Exit Report

Review of Base-Year 2006 MRA Models

and

Recommendations for Future Efforts

Prepared for

Saskatchewan Assessment Management Agency

by

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1. Background and Executive Summary

Although SAMA had previously used MRA in the development of agricultural land models, the recently completed 2006 base-year revaluation was the first to employ the technique to determine residential property values. The method was used in the valuation of houses in the following nine municipalities: Estevan, Humbolt, Kindersly, Martensville, Melfort, Melvin, Warman, Weyburn, and Yorkton. Three additional house models and a condominium model were developed for Moose Jaw.

SAMA retained the author to provide guidance on the modeling process, review models, and provide recommendations on performance standards and the role of MRA in future models. To this end, the author worked with staff on the development of modeling methodologies, helped construct initial models, and reviewed models as they were developed. He visited SAMA's offices three times to provide on-site training and mentoring and to discuss performance standards and related issues. This report provides a summary of the modeling process and results and provides recommendations for future models and performance standards.

The use of MRA in the base-year 2006 was a success, reducing data requirements and improving valuation accuracy. It is strongly recommended that SAMA continue the use of MRA in future revaluations and test its application in additional communities. As a general rule of thumb and with the caveat that heterogeneous communities require more sales than homogeneous ones, approximately 300 usable sales over a multi-year time frame can be adequate to support the development of a reliable model. In addition, SAMA should test application of MRA to selected clusters of small municipalities. When combined into a single model, individual towns, villages, and hamlet can constitute location variables in the model, analogous to neighborhoods in larger municipalities. Of course, SAMA should keep abreast of the current state of the art and continue to ensure that the modeling function is adequately staffed and supported.

Since the most important determinant of valuation performance (regardless of whether MRA is employed) is data quality, it is imperative that SAMA continue to ensure the quality of both sales and property characteristics data. Sales must be properly screened to determine whether they represent arm's-length, open-market transfers and construction quality, physical condition, effective age, and other key variables must be reviewed to ensure that they reflect the condition of the property at time of sale.

Aside from the Moose Jaw models, the 2006 base-year models were "hybrid" models that represent a traditional cost structure in format and provide for the inclusion of both additive and multiplicative components. While such models require extra care in development, they maximize flexibility and are more explainable to non-modelers than alternative model formats. It is recommended that SAMA continue using hybrid models in future revaluations for one-family homes, including testing its application in Moose Jaw. The 2006 models also made good use of "global" models that greatly expanded sample size, helping to determine value contributions for attributes with few sales in individual municipalities. SAMA should continue to develop global models and, based on results and related discussions, develop modeling guidelines that addresses which valuation rates or factors should be developed from individual models and which should be based, at least in part, on results from global models. Holdout sales, which helped establish the accuracy of MRA for Saskatchewan municipalities, served its purpose and is not required in future efforts. Instead, all available sales can be used in model development, thus increasing model accuracy and reducing the time required to develop and test models.

Sales used in the 2006 base-year models were adjusted to the June 30, 2006 valuation date based on a comparison of sales prices over time. While this worked well for the time frame of sales used in the models (2002 – 2006), future models could benefit from the introduction of more advanced time-trend techniques, namely "sales ratio trend analysis" and inclusion of time variables directly in initial MRA models. Future revaluations could also benefit from expanded GIS applications, particularly the plotting of sales prices and assessment ratios on thematic maps.

SAMA's current performance standards call for a median assessment ratio of 0.98 to 1.02 for residential and commercial sales used in the revaluation. While this provides solid support for market value assessments and current regulations already state that "adjusted" prices should be used, SAMA guidelines should make clear that appraisers must track time trends and adjust sales prices for any significant trends to the assessment date. Given strong, often changing trends already seen since the June 30, 2006 base date, time trends will undoubtedly be a key component of the next revaluation

In addition to the requirement of an overall median ratio of 0.98 to 1.02, SAMA must ensure that residential and commercial properties are *each* appraised at market value. This could be achieved by adopting IAAO standards in this regard, which require that the median ratio for each property type be within 5% of the overall median and, if not, that an appropriate test be conducted to check whether observed differences are statistically significant. The provision for statistical testing guards falsely concluding that the standards has not been met when discrepancies of more than 5% can be attributable to small sample sizes and sampling error. As well, SAMA should work toward developing standards for assessment uniformity as measured by the COD. The research conducted on CODs attained in the current revaluation and reported in section 5.5 provides a strong start on this regard. Of course, any COD standards must recognize differences in appraisal difficulty among different types of municipalities and, again, an appropriate statistical test can be conducted to determine whether there are adequate sales to conclude that standards or guidelines have not been achieved.

2. MRA Overview and Role in 2006 Base-Year Revaluation

2.1 Overview of MRA

Multiple regression analysis (MRA) is a widely used statistical method for estimating a dependent variable based on multiple independent variables. In mass appraisal, sale price serves as the dependent variable and independent variables include property attributes such as house size, neighbourhood, construction quality, and effective age. Once the model is constructed from sold properties, it can be applied to estimate values for unsold properties. Various statistics provide feedback on the ability of the model to predict known sales prices and the degree of confidence one can have in the rates and adjustments developed by the model. MRA models can take one of three forms: additive, multiplicative, and hybrid.

Additive models. Additive models are the most common and easiest to develop. They have the form:

$$SP = B0 + B1*X1 + B2*X2 + B3*X3 \ldots$$

where SP represents sale price, X1, X2, etc. represent variables for property characteristics, and B1, B2, etc. represent corresponding "coefficients" (rates and adjustments). B0 represents the model "constant", which is a lump sum amount. Notice that the contribution of each variable and its coefficient are added to the constant to obtain a total estimated property value decomposable into the contribution of each variable in the model. As in all MRA models, the coefficients represent the rates and adjustments that best estimate values for the sample of sold properties.

Multiplicative models. Multiplicative models take the form:

$$SP = B0 * X1^{B1} * X2^{B2} * B3^{X3} \ldots$$

In this case the various parts of the model are multiplied together. In a typical case, X1 represents size, B1 is an exponent that dampens the contribution of additional units and thus produces a size curve, and $X2^{B2}$, $B3^{X3}$, etc. represent. multipliers for various location and quality attributes, such as neighbourhood and housing style. Notice that variables and their corresponding coefficients are interchangeable in that, at the modeler's discretion, either can serve as the exponent. If a variable is used as an exponent, the model will determine its appropriate multiplier (e.g., 1.25 for lakefront location or 0.92 for location on a busy street). If variables are expressed as multipliers (e.g., land to building ratio), the model will calibrate an exponent that either contracts or expands the specified multiplier.

Multiplicative models have several advantages over additive model. One of the most important is that they can calibrate curves and thus implicitly incorporate economies of scale. A second is that they develop multipliers or percentage adjustments that better accommodate lower and higher value properties. On the other hand, calibration of multiplicative models requires logarithms and is thus more complex than calibration of additive models. In addition, property components such as land, main living area, and secondary areas that are intuitively additive must be re-expressed as multipliers (e.g., land to building ratio or ratio of basement area to main living area). Multiplicative models are especially popular for vacant land, since there is only one size variable and economy-of-scale issues are of paramount importance.

Hybrid models. Technically known as "nonlinear" models, hybrid models can represent any combination of additive and multiplicative components. In effect, the model builder has complete freedom in model specification and logarithms are *not* required. The modeler specifies the equation and, through an iterative process, MRA determines the optimal coefficients or adjustments for each variable. While hybrid models have obvious advantages, they require more care in specification and calibration and lack some of the statistical diagnostics and options available with other model types.

MRA has been used in mass appraisal since the early 1970s but gained much broader use with the proliferation of PCs and user-friendly statistical software. The main requirements for success are good data, competent modelers, and a CAMA system capable of supporting its use. With these in place, the technique is usually able to produce more accurate estimates because of its superior ability to capture the market-indicated contribution of each attribute included in the analysis. Of course, as with any mass appraisal technique, appraisers must review estimated values and make required adjustments for unique situations and features when few sales are available.

