		$ 270,118	
Comparability		100%		100%		99%		99%	
Sale Price / Market Conditions Adj.		**$260,000**	($18,720)	**$290,000**	($8,700)	**$267,500**	$1,605	**$227,500**	$2,048
Total Sf	2,954	2,796	$0	2,853	$0	2,424	$0	2,357	$0
SIZEADJ	0.8273	0.8402	$837	0.8354	$528	0.8746	$3,073	0.8815	$3,522
Fin. Basmt	0	610	($12,200)	1040	($20,800)	1030	($20,600)	1113	($22,260)
Fin. Attic	0	0	$0	0	$0	0	$0	0	$0
Land Value	$ 64,929	$ 50,799	$14,130	$ 53,121	$11,808	$ 51,321	$13,608	$ 51,759	$13,170
% AC	1	1	$0	1	$0	1	$0	1	$0
Fire Place	1	3	($5,000)	2	($2,500)	1	$0	1	$0
# Baths	2.5	3.5	($4,500)	2.5	$0	3.5	($4,500)	2.5	$0
Porch SF	195	0	$975	129	$330	0	$975	142	$265
DECK SF	0	0	$0	0	$0	0	$0	196	($1,568)
Garage SF	3	3	$0	3	$0	3	$0	3	$0
Pool SF	0	0	$0	0	$0	0	$0	0	$0
Wall Adj	1.057	1.057	$0	1	$11,571	1.057	$0	1	$9,519
Quality Adj	1.2824	1.2824	$0	1.2824	$0	1.2824	$0	1.2824	$0
Cond - % Good	0.9275	0.92	$883	0.95	($3,175)	0.92	$981	0.9125	$1,741
NH - Loc Adj	0.9667	0.9667	$0	0.9945	($776)	0.9667	$0	0.9667	$0
Story Type /Style	10	10	$0	10	$0	10	$0	10	$0
Net $Adj.			($23,595)		($11,714)		($4,858)		$6,438
Sum $Adj.			**$38,525**		**$51,488**		**$43,737**		**$52,046**

Adj Sales Price	**$ 252,817**		$236,405		$278,286		$262,642		$233,938

Table 8, Automated Comparables Report, provides the appraiser information supplemental to the adjustment about each sale. These supplemental attribute items are listed above the "**Sale Price/Market Conditions Adj**" on the grid. This display is optional and not all comparables applications provide this option.

Special conditions required of the appraiser by the scope of work can limit the available comparable pool within a specific location. The span of time by transaction date can reduce the pool of available comparables to be considered if, for example, transactions six months old or less are prescribed as part of the valuation problem. All sales in the example report are within one mile of the subject property, identical in style, and similar in size, age and condition. The transaction data is limited to within 36 months of the appraisal date; however, sales are adjusted for appropriate changes in market conditions, also known as a time-of-sale adjustment.

An automated comparable sales selection method saves time and improves consistency in adjustments and results. The automated selection method provides a sophisticated methodology, with the simplicity of explanation that is common with single property comparison methods. Appraisers in the private sector have been entering comparable data into forms software since the mid-1980's. The recent addition of the Uniform Appraisal Dataset (UAD) provides a method of standardizing comparable data for selection, thus improving results. The UAD will assist the appraiser in developing the AVM and adding value to their product by including an objective, impartial technique for selecting comparables. The automated comparables selection method saves time and builds efficiency into the appraisal process while providing accuracy and credibility not available in the manual comparables comparison approach.

V. Appraisal Uniformity - Equity Comparison Method

A required component in ad valorem mass appraisal is demonstrating the appraisal uniformity or equitable treatment of identical or similar properties during the valuation process. Many court cases and laws support the notion of equal treatment when developing value opinions for the purpose of ad valorem taxation. The court case carrying significant weight is **Allegheny-Pittsburgh Coal Co. v. County Comm'n, 488 U.S. 336 (1989) Allegheny Pittsburgh Coal Co. v. County Commission of Webster County, West Virginia.** In part, the United States Supreme Court ruled; "constitution and laws provide that all property of the kind held by petitioners shall be taxed uniformly according to its estimated market value."[19] Most states require equality of assessment as part of the mass appraisal process. Practitioners should also check for specific jurisdictional laws and/or rules governing uniformity and equal treatment.

A comparison method available that will reveal uniformity of values and equitable treatment is the previously described comparable sales method, with the caveat that the *appraised value* of the selected comparables is substituted for variable sale price on the comparison grid. All the adjustments are market-derived coefficients used to value all the property in the class. If the

[19] http://supreme.justia.com/cases/federal/us/488/336/

mass appraisal is a cost approach model the cost coefficients are used as the rates of adjustment on the grid. This method provides users with an instant view of how the subject property is valued in comparison to other properties and how the adjustment rates affect the value. Relying on uniformity of appraised value as the measure of comparability increases the pool of comparables as no sale is required for this method, the chance of selecting identical or near identical properties is greater than with comparable sales selection. The number of adjustments and their amounts is usually minimized by use of decidedly similar property characteristics.