2.2 MRA in Saskatchewan

Like most assessment jurisdictions in North America, Saskatchewan historically relied on the cost approach is the appraisal of residential properties. The City of Regina began using MRA for the 2002 base year revaluation. The city developed six single-family residential models based on market areas and several condominium models based on property type (high rise, low rise, town houses, and converted warehouses). Saskatoon and Moose Jaw also developed 2002 base-year models. Moose Jaw developed four single-family models and a single model for condominiums.

Although residential models were not implemented until the 2006 base-year revaluation, SAMA built familiarity with the technique through various training venues, including UBC and IAAO courses and on-site third party training using Saskatchewan data. The agency used MRA to help develop agricultural land models in several prior revaluations and also conducted a number of residential pilot studies. A key feature in selection of the current Govern CAMA system is its flexibility in accommodating a wide variety of MRA model specifications.

After the successful completion of several pilot studies, SAMA made the decision to use MRA for a number of communities for the 2006 base-year revaluation. The agency hired a modeler, obtained modeling software, applied test models in Govern, and retained a consultant to provide external guidance and review. The modeling software is SPSS (Statistical Package for the Social Science), which provides both a traditional menu-driven

Windows interface and the ability to build, save, and run "syntax" files (pseudo English-like program files).

2.3 Modeling Approach

Modeling begins with downloading data from the Govern SQL data base. To help achieve adequate samples, a five-year time span of 2002-2006 sales was chosen. Initial pilot models were additive in format. While these models produced encouraging results, they tended to produce relatively high constants relative to average sales prices, which resulted in mild regressivity (over-appraisal of lower value properties and under-appraisal of higher value properties). This and the desire for a more flexible modeling format let to experimentation with hybrid models.

Communities selected as candidates for MRA were split into two groups: (l) larger cities and bedroom communities and (2) more rural, lower-value communities that lie generally northeast of Regina and Saskatoon. A "global" hybrid model was developed for each of the two groups (a global additive model had previously been developed for the combined communities). In addition, comparative additive and hybrid models were developed for the cities of Yorkton and Warma. In each case, the NLR model produced a better COD. Based on these results, as well as the ability of Govern to accommodate either, it was decided to use hybrid models in the revaluation.

Both global and market area models followed a structured approach, which can be summarized in the following steps.

- Descriptive statistics and initial filters. Basic descriptive statistics and graphs were run and filters set to remove unqualified sales and properties that did not meet criteria for inclusion in models. These statistics and graphs provided a profile of data distributions and the relationship between potential variables and price. A base lot size was also identified.

- Time trend analysis. Sale months were sequentially numbered (Jan 2002 = 1, Feb 2002 = 2, etc.) and prices plotted against time. Time trends were based on a regression of sales prices against time and all sales were adjusted at the indicated rate to June 30, 2006.

- Exploratory models. With sales prices adjusted for time, a series of exploratory models was specified and calibrated, the goal being to maximize model performance while making good appraisal sense. Anomalies or extreme prices were sometimes removed during this process. A key transformation was the combination of old and new quality classes (e.g., A and AO), which allowed the model to determine the separate effects of quality and effective age on price.

- Linearizations and constraints. Based on exploratory models, construction grades, building styles, and condition ratings were assigned numeric weights to ensure they would follow a reasonable progression and accommodate categories with no or few sales. Other, seldom-occurring variables were constrained to reasonable amounts based at least in part on results observed in the global models.

- Outliers. Based on an analysis of sales ratios and model residuals (difference between actual and predicted prices), the most extreme outliers (in all cases less than 2% of sales) were removed. The objective was to remove atypical prices that could compromise model coefficients.

- Holdout group. For model testing purposes, sales were randomly split between a model development group and smaller holdout group (approximately 20% of sales were assigned to the holdout group and 80% to the model group). The model was rerun on the model group and the coefficients applied against both the model and holdout groups. Sales ratios were checked for both groups.

- Final model. A final model was developed and a series of sales ratio tests and analyses conducted to ensure equity among various property groups. If problems were identified, the model was recalibrated to address the concerns.

Although calibrated from the market, the models resemble a traditional cost structure. In high-level equation format, the structure is as follows.

Value = NBHD * LOCATION * [BaseLandRate * BaseLotSize * LandSizeAdj

+ (((BaseRate * LivingArea * BldgSizeAdj + BsmtRates *BsmtAreas) * StyleAdjs

+ OtherAreaRates * OtherAreas) * QualAdj * CondAdj + OtherAdj) * PctGood]

where:

NBHD = model-calibrated neighbourhood factors
LOCATION = location factors (e.g., roads, traffic, utilities)
Other Areas = garages, carports, porches, patios, sheds, and fireplaces
Other Adjustments = heating, cooling, extra plumbing fixtures, swimming pools and hot tubs
PctGood = percent good based on effective age

Verbally, there is a land and building component. The land component consists of a base rate and size adjustment. The building component incorporates main living area, basements, patios, porches, garages, and several other secondary features. These are added together and adjusted for construction quality and condition. Main living area also receives a style adjustment. Other adjustments (e.g., extra plumbing fixtures) are added and the entire building component is adjusted for percent good and added to the land component. Finally, multipliers are applied for neighbourhood and location features such as roads and utilities. Notice the absence of a constant in the models.

3. 2006 Base-Year Models

3.1 Global Models

As mentioned, communities were assigned to one of two global models.

- Rural global model: Humbolt, Yorkton, Melfort, Melvin
- Urban global model: Estevan, Kindersly, Martensville, Warman, Weyburn

Although the initial purpose of the global models was to test and gain familiarity with hybrid models, a second important purpose was to determine benchmark rates and adjustments for features with few sales in individual communities. Knowledge gained from global models helped to linearize various features and to establish adjustments for secondary features with no or limited sales, such as swimming pools and hot tubs, in individual municipalities.

3.2 One-Family Models

A valuation model was developed for each of the nine municipalities listed above. Appendix 1 shows the final coefficients (as of March 3, 2008) for each model broken down by model component: land, living area/basements, building style, secondary areas, construction quality, condition, add items, and effective age (neighbourhood factors have been omitted). The location adjustments, like neighbourhood factors, apply to both land and buildings. Building style, quality, and condition were linearized based on exploratory and global models and an exponent developed to compress or expand the multipliers as indicated by the final model.

Appendix 2 contains performance results for the nine models. The first part shows MRA performance measures, including adjusted R-square, which is the percentage of variation in sales prices about the mean price explained by the model. R-square measures range from the mid .80s to the low .90s. The second half of the appendix shows key sales ratio measures based on a comparison of model-predicted values with time-adjusted sales prices. Median ratios all fall between 0.98 and 1.02 and 95% confidence limits for the median all bracket 1.00. Coefficients of dispersion (CODs) vary considerably depending on community characteristics, with better CODs found in municipalities with a newer, more homogeneous housing stock. The best CODs are 7.9 in Martensville and 8.2 in Warman, which have the lowest effective age of the nine communities. The two worst CODs are 16.6 in Melfort and 21.9 in Melville, which has both the oldest effective age and easily the lowest average sale price of the nine communities.

3.3 Moose Jaw Models

A global model, three one-family models, and a condominium model were developed for Moose Jaw. These models, developed after those for the other municipalities, were additive models (additive models were also developed for the 2002 base year). Again, median ratios were all between 0.98 and 1.02. The three one-family models produced CODs of 9.8 (average age = 23), 15.3 (average age = 40), and 20.9 (average age = 93). The condo model, based on 95 sales, produced a COD of 8.8.

4. Recommendations for Future Models

This section presents recommendation for future models. It is divided into two sections: general recommendations and technical recommendations.

4.1 General Recommendations

- Continue use of MRA. The project was a success in terms of improving performance results. Looking forward, MRA also has the substantial advantage that it requires less property characteristics details, since it is rooted directly in sales and can be viewed as a market-based method of allocating predicted values among significant value contributors.

- Consider adding additional municipalities with adequate sales. Given results achieved, SAMA should consider development of MRA models for other municipalities that have adequate sales. Experience shows that at least 300 usable sales are required to support a reliable model for one-family homes in a community. As with the current models, five years of sales can be used to enlarge sample sizes. Similar communities can be combined if necessary.

- Consider testing MRA for selected clusters of smaller municipalities. Individual towns, villages, or hamlet can constitute variables in such model, analogous to neighborhoods for larger municipalities. Ontario follows this approach in rural areas and SAMA staff could contact the Municipal Property Assessment Corporation (MPAC) of Ontario for more information about their approach and experiences.

- Adequately staff the modeling function. In addition to a lead modeler, SAMA should train additional staff in modeling so that it is not entirely dependent on one person. Unfortunately, a four-year revaluation cycle is not conducive to retention of modeling expertise. Nevertheless, pilot programs and new applications can be explored in the interim, while other projects requiring statistical expertise are periodically present themselves. An external consultant can sometimes provide helpful guidance in deciding modeling methods and techniques and in reviewing individual models for statistical integrity and acceptability of results.

- Keep abreast of state-of-the-art. SAMA staff should keep their skills current and stay abreast of new techniques and technologies by participating in IAAO and other training opportunities. The annual IAAO/URISA CAMA and GIS Conference is a particularly valuable opportunity in this regard.

- Continue to emphasize data quality. This applies to both sales and property characteristics data. As mentioned, the primary determinant of model success is the accuracy and consistency of data used in model development. Low-value sales were a particular issue in at least one model. Staff should be vigilant to ensure that these sales represent arm's-length, open market transfers and, if so, that construction quality, physical condition, effective age, and other key variable reflect the condition of the property at time of sale.

4.2 Technical Recommendations

- Preserve model format. The choice of a nonlinear model structure was made after comparative testing and explanability considerations. The structure provides for both additive terms and multipliers and offers maximum flexibility in model specification. As well, the structure is explainable in that it resembles a traditional cost model format. SAMA should be able to use the chosen structure again for the 2010 base year revaluation with no or minimal changes.

- NLR models for Moose Jaw. For 2010 Moose Jaw's one-family models should be converted to the same format used for the other municipalities. This can be expected to have the same benefits observed for the other municipalities: slight performance improvement and better explanability, including suppression of the model constant. However, additive (or multiplicative) models can be used for condominiums.

- Time adjustments. Time adjustments in the current models were based on a regression of sales prices on months (coded 1-60). There are several opportunities for improvement. First, time adjustments should be based on the sales ratio trend method or, optimally, by including time variables directly in MRA models. In addition, time trends may be far more complex than the simple linear trends that characterized 2002-2006 sales. It is recommended that sale-assessment ratios (SARs) be plotted against time to help identify trends and break points, that a preliminary time trends be developed from a regression of SARs on time, and that final adjustment be based on time variables included in preliminary MRA models. NLR models lend themselves well to this approach in that time adjustments can be specified as factors that give direct percentage adjustments with the need for logarithms as in the current approach.

- Modeling guidelines. During development of the 2006 base year models, various modeling decisions (e.g., what to do about pools and hot tubs and styles or quality classes with no or few sales) were often documented in modeling notes and correspondence. It is recommended that global models again be developed for the 2010 base year and that, based on the results and related discussions, SAMA develop a document on modeling guidelines covering many of these same issues, as well as new ones that arise. The document would address which valuation rates or factors should be developed from individual models and which should be based, at least in part, on results from the global models, as well as the allowable range of coefficients for such variables (e.g., fireplaces must be between $1,000 and $5,000, or whatever).

- Holdout group. While the use of a holdout group was helpful in proving the reliability of the current models, now that the approach has been well tested and the results documented, it is no longer necessary to specify a holdout group in future models of the same type. Using all sales for model development will save work and maximize model accuracy. If a new approach is tested or models are extended to other property types, then use of a holdout group would again be good practice.

- GIS applications. Although the press of time did not allow it, future revaluations would benefit from expanded GIS applications, particularly the plotting of sales prices and assessment ratios on thematic maps. Govern's GovView would appear to facilitate such analyses.

5. Performance Standards

5.1 Rationale of Standards

Assessment agencies need to establish performance standards so that both internal and external stakeholders know what is expected and can take appropriate actions if standards are not achieved. Assessment performance standards should cover required level of assessment and uniformity measures. The standards should ensure that each major property group is assessed at the required level and with acceptable uniformity.

In addition to ensuring acceptable measures of level and equity, performance standards provide for a sound, equitable, and transparent revenue base and provide ratepayers with an objective means of evaluating the accuracy and fairness of assessments. If ratepayers are convinced that other properties in their class are accurately and equitably assessed, they will be more willing to pay their fair share and less likely to file challenges or complaints. Thus, assessment standards are an important component of an effective assessment system. Administrators should set standards that meaningful and practical. In particular, uniformity standards should recognize differences in the complexity and difficulty of appraisal among different types of communities.

5.2 Professional Standards and Practice

The International Association of Assessing Officers' *Standard on Ratio Studies* (last updated in 2007) provides for standards in three specific areas[1]:

[1] See *Standard on Ratio Studies* (IAAO, 2007), Table 2-3, "Ratio Study Uniformity Standards Indicating Acceptable General Quality", page 33.

- Assessment level. The overall level of assessment for each major property type (most notably residential, commercial, and vacant land) as measured by the median ratio should be within 10 percent of the legal requirement. For Saskatchewan and other jurisdictions with a 100 legal standard, this implies a level of assessment of 0.90 to 1.10.

- Assessment uniformity. CODs for residential improved properties should be no more than 10.0 to 20.0 depending on housing stock. The standard of 10 applies to the largest jurisdictions with a newer or relatively homogeneous housing stock. The standard of 15 applies to large and mid-sized jurisdictions with a mixed housing stock. The standard of 20 generally applies to rural areas or smaller municipalities with older houses or thin, depressed markets. All of SAMA's client municipalities likely fall under the 15 or 20 requirement. Standards for commercial properties and residential vacant land range from 15.0 to 25.0. Standard for non-residential vacant land range from 20.0 to 30.0, again depending on the composition of the property base.

- Vertical equity. "Vertical" equity relates to uniformity in assessment levels between low and high value properties. Vertical equity can be measured by the price-related differential (PRD) which, according to IAAO standards, should fall between 0.98 and 1.03. PRDs above 1.03 tend to indicate "assessment regressivity" (the relative under-appraisal of higher value properties) and values under 0.98 indicate "assessment progressivity" (the relative over-appraisal of higher value properties).

An important issue in evaluating compliance with assessment standards is whether failure to achieve a standard is symptomatic of an underlying problem for all properties in the class or whether it can simply be attributed to small sample size and sampling error. IAAO recommends that an appropriate statistical test or analysis be conducted for this purpose with a 95% confidence threshold considered appropriate in most cases. If the test is not statistically significant at the required confidence level, then the oversight agency cannot conclude that the standard has not been met.

5.3 General Practice in North America

Although most state and provincial assessment agencies have defined assessment performance requirements, most are more tolerant than IAAO standards[2]. This is probably appropriate in that failure to comply often results in the oversight agency ordering adjustments to values or possibly revaluation. Still, a number of agencies (including Alberta, British Columbia, Colorado, Iowa, Ontario, Texas, and Saskatchewan) have set tighter standards for assessment level than the 0.90 to 1.10 window in the IAAO Standard.

While the IAAO Standard emphasizes that COD standards should vary depending on the composition of properties, most states and provinces have adopted a single COD standard per

[2] For a comprehensive survey of ratio study practices, including some tabulations relevant to performance standards, see Alan S. Dornfest and Douglas C. Thompson, "State and Provincial Ratio Study Practices: 2003 Survey Results", *Journal of Property Tax and Assessment Administration* (IAAO), volume1 1, issue 1, 2004.

property class. Exceptions include Arizona, Arkansas, Colorado, Ontario, and New York. Others, including many Canadian provinces, have adopted "IAAO standards" into their statutes, rules, or regulations.