Appraisal uniformity checks are also helpful as a model performance tool to ensure the accuracy of the data, and the model deployment methods produce consistent values on identical property characteristics. In the text, *Mass Appraisal of Real Property*[20] the idea of using a basehome model is presented as another method for supporting the AVM and explaining the concept of appraisal uniformity for the market area or class of properties subject to AVM application.

VI. Definitions

Additive Model
A model in which the dependent variable is estimated by multiplying each independent variable by its coefficient and adding each product to a constant. *Glossary for Property Appraisal and Assessment, p 3*

Assessment Equity
The degree to which assessments bears a consistent relationship to market value. *Glossary for Property Appraisal and Assessment, p 11*

Automated Valuation Model
An automated valuation model (AVM) is a mathematically based computer software program that produces an estimate of market value based on market analysis of location, market conditions, and real estate characteristics from information that was previously and separately collected. The distinguishing feature of an AVM is that it is a market appraisal produced through mathematical modeling. Credibility of an AVM is dependent on the data used and the skills of the modeler producing the AVM. *Standard on Automated Valuation Models (AVMs) IAAO 2003, p 5*

Computer Assisted Mass Appraisal (CAMA)
A system of appraising property, usually only certain types of real property, that incorporates computer-supported statistical analyses such as multiple regression analysis and adaptive estimation procedure to assist the appraiser in estimating value. *Glossary for Property Appraisal and Assessment, p 28*

Direct Market Method/Analysis

[20] IAAO 314 W 10th St. Kansas City MO 1999 p207, R.Gloudemans, R.Almy,

In the direct market method, the market analyst specifies and calibrates a single model used to estimate market value directly using multiple regression analysis or another statistical algorithm.

Euclidean Distance Metric
A measure of distance between two points "as the crow flies." In property valuation, it is used to find the nearest neighbor or similar property based on an index of dissimilarity between property location and attributes. When using multivariate selection, the squared difference is divided by the standard deviation of the variable so as to normalize the differences. (Also see Minkowski Metric.) *Glossary for Property Appraisal and Assessment, p 52*

Hybrid Model
A model that incorporates both additive and multiplicative components. See also additive model and multiplicative model. *Glossary for Property Appraisal and Assessment, p 67*

Mass Appraisal
The process of valuing a group of properties as of a given date, using standard methods, employing common data, and allowing for statistical testing. *Glossary for Property Appraisal and Assessment, p 85*

Mass Appraisal/AVM Model
A mathematical expression of how supply and demand factors interact in a market. *Glossary for Property Appraisal and Assessment, p 85*

Minkowski Metric
A way of measuring distance. In mass appraisal model building it is the sum of absolute differences in each dimension. *Glossary for Property Appraisal and Assessment, p 87*

Model Calibration
Calibration: The process of estimating the coefficients in a mass appraisal/AVM model. *Glossary for Property Appraisal and Assessment, p 19.* **Model Calibration:** The development of adjustments, or coefficients based on market analysis that identifies specific factors with an actual effect on market value. *Glossary for Property Appraisal and Assessment, p 88*

Model Specification
The formal development of a model in a statement or equation, based on data analysis and appraisal theory**.** *Glossary for Property Appraisal and Assessment, p 88*

Multiplicative Model
A mathematical model in which the coefficients of independent variables serve as powers (exponents) to which the independent variables are raised or in which independent variables themselves serve as exponents; the results are then multiplied to estimate the value of the dependent variable. *Glossary for Property Appraisal and Assessment, p 89.*

Population

All the items of interest, for example, all the properties in a **jurisdiction** or **neighborhood**; all the observations in a data set from which a **sample** may be drawn. *Glossary for Property Appraisal and Assessment, p 104*

Regression Coefficient

The coefficient calculated by the regression algorithm for the data supplied that, when multiplied by the value of the variable with which it is associated, will predict (for simple regression) or help to predict (for multiple regression) the value of the dependent variable. For example, in the equation, Value = $10,000 + $5,000 x number of rooms, $5,000 is a regression coefficient. *Glossary for Property Appraisal and Assessment, p 118*

Representative Sample
A sample of observations from a larger population of observations, such that statistics calculated from the sample can be expected to represent the characteristics of the population being studied. *Glossary for Property Appraisal and Assessment, p 120*

VII. Suggested Further Reading

International Association of Assessing Officers, *Glossary for Property Appraisal and Assessment.*

International Association of Assessing Officers, *Standard on Mass Appraisal of Real Property, April 2013.*

International Association of Assessing Officers, *Standard on Automated Valuation Models (AVM's),* September 2003.

Thimgan, G. E., *Property Assessment Valuation,* 3rd ed. (Kansas City, MO: International Association of Assessing Officers, 2010).

Gloudemans, Robert J., *Mass Appraisal of Real Property*, (Kansas City, MO: International Association of Assessing Officers, 1999).

Gloudemans, Robert J. and Richard Almy, *Fundamentals of Mass Appraisal*, (Kansas City, MO: International Association of Assessing Officers, 2011).

NCSS Statistical Software – Data Analysis & Graphics at www.NCSS.com.

IBM SPSS Statistical Software at www.IBM.com.

XLSTAT Statistical Analysis for Microsoft EXCEL at www.Analyse-it.com.