Many states and provinces have adopted the practice of statistical testing before concluding that standards have not been met. Such testing, however, is more straightforward for assessment level than for uniformity and rarely applied to the COD (exceptions are Arizona, Arkansas, and Kansas).3

5.4 SAMA Standards

SAMA's current regulations call for an overall level of assessment as measured by the median assessment-to-sales ratio of 0.98 to 1.02. The ratio must be achieved for improved residential and commercial sales used in the revaluation of a municipality. Assessed values that reflect the characteristics of each property when sold are to be compared against "adjusted" sales prices for the same properties. Although not explicit, adjusted sales prices would include any required adjustments for date of sale, financing, or the inclusion of chattels or intangibles in sales prices.

Although the 0.98 to 1.02 standard is as strict as any in North America in terms of requiring assessments to be centered on market value, it says nothing about uniformity among or within property classes. Section 5.6 below makes recommendations for helping to ensure reasonable uniformity among individual properties in a municipality, so that all pay only their fair share of property taxes.

5.5 Study of CODs Achieved in 2009 Revaluation

This section analyzes residential CODs achieved in the base-year 2006 revaluation in an attempt to identify what community characteristics tend to be associated with relatively good or poor performance. Quantifying the relationship between these features and typical CODs is the first step in determining realistic COD goals for future revaluations. Conclusions drawn from the research are incorporated into performance recommendations discussed in section 5.6. (Readers not interested in the COD study can skip directly to section 5.6).

5.5.1 Background

SAMA developed market-adjusted cost values for improved residential properties not included in MRA models. To obtain adequate sales for valuation analysis, many of the smallest communities were combined into the same market stratification code (Mkt_Strat_Code) and analyzed together: some on a regional basis and others on a provincial basis. The table below shows the different "cluster type" codes assigned to each Mkt_Strat_Code included in the present analysis.

[3] SAMA conducted statistical confidence tests for CODs in municipalities for which MRA models were developed.

Cluster Code	
41	Larger agricultural community
42	Mid-sized agricultural community
43	Small agricultural community
44	Very small agricultural community
61	Bedroom community with strong urban influence
62	Bedroom community with moderate urban influence
63	Bedroom community with weak urban influence
64	Bedroom community with weakest urban influence
71	Large resort community
73	Small resort community
91	Large rural community
92	Mid-sized rural community
93	Small rural community
94	Very small rural community

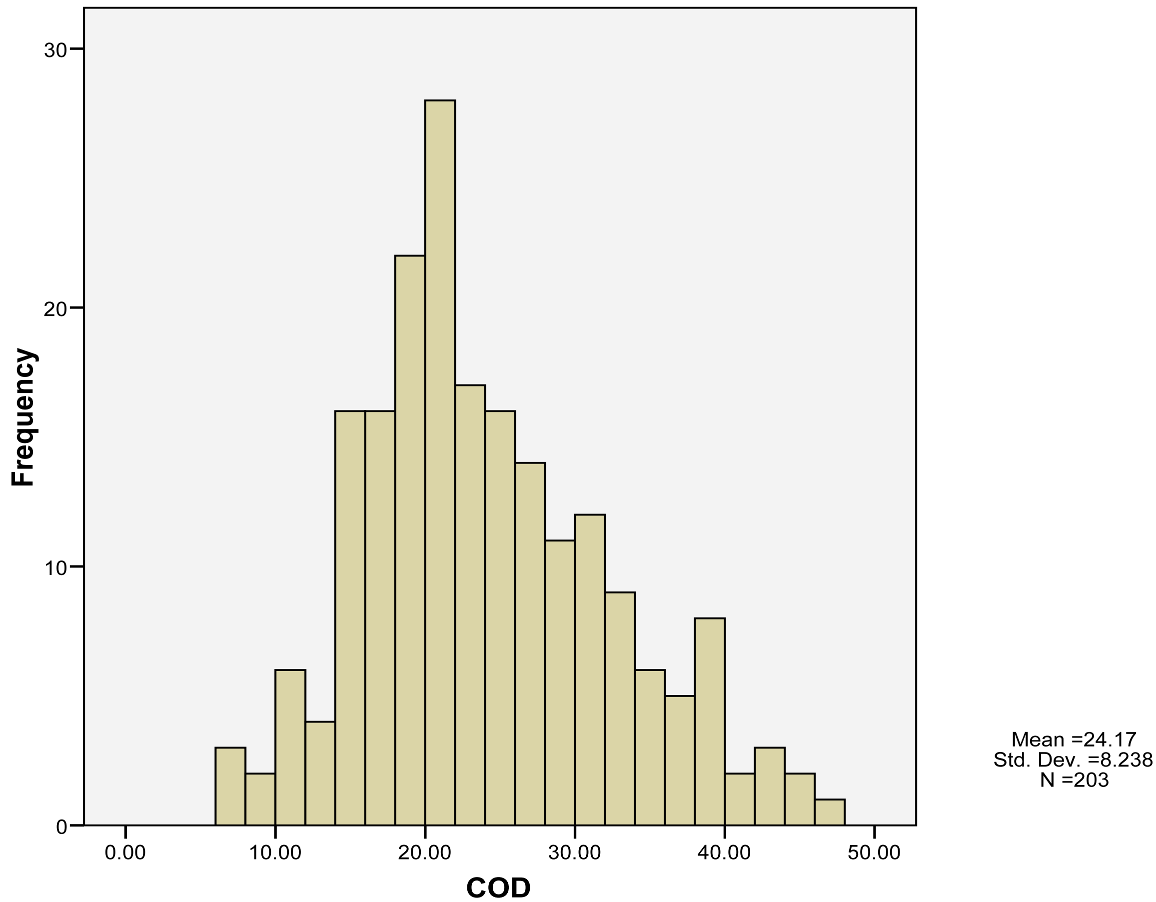
Clusters 91-94 represent acreage parcels in rural municipalities. Cluster code 91communities are located near or surround large urban communities and have an active market in which urban land values exceed agricultural values. Cluster code 94 communities have a limited market and very low land values.

At the completion of preliminary values for these communities SAMA produced a sales file that contained 9,903 qualified sales from 207 Mkt_Strat_Codes. The file was edited to remove duplicate sales, pre-2002 sales, and the following atypical cases:

Living area < 360 square feet
Missing year built
Functional obsolescence > 35%
Percent complete < 25%
Time-adjusted sale price < $4,000
Assessment ratio < .25 or > 4.00

One of the 207 strata, PROV22PXXC, contained 634 sales from the smallest rural communities (cluster codes 93 and 94) across all seven regions of the Province. This Mkt_Strat_Code was partitioned by cluster code and region, yielding eleven sub-strata (cluster code 93 communities fell in four regions and cluster code 94 municipalities fell in all seven), which served to increase the number of strata available for analysis from 207 to 217. After eliminating 14 of these strata because they had less than five usable sales or exhibited extreme sales ratio statistics (e.g., CODs of less than 5 or greater than 50), 203 strata were available for analysis. Exhibit 1 below shows a histogram of CODs for these 203 strata. Note that the average COD is 24.17 and that the range is from approximately 5.0 to almost 50.0.

Exhibit 1. Distribution of CODs

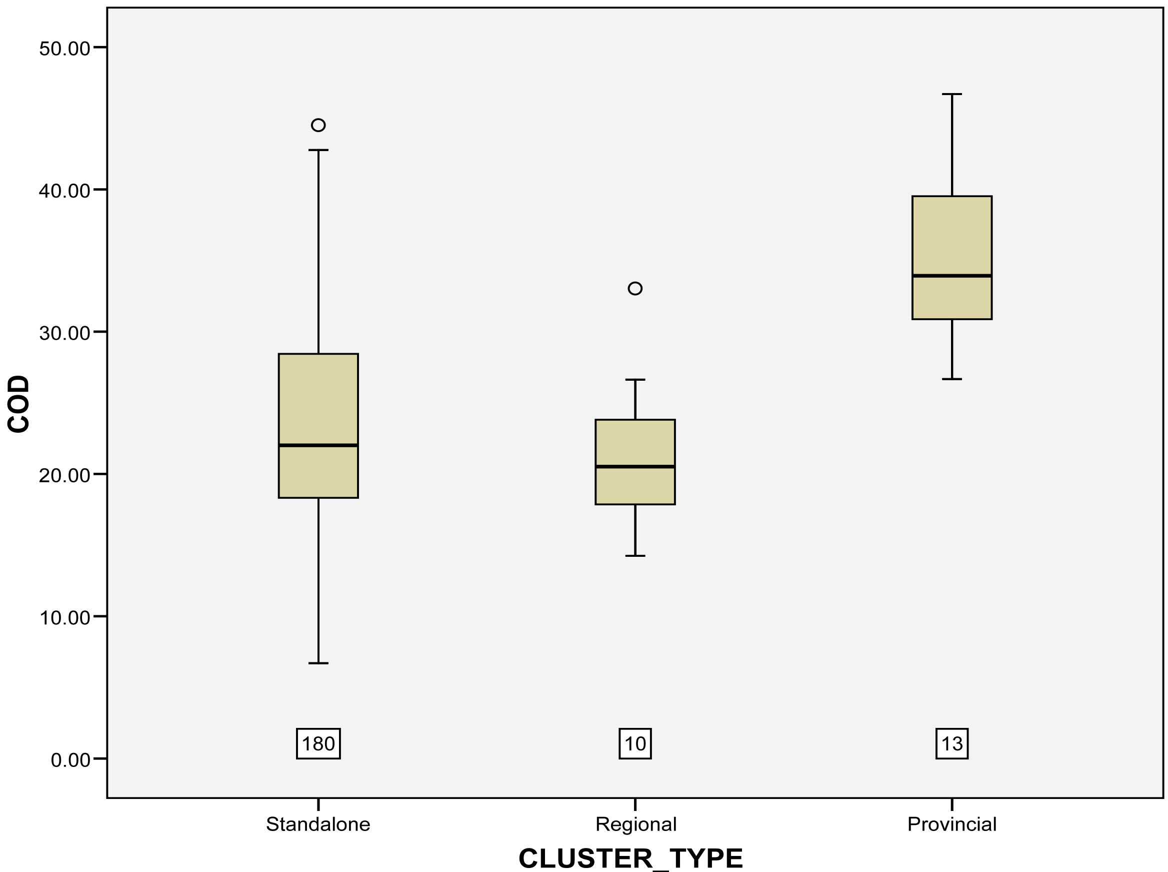


5.5.2 Explanatory Variables

An analysis was conducted to evaluate what characteristics were associated with relatively good or poor CODs. The following variables were considered:

- Level of analysis: standalone, regional, or provincial. The large majority of strata were standalone. Because there were adequate sales to conduct a local analysis, one would expect better CODs in these communities and worse CODs in analyses conducted at the provincial level. Exhibit 2 below strongly confirms this expectation (the numbers at the bottom of the chart are the number of cases in each category).

Exhibit 2. Box Plot of COD with Cluster Level

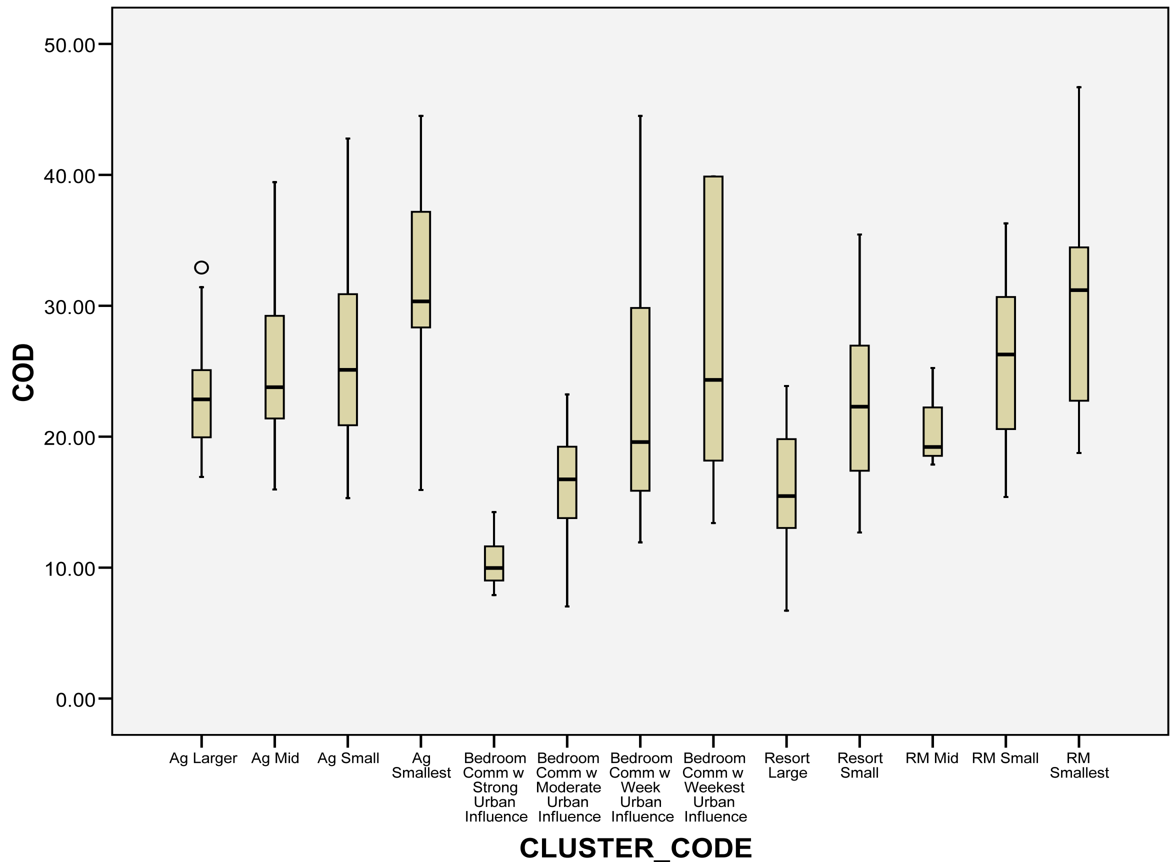


- Cluster type. One would expect bedroom communities to have lower CODs than agricultural and rural communities. In addition, CODs likely increase with decreasing levels of market activity, e.g., bedroom communities with a strong urban influence may well have better CODs than those with little urban influence. Exhibit 3 consistently confirms these expectations.

- Percent of agricultural or mixed use sales. Approximately 9% of sales were assigned a use code of agricultural or mixed use at time of sale. These properties may exhibit more market variation and be harder to value than residential (or resort) sales.

- Average age. Properties with older improvements are generally more difficult to value than newer improvements with less depreciation and obsolescence. This is confirmed by a moderately strong correlation of .349 between average age and COD.

Exhibit 3. Box Plot of COD with Cluster Type



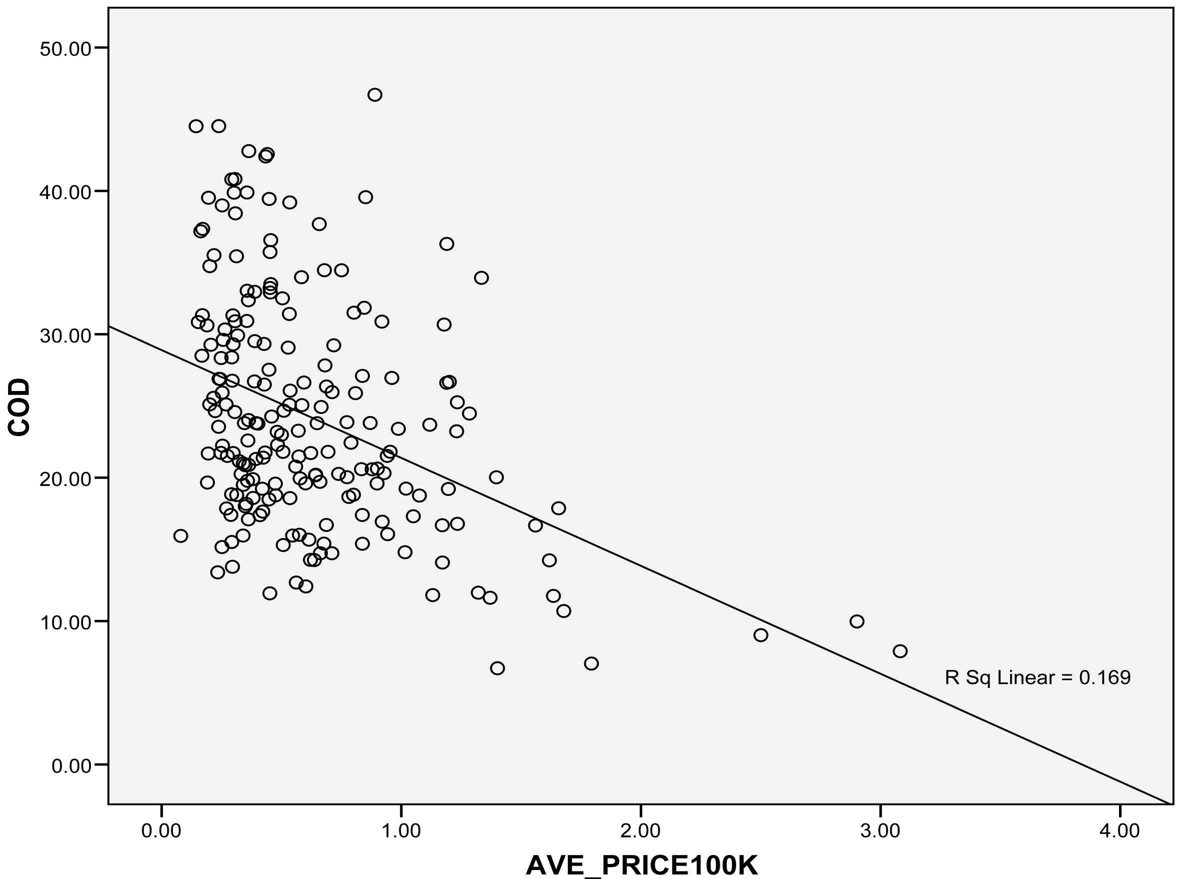
- Percent of properties in below average condition. While this variable might be expected to be significant for the same reason as average age, less than 1% of sales were coded as being in poor or below average condition.

- Prevalence of low quality improvements. A variable was constructed to measure the prevalence of low quality classes: the lower the class, the higher the variable (E=1, D=.50, C/D = .25, else=0).

- Standard deviation of quality class. It might be hypothesized that a high variance in quality classes (with alpha grades converted to numeric equivalents) may also cause appraisal difficulties and be associated with higher CODs. However, the correlation coefficient of this variable with COD was zero and the variable was omitted from further analysis.

- Average time-adjusted sale price. Lower priced properties are associated with relatively more price volatility and are harder to appraise than mid-range or even upper end properties. Exhibit 4 shows the strong correlation between average price (divided by $100,000) and COD.

Exhibit 4. Graph of COD with Average Price



- Variation in prices. The COV of time-adjusted sales prices (standard deviation divided by mean) exhibits an equally strong relationship with COD. In this case, the higher the COV of prices, the higher the COD. Thus, greater heterogeneity, as reflected in greater price variation, appears to present greater appraisal difficulties.

- Land-to-total value ratio. A variable was constructed for the ratio of land value to total appraised value. There was no prior expectation for this variable. On the one hand, land may be regarded as more difficult to value than improvements. On the other hand, relatively high land values may signal a stronger, more predictable market.

- Average number of acres. This variable exhibited a mild positive correlation with COD.

- Average building size (TRA). This variable exhibited a mild negative correlation with COD, indicating that larger (probably newer) improvements may be somewhat easier to value than smaller (probably older) improvement.

- Variation in building size (TRA). Although it was anticipated that this variable may be a proxy for heterogeneity, it's correlation with COD was near zero.

- MAF. It was hypothesized that lower MAFs may be associated with depressed, difficult markets and therefore higher CODs, and by the same token that higher MAFs may be associated with lower CODs. Consistent with this expectation, the correlation coefficient between MAF and COD was -.339.

5.5.3 COD Regression Analyses

Exhibit 5 shows the results of a regression of COD on the variables explained above after the deletion of eight outliers (leaving 195 strata in the final analyses). The model explains about 42% of the variation in CODs, meaning that CODs vary for many reasons not explained by the variables included in the analysis. These would include the reliability and consistency of sale price data, differences in local market conditions, and variations in valuation methods and procedures themselves. Still, the model in exhibit 5 is able to explain or predict actual CODs obtained in the revaluation with an average error 19.0% (ratios of predicted to actual CODs ranged from .47 to 1.60).

Exhibit 5. Regression of COD on All Candidate Variables

Model Summary[g]

Model: 6

R	R Square	Adjusted R Square	Std. Error of the Estimate
.660	.436	.418	6.15206

g. Dependent Variable: COD

Coefficients[a]

Model: 6

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	15.998	3.562		4.491	.000
COV_PRICE	8.730	2.941	.206	2.969	.003
PROV_CLUSTER	9.998	1.838	.310	5.439	.000
AVE_PRICE100K	-2.354	1.556	-.132	-1.513	.132
BEDROOM_MOD_STRONG	-5.324	1.803	-.196	-2.953	.004
RESORT_LARGE	-5.280	2.031	-.151	-2.600	.010
AVE_AGE10YRS	1.104	.579	.144	1.906	.058

a. Dependent Variable: COD

Six variables emerge as significant in the model (all the other variables were statistically insignificant). In order of statistical significance, they are:

- Provincial cluster (binary variable coded 0 or 1). As suggested earlier, these communities are the most remote and easily the most difficult to appraise. The model suggests that that their CODs are, other things equal, 10 points higher than CODs in other communities.

- COV of price. A doubling of the standard deviation relative to the average price is associated with an 8.7 increase in COD.

- Moderate or strong bedroom community (binary variable coded 0 or 1). Other things equal, these communities have CODs 5+ points lower than other communities.

- Large resort communities (binary variable coded 0 or 1). Typically these communities also have CODs 5+ points lower than other communities

- Average age. Each 10 years of age is associated with an increase of slightly more than a point in the COD.

- Average price. This variable was initially stronger but lost strength as other variables entered the model. Still, it suggests that an increase of $100,000 in average price is associated with a reduction of over 2 points in the COD.

To determine the ability of cluster type alone to explain variations in COD, the model was rerun using only binary variables for cluster codes. As shown in exhibit 6, the model explains slightly more than one-fourth of the variation in COD. Stronger bedroom communities are associated with the best CODs, followed by larger resort communities. Small agricultural communities have the worst CODs, followed by the smallest rural communities. Thus, while community type is crucial, other variables are also important in developing performance benchmarks.

Exhibit 6. Regression of COD on Cluster Types

Model Summary

Model: 4

R	R Square	Adjusted R Square	Std. Error of the Estimate
.528	.278	.263	6.92263

Coefficients[a]

Model: 4

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	25.744	.567		45.394	.000
BEDROOM_MOD_STRONG	-11.034	1.686	-.407	-6.543	.000
RESORT_LARGE	-8.894	2.163	-.255	-4.112	.000
AG_SMALLEST	9.346	3.507	.165	2.665	.008
RURAL_SMALLEST	4.326	2.077	.129	2.082	.039

a. Dependent Variable: COD

Finally, to turn the coin around, a final model was run omitting cluster types. This helps focus attention on the available underlying characteristics themselves (e.g., average age and price) as opposed to how the communities have been grouped based on these and other characteristics. Exhibit 7 shows the results. The model explains slightly more than one-third of the variation in CODs. Interestingly, the most significant variable is the percentage of agricultural and mixed use properties. Again, the variable suggests that, other things equal, agricultural communities will have CODs that are, on average, 10 points higher than in other communities. Older properties and large variations in price are again associated with high COD. Higher prices are associated with better CODs.

Exhibit 7. Regression of COD with Cluster Types Omitted

Model Summary

Model: 6

R	R Square	Adjusted R Square	Std. Error of the Estimate
.593	.352	.338	6.56206

Coefficients[a]

Model: 6

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	15.747	3.840		4.101	.000
COV_PRICE	11.420	3.102	.269	3.682	.000
AVE_AGE10YRS	.970	.627	.126	1.546	.124
PCT_AGMIXED	9.987	2.214	.290	4.511	.000
AVE_PRICE100K	-5.351	1.633	-.299	-3.276	.001

a. Dependent Variable: COD

5.5.4 Conclusions

Cumulatively these results suggest a framework that could be used to establish benchmark COD based on cluster type and other key variables, particularly average age, average price, and the variation in prices. As the analysis shows, both cluster type and these other characteristics are important. In addition, CODs standards must allow room for variations due to the factors not accounted for here, particularly local market variations within cluster types.

5.6 Performance Standards Recommendations

The following are suggestions that could be considered in developing performance standards or goals for future revaluations. As with any recommendations, they will benefit from discussion and refinement. While the end objective is to continue improvements in the accuracy and uniformity of property valuations, setting realistic performance goals can help stakeholders focus on achievable targets and monitor progress toward their accomplishment.

1. Time-adjustments. While present standards include an implicit provision for time-adjustments, SAMA guidelines should make clear that appraisers must track time trends and adjust sales prices for any significant trends to the assessment date (presumably June 30, 2010 for the next revaluation). Given rapid and too often volatile market changes seen across all of North America in recent years, it is crucial that time trends be analyzed and captured. Achieving a median of 0.98 to 1.02 on sales used in a reappraisal is meaningless if those sales do not properly reflect the target assessment date.

2. Equity between residential and commercial properties. The present standard requires only that the overall assessment level for residential and commercial sales *combined* be between 0.98 and 1.02. It says nothing about required levels for each class, meaning that one of the two classes could be assessed well above the other. In contrast, IAAO standards recommend that each major class of property be assessed within 5% of the overall level and notes that one can conclude that this standard has not been met if an appropriate statistical test determines that the allowed tolerance has been exceeded at the 95% confidence level[4]. SAMA should require the same for commercial and residential property and determine whether valuation models could be amended or adjusted to address any violations. The requirement of statistical testing provides an adequate safeguard that observed difference are attributable to systematic difference, not just to small samples or sampling errors.

3. COD standards. IAAO recommends that assessment agencies develop uniformity (COD) goals or standards. Fortunately, the 2007 *Standard on Ratio Studies* better recognizes the need to consider local variations in setting such standards and, if fact, suggests looser

[4] See especially IAAO *Standard on Ratio Studies* (2007), section 11.2.3 (Uniformity among Strata).

COD standards for rural, older, less active, or depressed communities than the previous (1999) standard[5].

The research on COD attained in the 2006 base-year revaluation discussed in section 5.5 above provides a good start to development of appropriate expectations for the wide range of municipalities in Saskatchewan. One practical approach would be to construct a typical range of CODs by cluster type based on exhibit 3 and the MRA results presented in exhibits 5-7. The midpoint of the range would reflect the typical COD for that cluster type. 25th and 75th percentiles would reflect typical variation dependent on average age, average prices, and other variables significant in the MRA analyses. 10th and 90th percentiles would allow for additional variation dependent on local conditions and factors.

Based on these analyses, SAMA could formulate a reasonable range for performance expectations for CODs in various types of municipalities (based at a minimum on cluster type). The objective in any revaluation in any community would be to achieve a COD in the lower end of the expected range. The objective over time for all communities would be to achieve lower average CODs across all cluster types. Statistical tests are available to determine whether one can conclude that minimum requirements have not been met[6].

4. Vertical equity and PRD standards. Meaningful standards for vertical equity, as measured by the PRD or otherwise, are especially difficult to develop. While the IAAO Standard calls for PRDs of 0.98 to 1.03, as the Standard itself emphasizes, the PRD is sensitive to outliers and testing is required to conclude whether a meaningful problem exists. Technically, a problem is that one can get quite different results when graphing or otherwise comparing assessment ratios against assessed value (the numerator in ratios) or sales prices (the denominators in ratios)[7]. For these reasons, while SAMA should calculate and monitor PRDs, it is not necessary or productive at this time to develop specific standards or requirements. The best way to track vertical equity in ratio study analyses is to plot ratios against "value" computed as ½ of assessed value + ½ of sale price, which serves to minimize the considerable bias that can be inherent in using sale price alone.

[5] See table 2.3 (page 33) and the discussion in 11.2.1 (Oversight Uniformity Standards).
[6] See Robert J. Gloudemans, "Confidence Intervals for the COD: Limitations and Solutions", *Assessment Journal* (Nov/Dec 2001).
[7] This problem also tends to bias the PRD slightly upward, which is the reason that IAAO's recommended PRD standard is centered slightly above 1.00.

Appendix 1
One-Family Model Coefficients

	Humboldt	Kindersley	Martensville	Warman	Weyburn	Estevan	Yorkton	Melville	Melfort
Location									
Abutt Apartment Factor	0.905	1.000	1.000	1.000	1.000	0.961	0.942	1.000	0.928
Abutt Green Space Factor	1.000	1.023	1.056	1.000	1.000	1.068	1.135	1.147	1.000
Abutt Highway Factor	1.000	1.000	1.000	0.964	0.972	0.845	0.990	1.000	1.000
Abutt Commercial Factor	1.000	0.970	0.960	0.991	0.843	1.000	1.000	1.000	0.928
Abutt Railway Factor	1.000	0.788	1.000	0.979	1.000	1.000	0.922	1.000	1.000
Abutt Main Traffic Factor	1.000	1.000	0.936	0.982	0.974	0.931	1.000	1.000	1.000
No Sidewalk Factor	1.000	0.933	0.983	1.000	0.983	1.000	1.000	1.000	0.979
Gravel Street Factor	1.000	1.000	0.989	0.910	0.997	0.913	1.000	1.000	1.000
Land									
Land Size Cap	20,000	15,000	20,000	15,000	20,000	20,000	20,000	15,000	12,500
Land Rate	2.663	4.057	9.530	11.438	2.920	2.240	0.810	0.500	0.750
Median Land Size	6900	6250	7140	6534	7288	6200	7200	7000	6714
Land Exponent	0.395	0.583	0.240	0.247	0.447	0.581	1.654	0.500	0.500
Living Area/Basements									
Main Living Area Rate	80.724	91.390	79.974	76.496	70.150	89.263	65.491	44.430	66.072
Median Main Living Area	1115	1104	1128	1161	1054	1072	1080	1000	1049
Main Living Area Exponent	-0.690	-0.485	-0.216	0.000	-0.335	-0.484	-0.294	0.000	-0.390
Basement Rate	8.311	4.679	19.428	25.301	22.784	19.686	21.011	28.918	10.000
Basement Finish Rate	2.856	9.926	18.714	2.054	6.103	7.568	8.522	7.018	10.212
Byuilding Type/Style									
1 Storey Weight	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1.25 Storey Weight	1.080	1.000	1.210	1.000	1.000	1.127	1.000	1.000	1.000
1.5 Storey Weight	0.996	1.046	1.210	1.000	1.000	0.955	1.000	1.000	1.000
1.75 Storey Weight	0.987	1.266	1.210	1.000	1.000	1.052	1.000	1.000	1.000
2 Storey Weight	0.965	1.023	0.977	0.968	1.000	1.007	1.009	1.000	1.021

2.25 Storey Weight	1.000	1.000	1.000	1.000	1.000	1.000	1.009	1.000	1.000
2.5 Storey Weight	1.000	1.000	1.000	1.000	1.000	1.000	1.009	1.000	1.021
2.75 Storey Weight	1.000	1.000	1.000	1.000	1.000	1.000	1.009	1.000	1.000
3 Storey	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
3.25 Storey	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bi-Level Weight	1.049	1.057	1.023	1.097	1.041	1.063	1.083	1.196	1.033
Tri-Level (±30) Weight	1.090	1.131	1.056	1.234	1.077	1.114	1.081	1.109	1.099
Hill Style Weight	1.000	1.000	1.000	1.000	1.000	1.150	1.000	1.023	1.000
1+Attic Style Weight	1.000	1.000	1.000	1.000	1.000	1.150	1.000	1.023	1.000
Linearized Style Exponent	1.011	1.000	1.636	0.793	1.667	0.908	0.715	0.748	0.967
Secondary Areas									
Attached Garage Rate	44.398	50.265	39.987	21.542	40.194	35.341	34.913	33.323	41.069
Built-in Garage Rate	44.398	50.265	47.984	21.542	42.090	35.341	34.913	33.323	41.069
Detached Garage Rate	26.822	36.556	10.000	10.000	32.762	31.807	31.422	19.994	36.415
Second Garage Rate	22.199	25.132	19.994	10.771	20.097	20.000	17.457	19.994	20.535
Deck Rate	8.072	9.139	7.997	7.650	7.015	8.926	6.549	4.443	6.607
Carport Rate	0.000	0.000	0.000	0.000	0.000	17.487	0.000	12.675	0.000
Porch Rate	20.181	22.848	19.994	19.124	17.538	22.316	16.373	6.665	16.518
Patio Rate	16.145	18.278	15.995	15.299	14.030	17.853	13.098	8.886	13.214
Shed Rate	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000
Construction Quality									
AA+80 Quality Weight	2.278	2.247	2.038	1.910	2.139	1.803	2.047	2.434	2.230
AA+70 Qualtiy Weight	2.158	2.129	1.931	1.811	2.027	1.710	1.940	2.306	2.111
AA+60 Quality Weight	2.030	2.002	1.816	1.703	1.906	1.608	1.824	2.169	1.987
AA+50 Quality Weight	1.901	1.875	1.701	1.594	1.785	1.505	1.709	2.031	1.862
AA+40 Quality Weight	1.773	1.749	1.586	1.487	1.665	1.404	1.593	1.894	1.736
AA+30 Quality Weight	1.644	1.622	1.471	1.379	1.544	1.302	1.477	1.757	1.610
AA+20 Quality Weight	1.524	1.504	1.364	1.379	1.432	1.302	1.370	1.629	1.493
AA+10 Quality Weight	1.396	1.377	1.249	1.379	1.311	1.302	1.255	1.492	1.367
AA Quality Weight	1.396	1.377	1.249	1.264	1.277	1.156	1.139	1.350	1.241
AA/A Quality Weight	1.333	1.369	1.249	1.129	1.130	1.136	1.101	1.250	1.241

A Quality Weight	1.197	1.156	1.166	1.101	1.130	1.081	1.088	1.150	1.091
A/B Quality Weight	1.158	1.127	1.077	1.061	1.000	1.024	1.039	1.050	1.056
B Quality Weight	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
B/C Quality Weight	0.800	0.909	0.900	0.786	0.833	0.857	0.868	0.750	0.888
C Quality Weight	0.678	0.775	0.817	0.740	0.833	0.728	0.613	0.500	0.719
C/D Quality Weight	0.216	0.576	0.749	0.508	0.410	0.674	0.497	0.400	0.574
D Quality Weight	0.130	0.121	0.010	0.400	0.410	0.483	0.091	0.300	0.419
E Quality Weight	0.130	0.121	0.010	0.250	0.410	0.483	0.091	0.200	0.419
F Quality Weight	0.130	0.121	0.010	0.250	0.410	0.483	0.091	0.100	0.419
Linearized Qual. Exponent	1.017	0.913	0.643	0.981	1.203	0.820	0.511	1.000	0.882
Condtition									
Excellent Cond. Weight	1.838	1.977	1.377	1.250	1.181	1.160	1.500	1.650	1.185
Superior Cond. Weight	1.838	1.977	1.377	1.250	1.181	1.160	1.500	1.500	1.185
Very Gd, Cond. Weight	1.800	1.593	1.377	1.250	1.072	1.099	1.105	1.250	1.185
Good Cond. Weight	1.225	1.229	1.000	1.100	1.000	1.084	1.040	1.000	1.117
Above Ave. Cond. Weight	1.034	1.108	1.000	1.000	1.000	1.013	1.000	1.000	1.026
Average Cond. Weight	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Below Ave. Cond. Weight	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.471	0.850
Poor Cond. Weight	0.700	0.700	0.700	0.700	0.700	0.700	0.700	0.471	0.700
Linearized Cond. Exponent	1.086	1.036	1.294	0.800	1.909	1.333	0.841	0.946	0.821
Add Items									
Fire Place Rate	5763	2710	3018	4000	4000	1960	4978	2500	3660
Hot Tub Rate	0	0	0	0	5000	5000	0	4000	1666
Pool Rate	0	0	0	0	-10000	-10000	0	0	0
Extra Plumbing Rate	1280	1076	736	2095	0	0	0	3384	1060
Air Condition Rate	0	5000	5266	0	5619	3464	5448	0	3455
Inferior Heating Rate	0	-10346	-10000	0	-5000	-5000	-5000	0	0
Effective Age									
Effective Age Cap	N/A	N/A	N/A	N/A	N/A	N/A	60	60	N/A
(1-Effage/200) Exponent	3.225	2.692	3.203	3.713	1.648	1.060	2.022	0.983	0.990

Appendix 2
One-Family Performance Results

	Humboldt	Kindersley	Martensville	Warman	Weyburn	Estevan	Yorkton	Melville	Melfort
Model Performance									
Number of Sales	472	426	668	657	837	894	1234	386	488
Sales Used	462	421	518	519	612	712	965	356	478
Residual Outliers (> ±3 sd)	5	4	2	9	5	4	5	3	2
Percent Outliers	1.1%	1.0%	0.4%	1.7%	0.8%	0.6%	0.5%	0.8%	0.4%
Adjusted R Square	0.931	0.862	0.852	0.892	0.897	0.915	0.923	0.897	0.876
Avg Time Adj. Sale Price	96,230	114,914	165,761	182,524	105,247	129,826	91,980	53,784	86,991
Avg Effective Age	37.3	41.5	18.4	16.9	43.5	43.9	38.8	50.8	41.7
Sales Ratios									
Sales	462	421	667	657	818	894	965	356	478
% Outliers (ASR>2 or <0.5)	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.0%	2.0%	0.0%
Median	1.018	0.997	0.998	0.998	1.017	0.997	1.008	1.019	1.013
95% Conf Interval: Lower	0.991	0.981	0.990	0.991	0.998	0.986	0.993	0.998	0.988
95% Conf Interval: Upper	1.034	1.011	1.009	1.008	1.03	1.009	1.017	1.054	1.033
Minimum Ratio	0.576	0.594	0.612	0.547	0.528	0.536	0.539	0.350	0.526
Maximum Ratio	1.936	1.795	1.941	1.923	2.191	2.112	1.970	2.295	1.968
PRD	1.039	1.033	1.011	1.011	1.042	1.033	1.031	1.066	1.046
COD	14.5%	14.7%	7.9%	8.2%	15.6%	13.5%	14.0%	21.9%	16.6%